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. 3900 – 4186

S.No	Course Name	Code
3900	Mathematics-I	18MTC01
3901	Chemistry	18CYC01
3902	Engineering Mechanics	18CEC01
3903	Engineering Graphics and Design	18MEC01
3904	Basic Electrical Engineering	18EEC01
3905	Basic Electrical Engineering Lab	18EEC02
3906	Chemistry Lab	18CYCO2
3907	Mathematics -II	18MTC03
3908	Optics and Semiconductor Physics	18PYC01
3909	Programming for Problem Solving	18CSC01
3910	English	18EGC01
3911	Optics and Semiconductor Physics Laboratory	18PYC02
3912	Programming for Problem Solving Lab	18CSC02
3913	Workshop/ManufacturingPractice	18MEC02
3914	English Lab	18EGC02
3915	Engineering Mathematics-III	16MTC05
3916	Network Theory	16EC C02
3917	Electronic Devices and Circuits	16EC C03
3918	Signals and Systems	16EC C04
3919	Electromagnetic Theory and Transmission Lines	16EC C05
3920	Electronic Workshop and Network Lab	16EC CO6
3921	Electronic Devices Lab	16EC C07
3922	Soft Skills and Employability Enhancement Lab	16EG C03
3923	Digital Logic Design	16EC C08
3924	Analog Electronic Circuits	16EC C09
3925	Analog Communication	16EC C10
3926	Antennas and Wave Propagation	16EC C11
3927	Electronic Instrumentation	16EC C12
3928	Engineering Economics and Accountancy	16MB C01
3929	Digital Logic Design Lab using Verilog	16EC C13

3930	Analog Electronic Circuits Lab	16EC C14
3931	Analog Communication Lab	16EC C15
3932	Digital Communication	16ECC18
3933	Integrated Circuits and Applications	16ECC19
3934	Microprocessors and Microcontrollers	16ECC20
3935	Control Systems	16ECC21
3936	Computer Organization and Architecture	16ECE01
3937	Digital Communication Lab	16ECC22
3938	Integrated Circuits and Applications Lab	16ECC23
3939	Microprocessors and Microcontrollers Lab	16ECC24
3940	Embedded System Design	16ECC25
3941	Digital Signal Processing	16ECC26
3942	Microwave Engineering	16ECC27
3943	Wireless Mobile Communication	16ECC28
3944	Analog and Mixed Signal Design	16ECE03
3945	Coding Theory and Techniques	16ECE04
3946	Data Structures	16ITE27
3947	Java Programming	16ITE25
3948	Python Programming	16ITE26
3949	Embedded System Design Lab	16ECC29
3950	Digital Signal Processing Lab	16ECC30
3951	Microwave Engineering Lab	16ECC31
3952	Radar Systems	EC 411
3953	Data Communications and Computer Networks	EC 412
3954	VLSI Design	EC 413
3955	Electronic Instrumentation	EC 414
3956	Industrial Administration and Financial Management	ME 419
3957	Embedded Systems	EC 462
3958	Satellite Communication	EC 464
3959	Electronic Design and Automation Lab	EC 415
3960	Advanced Simulation Lab	EC 416
3961	Project Seminar	EC 417
3962	GPS and Augmentation systems	EC 421
3963	Real Time Operating System	EC 472
3964	Digital Image Processing	EC 475
3965	JAVA Programming	CS 486
3966	Entrepreneurship	ME 464
3967	Internet of Things	IT 429
3968	Disaster Mitigation and Management	CE 422
3969	Seminar	EC 422
3970	Project	EC 901
3971	Data and Computer Communication Networks	16ECC101
3972	Probability and Random Processes	16ECC105
3973	Coding Theory and Techniques	16ECC106
3974	Satellite and Microwave Communications	16ECE105
3975	Global Navigational Satellite Systems	16ECE102
3976	Embedded System Design	16ECE111

3977	Communications Lab	16ECC107
3978	Seminar – 1	16ECC109
3979	Soft Skills Lab	16 EG 104
3980	Modern Digital Signal Processing	16ECC102
3981	Detection and Estimation Theory	16ECC103
3982	Wireless Mobile Communication Systems	16ECC104
3983	Image and Video Processing	16ECE104
3984	Software Defined and Cognitive Radio	16ECE113
3985	Selected Topics in Strategic Electronics	16ECE119
3986	Computer Communication Networks Lab	16ECC108
3987	Seminar – 2	16ECC110
3988	Mini project	16ECC111
3989	Project work - Project Seminar	16ECC112
3990	Project work - Dissertation	16ECC113
3991	Microcontrollers for Embedded System Design	16EC C201
3992	CMOS VLSI Design	16EC C202
3993	Analog and Mixed Signal IC Design	16EC C205
3994	Computer Communication Networks	16EC E201
3995	VLSI Technology	16EC E206
3996	Optimization Techniques	16EC E213
3997	Design and Simulation Laboratory-I	16EC C207
3998	Seminar - 1	16EC C209
3999	Soft Skills	16 EG 104
4000	RF IC Design	16EC C203
4001	Embedded Processors and Architecture	16EC C204
4002	Real Time Operating Systems	16EC C206
4003	VLSI Physical Design Automation	16EC E210
4004	Low Power VLSI Design	16EC E207
4005	CPLD & FPGA Architectures and Applications	16EC E204
4006	Design and Simulation Laboratory-II	16EC C208
4007	Seminar - 2	16EC C210
4008	Mini Project	16EC C211
4009	Project work -Project Seminar	16EC C212
4010	Project work and Dissertation	16EC C213
4011	Principles of Management	16MBC101
4012	Managerial Economics	16MBC102
4013	Financial Accounting and Analysis	16MBC103
4014	Marketing Management	16MBC104
4015	Statistics for Management	16MBC105
4016	Business Communication	16MBC106
4017	Business Law	16MBC107
4018	Information Technology Applications for Business	16MBC108
4019	InformationTechnology (IT) Lab	16MB C109
4020	Soft Skills Lab	16EG C103
4021	Organisation Behaviour	16MB C110
4022	Business Environment and Ethics	16MB C111
4023	Human Resource Management	16MB C112

4024	Financial Management	16MB C113
4025	Business Research Methods	16MB C114
4026	Operations Research	16MB C115
4027	Operations Management	16MB C116
4028	Business Analytics	16MB C117
4029	Statistical Software Lab	16MB C118
4030	Strategic Management Accounting	16MB C120
4031	International Business	16MB C121
4032	Strategic Management	16MB C122
4033	Investment Management	16MB E101
4034	International Finance	16MB E102
4035	Performance and Compensation Management	16MB E103
4036	Organizational Development and Change Management	16MB E104
4037	Product and Brand Management	16MB E105
4038	Promotion and Distribution Management	16MB E106
4039	Total Quality Management	16MB E107
4040	Technology Management	16MB E108
4041	Relational Database Management Systems	16MB E109
4042	E-Business	16MB E110
4043	Logistics and Supply Chain Management	16MBC124
4044	Entrepreneurial Development	16MBC125
4045	Financial Risk Management	16MBE111
4046	Banking and Insurance	16MBE112
4047	Industrial Relations and Labor Laws	16MBE113
4048	Services and Retail Marketing	16MBE116
4049	Enterprise Resource Planning	16MBE118
4050	Cloud Computing and Internet of Things	16MBE119
4051	Engineering Mathematics - I	18MT C 01
4052	Physics	18PY C 05
4053	Programing for problem solving	18CS C 01
4054	English	18EG C 01
4055	Physics Lab	18PY C 08
4056	Programming for Problem Solving Lab	18CS C 02
4057	Workshop/ Manufacturing Practice	18ME C 02
4058	English Lab	18EG C 02
4059	Mathematics - II	18MT C 03
4060	Chemistry	18CY C 01
4061	Engineering Mechanics	18CE C 01
4062	Engineering Graphics and Design	18ME C 01
4063	Basic Electrical Engineering	18EE C 01
4064	Basic Electrical Engineering Lab	18EE C 02
4065	Chemistry Lab	18CY C 02
4066	Engineering Mathematics-III	16MT C 03
4067	Chemical Technology	16CH C 01
4068	Fluid Mechanics	16CH C 02
4069	Material and Energy Balance	16CH C 03
4070	Physical Chemistry	16CY C 07

4071	Engineering Economics and Accountancy	16MB C 01
4072	Chemical Technology Lab	16CH C 04
4073	Physical Chemistry Lab	16CY C 08
4074	Basics of Mechanical and Electrical Engg. Lab	16ME C 13 /16EE C 05
4075	Chemical Engineering Thermodynamics - I	16CH C 05
4076	Chemical Reaction Engineers - I	16CH C 06
4077	Material Science for Chemical Engineers	16CH C 07
4078	Mechanical Unit Operations	16CH C 08
4079	Process Heat Transfer	16CH C 09
4080	Advanced Organic Chemistry	16CY E 01
4081	Numerical Techniques and Statistical Methods	16MT E 01
4082	Fertilizer Technology	16CH E 01
4083	Fluid Mechanics Lab	16CH C 10
4084	Programming Laboratory for Numerical Methods	16MT C 07
4085	Chemical Reaction Engineering - II	16CH C 11
4086	Mass Transfer Operations – I	16CH C 12
4087	Process Instrumentation	16CH C 13
4088	Surface Coating Technology	16CH E 02
4089	Technology of Vegetable Oils and Fats	16CH E 03
4090	Corrosion Engineering	16CH E 04
4091	Mineral Processing Technology	16CH E 05
4092	Mechanical Unit Operations Lab	16CH C 14
4093	Process Heat Transfer Laboratory	16CH C 15
4094	Surface Coating Technology Lab	16CH E 06
4095	Technology Of Vegetable Oils And Fats Lab.	16CH E 07
4096	Bio Chemical Engineering	16CH C 16
4097	Chemical Engineering Thermodynamics – II	16CH C 17
4098	Chemical Process Safety	16CH C 18
4099	Process Dynamics and Control	16CH C 19
4100	Process Modeling Simulation And Optimization	16CH C 20
4101	Energy Engineering.	16CH E 08
4102	Fluidization Engineering	16CH E 09
4103	Pharmaceutical Technology	16CH E 10
4104	Chemical Reaction Engineering Laboratory	16CH C 21
4105	Process Dynamics And Control Laboratory	16CH C 22
4106	Process Modeling Simulation Laboratory	16CH C 23
4107	Chemical Process Safety	CH 411
4108	Mass Transfer Operations -II	CH 412
4109	Petrochemical Engineering	CH 413
4110	Principles and Practice of Management	MB 216
4111	Process Equipment Design	CH 414
4112	Fertilizer Technology	CH 461
4113	Membrane Separation Processes	CH 462
4114	Mineral Processing Technology	CH 463
4115	Polymer Technology	CH 464
4116	Pulp and Paper Technology	CH 465
4117	Equipment Design and Drawing	CH 415

4118	Mass Transfer Operations Laboratory	CH 416
4119	Project Seminar	CH 417
4120	Plant Design and Economics	CH 421
4121	Transport Phenomena	CH 422
4122	Corrosion Engineering	CH 471
4123	Fluidization Engineering	CH 472
4124	Pollution Control in Process Industries	CH 473
4125	Sugar Technology	CH 474
4126	Disaster Mitigation and Management	CE 422
4127	Entrepreneurship	ME 464
4128	Nano Materials and Technology	PE 484
4129	Nuclear Engineering	CH 481
4130	Seminar	CH 423
4131	Project	CH 901
4132	Surveying	16CE C03
4133	Building Materials Planning and Construction	16CE C04
4134	Strength of Materials-I	16CE C05
4135	Engineering Geology	16CE C06
4136	Engineering Mathematics-III	16MT C05
4137	Engineering Economics and Accountancy	16MB C01
4138	Surveying Lab-I	16CE C07
4139	Engineering Geology Lab	16CE C08
4140	Computer Aided Civil Engineering Drafting Lab	16CE C09
4141	Transportation Engineering	16CE C10
4142	Construction Management and Administration	16CE C11
4143	Water and Waste Water Engineering	16CE C12
4144	Strength of Materials-II	16CE C13
4145	Fluid Mechanics-I	16CE C14
4146	Strength of Materials Lab	16CE C15
4147	Surveying –II Lab	16CE C16
4148	Soft Skills and Employability Enhancement Lab	16EG C03
4149	Survey Camp	16CE C17
4150	Reinforced Concrete Design-I	16CE C18
4151	Soil Mechanics	16CE C19
4152	Theory of structures-I	16CE C20
4153	Concrete Technology	16CE C21
4154	Fluid Mechanics-II	16CE C22
4155	Fluid Mechanics Lab	16CE C23
4156	Environmental Engineering Lab	16CE C24
4157	Concrete Laboratory	16CE C25
4158	Rock Mechanics	16CE E01
4159	Advanced Surveying	16CE E02
4160	Advanced Strength of Materials	16CE E03
4161	Theory of Structures-II	16CE C 26
4162	Reinforced Concrete Design-II	16CE C27
4163	Water Resources Engineering-I	16CE C28
4164	Foundation Engineering	16CE C29

4165	Soil Mechanics Laboratory	16CE C30
4166	Hydraulics and Hydraulic Machinery Lab	16CE C31
4167	Transportation Engineering Lab	16CE C32
4168	Finite Element Method	16CE E04
4169	GIS and Remote Sensing	16CE E05
4170	Artificial Neural Networks, Fuzzy Logic and Expert Systems	16CE E06
4171	Industrial Visit	16CE C33
4172	Mathematics-I	18MT C01
4173	Introduction to Mechanics and Electromagnetic Theory	18PY C03
4174	Programming for Problem Solving	18CS C01
4175	English	18EG C01
4176	Mechanics and Electromagnetic Lab	18PY C06
4177	Programming for Problem Solving Lab	18CS C02
4178	Workshop/Manufacturing Practice	18ME C02
4179	English Lab	18EG C02
4180	Mathematics-II	18MT C03
4181	Chemistry	18CY C01
4182	Engineering Mechanics	18CE C01
4183	Engineering Graphics and Design	18ME C01
4184	Basic Electrical Engineering	18EE C01
4185	Basic Electrical Engineering Lab	18EE C02
4186	Chemistry Lab	18CY C02

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, Cauchey'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 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. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics, Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

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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.

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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 $KMno_4$, $K_2Cr_2O_7$; **Reduction** with $LiAlH_4$,$NaBH_4$

Cyclization (Diels - Alder reaction)

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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 & CompanyLtd, 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., 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, 8thedition (2006).

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).

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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 pplicable), 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 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.

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.

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

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.

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.

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 and Clairaut's differential equations ,Orthogonal trajectories of a given family of curves.

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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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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, CO_2), 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, 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.

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. 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.

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-IUnderstanding 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.

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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 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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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.

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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16MT C05

ENGINEERING MATHEMATICS-III

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

Course objectives: *Students will be able to understand*

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

Course outcomes: *Students will able to*

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

UNIT – I

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

UNIT-II:

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

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UNIT - III

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

UNIT - IV

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

UNIT - V

Expansion of functions, Singularities & Residues: Taylor's and Laurent's series Expansions (Only statements). Zeros, types of singularities, Residues and Cauchy's Residue theorem, Evaluation of real integrals by Cauchy's residue theorem. Evaluation of improper real integrals of the type: $\int_{-\infty}^{\infty} f(x)dx$ Where f(x) has no poles on real axis and $\int_{0}^{2\pi} f(\sin\theta, \cos\theta)d\theta$.

Text Books:

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

Suggested Reading:

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

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16EC C02

NETWORK THEORY

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

Course Objectives: *Students will be able to understand*

1. The nature of different circuit elements, fundamental circuit laws, theorems and analyze circuits using graph theory.
2. The transient response of first, second order circuits and wave-shaping.
3. The concept of steady state and applying phasor analysis to AC circuits in sinusoidal steady state and analyzing magnetic coupled circuits.
4. Series and parallel resonant circuits, two port network parameters.
5. The concept of symmetrical and asymmetrical networks.
6. The concept of passive Filters.

Course Outcomes: *Students will able to*

1. Apply basic concepts of electric circuits and also simplify using network theorems. They will also be able to find Solution to networks using topological description.
2. Analyze RL,RC,RLC circuits using Transient and Steady State Responses for dc and ac input signals.
3. Represent vector, phasor diagrams and also find power calculations for ac circuits. They will be able to classify dot convention rules, self and mutual inductance for simple magnetic coupled circuits.
4. Discuss complex frequency analysis to series and parallel resonant circuits. Students will be able to compare Z,Y,H, two port network parameters and their interconnections.
5. Classify and define symmetrical and asymmetrical network characteristics.
6. Design and calculate parameters of passive filters.

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UNIT-I

Basic Concepts of Electric Circuits: Classification of basic components, Ohm's law, Kirchoff's laws, network reduction techniques, nodal and mesh analysis, Source transformations, Star and Delta transformations, Thevenin's and Norton's theorems, Superposition theorem, Maximum power transfer theorem, Reciprocity theorem, Tellegen's theorem, Millman's Theorem, Duality Theorem.

Network Topology: Topological description of networks. Network graphs, tree, chord, incidence matrix, tieset matrix, cutset matrix. Formulation of node and loop equations and solution to networks.

UNIT-II

Time domain analysis: steady state and transient analysis for basic RL, RC and RLC circuits in linear time invariant first order and second order circuits, Formulation of integral, differential equations, Zero Input Response (ZIR), Zero State Response (ZSR), complete response.

Wave- Shaping: RC, RL and RLC circuits, response to Step, Pulse, Square wave inputs.

UNIT-III

Steady state Sinusoidal analysis: Steady state response of RLC networks to exponential signals, Sinusoidal signals, phasor and vector representations, impedance and admittance, application to network theorems.

Calculation of power in a.c. circuits: Average power, apparent power, complex power.

Magnetic coupled circuits: Concept of self, mutual inductance, co-efficient of coupling, dot convention rules and analysis of simple circuits.

UNIT-IV

Frequency domain analysis: Concept of complex frequency, impedance and admittance functions, Pole-Zero cancellation, calculation of natural response from pole zero plot. Series and parallel resonance, Q-factor, selectivity, bandwidth.

Two port networks: Z, Y, h, g, ABCD and Inverse ABCD parameters, equivalence of two port networks. Inter connection of two port networks, ideal transformers.

UNIT-V

Symmetrical and Asymmetrical networks: Characteristic impedance, propagation constant, image and iterative impedances for T, π, L, Bridged T and Lattice networks. Introduction to Attenuators and equalizers.

Passive Filters: Classification of filters (Low pass, High pass, Band pass and Band stop), Characteristic impedance, Design of Constant K, m-derived and composite filters.

Text Books:

1. William H.Hayt, Jr.,Jack E. Kemmerly& Steven M.Durbin, "Engineering Circuit Analysis", 8th ed, McGraw Hill, 2013.
2. C.L.Wadhwa, "Network Analysis and Synthesis", 4^{th} edition, New Age International Publications, 2016.

Suggested Reading:

1. M.E. Van Valkenburg M.E, " Network analysis" PHI, New Delhi, 3^{rd} Edition 2002.
2. Charels A. Desoer and Ernest S Kuth, "Basic Circuit Theory" McGraw Hill, 2009.
3. Lawrence P. Huelsman, "Basic Circuit Theory" Pearson Publication, 3^{rd} edition, 2009.

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16EC C03

ELECTRONIC DEVICES AND CIRCUITS

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

Course objectives: *Students will be able to understand*

1. The concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
2. The applications of diodes.
3. The various configurations, characteristics and biasing techniques of transistors – BJT, JFET & MOSFET.
4. The applications of transistor as a switch and an amplifier.
5. The analysis of BJT & FET in various configurations using small signal equivalent models.
6. The frequency response of various amplifiers.

Course Outcomes: *Students will able to*

1. Recall the elementary concepts of diode and relate them to special devices. Students will also be able to define the working principles of BJT, FET.
2. Classify and relate the performance of different types of rectifiers. Students will be able to compare and contrast the biasing techniques, different configurations, characteristics of BJT & FET.
3. Modeling of different amplifiers.
4. Examine different non-linear wave shaping circuits and draw an inference for their outputs. Students will be able to distinguish different types of rectifying circuits and amplifier circuits and their performance parameters.
5. Choose the best configuration for the specifications like ripple factor in case rectifiers, gain in case of amplifiers.
6. Design, develop and improve the performance of the amplifier circuits.

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UNIT – I

Semiconductor Diode Characteristics:

The p-n junction as a Diode and Energy Band Diagram, Current components in p-n diode, The Volt-ampere characteristics and temperature dependence, Diode Resistance, Transition Capacitance, Diffusion Capacitance, p-n diode switching times, Zener Diode, Zener voltage regulator and its limitation.

Elementary treatment of SCR- UJT- Diac- Triac - Varactor diode - PIN diode - Tunnel diode.

UNIT – II

Diode Applications:

Diode as a circuit element, small signal diode models, Clipping and Clamping circuits, Clamping circuit theorem.

Half wave, Full wave and Bridge Rectifiers - their operation, performance characteristics- ripple factor calculations, and analysis; Filters (L, C, LC and CLC filters).

UNIT – III

Bipolar Junction Transistor:

Construction and Operation of NPN and PNP transistor, current components and current flow in BJT, Modes of transistor operation, Early effect, BJT input and output characteristics of CB, CE CC configuration- h-parameters.

BJT biasing techniques, stability factors, Bias compensation techniques, Thermal runaway, Thermal stability, BJT as an amplifier and as a switch.

UNIT – IV

Field Effect Transistors:

The Junction Field Effect Transistor, the Pinch-off Voltage V_P, V-I characteristics of JFET. JFET biasing-zero current drift biasing, biasing of FET, FET as an amplifier and as a switch.

MOSFETs: Enhancement & Depletion mode MOSFETs, V-I characteristics, MOSFET as resistance, Biasing of MOSFETs, MOSFET as a switch, Introduction to FinFET.

UNIT – V

Amplifiers:

Analysis of BJT circuits using h-parameters in various configurations - their comparison (approximate and exact analysis), Millers Theorem & its duality – application circuits, frequency response. Analysis of FET circuits using equivalent model for various configurations - their comparison.

Text Books:

1. Millman and Halkias, “ Electronic Devices and Circuits” 2nd Edition, McGraw Hill Publication 2007.
2. Robert L. Boylestad, “Electronic Devices and Circuit Theory”, 10th Edition, PHI, 2009.

Suggested Reading:

1. David Bell, “Fundamentals of Electronic Devices and Circuits”, 5th Edition, Oxford University Press 2008.
2. Jacob Millman, Christos Halkias, Chetan Parikh, “Integrated Electronics”, 2nd Edition, McGraw Hill Publication, 2009.
3. Christian Piguet, “Low Power CMOS Circuits Technology, Logic Design and CAD Tools” 1st Indian Reprint, CRC Press, 2010.

16EC C04

SIGNALS AND SYSTEMS

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

Course Objectives: *Students will be able to understand*

1. Signals and systems representation/classification and also the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. Sampling theorem, the time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transforms.
3. The concepts of convolution and correlation integrals and also the properties in the context of signals/systems.

Course Outcomes: *Students will able to*

1. Classify signals, systems and analyze the signals using Fourier series.
2. Understand signal spectrums and characterize the systems.
3. Represent the signals by generalized exponentials using Laplace transforms and evaluate LTI system characteristics.
4. Demonstrate conversion of continuous time signal to discrete time signal and obtain discrete system characteristics using DTFT and Z Transform.
5. Compare the signals using correlation.
6. Relate input and output response of the system using Convolution.

UNIT– I

Continuous Time Signals: Introduction to signals and their representations. Classification of signals. Introduction to systems and their classifications. Orthogonality of signals, Complete set of mutually orthogonal functions, Harmonic signals.

Signal Representation: Exponential Fourier series, Existence and Convergence. Symmetry conditions, Amplitude and Phase spectra. Properties of Fourier series. Power Spectral Density.

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UNIT – II

Signal Representation by Continuous Exponentials:

The direct and inverse Fourier transforms, Existence and properties of Fourier Transforms, Frequency spectrum. Fourier Transform of singularity functions and periodic signals. Energy Spectral Density, Filter characteristics of linear systems, Distortion less system, Phase delay and group delay. Causality and physical reliability: The Paley-weiner criterion.

UNIT – III

Signal Representation by Generalized Exponentials: The Bilateral and unilateral Laplace transforms. Region of convergence and its properties. Properties of Laplace transform, Inverse Laplace transform, Laplace transform of periodic signals, Applications to circuit analysis (RL, RC and RLC). LTI system: Impulse response, System transfer function, Stability and Causality.

UNIT – IV

Discrete Time Signals: Sampling of continuous time signals. DTS representation. Discrete Time Fourier Transform and properties.

Z–Transform: The Direct Z-Transform, Region of convergence and its properties. S–Plane and Z–Plane correspondence, Z–Transform properties. Inverse Z–Transform, Discrete LTI system: impulse response and system transfer function, Stability and Causality.

UNIT – V

Convolution: Continuous convolution, Graphical interpretation and its properties. Discrete convolution, Graphical interpretation and its properties.

Correlation: Continuous correlation: Cross correlation and Auto correlation, their graphical interpretation and properties. Discrete correlation: Cross correlation and Auto correlation, their graphical interpretation and properties.

Text Books:

1. B.P.Lathi, "Signals, Systems and Communications", BS Publications, 2008, 3rd Edition.
2. Alan V. Oppenheim,Alan S. Willsky,S.Hamid Nawad , "Signals and Systems" PHI 2nd Edition 2015.

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Suggested Reading:

1. Simon Haykin, “Signals and Systems,” Wiley India, 2009, 5th Edition.
2. M.J. Robert “Fundamentals of signals and systems”, McGraw Hill, 2008.
3. Narayana Iyer, “Signals and Systems”, Cengage learning, First Impression 2012.

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16EC C05

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

Instruction	4 Hours per week
Duration of Semester end Examination	3 Hours
Semester end Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: *Students will be able to understand*

1. The mathematical fundamentals necessary for understanding the electromagnetic theory.
2. The electrostatics and magnetics along with Maxwell's equations for EM Waves.
3. The concepts of transmission lines.

Course Outcomes: *Students will able to*

1. Comprehend mathematically the coordinate systems and solve simple static electromagnetic problems using various laws and theorems.
2. Understand Maxwell's equations in different forms (differential and integral) and apply them to diverse engineering problems.
3. Demonstrate the Electromagnetic wave properties with respect to different transmission mediums.
4. Compare the plane wave transmission and reflection at different boundaries.
5. Predict the behavior of reflection and refraction of the waves in different mediums.
6. Estimate the transmission line properties, reflection and matching concepts.

UNIT – I

Review of coordinate systems. Coulomb's Law, Electric field due to various Charge Distributions. Electric flux and flux density. Gauss Law: Integral form, point form and its applications. Work, Potential and Energy, Energy Density, Dipole, Laplace's and Poisson's equations. Current and Current Density, Continuity of current Equation, Relaxation Time.

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UNIT – II

Capacitance of Parallel plate, Coaxial and Spherical Capacitors.

Biot-Savart's law, Ampere's law: Integral form, point form and its applications. Stoke's theorem, Magnetic flux and magnetic flux density. Vector magnetic potential. Forces due to Magnetic Fields, Inductance: Self-inductance, calculation of inductance for simple structures.

UNIT – III

Time varying fields, Maxwell equations: Integral form and Point form. Boundary conditions.

Wave equations, Uniform plane waves in lossy and lossless medium. Skin Depth, Polarization, Instantaneous and average Poynting theorem and its applications.

UNIT – IV

Reflection and Refraction of Plane Waves - Normal and Oblique Incidence for both perfect Conductor and perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection.

Transmission Lines - I: Types, Parameters, Transmission Line Equations, Primary and Secondary Constants, Characteristics Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line. Impedance at any point on the transmission line.

UNIT – V

Transmission Lines - II: RF and UHF Lines, Open and short circuit lines

and their significance. Properties of Lines. Distortion and

distortion less transmission line, Concept of loading of a transmission line, Campbell's formula. Reflection and VSWR. Matching: Quarter wave transformer, Single Stub matching. Smith chart and its applications.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics" 6^{th} edition, 2015, Newyork Oxford University Press.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics" 8^{th} edition, 2016, TMH.
3. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems" 2^{nd} edition., 2000, PHI.

Suggested Reading:

1. "Networks Lines and Fields", John D. Ryder, 2^{nd} edition, 2015, PHI.

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16EC C06

ELECTRONIC WORKSHOP AND NETWORKS LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: *Students will be able to understand*

1. Understand the basic Concepts of Electric Circuits and equipment.
2. Understand the operation of CRO and LCR –Q meter.
3. Verify network theorems.
4. Design and verify Resonant circuits, Attenuators and passive filters.

Course Outcomes: *Students will able to*

1. Measure R,L,C components using electronic equipment.
2. Use CRO and power devices.
3. Conduct experiments on DC and AC circuits and also verify the network theorems.
4. Design passive filters.
5. Measure two port parameters.
6. Simulate a circuit using the simulation software.

EXPERIMENTS LIST

1. Study of RLC components, Bread board, Regulated power supply, Function generator, CRO.
2. Measurement of R, L, C components using LCR - Q Meter.
3. Soldering for simple circuits.
4. Verification of Ohm's law, KVL and KCL.
5. Verification of Superposition theorem and Tellegen's theorem.
6. Verification of Thevenin's and Norton's theorems.
7. Verification of Maximum power transfer theorem and Reciprocity theorem.
8. Verification of Transient Response in RC, RL circuits for DC inputs.
9. Design and Verification of Series Resonance.

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10. Design and Verification of Parallel Resonance.
11. Measurement of two-port network parameters (Z,Y,h,T).
12. Design and Verification of Attenuators.
13. Design & verification of Constant-K low-pass & high-pass filters.
14. Design & verification of m-derived low-pass & high-pass filters.

Note: Experiments are to be simulated by using any simulating software.

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16EC C07

ELECTRONIC DEVICES LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course objectives: *Students will be able to understand*

1. The V-I characteristics of diodes.
2. The design and performance evaluation of various diodes as rectifiers.
3. The characteristics of transistor in various configurations.
4. The design of various biasing techniques for transistors –BJT, JFET.
5. The analysis of amplifiers –BJT, JFET.
6. The behavior of various special diodes.

Course Outcomes: *Students will able to*

1. Recall the elementary concepts of diode, BJT, FET.
2. Classify and relate the performance of different types of rectifiers. Compare and contrast the biasing techniques, different configurations, characteristics of BJT & FET.
3. Model different amplifier circuits.
4. Examine different non-linear wave shaping circuits and draw an inference for their outputs. Distinguish different types of rectifying circuits and amplifier circuits and their performance parameters.
5. Choose the best configuration for the specifications provided.
6. Design, develop and improve the performance of the amplifier circuits.

List of Experiments:

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode characteristics and its application as voltage regulator.
3. Clipping and Clamping Circuits.

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4. Design, realization and performance evaluation of half wave rectifiers without filters and with filters(capacitor filter and π section filters).
5. Design, realization and performance evaluation of full wave rectifiers without filters and with C & section filters.
6. Plotting the characteristics of BJT in Common Base configuration and measurement of h-parameters.
7. Plotting the characteristics of BJT in Common Emitter configuration and measurement of h-parameters.
8. Plotting the characteristics of JFET in CS configurations and measurement of Transconductance and Drain resistance.
9. BJT biasing circuits.
10. FET biasing circuits.
11. Common Emitter BJT Amplifier and measurement of Gain, bandwidth, input and output impedances.
12. Common Source FET Amplifier and measurement of Gain, bandwidth, input and output impedances.
13. Emitter Follower / Source Follower circuits and measurement of Gain, bandwidth, input and output impedance.
14. Characteristics of special semi-conductor devices-UJT and SCR.
11. Characteristics of Tunnel diode and photo diode.

Suggested Reading:

1. Robert Diffenderfer, “Electronic Devices Systems and Applications”, Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, “Basic Electronics, A Text - Lab Manual”, 7th Edition, TMH 2001.

Note:

1. Wherever possible, Analysis and design of circuits should be carried out using SPICE tools.
2. A minimum of 12 experiments should be performed.

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16EG CO3

SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT LAB

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

Course Objectives: *Students will be able to understand*

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

Course Outcomes: *Students will able to*

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

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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16EC C08

DIGITAL LOGIC DESIGN

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

Course Objectives: *Students will be able to understand*

1. To learn various techniques for logic minimization.
2. To comprehend the concepts of various combinational circuits.
3. To understand the concepts of various sequential circuits.
4. To learn the fundamentals of Verilog HDL.
5. To learn the various abstraction levels in Verilog HDL.
6. To simulate and synthesize the process/concepts.

Course Outcomes: *Students will able to*

1.. The Various switching algebra theorems and minimization of switching functions.
2. The Structure of different digital logic elements like gates, multiplexers, encoders, decoders, adders and subtractors to build simple applications.
3. Different types of flip-flops and sequential circuits.
4. The Design of FSM.
5. The Design and simulation of various combinational and sequential logic circuits using Verilog HDL.
6. The Simulation and synthesis of digital logic design using Verilog HDL.

Unit-I

Introduction to Boolean algebra, Basic Postulates and theorems, Canonical forms and Standard forms, Simplification of switching function using theorems, Introduction to Logic Gates, Ex-OR, Ex-NOR operations. Minimization of Switching Functions: Karnaugh map method, Quine – McCluskey Tabular Minimization Method. Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

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Unit-II

Binary Arithmetic Circuits: Binary Adders, Subtractors and BCD adder.Code converters:Binary to Gray, Gray to Binary, BCD to excess3,BCD to Seven Segment display. Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Implementations of Logic Functions using Decoders and Multiplexers.

Unit-III

Introduction to Sequential Logic: Types of Flip-Flops, Excitation tables and Flip-Flop Conversions. Hold and setup times. Classification of sequential circuits. Shift registers and counters, Design of synchronous and asynchronous up/down counters, modulo-N counters.State Diagram, State Table, Mealy and Moore type FSM, Sequence Detection using FSM.

Unit-IV

Introduction to HDLs, Basic Concepts of Verilog HDL, Data Types, System Tasks and Compiler Directives. Gate Level Modelling: Gate Types and Gate Delays. Dataflow Modeling: Continuous Assignment and Delays. Design of Stimulus Block.

Unit-V

Behavioral Modelling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modelling.Introduction to tasks and functions.Design of Mealy and Moore state models using Verilog HDL.Introduction to Logic Synthesis.

Text books:

1. Morris Mano M. and Michael D.Ciletti, "Digital Design, With an Introduction to Verilog HDL" 5th edition, Pearson 2013.
2. Samir Palnitkar, "Verilog HDL,A guide to Digital design and synthesis", 2/e , Pearson Education, 2008.

Suggested Readings:

1. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.
2. Donald P. Leach, Albert Paul Malvino, GouthamSaha, "Digital Principles and applications" 6th edition Tata McGraw Hill.
3. ZhiKohavi,NirajK.Jha, "Switching and Finite Automata Theory" 3rd edition, Cambridge Press.

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16EC C09

ANALOG ELECTRONIC CIRCUITS

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

Course objectives: *Students will be able to understand*

1. The concept of multistage amplifiers and their analysis.
2. The concept of feedback amplifiers and their analysis.
3. The various multivibrators.
4. The various large signal amplifiers and their analysis.
5. The design and analysis of various tuned amplifiers.
6. The various regulators using transistors.

Course Outcomes: *Students will able to*

1. Define the high frequency model of BJT and FET.
2. Compare and contrast different types of multistage, feedback, power and tuned amplifiers.
3. Apply the concepts of BJT in multivibrators, feedback, multistage amplifiers and tuned amplifiers.
4. Categorize different types of feedback amplifiers, power amplifiers and voltage regulators.
5. Choose the best configuration for the specifications (like conversion efficiency in case power amplifiers, input and output impedance, resonating frequency and bandwidth).
6. Build narrow band amplifiers and improve the performance of the transistors voltage regulators.

UNIT – I

Multi stage amplifiers:

Multi stage amplifiers: CE-CE, CE-CB, CC-CC - Bootstrap, High frequency equivalent circuit– Analysis – BJT (f_T , f_β and gain band-width product) & FET, Amplifier Frequency response, Multistage amplifiers: low frequency and High frequency analysis of RC coupled, Transformer coupled and Direct coupled amplifiers with BJT and FET.

UNIT – II

Feedback amplifiers:

Feed Back Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, Voltage and current, series and shunt feedbacks. Stability considerations.

Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillator, LC oscillator, Crystal oscillator, Amplitude and frequency stability of oscillator.

UNIT III

Multivibrators:

Analysis and design of Transistor Multivibrators – Bistable, Monostable and Astable circuits. Operation of regenerative comparator (Schmitt Trigger).

UNIT – IV

Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Design considerations of transformer coupled and transformer less push-pull audio power amplifiers under Class-A, Class-B, Class D and Class-AB operations, Heat Sinks.

UNIT – V

Tuned Amplifiers:

General consideration, Analysis and design of single tuned, inductively coupled and double tuned types with BJT, selectivity, gain & bandwidth comparison of multistage single tuned and double tuned amplifiers, the problem of stability in RF amplifiers, Neutralization &unilaterisation staggered tuned amplifiers. Class B and Class C tuned amplifiers.

Regulators: Transistorized series and shunt regulators.

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2011.
2. Donald Schilling, Charles Belove, TuviaApelewicz Raymond Saccardi, "Electronic Circuits: Discrete and Integrated", TMH, 3rd Edition, 2012.

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Suggested Reading:

1. David Bell, “Fundamentals of Electronic Devices and Circuits”, 5^{th} Edition, Oxford University Press 2008.
2. Robert L. Boylestad, “Electronic Devices and Circuit Theory”, 10^{th} Edition, PHI, 2013.
3. Ben G Streetman and Sanjay Banerjee, “Solid State Electronic Devices”, 6^{th} Edition, Pearson Education, 2005.

16EC C10

ANALOG COMMUNICATION

Instruction	4 Hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: *Students will be able to understand*

1. The concept of modulation and also analyze continuous / pulse modulation schemes.
2. The design procedure of AM and FM transmitters and receivers.
3. The concept of noise and its effect on modulation schemes and also to estimate the figure of merit.

Course Outcomes: *Students will able to*

1. Understand the need for modulation, representation of various AM modulation schemes and further they will able to generate and demodulate various types of AM signals.
2. Represent, analyze and distinguish FM and PM signals and also they will be able to generate and demodulate FM signals.
3. Understand the functioning of transmitters. They will be able to evaluate the radio receiver characteristics. To understand the necessity of Pre-emphasis and De-emphasis in FM broadcasting.
4. Understand and analyze the concept of Random Variable and Random Process. Further they will be able to evaluate the Response of Linear Systems for random signals.
5. Know the various sources of noise. They will be able to represent and analyze noise. Further they can evaluate and compare its effect on analog modulation schemes.
6. Demonstrate the Sampling theorem and analyze various sampling processes. Further they will be able to understand the various pulse modulation schemes.

UNIT – I

Linear Modulation Schemes: Need for Modulation, Double Side Band Suppressed Carrier Modulation, Balanced Modulator, Ring Modulator, Coherent Detector and Costas Detector.Conventional Amplitude Modulation, Phasor Diagram of AM, Switching Modulator,Square Law

Modulator, Envelope Detector. Hilbert Transform and its Properties, Complex Representation of Signals: Pre-Envelope, Complex Envelope, Natural Envelope, Canonical Representation of Band Pass Signals. Single Side Band Modulation, Phase Shift Modulator,Vestigial Side Band Modulation.

UNIT – II

Non-LinearModulation Schemes: Angle Modulation, Frequency Modulation and Phase modulation, Concept of Instantaneous Phase and Frequency. Types of FM modulation: Narrow Band FMand Wide Band FM.FM Spectrum in Terms of Bessel Functions. Phasor Diagram of NBFM. Frequency Multipliers and Mixers. Direct and Indirect (Armstrong's) methods of FM Generation. Balanced Slope Detector and Foster–Seeley Discriminator for FM Demodulation. Introduction to PLL.

UNIT – III

Transmitters and Receivers: High Level and Low Level AM Transmitters.FM Transmitters. Principle and Operation of Tuned Radio Frequency and Super Heterodyne Receivers. Selection of RF Amplifier. Choice of Intermediate Frequency. Image Frequency and its Rejection Ratio, Receiver Characteristics: Sensitivity, Selectivity, Fidelity. Double Spotting, Tracking and Alignment. Pre-emphasis and De-emphasis.

UNIT – IV

Probability, Random Variables and RandomProcess : Probability, Joint and ConditionalProbability, Concept of Random Variables, Distribution and DensityFunctions and theirproperties: Binomial, Poisson, Uniform, Exponential, Gaussian and Rayleigh Distributions. Operations on RandomVariables:Moments about Origin and Central Moments. RandomProcess: Concept, Stationarity and Ergodicity, Auto CorrelationFunction, Spectral Characteristics : Power Spectral Density and itsProperties. Linear System withRandominputs:Random Signal Response of LinearSystem, Auto Correlation of Response.

UNIT – V

Noise : Noise Sources, Thermal Noise. White Noise andcoloured noise. Noise Temperature. Noise in Two-Port Network: Noise Figure, Equivalent Noise Temperature and Noise Bandwidth. Noise Figure and Equivalent Noise Temperature for Cascaded Stages. S/N Ratios and Figure of Merit Calculations for AM, DSB-SC and SSB systems.

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Pulse Analog Modulation Schemes: Sampling of low Pass and Band Pass Signals. Types of Sampling. Pulse Modulation Schemes: PAM, PWM and PPM.

Text Books:

1. Simon Haykin, “Communication Systems”,2nd Edition, Wiley India, 2011.
2. Peyton Z. Peebles JR., “Probability Random Variables and Random Signal Principles”, Tata Mc Graw Hill, edition, 4/e, 2002.
3. Herbert Taub, Donald L. Shilling &GoutamSaha, “Principles of Communication Systems,” 3rd Edition, TMH, 2008.

Suggested Reading:

1. Singh, R.P. and Sapre, S.D., “Communication Systems,” TMH, 2007.

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16EC C11

ANTENNAS AND WAVE PROPAGATION

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

Course Objectives: *Students will be able to understand*

1. The basic principles of an antenna and its parameters for characterizing its performance.
2. The fundamental concepts of various types of antennas, arrays for customizing the pattern parameters.
3. The propagation behavior of the radio wave in both troposphere and ionosphere.

Course Outcomes: *Students will able to*

1. Understand the basic parameters of an antenna.
2. Extend current distribution concept in order to estimate the field patterns.
3. Appraise the concepts of broad side and end fire arrays.
4. Identify the significance of antenna array with respect to working principle and radiation pattern.
5. Understand the working principle and characteristics of various antennas.
6. Study the behavior of radio waves in various modes of wave propagation.

UNIT – I

Principles of radiation, retarded potential and isotropic radiator, Basic antenna parameters: Radiation patterns, radiation intensity, far field, near field, gain and directivity, Antenna Polarization, effective aperture area and efficiency. Point sources, current distribution, infinitesimal dipole.

UNIT – II

Half-wave dipole, quarter wave monopole, Effect of earth on vertical patterns, Loop antenna, Far field pattern of circular loop with uniform current.

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Qualitative treatment of Helical Antennas: Axial mode pattern, wideband characteristics, radiation efficiency, Bandwidth.

UNIT – III

Arrays of point sources, two element array with equal and unequal amplitudes, different phases.Effect of inter element phase shift on beam scanning. Linear array with uniform distribution. Broadside and End fire arrays. Principle of pattern multiplication. Introduction to nonlinear arrays.

UNIT– IV

VHF, UHF Rhombic Antenna, Yagi - Uda Array, Design of Horn antenna, Parabolic Reflector and Cassegrain feed, Lens antennas. Log-Periodic antenna.Microstrip antennas: different types, advantages and disadvantages of Microstrip antennas, Design of rectangular Microstrip antennas.

UNIT – V

Ground wave propagation, Space and Surface waves, Tropospheric refraction and reflection, Duct propagation, Sky wave propagation: Critical frequency, Maximum Usable Frequency (MUF) and Skip distance, Introduction to regular and irregular variations in ionosphere. Friis transmission formula, Line of sight propagation.

Text Books:

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design," 3rd Edition, John Wiley, 2005.
2. John D. Krauss, Ronald J. Marhefka & Ahmad S. Khan, "Antennas and Wave Propagation," 4th Edition, TMH, 2010.
3. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2001.

Suggested Readings:

1. Chatterjee, R., "Antenna Theory and Practice", New Age Publishers, 2008.

16EC C12

ELECTRONIC INSTRUMENTATION

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

Course Objectives: *Students will be able to understand*

1. To impart a basic knowledge of International Standards for various physical quantities.
2. To provide a basic understanding of measurement systems and an in-depth understanding of measurement errors.
3. To expose the students to many varieties of transducers, measuring instruments, their Operating principles and construction.
4. To provide an idea of strengths and weaknesses of the various types of sensors and Transducers.
5. To introduce students to various types of spectrum analyzers, virtual instrumentation techniques and their applications.
6. To provide basic exposure to some of the prominent bio-medical Instrumentation systems.

Course Outcomes: *Students will able to*

1. Understand the various standards available for the measurement process.
2. Evaluate and perform accurate measurements for any engineering system with clear idea of the potential errors.
3. Understand the working principles of various transducers.
4. Select an appropriate transducer for given application.
5. Use instruments like spectrum analyzer, DSO and other virtual instrumentation techniques for appropriate measurements.
6. Understand the fundamentals of various Biomedical instrumentation systems.

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UNIT– I

Accuracy and Precision - Conformity and Significant figures, Resolution and Sensitivity,Types of Errors,Loading effect, Absolute errors and Relative errors, Measurement of error combinations, Statistical analysis,Probable error and Limiting errors, Calibration, IEEE standards, Elements of ISO 9001, Quality management standards.

UNIT – II

Classification of transducers, factors for selection of a transducer, Passive electrical transducers: Strain gauges - gauge factor, types of strain gauges - bonded and un-bonded, rosettes, LVDT - construction and displacement measurement, Capacitive transducer and thickness measurement. Active electrical transducers: Piezo-electric transducer and different modes of operation, photo-conductive, photo-voltaic and photo - emissive transducers, semiconductor stain gauges.

UNIT – III

Characteristics of sound, pressure, power and intensity levels. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermocouples. Introduction to Micro-Electro-Mechanical Systems (MEMS).

UNIT – IV

Block diagram, specification and design considerations of different types of DVMs. Spectrum analyzers. Delayed time base oscilloscope, Digital storage oscilloscope. Introduction to Virtual Instrumentation, SCADA. Data Acquisition System- block diagram.

UNIT – V

Human physiological systems and related concepts. Bio-potential electrodes Bio-potential recorders - ECG, EEG, EMG and CT scanners, magnetic resonance and imaging systems, Ultrasonic Imaging systems.

Text Books:

1. Albert D. Helfric, and William D. Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, PHI, 2010.
2. H S Kalsi, “Electronic Instrumentation”, 3/e, TMH, 2011.
3. Nakra B.C, and Chaudhry K.K., “Instrumentation, Measurement and Analysis”, TMH, 2004.

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Suggested Readings:

1. David A. Bell, "Electronic Instrumentation & Measurements" PHI, 2nd Edition, 2003.
2. Khandpur. R.S., "Handbook of Bio-Medical Instrumentation", TMH, 2003.
3. Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, "Biomedical Instrumentation and Measurements", PHI, 2nd Ed, 1980.

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16MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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

Course Objectives: *Students will be able to understand*

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

Course Outcomes: *Students will able to*

1. apply fundamental knowledge of Managerial economics concepts and tools.
2. understand various aspects of demand analysis and forecasting.
3. understand price determination for different markets.
4. study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
5. analyze different opportunities and come out with best feasible capital investment decisions.
6. apply accountancy concepts and conventions, Final accounts and financial analysis.

UNIT-I: Introduction to Managerial Economics

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

UNIT-II: Demand Analysis

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

UNIT-III: Production and Cost Analysis

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

UNIT-IV: Accountancy

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

UNIT-V: Capital Budgeting

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

Text Books:

1. Mehta P.L., "Managerial Economics –Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2013.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 2013.
3. Panday I.M. "Financial Management", Vikas Publishing House, 11th edition, 2015.

Suggested Readings:

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

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16EC C13

DIGITAL LOGIC DESIGN LAB USING VERILOG

Instruction	3Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: *Students will be able to understand*

1. To simulate and synthesize combinational logic circuits.
2. To simulate and synthesize sequential logic circuits.
3. To write a test bench for verifying the functionality of digital design.
4. To simulate various abstraction levels.
5. To learn and implement procedure for any digital design.

Course Outcomes: *Students will able to*

1. Design a Digital circuit using Verilog HDL.
2. Understand various abstraction levels of a digital design.
3. Verify the functionality of a design using Test bench.
4. Simulate and synthesize combinational logic circuits.
5. Simulate and synthesize sequential logic circuits.

Write a Verilog HDL to Simulate and Synthesize the following

1. Logic Gates.
2. Arithmetic Units: Adders and Subtractors.
3. Multiplexers and De-multiplexers.
4. Encoders, Decoders, Priority Encoder and Comparator.
5. Implementation of logic function using Multiplexers and Decoders.
6. Arithmetic and Logic Unit.
7. Flip-Flops.
8. Up, Down and UP/Down Counters.
9. Sequence Detector using Mealy and Moore type state machines.

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16EC C14

ANALOG ELECTRONIC CIRCUITS LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course objectives: *Students will be able to understand*

1. The basic knowledge of various multivibrators.
2. The design and analysis of the multistage amplifiers.
3. The frequency response and behavior of various feedback amplifiers.
4. The generation of analog signals using oscillators.
5. The design and analysis of power amplifiers.
6. The design concepts of tuned amplifiers and band width measurement.

Course Outcomes: *Students will able to*

1. Define the bandwidth of multistage amplifiers using BJT and FET.
2. Compare and contrast different types of multistage configurations, feedback, power, tuned amplifiers.
3. Apply the concepts of analysis of BJT and compare the results in the lab for multi-vibrators, feedback, multistage amplifiers and tuned amplifiers.
4. Categorize different types of feedback amplifiers, power amplifiers and voltage regulators.
5. Choose the best configuration for the specifications (like conversion efficiency in case power amplifiers, input and output impedance, resonating frequency and band-width).
6. Build narrow band amplifiers and improve the performance of the transistors voltage regulators.

ANALOG CIRCUITS LAB

1. Design and development of Astable multivibrator.
2. Design and development of Monostable multivibrator.
3. Design and development of Bistable multivibrator.

4. Design and development of Schmitt Trigger.
5. Design and development of Voltage to Frequency converter.
6. Design andfrequency response of Single stage and Multistage RC - Coupled amplifier using BJT.
7. Design andfrequency response of Single stage and Multistage RC - Coupled amplifier using FET.
8. Voltage series feedback amplifier.
9. Voltage shunt feedback amplifier.
10. Current series feedback amplifier.
11. Current shunt feedback amplifier.
12. RC Phase Shift Oscillator.
13. Hartley Oscillator &Colpitts Oscillator.
14. Design of Class-A power amplifier.
15. Design of Class-B power amplifier.
16. Tuned Amplifiers (Single and Double).

Suggested Reading:

1. Robert Diffenderfer, "Electronic Devices Systems and Applications", Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, A Text - Lab Manual", 7th Edition, TMH 2001.

Note:

1. Wherever possible, Analysis and design of circuits should be carried out using SPICE tools.
2. A minimum of 12 experiments should be performed.

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16EC C15

ANALOG COMMUNICATION LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course objectives: *Students will be able to understand*

1. The concepts of various modulation schemes like AM, FM &PM.
2. The generation & detection methods of FM and AM.
3. The principles of various AM and FM transmitters and receivers.
4. The representation and analysis of various noise sources.

Course Outcomes: *Students will able to*

1. Demonstrate the generation and detection of various analog modulated signals.
2. Understand the sampling concept and further they can generate and detect various pulse modulated signals.
3. Obtain and analyze frequency response of Pre-Emphasis and De-Emphasis circuits.
4. Evaluate Mixer, Radio receiver and PLL characteristics.
5. Understand the concept of multiplexing and also can compare FDM and TDM techniques.
6. Estimate the Power spectral density of noise and Signal to Noise ratio and further able to analyze spectrums of AM and FM signals.

List of Experiments

1. AM signals generation and detection.
2. Generation of DSB-SC using Balanced modulator.
3. SSB Modulation and Demodulation.
4. FM generation and detection.
5. Frequency response of Pre-Emphasis and De-Emphasis circuits.
6. Evaluation of Radio Receiver characteristics.
7. Sampling of continuous time signal and its Reconstruction (PAM).
8. Frequency division Multiplexing and De-Multiplexing.

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9. Time division Multiplexing and De-Multiplexing.
10. PWM Modulation and Demodulation.
11. PPM Modulation and Demodulation.
12. Determination of PLL Characteristics.
13. Analysis of Mixer Characteristics.
14. Spectral Analysis of AM and FM signals using Spectral Analyzer.

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16ECC18

DIGITAL COMMUNICATION

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To make the student learn the different techniques involved in digital transmission of analog signals.
2. To give the student an understanding of the various concepts of information theory and source coding schemes.
3. To make the student know about the need for error control coding.
4. To facilitate the student to understand various methods of generating and detecting different types of error correcting codes.
5. To enable the student to interpret the performance of digital modulation schemes.
6. To make the student learn various spread spectrumtechniques.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand the concept of pulse digital modulation schemes and compare their performance.
2. Interpret the concept of information theory and apply source coding schemes.
3. Demonstrate various error control schemes.
4. Develop the encoding and decoding techniques to detect and correct the errors.
5. Evaluate the performance of digital modulation schemes with probability of error.
6. Identify and apply spread spectrum modulation techniques.

UNIT-I

Digital Transmission of Analog Signals: Elements of a digital communication system, Uniform quantization, PCM system, Bandwidth requirement of PCM system, Noise in PCM Systems, Non- uniform quantization, TDM-PCM system. Differential quantization, Differential PCM system, Delta Modulation, Noise in DM system, ADM. Comparison of PCM ,DPCM,DM and DM schemes.

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UNIT-II

Information Theory: Uncertainty, Information and Entropy, Source coding: Source coding theorem, Shannon – Fano algorithm and Huffman coding. Discrete memoryless channels, Types of channels, cascaded channels, mutual information, Channel capacity, Information rate and Information capacity, Rate distortion theory.

UNIT-III

Error Control Coding: Need for error control coding, Types of transmission errors. Linear Block Codes (LBC): description of LBC, generation, Syndrome and error detection, minimum distance of a block code, error detecting capabilities and error correcting, Standard array and syndrome decoding.

Binary cyclic codes (BCC): description of cyclic codes, encoding, decoding and error correction of cyclic codes using shift registers, Convolution codes: description, encoding, decoding: Exhaustive search method and sequentialdecoding.

UNIT-IV

Digital Carrier Modulation Schemes: Optimum receiver for Binary Digital Modulation Schemes, Binary ASK, PSK, DPSK, FSK signaling schemes and their error probabilities. Introduction to MSK, Comparison of Digital Modulation Schemes. Introduction to M-ary Signaling Schemes, M-ary coherent PSK, QPSK, Synchronization methods.

UNIT –V

Spread-Spectrum Modulation: Need for spreading a code, generation and properties of PN sequence. Direct Sequence Spread Spectrum, Frequency Hopping spread spectrum systems and their applications.

Synchronization in Spread Spectrum Modulation: Acquisition and Tracking of Frequency Hopping spread spectrum and Direct Sequence Spread Spectrum systems.

Text Books:

1. Sam Shanmugham.K., "Digital and Analog Communication Systems," Wiley, 2012.
2. Simon Haykin, "Communication Systems," 4/e, Wiley India, 2011.
3. Herbert Taub, Donald L. Shilling &GoutamSaha, "Principles of Communication Systems," 4/e, Tata McGraw-Hill Education 2013.

Suggested Readings:

1. John Proakis, MassoudSalehi,"Digital Communications" 5/e , McGraw-Hill Higher Education, 2007.
2. R.P. Singh, S.D. Sapre, "Communication Systems", 2/e, Tata McGraw-Hill Education, 2008.

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16ECC19

INTEGRATED CIRCUITS AND APPLICATIONS

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To learn the concept of Op-Amp and its characteristics.
2. To impart the linear and nonlinear applications of operational amplifier.
3. To impart the theory and applications of 555 IC Timer, IC regulator and PLL.
4. To introduce the concepts of Data converters.
5. To analyze combinational and sequential circuits with ICs.
6. To introduce the concepts of memories, PLDs.

Course Outcomes:

Student will be able to:

1. Understand the basic construction, characteristics and parameters of Op-Amp.
2. Analyze the linear and nonlinear applications of Op-Amp.
3. Understand the concepts of IC555 timer, IC723 regulator and PLL.
4. Classify and describe the characteristics of different logic families
5. Design the Combinational and Sequential circuits with ICs.
6. Understand the concepts of memories, design of PLD's.

UNIT – I

Introduction to ICs: Integrated circuits classification, Integrated circuit package types, pin identification and temperature ranges.

Operational Amplifier: Op-Amp block diagram, ideal Op-Amp Characteristics, Op-Amp parameters: Input offset voltage, Output offset voltage, input offset and bias currents, Slew rate, CMRR and PSRR.

UNIT – II

Op-Amp Applications : Inverting and Non-inverting amplifiers with ideal and non-ideal Op-amps, Voltage Follower, Difference Amplifier, Summing Amplifier, ideal and practical Integrator and differentiator, Voltage to Current and Current to Voltage converters, Sample and Hold circuit. Comparator, Schmitt Trigger with and without reference voltage, Triangular waveform generator.

UNIT – III

555 Timer: Functional diagram. Modes of operation: Monostable, Astablemultivibrators, applications of 555 Timer.

Regulators: Analysis and design of regulators using IC 723.

PLL: Operation, lock range, Capture range, PLL applications: Frequency multiplier and frequency translator.

Data Converters: Specifications, DAC- Weighted Resistor, R-2R Ladder, ADC- Parallel / Comparator, Successive Approximation and Dual Slope.

UNIT – IV

Logic families: Digital IC characteristics. TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series characteristics, CMOS transmission gate, CMOS open drain and high impedance outputs. Comparison of TTL and CMOS logic families.

Combinational Circuits: Design using TTL-74XX or CMOS 40XX series: Decoders, drivers for LED, Encoder, priority encoder, Multiplexer and their applications, Demultiplexer, Digital comparator, Parallel and serial binary adder, Subtractor circuits using 2's complement. Carry look-ahead adder, BCD adder.

UNIT – V

Sequential Circuits: Design using TTL-74XX or CMOS 40XX series: Synchronous and Asynchronous counters, Cascading of BCD counters, applications of counters, Shift register and applications.

Memories: Memory Terminology, ROM, RAM types, Architectures, operation and applications, Expanding word size and capacity, Introduction to PLD's, PAL and PLA.

Text Books:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits," 4/e, PHI, 2010.
2. Ronald J. Tocci, Neal S. Widmer& Gregory L.Moss, "Digital Systems: Principles and Applications." PHI, 10/e, 2011.

Suggested Reading:

1. K.R.Botkar, "Integrated Circuits," 10/e, Khanna Publishers, 2010.
2. Roy Chowdhury D, Jain S.B, "Linear Integrated Circuits,"4/e, New Age International Publishers, 2010.
3. Jain R.P., "Modern Digital Electornics."4/e, TMH, 2011.

16ECC20

MICROPROCESSORS AND MICROCONTROLLERS

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the architecture and instruction set of 8086 microprocessor.
2. To familiarize the assembly language programming of 8086.
3. To understand the difference between assembler, emulator and debugger.
4. To understand the 8051 microcontroller concepts and applications of microcontrollers.
5. To familiarize programming aspects of 8051 both in assembly and C language.
6. To interface various peripherals to 8051 microcontroller.

Course Outcomes:

Students will be able to:

1. Understand the architecture of 8086 microprocessor and 8051 microcontroller.
2. Write an assembly language program for different applications by using instruction set of 8086 microprocessor.
3. Understand different programmable peripheral devices for a given application.
4. Distinguish between Microprocessor and Microcontroller based systems.
5. Identify and explain the operations of peripherals, typically used with interfacing microprocessors / microcontrollers.
6. Develop the microcontroller based programs for various applications.

UNIT – I

Microprocessors: Introduction to Microprocessor, 8086/8088 Architecture, pin description, Physical Memory Organization, Minimum mode 8086 system and timings, Maximum mode 8086 system and timings, Addressing modes, Instruction formats, Instruction set of 8086.

UNIT – II

Assembly language programming using 8086: Assembler directives and operators, Programs using data transfer, arithmetic, logical, branching and ASCII instructions. String processing, Stack, Interrupt Structure, Procedures and Macros, Introduction to assemblers and debugging tools. Brief overview of x86 series microprocessors.

UNIT – III

Interfacing with 8086: Semiconductor memory interfacing, Dynamic RAM interfacing, Interfacing I/O ports, PPI 8255, Modes of operation of 8255.
Special purpose programmable devices: Programmable interval timers (8253/8254), DMA controller (8257), Serial and parallel data transmission formats, Programmable communication interface (8251) USART, Programmable interrupt controller (8259).

UNIT – IV

Microcontrollers: Microprocessors vs Microcontrollers, Internal architecture of 8051 and its pin configuration, Memory organization. Addressing modes and bit addressable features. 8051 instruction set: Data transfer, arithmetic, logical and branching groups. Interrupt and I/O port structures and their operations. Basic assembly language programming with 8051.Introduction to 8051 programming in C language.

UNIT – V

8051 on-chip peripherals and their programming: Timer programming in assembly and C, serial port programming in assembly and C, Interrupt programming in assembly and C.

Interfacing with 8051: 8051 interfacing to external memory, Expansion of I/O ports - Interfacing with the PPI 8255.Interfacing ADC, 7 segment display, LCD module and Stepper motor with 8051.

Text Books:

1. Ray A.K and Bhurchandhi K.M, "Advanced microprocessor and peripherals", 3rd edition, TMH 2012.
2. Ayala K.J,"The 8051 Microcontroller Architecture, programming and Application", Penram International, 2007.
3. Mazidi M.A, Mazidi J.G and Rolin D Mckinlay, "The 8051 Microcontroller and Embedded systems using Assembly and C", 2nd edition, Pearson education 2007.

Suggested Readings:

1. Douglas V Hall, "Microprocessors and Interfacing Programming and Hardware", revised 2nd edition, THM 2007.
2. Ajay V. Deshmukh, "Microcontrollers – theory and applications", Tata McGraw-Hill Companies – 2011.

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16ECC21

CONTROL SYSTEMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce various control systems and their equivalent mathematical models, block diagrams and signal flow graphs.
2. To familiarize with the time response analysis of different systems.
3. To introduce the system analysis using Routh-Hurwitz and root locus techniques.
4. To illustrate various frequency domain techniques for the system analysis.
5. To familiarize compensators and controllers of a control system.
6. To introduce the state space analysis of a system.

Course Outcomes:

After completion of this course, a student will be able to:

1. Find the transfer function of a system represented by a block diagram and signal flow graph.
2. Evaluate the time domain specifications and steady state error of a system.
3. Analyze the stability of a system.
4. Analyze the system in frequency domain.
5. Compare various controllers and compensators.
6. Apply State Space Concept to analyze and design a control system.

UNIT-I

Control System Fundamentals: Classification of control systems, Open and Closed Loop control systems, Block diagram reduction and signal flow graphs, Mathematical modeling of a Mechanical system and conversion into electrical System.

UNIT-II

Time Response Analysis: Transfer function and Impulse Response, Types of Inputs, Transient Response of first and second order system with different inputs, Time domain Specifications. Types of Systems, static error coefficients, error series, PD, PI and PID controllers.

UNIT-III

Stability Analysis: Routh-Hurwitz criteria for stability. Root Locus Techniques, Analysis of typical systems using root locus techniques, Effect of location of roots on system response.

UNIT-IV

Frequency Response Analysis: Frequency domain specifications,Bode plot, Principle of Argument, Nyquist plot and stability criterion, Gain and Phase Margins from the Bode and Nyquist diagrams.

Lead and Lag compensators.

UNIT-V

State Space Analysis: Concept of State, State Variable, State vector and State space. State space representations of linear time invariant systems, State transition matrix, Solution of state equation, Controllability, Observability and Design of control systems using state variable feedback.

Text Book:

1. I.J.Nagrath and M.Gopal, "Control Systems Engineering", New Age International Publishers, 5/e 2012.
2. Benjamin C. Kuo, "Automatic Control Systems", 7/e, PHI, 2010.

Suggested Reading:

1. K. Ogata, "Modern Control Engineering", EEE, 5/e, PHI, 2003.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11/e Pearson 2008.
3. GopalMadan, "Digital control engineering", 1/e, New age publishers, 2008.

16ECE01

COMPUTER ORGANIZATION AND ARCHITECTURE

(Elective-I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To design and understanding of the different basic components of a computer system.
2. To understand fixed and floating point arithmetic algorithms.
3. To understand Instruction set, Instruction codes and Assembly Language.
4. To design and synthesize new and better computer architectures.
5. To understand input/output mechanisms.
6. To understand various parts of system memory hierarchy.

Course Outcomes:

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

1. Discuss the basic structure and organization of computer system.
2. Apply fixed and floating point arithmetic algorithms.
3. Explain Instruction cycle, register transfer and micro operations.
4. Discuss about RISC/CISC architectures, pipeline and vector processing.
5. Explain Input/output organization.
6. Discuss about Memory organization and Management.

Unit - I

Data Representation and Computer Arithmetic: Introduction to Computer Organization and architecture, Fixed point representation of numbers, Digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non restoring algorithms, Floating point representation with IEEE standards.

Unit - II

Basic Computer Organization and Design: Instruction codes, stored program organization, Computer registers and common bus system, Computer instructions: Timing and Control, Instruction cycle, Fetch and Decode, Register reference instructions, Memory reference instructions, I/O and Interrupt: Configuration, Instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, Address sequencing, Micro instruction format.

Unit - III

Central Processing Unit: Introduction, General register organization, Stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control, CISC and RISC: Features and Comparison,Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Basics of Vector processing and Array Processors.

Unit - IV

Input-Output Organization: Peripheral devices, I/O interface: I/O Bus and interface modules, I/O versus Memory Bus, Isolated versus memory mapped I/O, Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer, Modes of Transfer: Programmed I/O, Interrupt initiated I/O, Priority interrupt: Daisy chaining, Parallel Priority interrupt, Input- Output Processor: CPU-IOP communication, I/O channel.

Unit - V

Memory Organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory, mapping functions: direct, associate and set associate. Virtual memory: address mapping using pages, Page replacement, Memory management hardware: Segmented Page mapping, Memory protection.

Text Books:

1. MorisMano.M.,"Computer System Architecture," 3/e, Pearson Education, 2017.
2. Hamachar, VranesicZyonks, safeazak, "Computer Organization," 5/e, McGraw Hill, 2007.

Suggested Reading:

1. William Stallings, "Computer Organization and Architecture: Designing for performance," 7/e, Pearson Education, 2006.
2. John P.Hayes, "Computer Architecture and Organization," 3/e,TMH, 1998.

16EC C22

DIGITAL COMMUNICATION LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. Carry out experiments on various pulse digital modulation techniques.
2. Perform different line coding techniques.
3. Conduct the experiment to identify errors in cyclic codes
4. Work on convolutional encoder and decoder for controlling the errors.
5. Execute experiments on digital carrier modulation techniques.
6. Study the characteristics of MODEM.

Course outcomes:

Upon completing this course, students will be able to:

1. Experiment with various pulse digital modulation techniques.
2. Examine different line coding techniques.
3. To detect and correct errors in cyclic codes.
4. Assess the errors in convolutional encoder and decoder.
5. Demonstrate digital carrier modulation techniques experimentally.
6. Know the importance of MODEM characteristics.

List of Experiments

1. PCM generation and detection.
2. Data formats / Line coding.
3. Linear Delta Modulation and demodulation.
4. Adaptive Delta Modulation and demodulation.
5. Error detection and correction in cyclic codes.
6. Convolutional encoder and decoder.
7. ASK generation and detection.
8. FSK generation and detection.
9. BPSK generation and detection.
10. QPSK generation and detection.
11. Minimum Shift Keying generation and detection.
12. MODEM characteristics.

Reference Book:

1. Department Laboratory Manual.

Sample Mini Projects:

1. Develop a code for different digital modulation schemes and verify through simulation.
2. Design different Line coding schemes using logic Gates

16ECC23

INTEGRATED CIRCUITS AND APPLICATIONS LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. Tolearn the configurations and parameters of the 741 Op-Amp.
2. To explain the circuits of linear and nonlinear applications of Op-Amp
3. To know the concepts of IC555 timer, IC723 and data converters.
4. To know the various characteristics of TTL and CMOS gates.
5. To learn combinational and Sequential circuits using digital ICS.
6. To know the difference between linear and digital ICs.

Course Outcomes: Students will be able to

1. Analyze the configurations, parameters of Op-Amp (IC741).
2. Demonstrate the circuits of Op-Amp for various applications.
3. Analyze and design the circuits using IC555 timer, IC723 and data converters.
4. Analyze the characteristics of TTL and CMOS gates
5. Analyze and design various combinational circuits using digital ICs.
6. Analyze and design various sequential circuits using digital ICs.

Lab Experiments

Part-A: **Linear IC Experiments**

1. Voltage Follower, Inverting and Non Inverting Amplifiers using Op-Amp.
2. Measurement of Op-Amp parameters
3. Arithmetic Circuits using Op-Amp
4. Waveform generation using Op-Amp.
5. Astable, Monostable multi vibrators using IC555Timer.
6. Low and High Voltage Regulators using IC723.
7. D to A Converter using R-2R ladder.

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Part-B: Digital IC Experiments

1. Measurement of various characteristic parameters of TTL and CMOS gates.
2. Logic function Implementations using Decoders.
3. Logic function Implementations usingMultiplexers
4. Binary adder and subtractor, BCD adders using ICs.
5. Design of Synchronous, Asynchronous up/down counters.
6. Shift registers and ring counter using ICs.
7. Interfacing counters with 7-segment LED display units.

General Note: At least 6 experiments from eachpart.
Reference Book: Laboratory Manual.

Mini Project cum Design Exercise(s):
To realize and design a Mini project using either linear or digital or combination of linear and digital IC's

Sample Mini Projects:

a) Design and implementation of a Digital clock.
b) Design and implementation of a Security Monitoringsystem.
c) Design and implementation of Binary Multiplier
d) Design and implementation of a Water level indicator using 555 IC
e) Design and implementation of FSK Modulator using 555 IC

ECC24

MICROPROCESSOR AND MICROCONTROLLER LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To develop and understand the assembly language programming concepts of 8086 Microprocessor.
2. To understand the difference between assembler, emulator and debugger.
3. To Interface different programmable controllers to 8086 microprocessor.
4. To Interface a microcontroller to external input/output devices and perform its programming.
5. To develop and understand the embedded C programming concepts of 8051 microcontroller.
6. To control the operation of various peripherals by using 8051 microcontrollers.

Course Outcomes:

Students will be able to:

1. Write the 8086 assembly language programs on arithmetic, logical operations and DOS function calls.
2. Know about different assemblers available for programming 8086 microprocessor.
3. Understand the advantage of various debugging tools available to program 8086 microprocessor.
4. Write and test embedded C programming on interfacing modules with 8051.
5. Learn the hardware and software interaction and integration.
6. Design and develop the 8051 based embedded systems for various applications.

I. List of Experiments

1. Study and use of 8086 microprocessor trainer kit and simple programs under different addressing modes.
2. Multiplication and division programs.
3. Single byte, multi byte binary and BCD addition, subtraction.
4. Code conversion.
5. Sorting and string search.

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6. Interfacing traffic signal controller using 8086.
7. Familiarity and use of 8051 microcontroller trainer kit and simple programs under different addressing modes.
8. Timer and counter operations and programming using 8051.
9. Interfacing applications using LED, switch, relay and buzzer
10. Interfacing ADC using 8051.
11. Generation of waveforms using DAC by interfacing it with 8051.
12. Program to control stepper motor using 8051.
13. Interfacing 7-segment display using 8051.
14. Interfacing LCD using 8051.

II. Mini Project cum Design Exercise(s):

Design and realize a mini project on 8086/ 8051 based interfacing for a given specification.

(Ex: Interfacing hex keypad to 8086 through keyboard and display controller (8279), Interfacing Elevator, Interfacing Real time clock etc.)

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16ECC25

EMBEDDED SYSTEM DESIGN

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To learn the fundamentals of the embedded system design.
2. To provide in depth understanding - ARM processor fundamentals and instruction set.
3. To learn architecture details of ARM 7 microcontrollers.
4. To interface various I/O devices to ARM 7 microcontroller.
5. To understand embedded system design environment.
6. To analyze various embedded applications and debugging tools.

Course Outcomes:

Students will be able to:

1. Know the fundamentals of the embedded system design.
2. Understand the ARM architecture and its instruction set.
3. Analyze various features of ARM7 microcontroller.
4. Able to interface various I/O devices to ARM 7 microcontroller.
5. Understand the Embedded system design cycle
6. Develop and Debug various embedded system applications.

UNIT – I

Introduction to Embedded systems: Embedded systems vs General computing systems, Classifications, Applications areas, Processor embedded into a system, Processor selection for embedded system, Embedded hardware units and devices in a system, Design metrics and Challenges in embedded system design. ARM design philosophy.

UNIT – II

ARM Processor Fundamentals: Register organization, Program Status Register, Pipeline, Introduction to exceptions.

ARM Instruction set: Data processing instructions, Branch instructions, Load-Store instructions, Software interrupt instruction, Program Status Register instructions, Loading constants, and Conditional executions. Introduction to THUMB instructions: Differences between Thumb and ARM modes, Register usage.Introduction to ARM C Programming.

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UNIT – III

ARM 7 Microcontroller (LPC2148)**:** Salient features of LPC 2148, Pin description of 2148, Architectural Overview. **ARM 7**(LPC2148) **Peripherals:** Description of General Purpose Input/Output (GPIO) ports, Pin control Block. Features, Pin description, Register description and operation of PLL, Timers, PWM, Interfacing: LED, Relay, Buzzer, LCD, DAC, DC motor. Communication protocols: Brief overview on I2C, SPI, and CAN.

UNIT – IV

Embedded System Design Cycle: Embedded system design and co-design issues in system development process, Design cycle in the development phase for an embedded systems. Embedded software development tools: Host and Target machines, Linker/Locators for embedded software, Embedded software into the target system.

UNIT – V

Debugging tools and Applications: Integration and testing of embedded hardware, Testing methods, Debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, Simulator, Emulator and In-Circuit Emulator, IDE, RTOS services, VxWorks features. Case Studies: Embedded system design for automatic vending machines and digital camera.

Text Books:

1. Raj Kamal, "Embedded Systems-Architecture, Programming and Design," 3/e, Tata McGraw Hill Education, 2015.
2. Andrew N.SLOSS, DomonicSymes, Chris Wright "ARM System Developers Guide- Designing and optimizing system software" ELSEVIER 1st Edition, 2004.
3. Steve Furber "ARM System On Chip Architecture" 2/e Pearson education, 2000.

Suggested Readings:

1. David E.Simon, "An Embedded software primer", Pearson Education,2004.
2. ARM 7 (LPC 214x) user manual from Philips semiconductors

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16ECC26

DIGITAL SIGNAL PROCESSING

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. Discrete-time signals in the frequency domain using DTFT and DFT.
2. Implementation of the FFT algorithms and its applications.
3. Design digital IIR and FIR filters for the given specifications.
4. The basics of Multirate digital signal processing and its applications
5. DSP processor architecture for the efficient implementation of DSP applications.
6. Decimator and interpolator on DSP Processor.

Course Outcomes:

Students will be able to:

1. Understand the concept of DTFT and DFT for signal processing applications.
2. Implement linear filtering using FFT.
3. Design and implement FIR and IIR filters for the given specifications.
4. Interpret the concepts of Multirate digital signal processing and its applications.
5. Demonstrate the design of digital filters using DSP Processor.
6. Examine the functionality of decimator and Interpolator on DSP Processor.

UNIT-I

Discrete Fourier Transform: Overview of Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Properties of DFT, Efficient computation of DFT-Fast Fourier Transform (FFT) algorithms: Radix-2 FFT algorithms – Decimation in Time, Decimation in Frequency algorithms, Inplace computation, bit reversal algorithm. Use of FFT algorithms in linear filtering.

UNIT-II

FIR Filter Design: Amplitude and Phase responses of FIR filters – Linear phase FIR filters – Windowing technique for design of FIR filters – Rectangular, Bartlet, Hamming, Blackman, and Kaiser Windows. Realization of digital filters-Direct form-I and II, cascade and parallel forms of IIR filters, Realization of linear phase FIR filter, Finite word length effects.

UNIT-III

IIR Filter Design: Butterworth and Chebyshev approximation, IIR digital filter design techniques- Impulse Invariant transformation, Bilinear transform techniques, Digital Butterworth and Chebyshev filters, Spectral transformation techniques. Comparison between FIR and IIR filters.

UNIT- IV

Multirate Digital Signal Processing: Introduction -Decimation by a Factor -D, Interpolation by a Factor -I, Sampling Rate Conversion by a Rational Factor -I/D. Implementation of Sampling Rate Conversion, Multistage implementation of Sampling Rate Conversion, polyphase decomposition, Noble Identities, Application of Multirate Signal Processing.

UNIT-V

DSP Processors: Introduction, Difference between DSP and General Purpose Processor architectures, need for DSP processors. General purpose DSP processor-TMS320C67XX processor, architecture, functional units, pipelining, registers, linear and circular addressing modes, instruction set.

Text Books:

1. Alan V. Oppenheim & Ronald W. Schafer, "Digital Signal Processing," PHI, 2/e, 2010.
2. John G. Proakis&Dimtris G. Manolakis, "Digital Signal Processing Principles, Algorithms and Application," PHI, 4/e, 2012.
3. RulphChassaing, "Digital Signal Processing and Applications with the C6713 and C6416 DSK", John wiley& sons, 2005.

Suggested Reading:

1. Sanjit K Mitra,"Digital Signal Processing, A computer based approach", TMH, 3/e, 2011.
2. TarunkumarRawat, "Digital Signal Processing", First edition, Oxford, 2015.
3. Avtar Singh & S. Srinivasan, "Digital Signal Processing Implementation using DSP microprocessors", Thomson Brooks, 2/e, 2004.

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16ECC27

MICROWAVE ENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
redits	3

Course Objectives:

1. To understand importance of microwaves and their applications.
2. To analyze and solve wave equations for both guided waves and waveguides.
3. To learn scattering parameters which are used to characterize microwave network.
4. To understand the principle and operation of microwave sources.
5. To know various microwave solid state devices and their characteristics.
6. To understand microwave power measurement techniques.

Course Outcomes:

Students will be able to:

1. Apply the wave equations and their solutions to analyze the waves between parallel planes and waveguides.
2. Determine the scattering matrix for various microwave components.
3. Analyze the interaction of electron beam, RF field for various microwave sources.
4. Know the characteristics of IMPATT and TRAPATT diodes.
5. Understand the microwave power measurement techniques.
6. Gain the knowledge on microwave applications.

UNIT – I

Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves.

Guided Waves: Waves between parallel planes. TE and TM waves. Characteristics of TE and TM waves,TEM waves. Velocity of propagation, Wave impedance, Attenuation in parallel plane guides.

UNIT - II

Rectangular Waveguides: Rectangular waveguides, TM and TE waves, Impossibility of TEM wave in waveguides. Power transmission and Power Losses. Wave Impedance, Attenuation factor and Quality factor of rectangular waveguides.

Circular Waveguides: Solutions of wave equations in cylindrical coordinates, Characteristics of TM and TE modes.

Microwave Cavities - Rectangular and Circular cavity resonators, Quality factor and applications of cavity resonator.

UNIT - III

Microwave Circuits and Components: Concept of microwave hybrid circuit, Introduction to scattering parameters. Properties and S-parameters of reciprocal

components- E and H Plane Tees, Magic Tee, Directional Coupler. Properties of Waveguide Corners, Twists and Bends.Hybrid ring.
Waveguide Attenuators - Different types, Resistive Card and Rotary Vane attenuator;
Waveguide Phase Shifters - Different types, Dielectric and Rotary Vane phase shifter.
Non reciprocal components: Ferrites – Composition and Faraday rotation; Ferrite components - Isolators, Gyrators and Circulators. S-parameters of Isolator and Circulator.

UNIT- IV
Microwave Tubes: Limitations of conventional tubes at microwave frequencies. Microwave tubes-O type and M type classifications.
O-type tubes: Two Cavity Klystron, Velocity modulation process, Bunching process. Output Power and Beam loading. Multi cavity Klystron Amplifiers. Reflex Klystron-Velocity Modulation, power output and efficiency, Electronic Admittance.
Helix TWT: Slow wave structures, Principle of operation and applications of helix TWT (qualitative treatment only).
M-type tubes: Introduction, Magnetron Oscillators, different types, ð-mode of operation, frequency pushing and pulling effects and their remedies. Cross field amplifier and BWO.

UNIT – V
Microwave Solid State Devices: Introduction, Transfer Electronic Devices- Gunn diode, RWH theory-Differential negative resistance and two valley model theory. Gunn oscillation modes.Applications of PIN and Varactor diode.
Avalanche Transit time devices: Introduction, IMPATT and TRAPATT diode – physical structure, negative resistance, power output and efficiency (qualitative treatment only).
Measurement of Power: Measurements of low, medium and high microwave power. Basic principles of Reflectometer.

Text Books:

1. E. C. Jordan & Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", 2/e, Pearson Education, 2006.
2. Samuel Y. Liao, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.

Suggested Reading:

1. Rizzi P, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2. Annapurna Das and Sisir K Das "Microwave Engineering" 1/e, 2000, Tata McGraw-Hill.
3. Herbert J.Reich, John G.Skalnik, Philip F. Ordung, Herbert L. Krauss," Microwave Principles", East-West Pvt. Ltd. Madras.

16ECC28

WIRELESS MOBILE COMMUNICATION

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To make the student understand the wireless communication systems and features of 4G mobile standards and their comparison with 1G, 2G, 2.5G and 3G technologies.
2. To give the student an understanding of Cellular system for Mobile.
3. To enable the student to understand the Mobile radio propagation models.
4. To provide the student with an understanding of small scale fading and diversity reception.
5. To make the student to learn the salient features of various multiple access systems.
6. To make the student to learn concepts of GSM, IS-95 CDMA and OFDM

Course outcomes:

Student will be able to:

1. Compare the technology trends changing from generation to generation.
2. Design a Cellular system for Mobile communications using frequency reuse for maximum coverage,
   less interference and optimum capacity.
3. Apply the large scale path-loss and analyze small scale fading.
4. Choose an appropriate Propagation model for either Outdoor or Indoor cellular communication.
5. Categorize various multiple access techniques according to the complexity, installation cost, speed of transmission, channel properties.
6. Analyze the system specifications of either GSM or CDMA based Mobile Communication Systems and OFDM.

UNIT - I

Wireless Communication Systems: Bluetooth, Trends in Radio and Personal Communications, Comparison of 1G, 2G, 2.5G and 3G technologies. UMTS system architecture and Radio Interface; Features of 4G, WLAN.

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UNIT – II

Cellular Concept -System Design Fundamentals : Frequency reuse, channel assignment strategies, Handoff process, factors influencing handoffs, types of handoffs, Interference and system capacity, Cross talk, Enhancing capacity and cell coverage, Trunked radio system, grade of service as per Erlang's B system.

UNIT – III

Mobile Radio Propagation models: Introduction to Radio Wave Propagation, Free space propagation model, three basic propagation mechanisms, ground reflection, Diffraction practical link budget design using path loss models, Outdoor propagation models: Longley Rice model and Okumura model. Indoor propagation models, partition losses. Small scale multipath propagation: Parameters of mobile multipath channels, types of small scale fading. Diversity reception methods.

UNIT – IV

Multiple Access Techniques: Need and concept of multiple access techniques, FDMA, TDMA, SSMA, CDMA, FHMA, SDMA. OFDM in wireless communication systems. Applications of multiple access techniques.

UNIT – V

Wireless systems: GSM: Services and Features, System architecture, Radio Sub system, Channel Types, Frame structure and Signal processing. CDMA Technologies: Digital Cellular standard IS-95 Forward Channel, Reverse Channel. Introduction to CDMA 2000.

Text Books:

1. Theodore.S. Rappaport, "Wireless Communications: Principles and Practice", 2/e, Pearson Education, 2010
2. T.L.Singhal "Wireless Communication Systems", 1/e, TMH Publications, 2010.

Suggested Reading:

1. William.C.Y.Lee, "Mobile Cellular Telecommunications: Analog and Digital Systems", 2/e, Mc-Graw Hill, 2011.
2. Kernilo, Feher, "Wireless Digital Communications", PHI, 2002.

16ECE03

ANALOG AND MIXED SIGNAL DESIGN

(Elective-II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. The concepts of MOS Devices.
2. Characteristic behavior of MOS amplifier in various configurations
3. Different types of Current mirrors and differential amplifiers using MOSFET.
4. Analysis of Two-stage Op-Amp amplifier
5. The analysis of switched capacitors, sample and hold circuits and stability of Op-Amp.
6. To analyze different types of data converters.

Course Outcomes:

Students will able to:

1. Recall the elementary concepts of MOS device, MOS amplifiers and Op-Amp
2. Classify and relate the performance of different types of MOS Amplifiers, Current Mirrors, Op-Amps and data converters
3. To Model MOS device under different cases
4. Examine different MOS amplifier configurations, Op-Amp, Data converters, will be able to distinguish different types of Op- Amp configurations and their performance parameters.
5. Choose the best configuration for the specifications Slew rate, conversion speed.
6. Design, develop and improve the performance of the data converters and Op-Amp.

UNIT 1: MOS amplifiers

Introduction to analog design, Basics of MOS device: general consideration, MOS VI Characteristics, Second order effects, MOS small signal model, Signal stage amplifier: common source amplifier, Source follower, common gate stage.

UNIT 2: Current mirrors & Op-Amp

Simple current mirrors, cascade current mirror (gain , output resistance), Bipolar current mirrors, High out impedance current mirrors: cascode gain stage, Wilson current mirror, Source degenerated current mirrors, MOS amplifiers using CM as load, Differential pairs with current mirror loads (MOS and bipolar) Operational amplifiers, Basic two stage MOS Operational amplifier–Characteristic parameters, two stage MOS Op-Amp with Cascodes

UNIT 3: Two Stage Op-Amp

MOS Telescopic-cascode Op-Amp, MOS Folded cascode op-amp, Fully differential folded cascode op-amp Current feedback op-amps, Op-Amp Stability and frequency compensation of Op-Amps, Phase margin and noise in Op-Amps, Comparators: Op-Amp Based Comparators.

UNIT 4: Switched Capacitors

Basic building blocks, basic operation and analysis, Inverting and Non-inverting integrators, signal flow diagrams.

Sample and Hold circuits - Performance Requirements, MOS Sample and Hold basics, Clock feed through problems

UNIT 5: D/A andA/DConverters

D/A converters: Specifications, Decoder based converter, Binary-scaled converters, Thermometer code converters, Current mode converters.

Nyquist rate A/D Converters: Integrated converters – successive approximation converters, Nyquist rate A/D Converters: Integrated converters – successive approximation converters.

Text books:

1. BehzadRazavi, Design of Analog CMOS Integrated Circuits, Tata McGrah Hill. 2002
2. David Johns, Ken Martin, Analog Integrated Circuit Design, John Wiley & sons. 2004

Suggested Reading:

1. Paul.R. Gray & Robert G. Major, Analysis and Design of Analog Integrated Circuits, John Wiley & sons. 2004
2. Jacob Baker.R.et.al., CMOS Circuit Design, IEEE Press, Prentice Hall, India, 2000.

16ECE04

CODING THEORY AND TECHNIQUES

(Elective-II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Mathematical models of various channels and basic notions of error control coding.
2. Implementation of channel coding techniques in digital communications.
3. Fundamentals of abstract algebra, finite fields and its extension.
4. Mathematical structure and algorithms for RS codes.
5. Concepts of interleaving and complete analysis of Convolutional codes.
6. Modern capacity approaching codes like Turbo codes and its encoding and decoding strategies.

Course Outcomes:

Student will be able to:

1. Understand the theory and principles of information theory and channel Coding.
2. Design and analyze the encoding and decoding circuits for Block codes.
3. Apply the principles of abstract algebra, finite fields and its extension to design related codes.
4. Develop and execute encoding and decoding algorithms associated with RS codes.
5. Demonstrate the ability to select and design simple convolutional codes.
6. Analyze modern capacity approaching codes like Turbo codes.

UNIT-I

Coded digital communication systems: Introduction, Channel models, Discrete Memory less channel, Binary Symmetric channel, Binary Symmetric Erasure Channel, Burst Channel, Types of Codes, Types of errors, Error control Strategies; channel coding Theorem, Channel coding gain.

UNIT II

Linear Block codes: Introduction, encoding, Syndrome computation and error detection, Standard array decoding, Maximum likelihood decoding, Encoder and Syndrome Generator implementations of systematic codes, Error-detecting and correcting capabilities, Hamming codes, Hamming bound.

Cyclic codes: Description, encoding and Syndrome computation and error detection, Encoder and Syndrome generator implementations of systematic and unsystematic codes, Generator and Parity check matrices.

UNIT III

Galois Fields: Fields, Binary arithmetic, Construction of Galois Fields GF (2^m) from GF (2), Basic properties of Galois Fields,
RS codes: Introduction, encoding and decoding using Berlekamp-Massey algorithm.

UNIT IV

Convolution codes: Introduction, Encoding, State diagram, Code Tree, Code Trellis diagram, Decoding: Maximum- Likelihood decoding, soft decision and hard decision decoding, Viterbi algorithm.

UNIT V

Turbo codes: Concatenation, Types of Concatenation, interleaving, types of interleavers, Turbo codes: Introduction, encoding and decoding using BCJR Algorithm.

Text books:

1. Shulin and Daniel J. Costello, Jr. "Error Control Coding," 2/e, Pearson, 2011.
2. L.H.Charles LEE, "Error control block codes for Communication Engineers", Artech, 2000, 1st edition.
3. Man Young Ree, "Error-Correcting Coding Theory", Mc-Graw-Hill publishing company, 1989,1st edition.

Suggested reading:

1. Bernard Sklar, "Digital Communications: Fundamentals and Applications - Prentice Hall, 2001.
2. K Sam Shanmugum, "Digital and Analog Communication Systems", Wiley, 2012.

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16ITE27

DATA STRUCTURES

(Elective-II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familisarise with different linear and nonlinear data structures.
2. To present the concepts of time and space complexity
3. To discuss applications of various data structures.
4. To develop a base for advanced computer science study.

Course Outcomes:

Student will be able to:

1. Understand basic data structures arrays and linked lists
2. Analyse time complexity of algorithms
3. Understand the basic operations of Stacks and Queues
4. Implement basic operations on data structures
5. Understand applications of binary trees and graphs
6. Understand various kinds of searching and sorting techniques

UNIT-I

Introduction to Data Structures and Algorithms: Elementary data structure organisation, classification of data structures, operations on data structures, Abstract Data Type, Algorithms, Different approaches to designing an algorithm, Control structures used in algorithms, Time and Space Complexity, Big O Notation, Omega Notation (Ω), Theta Notation (Θ)

UNIT-II

Arrays: Introduction, Declaration of Arrays, Accessing the Elements of an Array, Storing Values in Arrays, Operations on Arrays, **Linked Lists:** Introduction, Singly Linked Lists, Circular Linked Lists, Doubly Linked Lists, Applications of Linked Lists

UNIT-III

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on a Stack, Linked Representation of Stacks, Operations on a Linked Stack, Applications of Stacks, **Queues:** Introduction to Queues, Array Representation of Queues, Linked Representation of Queues, Types of Queues, Applications of Queues

UNIT-IV

Trees: Introduction, Types of Trees, Creating a Binary Tree from a General Tree, Traversing a Binary Tree, Applications of Trees, **Efficient Binary Trees:** Binary Search Trees, Operations on Binary Search Trees

UNIT-V

Graphs: Introduction, Graph Terminology, Directed Graphs, Bi-connected Components, Representation of Graphs, Graph Traversal Algorithms **Introduction to Searching:** Linear Search, Binary Search, Introduction to Sorting, Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Radix Sort, Heap Sort, Shell Sort, Tree Sort, Comparison of Sorting Algorithms

Text Books:

1. ReemaThareja, “Data Structures Using C”, Second Edition, Oxford Higher Education, 2014
2. Horowitz Ellis, SahniSartaj& Anderson-Freed Susan, “Fundamentals of Data Structures in C”, Orient BlackSwan, 2008

Suggested Reading:

1. NarasimhaKarumanchi, “Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles”, CareerMonk Publications, 2016.
2. NarasimhaKarumanchi, “Coding Interview Questions”, 3rd Edition, CareerMonk Publications, 2016
3. Yashavant P. Kanetkar, “Data Structure Through C”, BPB Publications, 2003.

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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16ITE25

JAVA PROGRAMMING

(Elective-III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the fundamentals of Java language which includes defining classes, invoking methods, inheritance, polymorphism, exception handling etc.
2. To solve real world problems by creating Java applications using sound OOP practices, standard class libraries and APIs.
3. To introduce event driven Graphical User Interface (GUI) programming and usage of standard class libraries.

Course Outcomes:

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 and Multithreading 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 interfaces in java as well as apply the knowledge of Event Handling.

UNIT-I

Evolution of java: Java's Magic: The Bytecode, The Java Buzzwords Objects, **Overview of Java:** Simple Java Programs, Java Primitive Types, Arrays: How to create and define arrays, Basic Operators, Control statements.

Introducing Classes: Declaring objects, methods, Constructors, this keyword, Method Overloading and Constructor Overloading, Objects as parameters, Returning objects, Use of static and final keywords.

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UNIT-II

Inheritance, Packages and Interfaces: Inheritance basics, using super keyword, Method overriding, Dynamic method dispatch , Abstract classes, using final with inheritance , Introduction to Object class,

Packages: Defining, Creating and Accessing a Package, importing packages,

Interfaces : Defining and implementing interfaces, Nested Interfaces.

Strings Handling: String Constructors, Length, Operations, String Comparison, Searching for strings, Difference between String &StringBuffer classes, StringTokenizer class and Wrapper classes and conversion between Objects and primitives.

UNIT-III

Exception Handling in Java: Exception handling fundamentals, Exception types, Usage of try, catch, throw, throws and finally clauses, writing your own exception classes.

Multithreading in Java: The java Thread Model, How to create threads, Thread class in java, Thread priorities, Thread synchronization.

Generics: What are Generics? Generic classes, bounded types, Generic methods and interfaces.

UNIT-IV

Collections Framework: Overview of Collection Framework, Commonly used Collection classes – ArrayList, LinkedList, HashSet, LinkedHashSet, TreeSet, Collection Interfaces –Collection, List, Set, SortedSet, Accessing a collection via an Iteration,Storing user-defined classes in collections, Map Interfaces and Classes, Using a comparator. Legacy classes – Vector, Hashtable, The Enumeration interface.

Input/Output : How to read user input (from keyboard) using scanner class, Stream classes, InputStream, OutputStream, FileInputStream, FileOutputStream, Reader and Writer, FileReader, FileWriter cl asses. File class.

UNIT-V

GUI Design & Event Handling: Component, Container, window, Frame classes. Working with Frame windowGUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling button click events, Adapter classes.Writing GUI Based applications.**Database Handling in Java**: Java Database Connectivity (JDBC)

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Text Books:

1. Herbert Schildt: “Java: The Complete Reference”, 8th Edition, Tata McGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell: “Core Java, Volume I—Fundamentals”, 8th edition, Prentice Hall, 2008.

Suggested Reading:

1. SachinMalhotra&SaurabhChoudhary: “Programming in Java”, 2nd Edition, Oxford University Press, 2014.
2. C. Thomas Wu, “An introduction to Object-oriented programming with Java”, 4th edition, Tata McGraw-Hill Publishing company Ltd., 2010.
3. K. Arnold and J. Gosling, “The JAVA programming language”, 3rdedition, Pearson Education, 2000.

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.
2. http://nptel.ac.in/courses/106106147/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

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PYTHON PROGRAMMING

(Elective-III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Introduce 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 for error handling.
5. Familiarize python visualization.

Course Outcomes:

After completion of the course, student will be able to:

1. Understand basic data structures of python.
2. Perform operations on strings.
3. Understand the concepts of file I/O.
4. Understand exception handling in Python.
5. Plot data using appropriate Python visualization libraries.
6. Develop basic 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.

Unit-II

Repetition Structures: Introduction, while loop, for loop, Sentinels, Input Validation Loops, Nested Loops.

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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.

Unit-IV

Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.

Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

Python File Input-Output: Opening and closing file, various types of file modes, reading and writing to files, manipulating directories

Unit-V

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

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.
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

16ECC29

EMBEDDED SYSTEM DESIGN LAB

Instruction	3 Hours per week
Semester end Examination Duration	3 Hours
Semester end Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To develop and understand the ARM7 C programming
2. To understand the usage of Integrated Development Environment (Keil)
3. To interface ARM7 to various input/output devices
4. To develop the programs using serial communication protocols
5. To process the analog signals using ARM7
6. To control the operation of various peripherals using ARM7 microcontroller

Course Outcomes:

Students will be able to:

1. Develop the ARM7 C programs using arithmetic, logical and branch operations
2. Understand the usage of various debugging tools available to program ARM7
3. Program ARM7 to interface various input/output modules
4. Know about the data transfer using serial communication protocols.
5. Analyze the hardware and software interaction and integration.
6. Design and develop the ARM 7 based embedded systems for various applications

List of Experiments

I. Basic ARM 7 Programming using instruction set

1. Study and use of ARM 7 Microcontroller trainer and Keil IDE
2. Programs using data manipulation and arithmetic instructions
3. Programs using logical and branch instructions
4. Sorting and String operations

II. ARM7 C programming:

5. LEDs and Switches interfacing
6. Relay and Buzzer interfacing
7. LCD interfacing
8. DAC interfacing

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9. ADC interfacing
10. DC Motor interfacing
11. 7-Segment display interfacing
12. Temperature sensor interfacing through SPI

III. RTOS programming:

13. Introduction to RTOS (VxWorks) and its basic functions.
14. RTOS Timerprogramming (VxWorks).
15. RTOS Task functionprogramming (VxWorks).

Sample Mini Projects:

Design and realize a mini project on ARM7/ARM9 for given specification.

i. UART Interfacing
ii. I2C interfacing for serial communication Application.

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16ECC30

DIGITAL SIGNAL PROCESSING LAB

Instruction	3 Hours per week
Semester end Examination Duration	3 Hours
Semester end Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. Design of digital filters using MATLAB.
2. FFT algorithm using MATLAB.
3. Multirate signal processing using MATLAB.
4. Spectral analysis of noisy signals using MATLAB.
5. Implementation of digital filters on DSP Processor.
6. Generate LTI system response on DSP Processor.

Course Outcomes:

Students will be able to:

1. Design and analyze the digital filters using MATLAB.
2. Implement FFT algorithms for linear filtering and correlation using MATLAB.
3. Experiment with multirate techniques using MATLAB.
4. Perform spectral analysis of noisy signal using welch's method.
5. Design and Implement the digital filters on DSP processor.
6. Obtain response of a LTI system to a ramp/step input on DSP processor.

List of Experiments

(A) Experiments on signal processing using MATLAB.

1. Basic matrix operations and Generation of test signals.
2. Linear Convolution , circular convolution and Correlation
3. Discrete Fourier Transform(DFT) and Fast Fourier Transform(FFT)
4. FIR filter design using different windows
5. IIR filter design: Butter worth, Chebyshev type 1 and 2: LPF, HPF, BPF & BSF filter.
6. Spectral Analysis of noisy signal using Welch's method.
7. Interpolation and Decimation.
8. Multistage filter.

(B) Experiments on DSK and CCS

1. Study of procedure to work in real- time.
2. Solutions of difference equations.
3. Linear Convolution.

4. Implementation of FIR filter.
5. Implementation of second order IIR filters.
6. Decimation and Interpolation.

Note:

1. Minimum of 6 from Part A and 4 from Part B is mandatory.
2. For Part "A", MATLAB with different toolboxes like Signal Processing, Signal Processing block set, and SIMULINK/ MATHEMATICA/ any popular software can be used.

References:

1. Vinay K. Ingle and John G. Proakis, "Digital Signal Processing using MATLAB", 4/e, Cengage learning, 2011.
2. B. Venkataramani and M. Bhaskar,"Digital Signal Processor architecture, programming and application", 6/e, TMH, 2006.

Sample Mini Projects:

1. Design the best IIR band pass filter to meet the given specifications:
   Pass band cut off frequencies: [500 600] Hz
   Stop band cut off frequencies: [525 675] Hz
   Pass band ripple: d" 2dB
   Stop band attenuation: e" 60dB
   Phase response: Approximately linear in pass band
   Consider Butterworth, Chebyshev, Elliptic and Bessel filters

2. Design the best low pass filter to meet the given specifications:
   Pass band cut off frequency: 1K Hz
   Stop band cut off frequency: 3K Hz
   Pass band ripple: d" 2dB
   Stop band attenuation: e" 80dB
   Group Dealy: d" 5ms
   Phase response: Approximately linear in pass band
   Consider FIR and Elliptic filters.

3. Design a three stage multirate filter to meet the given specifications:
   Pass band cut off frequency: 450 Hz
   Stop band cut off frequency: 500 Hz
   Pass band ripple: d" 3dB
   Stop band attenuation: e" 40dB
   Sampling frequency: 40 KHz
   Compare with single stage filter.
4. Consider a clean speech signal of length 5000 samples and compute the Power Spectrum. Now add 0dB random noise. Compute the power spectrum using Welch and Eigen value Estimation method and also compare with the original spectrum.

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16ECC31

MICROWAVE ENGINEERING LAB

Instruction	3 Hours per week
Semester end Examination Duration	3 Hours
Semester end Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To understand the characteristics of Reflex Klystron Oscillator (RKO) and Gunn Oscillator.
2. To learn frequency measurement techniques using cavity wave meters.
3. To determine VSWR for various loads using slotted section.
4. To calculate power ratios at ports of various microwave components.
5. To learn measurement of impedance for various microwave loads.
6. To plot the radiation pattern for an antenna.

Course Outcomes:

Students will be able to:

1. Know the characteristics of RKO and Gunn Oscillator.
2. Understand the relation between guide wavelength, free space wavelength and cut off wavelength.
3. Measure VSWR for various loads at microwave frequencies.
4. Estimate the microwave power ratios at various ports of microwave components.
5. Calculate unknown impedance of various microwave loads.
6. Understand the measurement of radiation patterns.

List of Experiments

1. Characteristics of Reflex Klystron Oscillator- To find the mode numbers and efficiencies of different modes.
2. Characteristics of Gunn diode and Gunn diode oscillator.
3. Measurement of frequency and Guide wavelength: Verification of the relation between guide wavelength, free space wavelength and cut-off wavelength.
4. Measurement of VSWR for the given loads.
5. Measurement of impedance for horn antenna, matched load, slide screw tuner etc.
6. Characteristics of Directional coupler.
7. Characteristics of E-plane, H-plane and Magic Tee.

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8. Characteristics of Circulator.
9. Radiation pattern of horn antenna.
10. Study of various antennas like dipoles, loops, Yagi antenna, log periodic antenna and their radiation pattern.

Sample Mini Projects:

1. To design microwave components such as: Directional couplers, circulators and Hybrid junctions using Simulation software.
2. To design antenna arrays such as: Binomial, Chebyshev, using Simulation software.

References:

1. Department Laboratory Manual.
2. G.S. Raghu Vamsi, "Basic microwave techniques and Laboratory manual", 2nd Edition, New age international publishers, 2009.

EC 411

RADAR SYSTEMS

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

Course Objectives:

1. To learn the principles of operation of radar systems.
2. Be able to design and simulate radar systems.
3. Be able to know the various types of tracking radars.
4. Be able to understand various types of radar clutters.
5. Be able to know the various types of radar displays.

Course Outcomes:

Student will be able to:

1. Understand the principles of operation of pulse radar system.
2. Know the applications of CW and FMCW radar.
3. Understand the working principle of MTI and Pulse Doppler Radar and matched filter concepts.
4. Get familiarization of various radar clutters and Phased array antennas.
5. Compare various tracking radars along with their advantages and disadvantages.
6. Understand various radar displays and radar receiver.

UNIT-I

Introduction to radar, radar block diagram and operation, radar frequencies, Applications of radar, Prediction of range performance, minimum detectable signal, receiver noise, probability density function, SNR, Integration of radar pulses, radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

UNIT-II

Doppler effect, CW radar, FM CW radar, multiple frequency CW radar. MTI radar, delay line canceller, range gated MTI radar, blind speeds, staggered PRF, limitations to the performance of MTI radar, non-coherent MTI radar.

UNIT-III

Tracking radar: sequential lobing, conical scan, monopulse: amplitude comparison and phase comparison methods, Low angle tracking, tracking in range, comparison of various trackers, Radar antennas.

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UNIT-IV

Radar Clutter: Introduction to radar clutter, surface clutter radar equation, Land clutter, Sea clutter, statistical models for surface clutter, detection of targets in clutter, Phased array Antennas.

UNIT-V

Radar receiver**:** The radar receiver, receiver noise figure, Super heterodyne receiver, importance of Matched filter, Duplexers and receiver protectors, Radar Displays.

Text Books:

1. Merril. I. Skolnik, "Introduction to Radar Systems", 2/e, MGH, 2001.
2. Mark A. Richards, James A. Scheer and William A. Holm, "Principles of Modern Radar: Basic Principles," YesDee Publishing Pvt. Ltd., India, 2012.

Suggested Reading:

1. Byron Edde, "Radar: Principles, Technology, Applications", Pearson, 2008
2. G.S.N Raju, "Radar Engineering And Fundamentals Of Navigational Aids", I.K. International publishing house Pvt. Ltd., 2010.

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EC 412

DATA COMMUNICATION AND COMPUTER NETWORKS

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

Course Objectives:

1. To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture.
2. To study the principles of network protocols and internetworking
3. To understand the Network security and Internet applications.
4. To understand the concepts of switched communication networks.
5. To understand the performance of data link layer protocols for error and flow control.
6. To understand various routing protocols.

Course Outcomes:

After completing this course the students will be able to:

1. Identify different tasks of computer communications networks and protocol architectures.
2. Analyze and compare circuit switching and packet switching concepts and understands ATM network concepts.
3. Analyze the performance of various Data link control protocols for flow control and error control.
4. Analyze the services and functions of the networks layer and recognize the different internetworking devices and their functions.
5. Understand how routing is carried out in large open networking environment and the operations of major internet routing protocols such as ICMP, ARP,OSPF and BGP.
6. Understand the importance of basic network security measures such as encryption, Authentication protocols and study standard Internet applications protocols.

UNIT-I

Introduction:

Data Communications and Networking for Today's Enterprise, A Communications Model, Data Communications, Networks. The Need for Protocol Architecture and Standardization, the TCP/IP Protocol Architecture, the OSI reference Model, Line Configurations. Basic concepts of networking. Network topologies. Types of Network: LAN, MAN, WAN.

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UNIT-II

Switched Communications Networks: Circuit-Switching Networks, Circuit-Switching Concepts Soft switch Architecture, Packet-Switching Principles, X.25, Frame relay. ATM Networks-Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, and ATM Service Categories.

UNIT-III

Data Link layer: Design issues, Services provided to the Network layer, framing, Error Control, Flow Control. Elementary Data Link Control Protocols**:** Stop and Wait, Sliding Window, Go Back-N, Selective Repeat. High-Level Data Link Control (HDLC).
MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Comparison of IEEE Standards IEEE 802.3, 802.4, 802.11, 802.15, 802.16.

UNIT-IV

Network Layer: Network Layer Design Issues, Routing algorithms: Shortest Path Routing, Flooding, Distance Vector Routing, Hierarchical routing, Broadcast, Multicast, Congestion Control- Congestion Control Algorithms. Quality of service. Internet Working. The Network Layer in Internet-IP Version 4 protocol, IP Addressing, Comparison of IPV4 and IP V6, Internet Control Protocols-ICMP, ARP, OSPF and BGP.

UNIT-V

Transport Protocols: The transport Service, Elements of Transport Layer, TCP and UDP protocol header formats.
Network Security and Internet Applications: Cryptography techniques, Authentication Protocols. Applications layer protocols: Domain Name System, SNMP, Electronic Mail, and World Wide Web.

Textbooks:

1. W. Stallings, "Data and Computer Communications", eight Edition, Prentice Hall -2007
2. A. Tanenbaum and D. Wetherall, "Computer Networks", fifth Edition, Prentice-Hall, 2011.

Suggested Reading:

1. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition. McGraw-Hill Forouzan Networking Series, McGraw-Hill, 2007
2. S. Keshav, "An Engineering Approach to Computer Networks", Second Edition, Addison-Wesley Professional Pearson Education, 2001

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EC 413

VLSI DESIGN

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

Course Objectives:

1. To study the basic concepts of verilog HDL.
2. To learn the various abstraction levels in verilog HDL.
3. To understand simulation and synthesis process/concepts.
4. To learn the various characteristics of MOS transistor.
5. To learn the various concepts required to obtain the digital logic layout diagrams.
6. To learn various subsystem design concepts.

Course Outcomes:

The student will be able to

1. Design and simulate various combinational and sequential logic circuits using verilog HDL
2. To simulate and synthesize digital logic designs.
3. Understand characteristic behaviour of MOSFET and layout desig rules.
4. Design CMOS based logic circuits.
5. Understand the design concepts of memories.
6. Understand the concepts of VLSI testing.

UNIT - I

Introduction to HDLs, Basic Concepts of Verilog, Data Types, System Tasks and Compiler Directives. Gate Level Modeling: Gate Types and Gate Delays. Dataflow Modeling: Continuous Assignment and Delays. Design of Stimulus Block.

UNIT - II

Behavioural Modeling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modeling.UDP. Design of Mealy and Moore state models using Verilog. Logic Synthesis, Synthesis Design flow, Gate level Netlist.

UNIT - III

Introduction to MOS Technology, Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS. Threshold voltage and Body Effect. MOS and CMOS circuit Design Process: MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams.

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UNIT – IV

Design of MOS inverters with different loads. Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, BiCMOS inverter, D flip flop using Transmission gates.

UNIT - V

Subsystem Design: Multiplexor, Comparator, Shifters, Programmable Logic Arrays.

Memories: Design of Dynamic Register Element, 3T, 1T Dynamic RAM Cell, 6T Static RAM Cell. NOR and NAND based ROM Memory Design.

Testing: Introduction to Testing, Fault models, Controllability, Observability.

Text Books:

1. Samir Palnitkar, "Verilog HDL: A guide to Digital design and synthesis", 2/e , Pearson Education, 2008.
2. Kamran Eshraghian, Douglas A. Pucknell, Sholeh Eshraghian, "Essentials of VLSI circuits and systems", PHI, 2011.
3. Neil H E Weste, David Harris, Ayan Banerjee "CMOC VLSI Design –A circuit and System Perspective", 3/e, Pearson Education, 2006.

Suggested Reading:

1. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.
2. John P. Uyemura, "Introduction to VLSI Circuits and systems", John Wiley & Sons, 2011.

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EC 414

ELECTRONIC INSTRUMENTATION

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

Course Objectives:

1. To impart a basic knowledge of International Standards for various physical quantities
2. To provide a basic understanding of measurement systems and an in-depth understanding of measurement errors.
3. To expose the students to the many varieties of transducers and measuring instruments, their operating principles, construction.
4. To provide an idea of the strengths and weaknesses of various types of sensors and transducers
5. To introduce students to various types of spectrum analyzers, virtual instrumentation techniques and their applications
6. To provide the students a basic exposure to some of the prominent bio-medical instrumentation systems

Course Outcomes:

Students will be able to:

1. Perform accurate measurements for any engineering system with clear idea of the potential errors
2. Know several important standards related to measurements and quality management
3. Select the appropriate passive or active transducers for measurement of physical phenomenon
4. Understand the operating principles of various types of transducers used to measure temperature, displacement, and other physical quantities.
5. Use instruments like spectrum analyzer, DSO and other virtual instrumentation techniques for appropriate measurements.
6. Understand the fundamentals of various Biomedical instrumentation systems

UNIT– I

Accuracy, Precision, Resolution and Sensitivity. Errors and their types. Calibration. Standards of measurement, classification of standards, IEEE standards, Elements of ISO 9001, Quality management standards.

UNIT – II

Classification of transducers, factors for selection of a transducer, transducers for measurement of velocity, force, Hot wire anemometer. Passive electrical transducers- Strain gauges - gauge

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factor types of strain gauges: rosettes, semiconductor stain gauges and strain measurement, LVDT-construction and displacement measurement, capacitive transducer and thickness measurement. Active electrical transducers: Piezo-electric, photo-conductive, photo-voltaic and photo-emissive transducers.

UNIT – III

Characteristics of sound, pressure, power and intensity levels. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermocouples. Humidity measurement, resistive capacitive, aluminum oxide and crystal Hygrometer types. Introduction to Micro-Electro-Mechanical Systems (MEMS).

UNIT – IV

Block diagram, specification and design considerations of different types of DVMs. Spectrum analyzers. Delayed time base oscilloscope, Digital storage oscilloscope. Introduction to Virtual Instrumentation, SCADA. Data Acquisition System- block diagram

UNIT – V

Human physiological systems and related concepts. Bio-potential electrodes Bio-potential recorders - ECG, EEG, EMG and CT scanners, magnetic resonance and imaging systems, Ultrasonic Imaging systems.

Text Books:

1. Albert D. Helfric, and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 2010.
2. H S Kalsi, "Electronic Instrumentation", 3/e, TMH, 2011.
3. Nakra B.C, and Chaudhry K.K., "Instrumentation, Measurement and Analysis", TMH, 2004

Suggested Readings:

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2nd Edition, 2003.
2. Khandpur. R.S., "Handbook of Bio-Medical Instrumentation", TMH, 2003.
3. Biomedical Instrumentation and Measurements – Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, PHI, 2nd Ed, 1980.

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ME 419

INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT

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

Objectives:

1. To make the students understand the roll importance and functions of Management in Industrial Organization
2. To make the students understand various types of business organizations and organization structures.
3. To make the students understand importance of plant location and plant layout
4. To ensure that the students understand the importance of industrial engineering students like method study and work measurement.
5. To make the students understand the importance of project management techniques
6. To make the students calculate the total cost of a product based on elements of cost

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

1. Understand the role and importance of management and its principles.
2. Understand the need and importance of various types of layouts used in manufacturing industries
3. Apply the techniques of method study and work measurement in industry to enhance productivity
4. Apply the techniques of project management in industry
5. Understand the importance of quality control and plot the control charts

6.Calculate the total cost of the product based on its elements.

UNIT-I

Industrial Organization: Definition of an organization, types of various business organizations, organization structures and their relative merits and demerits, functions of management.
Plant location and layouts: Factors affecting the location of plant and layout, types of layouts and their merits and demerits.

UNIT-II

Work study: Definitions, objectives of method study and time study, steps in conducting method study, symbols and charts used in method study, principles of motion economy,

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calculation of standard time by time study and work sampling, performance rating factor, types of ratings, jobs evaluation and performance appraisal, wages, incentives, bonus, wage payment plans

UNIT-III

Inspection and quality control: Types and objectives of inspection, S.Q.C., its principles. Quality control chart and sampling plans, quality circles, introduction to ISO.

Production planning and control: Types of manufacture, types of production, principles of PPC and its function, production control charts.

UNIT-IV

Optimization: Introduction to linear programming and graphical solutions, assignment problems.

Project Management: Introduction to CPM and PERT, determination of critical path.

Material Management: Classification of materials, materials planning, duties of purchase manager, determination of economic ordering quantities, types of materials purchase.

UNIT-V

Cost accounting: Elements of cost, various costs, types of overheads, break even analysis and its applications, depreciation, methods of calculating depreciation fund, nature of financial management, time value of money, techniques of capital budgeting and methods, cost of capital, financial leverage.

Text Books:

1. Pandey I.M. , Elements of Financial Management, Vikas Publ. House, New Delhi, 1994
2. James C Van Horne, John M Wachowicz, Jr., "Fundamentals of Financial Management", 13th edition, Prentice Hall Financial Times.
3. Khanna O.P., Industrial Engineering and Management, Dhanapat Rai & Sons

Suggested Reading:

1. S.N. Chary, Production and Operations Management, Tata McGraw Hill, 3rd Edition, 2006.
2. Paneer Selvam, Production and Operations Management, Pearson Education, 2007.
3. Joseph Monk, Operations Management, TMH Publishers, New Delhi, 2004.
4. Buffa Elwood S, Modern Production /Operations Management , John Wiley Publishers, Singapore, 2002
5. Everrete E. Adama & Ronald J. Ebert, Production & Operations Management, Prentice Hall of India, 5th Edition, 2005.
6. S.D. Sharma, "Operations Research", Kedarnath, Ramnath & Co., Meerut,2009

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EC 462

EMBEDDED SYSTEMS

(Elective - II)

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

Course Objectives:

1. To learn about fundamentals of the embedded system design
2. To understand the hardware and software details of the embedded systems.
3. To acquire knowledge on the serial, parallel and network communication protocols.
4. To understand the embedded system design life cycle and co-design issues.
5. To learn about the various embedded software development tools.
6. To design the embedded system for various applications.

Course Outcomes:

Student will be able to

1. Know the fundamentals of the embedded systems
2. Know the hardware and software details of the embedded systems.
3. Interface serial, parallel and network communication protocols to embedded systems
4. Know the embedded system design life cycle and co-design issues.
5. Analyze the various embedded system applications
6. Develop the various embedded system applications

UNIT – I

Introduction To Embedded Systems: Embedded systems Vs General Computing Systems, History of embedded systems, classifications, applications areas, characteristics and quality attributes of embedded systems, Design metrics and challenges in embedded system design.

UNIT – II

Embedded Hardware and Software: Processor embedded into a system, Processor selection for embedded system, embedded hardware units and devices in a system, embedded software in a system and an overview of programming languages, challenges and issues related to embedded software development.

UNIT – III

Communication protocols: I^2C, CAN, USB, Firewire-IEEE 1394 Bus standard, Advanced serial high speed buses. Parallel Bus device protocols: ISA, PCI, PCI-X , ARM Bus, Advanced parallel high speed buses. Internet Enabled Systems-Network protocols: HTTP, TCP/IP, Ethernet. Wireless and mobile system protocols

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UNIT – IV

Embedded System design and co-design issues in system development process, Design cycle in the development phase for an Embedded Systems. Embedded software development tools: Host and Target Machines, Linker/Locators for embedded software, Embedded Software into the Target system. Issues in hardware and software design and co-design

UNIT – V

Integration and testing of embedded hardware, testing methods, debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, simulator, emulator and In-circuit emulator, IDE, RTOS Characteristics, Case Study: Embedded Systems design for automatic vending machines and digital camera.

Text Books:

1. Raj Kamal, "Embedded Systems-Architecture, Programming and Design," 3/e, Tata McGraw Hill Education, 2015.
2. Shibu K V, "Introduction to Embedded systems", 1/e, McGraw Hill Education, 2009.
3. Frank Vahid and Tony Givargis, "Embedded System Design: A Unified Hardware/Software Approach, 1999.

Suggested Reading:

1. David E.Simon, "An Embedded software primer", Pearson Education, 2004.
2. Embedded System Design : A Unified Hardware/ Software Introduction, 1/e, Wiley, John & Sons.

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EC 464

SATELLITE COMMUNICATION
(Elective - II)

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

Course objectives:

1. To develop awareness about satellite communication system architecture and satellite orbits.
2. To acquire the knowledge about orbital effects and mechanics of launching a satellite.
3. Study of various satellite subsystems.
4. To design a satellite link considering different parameters like noise and losses.
5. To familiarize with the satellite applications.

Course outcomes:

Student will be able to:

1. Understand the development history and applications of satellite systems
2. Know the orbital effects and mechanics of launching a satellite would be understood by the student.
3. Analyze the various Satellite subsystems.
4. Understand the role and importance of a satellite transponder.
5. Analyze the link budget of a satellite link for specified C/N ratios.
6. Know the applications of satellite like VSAT and DBS.

UNIT-I

Introduction of satellite communications

Brief history of satellite communications, Block diagram of earth segment and space segment, Brief introduction of Indian scenario in communication satellites.

Orbital aspects of Satellite Communication

Introduction to geo-synchronous and geo- stationary satellites, Kepler's laws (statements and explanation only), applications of satellite communications.

UNIT-II

Orbital Mechanics and Launchers

Orbital elements, Locating the satellite with respect to the earth, sub- satellite point, look angles, Orbital effects in communication system performance, Orbital perturbations, mechanics of launching a synchronous satellite.

UNIT-III

Satellite sub-systems

Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Communications subsystems (transponders), Space craft antennas, multiple access techniques, comparison of FDMA, TDMA, CDMA.

UNIT-IV

Introduction to satellite link design, considerations for design of satellite system, basic transmission theory, system noise temperature and G/T ratio, design of down link and uplink, design of satellite links for specified C/N, overall C/N for uplink and downlink.

UNIT-V

Introduction to Direct Broadcast Satellite Television

C band and Ku band home satellite TV, Block diagram of Digital DBS TV Overview of VSAT systems, VSAT network architecture, One way and two way implementation.

Text Books

1. Timothy Pratt and Charles W Bostian,Jeremy E.Allnutt, "Satellite Communications", 2/e, John Wiley, 1986.
2. Dennis Roddy "Satellite Communications", Fourth edition", Mc Graw Hill, 2006.

Suggested Reading:

1. 1. M. Richharia, "Satellite Communication Systems: Design Principles", Mc Graw Hill, 2/e, 2003.

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EC 415

ELECTRONIC DESIGN AND AUTOMATION LAB

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

Course Objectives:

1. To simulate and synthesize combinational logic circuits
2. To simulate and synthesize sequential logic circuits
3. To obtain RTL schematic
4. To simulate switch level modules
5. To learn implement procedure for any design on FPGA
6. To study the speed, power and area constraints of FPGA/CPLD

Course Outcomes:

The student will be able to

1. Simulate and synthesize combinational logic circuits
2. Simulate and synthesize sequential logic circuits
3. Obtain gate level net-list and RTL diagrams
4. Implement sequence detector using FSM on FPGA
5. Implement mini projects on FPGA/CPLD
6. Design adder using UDP

Part A

Write the Code using VERILOG, Simulate and synthesize the following

1. Arithmetic Units: Adders and Subtractors.
2. Multiplexers and De-multiplexers.
3. Encoders, Decoders, Priority Encoder and Comparator.
4. Implementation of logic function using Multiplexers and Decoders.
5. Arithmetic and Logic Unit with minimum of eight instructions.
6. Flip-Flops.
7. Registers/Counters.
8. Sequence Detector using Mealy and Moore type state machines.
9. Implementation of any application of UDP.

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Note:-

1. All the codes should be implemented appropriately using Gate level, Dataflow and Behavioral Modeling.
2. All the programs should be simulated using test benches.
3. Minimum of two experiments to be implemented on FPGA/CPLD boards.

Part B

Switch Level modeling of CMOS circuits

1. Basic Logic Gates: Inverter, NAND and NOR.
2. Half Adder and Half Subtractor.
3. 4:1 Multiplexer.
4. 2:4 Decoder.
5. Design of any basic circuit using CADENCE tool.

Mini project:

i) Design a 8-bit CPU.
ii) Generation of different waveforms using DAC.
iii) RTL code for Booth's algorithm for signed binary number multiplication.
iv) Development of HDL code for MAC unit and realization of FIR Filter.
v) Design of 4-bit thermometer to Binary Code Converter.

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EC 416

ADVANCED SIMULATION LAB

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

LAB EXPERIMENTS

1. Familiarization with simulation tools like LabVIEW and Network Simulator2 (NS2)
2. Working with loops, Structures and Mathscripts
3. (a) Combinational circuits(Adders , Substractors , Mux , Demux, Decoder and Encoder)
   (b) Sequential circuits (Flip flops, counters and registers)
4. (a) Convolution and correlation of signals
   (b) Filters (FIR and IIR)
5. (a) Analog modulation and demodulation schemes(AM and FM)
   (b) Digital carrier modulation and demodulation schemes (ASK and FSK)
6. (a) Time domain analysis (State variable analysis)
   (b) Frequency domain analysis (Nquist and Bode plots)
7. Study of basic features and functions of RTOS (VxWorks)
8. VxWorks Task function programming
9. VxWorks Timer programming
10. VxWorks IPC Programming-I
    (a) Signals
    (b) Semaphores
11. VxWorks IPC Programming-II
    (a) Message Queques
    (b) Mail boxes
12. Creation of a network with at least four nodes.
13. Transmission between the nodes in a network.
14. Simulation of the data transfer between the nodes using TCP

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Mini Project cum Design Exercise(s).

Design and development of any one of the following applications.

(a) Digital IIR Notch filter

(b) Multistage design of decimator and interpolator

(c) Discrete multitone transmitter and receiver

(d) ALU

(e) Universal shift registers

(f) Code converters

(g) PLL

(h) Implementation of the Real time scheduling algorithms

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EC 417

PROJECT SEMINAR

Instruction	3L Periods per week
Sessionals	25 Marks
Credits	1

The objective of the project seminar is to actively involve the student in the initial work required to undertake the final year project. Dealing with a real time problem should be the focus of the under graduate project.

It may comprise of

- Problem definition and specifications.
- A broad understanding of the available techniques to solve a problem of interest.
- Presentation (Oral & written) of the project.

The department should appoint a project coordinator who will coordinate the following.

- Grouping of students as project batch(a maximum of 3 in group)
- Allotment of projects and project guides
- Project monitoring at regular intervals.

Each project group/batch is required to

1. Submit a one page synopsis of the seminar to be delivered for display on notice board.
2. Give a 30-40 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write up on the talk delivered.

Three (3) teachers will be associated with the evaluation of the project seminar for the award of the sessional marks which should be on the basis of performance on all the three items stated above.

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EC 421

GPS AND AUGMENTATION SYSTEMS

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

Prerequisite: A prior knowledge of satellite communication and Radio Navigation Aids is required.

Course Objectives:

1. To explain the basic principle of GPS and its operation.
2. To make the students to understand signal structure, errors, coordinate systems
3. To make the students understand the GPS navigation and observation files and compute the position.
4. Highlight the importance of integrating GPS with other systems.
5. To demonstrate the principle of DGPS and to facilitate the various augmentation systems.
6. To make the students appriciate the signaificance of augmentaion systems.

Course Outcomes:

Student will be able to:

1. Understand the principle and operation of GPS.
2. Frame various coordinate systems for estimating position.
3. Estimate the various errors and their effect on position estimation.
4. Compute user position from Navigation and Observation data formats.
5. Use GPS in various fields such as navigation, GIS etc.
6. Apply DGPS principle and can also analyze various augmentation systems.

UNIT-I

GPS fundamentals

GPS Constellation, Principle of operation, GPS orbits, Orbital mechanics and Satellite position determination, Time references. Dilution of precision: HDOP, VDOP, PDOP & GDOP.

UNIT-II

Coordinate systems

Geometry of ellipsoid, geodetic reference system, Geoid and Ellipsoid and Regional datum. World Geodetic System (WGS-84), Indian Geodetic System (IGS), Earth Centered Inertial (ECI), Earth Centered Earth Fixed (ECEF).

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Various error sources in GPS: Satellite and Receiver clock errors, ephemeris error, Multipath error, atmospheric errors, the receiver measurement noise and UERE.

UNIT-III

GPS measurements

GPS signal structure, SPS and PPS services, C/A and P-code and carrier phase measurement, position estimation with pseudo range measurement, Spoofing and anti-Spoofing, GPS navigation and observation data formats.

UNIT-IV

GPS Applications

Surveying Mapping Marine, air and land Navigation, Military and Space Application. GPS Integration with Geographic Information System (GIS), Inertial Navigation System (INS), Pseudolite and Cellular. Indian Regional Navigation Satellite System (IRNSS).
Differential GPS (DGPS): Principle of DGPS, Types of DGPS: Local Area DGPS (LADPS), Wide Area DGPS (WADGPS).

UNIT-V

GPS Augmentation systems:

Need for augmentation, RNP parameters. Types of augmentation systems: Satellite Based Augmentation system (SBAS): Wide Area Augmentation System (WAAS), GPS Aided GEO Augmented Navigation (GAGAN). Ground Based Augmentation System (GBAS): Local Area Augmentation System (LAAS).

Text Books:

1. Ahmed El-Rabbany, "Introduction to GPS", Artech House Publishers, 2/e, Boston 2006.
2. Elliot D Kaplan and Christopher J Hegarty,"Understanding GPS principles and applications", Artech House Publishers, 2/e Boston & London 2005.

Suggested Reading:

1. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice," Springer Verlog, 5/e, 2008.
2. Pratap Misra and Per Enge, "Global Positioning System Signals, Measurement, and Performance," Ganga- Jamuna Press, 2/e, Massachusetts, 2010.
3. Bradford W.Parkinson and James J. Spilker, "Global Positioning system: Theory and Application," Vol.II, American Institution of Aeronautices and Astronautics Inc., Washington, 1996.

EC 472

REAL TIME OPERATING SYSTEMS

(ELECTIVE –III)

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

Course Objectives:

1. To understand the need of real time operating system.
2. To learn the basic concepts of interprocess communication (IPC).
3. To analyse various scheduling algorithms related to RTOS.
4. To introduce the elementary concepts of Vx works.
5. To study the basic concepts of UNIX operating system.
6. To undetstand the design and development of a target system.

Course Outcomes:

Student will be able to:

1. Understand Real-time operating system requirements and applications.
2. Categorize different scheduling approaches for real time scheduler.
3. Compare different real time systems.
4. Analyze a module and understand design issues.
5. Develop a real time embedded system module.
6. Build a user end module.

UNIT-I

Introduction to Real Time Systems

Structures of Operating System (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of OS and Hardware architecture, Evolution of operating systems, Batch, multi programming. Multitasking, Multiuser, parallel, distributed and real-time OS.

UNIT-II

Process Management of OS/RTOS

Hard versus Soft Real-Time System: Jobs and Processors, release time, deadlines, and timing constraints, hard and soft timing constraints, hard real-time systems. Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread scheduling, Multiprocessor scheduling concept, Real Time scheduling concept.

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UNIT-III

Real Time Operating System Concepts

Foreground and Background Systems, Shared Resource, Critical section of a Code, Multi Tasking, Task, Context switch, Kernel, Scheduler, Preemptive and non-preemptive kernel, Inter Task Communication: Message Mailboxes, Message queues or pipes and Event flags, Semaphores, Interrupts.

UNIT-IV

Introduction to Vxworks/UNIX OS

Elementary Concepts of VxWorks: Multitasking, Task State Transition, Task Control- Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Deletion Safety.

Fundamental Concepts of UNIX Operating Systems

Unix Kernel – File system, Concepts of – Process,

Concurrent Execution & Interrupts. Process Management – forks & execution. Basic level Programming with system calls, Shell programming and filters.

UNIT-V

Linux development process

Types of Host /Target Development and debug setup, Generic Architecture of an Embedded Linux System, System start up, Types of Boot configurations, System Memory Layout, Development Tools: Project Workspace, IDE, GNCC cross platform, selecting and configuring kernel, Setting up bootloader.

Text Books:

1. Tanenbaum,"Modern Operating Systems," 4/e, Pearson Edition, 2014.
2. Jane W.S.Liu, Real Time Systems, Pearson Education, Asia, 2001.

Suggested Reading:

1. Jean J Labrosse,"Embedded Systems Building Blocks Complete and Ready-to-use Modules in C" ,2/e, CRC Press ,1999.
2. Karim Yaghmour, Jon Masters, Gilad Ben-Yesset, Philippe Gerum, "Building Embedded Linux Systems", O'Reilly Media, 2008.
3. Wind River Systems, "VxWorks Programmers Guide 5.5", Wind River Systems Inc.2002.

EC 475

DIGITAL IMAGE PROCESSING

(ELECTIVE - III)

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

Course Objectives:

1. To Understand the formation of images are formed and represent digitally.
2. To study transform-domain representation of images.
3. To know the principles of image compression and enhancement .
4. Students would be able to solve the problems related to image restoration.
5. To learn lossy and lossless Compression techniques.

Course Outcomes:

Student will be able to:

1. Understand how images are formed, sampled, quantized and represented digitally.
2. Learn the properties and applications of transforms like Fourier, DCT, Haar, DWT and WHT.
3. Use the principles of image compression, enhancement and segmentation for practical applications.
4. Implement the image restoration techniques on the given image.
5. Remove the redundancy in an image.
6. Implement algorithms of image processing using MATLAB in real time systems.

UNIT – I

Elements of Digital Image Processing Systems, Digital image representation, elements of visual perception, Image sampling and Quantization, Basic Relationships between pixels.

UNIT – II

Properties and Applications of Fourier transform: FFT, Discrete cosine transform, Hadamard transform, Haar transform, Slant transform, DWT and Hotelling transform.

UNIT – III

Spatial enhancement techniques: Histogram equalization, direct histogram specification, Local enhancement.

Frequency domain techniques : Low pass, High pass and Homomorphic Filtering, Image Zooming Techniques.

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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.

CS 486

OBJECT ORIENTED PROGRAMMING WITH JAVA

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

Course Objectives:

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

Course Outcomes:

1. Design, create, build, and debug Java applications and applets.
2. Create multiple threads for achieving multiple tasks.
3. Write programs using graphical user interface (GUI) components and Java's Event Handling models.
4. Use user defined exception handling to customize any type of errors
5. Create collections to organize objects
6. Use inheritance to reuse objects

Unit-I

Introduction to OOP : Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages ,Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK 1.6.

Programming Constructs : Variables, Primitive Datatypes, Identifiers- Naming Conventions, Keywords, Literals, Operators Binary ,Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control-Branching, Conditional, loops.

Unit-II

Classes and Objects : classes, Objects Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Command line arguments.

Inheritance: Types of Inheritance, Deriving classes using extends keyword, method overloading ,super keyword, final keyword, Abstract class .

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Unit-III

Interfaces, Packages and Exceptions : Interface, Extending interface, Interface Vs Abstract classes, Packages-Creating packages, using Packages, Access protection, java.lang package. Exception -Introduction, Exception handling techniques- try... catch, throws, finally block, user defined exception.

MultiThreading : java.lang.Thread , The main Thread, Creation of new threads, Thread priority, Multithreading- Using isAlive() and join(), Synchronization, suspending and Resuming threads, Communication between Threads.

Unit-IV:

Input/Output : Reading and writing data, java.io package.

Generics and java.util : Generics,Using Generics in Arguments and Return Types, Defining Your Own Generic Classes, Linked List, Hashset Class, Treeset Class, Hashmap Class,Treemap Class, Collections, Legacy Classes and Interfaces, Difference between Vector and Arraylist , Difference between Enumerations and Iterator.

Unit-V:

Applets: Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint(),update() and repaint().

Event Handling : Introduction, Event Delegation Moldel, java.awt.event Description, Sources ofEvents, Event Listeners, Adapter classes, Inner classes.

Abstract Window Toolkit: Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons,List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar.

TEXT BOOK:

1. Programming in JAVA,2ed, Sachin Malhotra, Saurabh choudary, Oxford University Press

Suggested Reading:

1. The Complete Reference Java, 8ed, Herbert Schildt, TMH
2. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
3. Object Oriented Programming with JAVA, Essentials and Applications, Raj Kumar Bhuyya,Selvi, Chu TMH
4. Introduction to Java Programming, 7th ed, Y Daniel Liang, Pearson

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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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IT 429

INTERNET OF THINGS (for ECE)

Instruction	4 L periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Programming and Problem Solving, Basic Electronics, Computer Organization

Course Objectives:

1. To provide an overview of Internet of Things, building blocks of IoT and the real-world applications
2. To introduce Rasberry Pi device, its interfaces and Django Framework.

Course Outcomes:

After successful completion of the course, student will be able to

1. Understand the terminology, enabling technologies and applications of IoT
2. Learn the concept of M2M (machine to machine) and describe the differences between M2M and IoT.
3. Understand the basics of Python Scripting Language which is used in many IoT devices
4. Describe the steps involved in IoT system design methodology
5. Design simple IoT systemsusing the understanding of the Rasberry Pi board and interfacing sensors and actuators with Rasberry Pi
6. Develop web applications using python based web application framework called Django.

Unit I

Introduction & Concepts: Introduction to Internet of Things- Definitions & Characteristics of IoT, Physical Design of IOT-Things in IoT, IoT Protocols, Logical Design of IOT-IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IOT Enabling Technologies-Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IOT Levels & Deployment Templates.

Unit II

Domain Specific IoTs – IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

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IoT and M2M – Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

Unit III

Introduction to Python–Motivation for using Python for designing IoT systems, Language features of Python, Data types- Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, file handling, data/time operations, classes, Exception handling, Python packages of Interest for IoT - JSON, XML, HTTPLib, URLLib, SMTPLib

Unit IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

Unit V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Rasberry Pi- About theRasberry Pi board, Rasberry Pi interfaces-Serial, SPI,I2C, Other IoT Devices- pcDuino, BeagleBone Black, Cubieboard

IoT Physical Servers and Cloud Offerings- Introduction to cloud storage models and Communication APIs, WAMP-AutoBahn for IoT, Xivelycloud for IoT

Python Web Application Framework: Django Framework-Roles of Model, Template and View

Text Books:

1. ArshdeepBahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach, Universities Press, 2015.

Suggested Reading:

1. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.

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CE 422

DISASTER MITIGATION AND MANAGEMENT

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

Course Objectives:

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. To impart knowledge in students about the nature, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro metrological and geological based disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.
4. To equip the students with the knowledge of various chronological phases in the disaster management cycle.
5. To create awareness about the disaster management framework and legislations in the context of national and global conventions.
6. To enable students to understand the applications of geospatial technologies like remote sensing and geographical information systems in disaster management.

Course Outcomes:

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at local level
2. Ability to choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Ability to understand various mechanisms and consequences of natural and human induced disasters for the participatory role of engineers in disaster management.
4. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans
5. Ability to understand various participatory approaches/strategies and their application in disaster management
6. Ability to understand the concepts of remote sensing and geographical information systems for their effective application in disaster management.

UNIT-I:

Introduction to Natural, human induced and human made disasters – Meaning, nature, types and effects; International decade of natural disaster reduction (IDNDR); International strategy of natural disaster reduction (ISDR)

UNIT-II:

Natural Disasters– Hydro meteorological disasters: Causes, impacts, Early warning systems, structural and non-structural measures for floods, drought and cyclones; Tropical cyclones: Overview, cyclogenesis, drought monitoring and management.; Geographical based disasters: Earthquakes and Tsunami- Overview, causes, impacts, zoning, structural and non-structural mitigation measures; Tsunami generation; Landslides and avalanches: Overview, causes, impacts, zoning and mitigation measures. Case studies related to various hydro meteorological and geographical based disasters.

UNIT III:

Human induced hazards: Risks and control measures in a chemical industry**,** Causes, impacts and mitigation measures for chemical accidents, chemical disaster management, current status and perspectives; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents and traffic accidents .

UNIT IV:

Use of remote sensing and GIS in disaster mitigation and management; Scope of application of ICST (Information, communication and space technologies in disaster management, Critical applications& Infrastructure; Potential application of Remote sensing and GIS in disaster management and in various disastrous conditions like earthquakes, drought, Floods, landslides etc.

UNIT V:

Concept of Disaster Management: Introduction to disaster management, Relationship between Risk, vulnerability and a disaster, Disaster management cycle, Principles of disaster mitigation: Hazard identification and vulnerability analysis, Early warning systems and forecasting; Infrastructure and development in disaster management; Disaster management in India: National disaster management framework at central, state, district and local levels. Community based disaster management.

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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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EC 422

SEMINAR

Instruction	3L Periods per week
Sessionals	25 Marks
Credits	1

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of state of the art topics in a broad area of his /her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to following aspects of seminar presentations.

- Literature survey
- Consolidation of available information
- Power point Preparation
- Technical writing

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.

2. Give twenty(20) minutes presentation through OHP/ PPT/ Slide Projector followed by Ten(10) minutes discussion

3. Submit a report on the seminar topic with list of references and hard copy of the slides.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule should be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar should be from any peer reviewed recent journal publications.

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EC 901

PROJECT

Instruction	6L Periods per week
University Examination	Viva-voce
University Examination	100 Marks
Sessionals	50 Marks
Credits	9

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Sessional marks should be based on the marks, awarded by a project monitoring committee of faculty members as well as the marks given by the guide.

Common norms are established for final documentation of the project report, the students are directed to download from the website regarding the guidelines for preparing the project report and the project report format.

The project report shall be evaluated for 100 Marks by the External Examiner.

If the project work found inadequate in the end examination, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.

Break up for 100 Marks in the end examination:

1. Power point presentation 20 Marks
2. Thesis/Report preparation 40 Marks
3. Viva-voce 40 Marks

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16ECC101

DATA AND COMPUTER COMMUNICATION NETWORKS

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Digital communication is required

Course Objectives:

The main objective of this course is that the student shall develop an understanding of the underlying structure of the data and communication networks with special emphasis on the following concepts:

1. Fundamental concepts of computer networking like protocols, structured architecture models and topologies;
2. Link control concepts of flow and error control, switching concepts of circuit switching, packet switching, ATM etc., SS7.
3. Working of network components like Bridges, switches ; routing concepts and routing strategies; Network management, transport and application layer concepts

Topics Covered:

UNIT – I

Data Communications Model, communication Tasks, basic concepts of Networking and Switching, Line/Networking configurations; Protocols and Architecture, PDU, OSI and TCP/IP Architectures, Comparisons between OSI and TCP/IP; Flow Control, Sliding Window Flow Control, Error control, ARQ Protocols.

UNIT – II

Data Link Control, Bit stuffing, HDLC frame format, HDLC Modes and Operation; Circuit Switching concepts, Circuit SwitchElements, Three Stage Blocking type Space Division Switch, Time Division Switching**;** Packet Switching, Datagram and Virtual Circuit switching Principles, Effects of variable packet size.

UNIT – III

Control Signaling Functions, In Channel Signaling, Common Channel Signaling, Introduction to Signaling System Number 7 (SS7); X.25, X.25 Protocol Control Information; Routing, Routing in Packet Switched Networks and Routing Strategies; LAN Architecture, Topologies, Choice of Topology, Ring and Star Usage, MAC and LLC, Generic MAC Frame Format; Hubs, Two Level Star Topology, Layer 2 Switches.

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UNIT – IV

Bridge, Bridge Operation, Bridges and LANs with Alternative Routes, Spanning Tree, Loop resolution in bridges; Internetworking; Internet Protocol, IP address, IPv4, IPv6 comparison; Transport layer protocols, UDP Operation, TCP features, TCP/IP Addressing Concepts, Credit based Flow Control, Error Control and Congestion Control.

UNIT – V

Wireless LAN, IEEE 802.11 Architecture, IEEE 802.11- Medium Access Control logic; ATM, features and Architecture of ATM, Quality of Service in ATM; Security in the Internet, IP Security, Firewalls; Network Management System, SNMP.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Explain the importance of data communications and each of the Computer Networks related communication protocols in a structured architecture.
2. Analyze the services and features at various layers of data communication network architecture such as switching methodologies, flow and error control mechanisms etc.
3. Select appropriate routing strategies and congestion control algorithms for various networks.
4. Distinguish the operation of UDP & TCP and IPV 4 and IPV6 in terms of features and concepts.
5. Analyze the features and operations of various technologies like ATM, ISDN and applications like Mail Transfer, network management etc.

Suggested Reading:

1) William Stallings, "Data and Computer Communications", Ninth Edition, Pearson Prentice Hall, 2011.
2) Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, Tata Mc Graw Hill, 2007.

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16ECC105

PROBABILITY AND RANDOM PROCESSES

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge about probability and random variables is required.

Course Objectives:
Upon successful completion of the course, students will be able to:

1. Apply the knowledge of probability, random variables and random processes gained in this course to several complex engineering problems.
2. Model a random variable / process into a mathematical model. Compute probability distributions and estimate statistical / time variations
3. Identify a random signal, obtain the autocorrelation and PSD. Also able to estimate the response of a linear system to a random process such as noise.

Topics Covered:

UNIT I
Probability and distribution: Joint and conditional probability, independent events, Combined sample space, events in the combined space, probabilities in combined experiments, concept of random variables, distribution and density functions: Binomial, Poison, Uniform, Exponentia, Gaussian, and Rayleigh distributions. Conditional distribution and density functions.

UNIT II
Operations in Random Variables: Expectation, moments, Chebychev's inequality and Markov's inequality. functions that give moments, characteristic functions, moment generating function, transformation of a random variable, computer generation of one random variable, vector random variables, joint distribution and joint density properties, condition distribution and density, statistical independent, sum of several variables, central limit theorem: unequal distribution, equal distribution.

UNIT III
Multiple Random Variables and Processes: Expected value of a function of Random variables, Joint moments about the origin, joint central moments, joint characteristic functions, jointly Gaussian random variables and properties, Linear transformation of Gaussian Random Variables. Sampling and Limit theorems: estimation of Mean, Power and Variance. Complex random variables.

UNIT IV
The random process and spectral characteristics: concept, stationarity and independence, correlation functions, complex random processes.

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Spectral Characteristics of Random Processes: Power density spectrum and its properties. Relationship between power spectrum and auto correlation function. Cross power density spectrum and its properties, Relationship between cross power spectrum and cross correlation.

UNIT V

Linear System with Random Inputs: Random signal response of linear systems, auto correlation of response and cross correlation functions of input and out put. System evaluation using random noise. White and colored noise. Spectral characteristic of a system response. Noise band width, band pass, band limited processes and narrow band processes, properties of band limited processes. Modeling of noise sources, an antenna as noise source.

Course Outcomes:

Upon the completion of the course, the student will be able to

1. Understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.
2. Characterize probability models and function of random variables based on single & multiples random variables.
3. Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits.
4. Demonstrate the specific applications to Poisson and Gaussian processes and representation of low pass and band pass noise models.
5. Apply the theory of random processes to signal processing and communications systems and characterize systems by analyzing random process response.

Suggested Reading:

1. Peyton Z. Peebles JR., "Probability Random Variables and Random Signal Principles", Tata Mc Graw Hill, edition, 4/e, 2002.
2. Athanasios Papolis, "Probability, Random Variables and Stochastic Processes", McGraw Hill, Inc., 3rd edi., 1991.
3. Stark, "Probability & Random Process with Application to Signal Processing", Pearson Education, 3rd edition, 2002.

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16ECC106

CODING THEORY AND TECHNIQUES

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites:

A good background of mathematics including matrices, probability theory is expected and the student must have completed the related courses including Digital Communications, Information Theory and Source coding.

Course Objectives:

1. To study the various algorithms and compare bit error rate for different systems.
2. To develop an understanding of the underlying mathematical structure and algorithms different codes and how they applicable.
3. To study and analyze the real time applications of each coding technique.

Topics Covered:

UNIT – I
Introduction:
Digital communication system, Wireless channel statistical models, BER performance in AWGN and fading channels for different modulation schemes, BER performance of CDMA, FH – CDMA in AWGN and fading channels, capacity of fading channels with CSI, Diversity reception, channel coding Theorem, Channel coding gain.

UNIT – II
Block Coding:
Galois fields, polynomials over Galois fields, RS codes, Decoding Techniques for RS codes, LDPC encoder and decoder, Performance analysis of RS and LDPC codes. BCH codes.

UNIT – III
Convolution codes:
Linear convolution encoders, Structural properties of Convolution codes, Viterbi decoding technique for convolution codes – Soft / Hard decision, concatenation of block codes and convolutional codes, performance analysis, concept of Trellis coded modulation.

UNIT – IV
Turbo Codes:
Parallel concatenation, Turbo encoder, Iterative decoding using BCJR algorithm, Performance analysis.

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UNIT – V

Space – Time Coding:

MIMO systems, MIMO fading channels, rate gain & diversity gain, transmit diversity, Alamouti scheme, OSTBC codes, Linear space – time codes, trellis space – time codes, Space – time codes with no CSI

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop mathematical model for various types of wireless channels and assess Channel capacity and information rates.
2. Able to apply linear algebra, concept of Galois field, conjugate roots, minimal polynomial in channel coding techniques for error control.
3. Explain Structural, Distance properties and analyze efficient decoder algorithms of Convolutional codes.
4. Explore efficient design methods and the powerful soft iterative decoding techniques for high capacity codes like LDPC codes and Turbo codes
5. Understand and appreciate the use of Alamouti codes, Space-time block codes & Space-time trellis codes.

Suggested Reading:

1. S.B. Wicker, Error control systems for Digital communication and storage, Prentice-hall 1995.
2. E. Biglieri, Coding for Wireless Channels, Springer,2007.
3. K.L.Du & M.N.S.Swamy, Wireless Communication Systems: From RF Subsystems to 4G Enabling Technoligies, Cambridge,2010.
4. J.G. Proakis & M. Salehi, Digital Communications, Mc Graw-Hill, 2008.

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16ECE105

SATELLITE AND MICROWAVE COMMUNICATIONS

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of satellite communication is required

Course Objectives:

1. To acquire the essential knowledge to understand CCITT modulation plans, units for power calculations, Noise calculations.
2. To explain the students about LOS propagation, Link engineering, path and link reliability, Tropospheric scatter communication system.
3. To get the concepts of Earth station technology, V-SAT, GIS and GPS.

Topics Covered:

UNIT I

Introductory concepts: Transmission problem, simplified transmission system, the decibel and basic derived decibel unit, Neper, practical transmission, speech, SNR, Noise figure and noise temperature, EIRP and conversion factors, CCITT modulation plan, loading of FDM system, pilot tones, noise calculation, through super group techniques, compandors, characteristics of carrier equipment.

UNIT II

Line-of-sight communication systems: Link engineering, propagation characteristics in free space, path calculations, feeding, diversity reception, noise power ratio and its measurements, frequency planning. Path and link reliability, rainfall and other precipitation attenuation, radio link repeaters, antenna towers and masts, plain reflectors as passive repeaters, noise planning on radio links.

UNIT – III

Tropospheric scatter communication system: Introduction, phenomenon of tropospheric scatter, tropospheric fading, path loss calculations, aperture to medium coupling loss take of angle, equipment configuration, isolation, inter modulation, typical tropospheric scatter parameters. Frequency assignment. Earth station technology: The satellite earth space window, path loss considerations of the up link and down path calculations.

UNIT- IV

Earth station, G/T, C/N , link calculation, C/N for the complete link, and design of communication systems via satellites, Modulation, Multiplexing and multiple access techniques: TDMA,FDMA, CDMA,SSMA, SPADE.

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UNIT – V

Reliability, Redundancy, Quality assurance, Echo control and Echo suppression, introductory concepts of VSATS, GIS, GPS and Future trends, Pay load engineering – Definition, constraints, specification and configurations.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Acquire fundamental knowledge of CCITT modulation plans, power and noise calculations.
2. Analyze LOS propagation system and calculate the path and link reliability.
3. Understand and compare the Tropospheric communication system and also the concepts of Earth station Technology.
4. Calculate G/T and C/N ratios of a path link.
5. Understand the basic concepts of VSAT, GIS, GPS and payload engineering.

Suggested Reading:

1. Roger L Free man, "Telecommunication transmission handbook", John Wiley, 4th Edition, 1998.
2. T.Pratt & C.W. Bostian, "Satellite Communication Systems", PHI, 1st edition,1986.
3. B.G.Evans, Satellite communication system edited, 3rd edition, IET, U.K., 2008.
4. Dennis Roddy, "Satellite Communication Systems", Mc Graw Hill publications, 4th Edition, 2006.
5. Wayne Tomasi "Advanced Electronics Communication System" Pearson Education, 6thEdt, Apr 2003.

16ECE102

GLOBAL NAVIGATION SATELLITE SYSTEMS

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Pre-requisite: A prior knowledge of Satellite Communication, Radio Navigation Aids and INS is required.

Course Objectives

1. To explain the basic principles of various positioning techniques and introduce GPS operating principle.
2. To make the students to understand the essential features such as signal structure, errors, coordinate systems etc., and highlight the importance of integrating GPS with other systems.
3. To teach the necessity of augmentation of GPS and discuss SBAS and GBAS systems.

Topics Covered:

UNIT 1

GPS fundamentals: INS, Trilaiteration, Hyperbolic navigation, Transit, GPS principle of operation, architecture, operating frequencies, orbits, Keplerian elements.Solar and Siderial days, GPS and UTC Time.

UNIT 2

GPS Signals:, Signal structure, C/A and P-Code, ECEF and ECI coordinate systems and WGS 84 and Indian datums, Important components of receiver and specifications, link budget.

UNIT 3

GPS Error Models: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Antenna Phase center variation, multipath; estimation of Total Electron Content (TEC) using dual frequency measurements, Various DOPs, UERE. Spoofing and Anti-spoofing. : Future GPS satellites, new signals and their benefits GPS integration – GPS/GIS, GPS/INS, GPS/pseudolite, GPS/cellular.

UNIT 4

GPS data processing, DGPS and Applications: RINEX Navigation and Observation formats, Code and carrier phase observables, linear combination and derived observables, Ambiguity resolution, cycle slips, Position estimation. principle of operation of DGPS, architecture and errors.

UNIT 5

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Other Constellations and Augmentation systems Other satellite navigation constellations GLONASS and Galileo IRNS System. : Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS. Local area augmentation system (LAAS) concept.

Course Outcomes

1. Students will understand various data formats obtained from GNSS signals.
2. Students will be able to calculate satellite and user position.
3. Students will be able estimate the contribution of each error
4. Students are expected to estimate the GNSS positional accuracy.
5. Students will understand the concepts of Global and Regional Navigation and Augmentation systems developed by other nations.

Suggested Reading:

1. B.Hofmann Wollenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice", Springer Wien, new York, 2000.
2. Pratap Misra and Per Enge, "Global Positioning System Signals, Measurements, and Performance," Ganga-Jamuna Press, Massachusetts, 2001.
3. Ahmed El-Rabbany, "Introduction to GPS," Artech House, Boston, 2002.
4. Bradford W. Parkinson and James J. Spilker, "Global Positioning System: Theory and Applications," Volume II, American Institute of Aeronautics and Astronautics, Inc., Washington, 1996.

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16ECE111

EMBEDDED SYSTEM DESIGN

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisite: A prior knowledge of Microprocessors-Microcontrollers and basics of operating Systems is required.

Course Objectives:

1. To learn the fundamentals of the embedded system design
2. To understand RTOS environment in embedded system
3. To analyze various embedded applications and debugging tools

Topics Covered:

UNIT – I
Introduction to Embedded Systems: An Embedded system, Classification, processor in the system, other hardware units, structural units in a processor, processor selection for an embedded system, memory devices, memory selection for an embedded system, introduction to ARM processors.

UNIT – II
Devices and Buses: I/O devices, Serial communication using IIC and CAN buses, advanced I/O buses between the networked multiple Devices, Device drivers: Classification, Parallel port device drivers in a system, Serial port device drivers in a system.

UNIT – III
Interprocess communication and synchronization of processes, Task and Threads: Multiple processes in an application, problem of sharing data by multiple tasks and routines, Embedded programming in C++ and Java.

UNIT – IV
Real time Operating Systems: Operating system services, Real time operating system services, interrupt routines in RTOS Environment, RTOS Task scheduling, embedded Linux internals, OS Security issues, Mobile OS.

UNIT – V
Hardware-Software Co-Design in an Embedded System: Embedded system project Management, Embedded system Design and Co-Design issues in system development process. Design cycle in system development phase for an embedded system, Emulator and ICE, Use of software tools for development of Embedded systems, Case studies of programming with RTOS(Examples: Automatic chocolate vending machine, vehicle tracking system, Smart card).

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Course Outcomes:

Students will be able to

1. Choose appropriate processor for an Embedded System application.
2. Understand various Serial communication protocols like IIC, CAN.
3. Understand inter process communication techniques for multiprocessing.
4. Know different Real Time Task Scheduling algorithms.
5. Develop and Debug various embedded system applications.

Suggested Reading:

1. Raj Kamal,"Embedded Systems" Architecture, Programming and Design, TMH, 2006.
2. Jonathan W Valvano, "Embedded Micro Computer Systems" Real Time Interfacing, Books / cole, Thomson learning 2006.
3. Arnold S Burger, "Embedded System Design" An Introduction to Processes, Tools and Techniques by CMP books, 2007.
4. David.E. Simon, "An Embedded Software Primer", Pearson Edition, 2009.
5. Andrew N.sloss, Dominic Symes, Chris Wright, "ARM System Developer's guide", Elsevier publications 2005.

16ECC107

COMMUNICATIONS LAB

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of Digital communication is required.

Course Objectives:

The main objective of this course is that the student shall develop an understanding of the underlying concepts of communication systems with special emphasis on the following concepts:

1. Fundamental modulation schemes and Synchronous and asynchronous serial data communication.
2. Study of noise figure and error coding.
3. Establishing a simple optical fiber communication link.

List of Experiments Covered:

1. Study of Phase Shifter, Multiplier and Integrate and Dump Filter
2. Measurement of noise figure
3. Analysis of error coding, parity check and hamming check.
4. Study of wavelength division multiplexing and de-multiplexing.
5. Establishment of Analog / Digital links on optical fibre communication systems, study of 4 channel TDM on optical fibre link
6. Serial communication using RS 232C / Standard Asynchronous / Synchronous model
7. Characterization of Optical directional coupler.
8. Study of modulation schemes using Spectrum analyzer.
9. Simulation of Analog and Digital Communication Modulators / Demodulators using MATLAB and SIMULINK.
10. Simulation of Channel coding / decoding using MATLAB and SIMULINK

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Experiments on TMS320 C6748 Processor using CCS

11. Familiarity with CCS-Creation, debugging and running a project

12. Implementation of convolution and correlation

13. Implementation of Decimation and Interpolation

14. Implementation of FFT

15. Implementation of FIR and IIR filters

Course Outcomes:
Upon completion of this course, the student will be able to

1. Able to apply suitable modulation schemes and coding for various applications.
2. Examine the Analog / Digital links on optical fibre communication systems, study of 4 Channel TDM on optical fibre link.
3. Utilize the Optical directional coupler and Spectrum analyzer.
4. Develop the simulation models for different modulation schemes and perform channel Coding using MATLAB and SIMULINK.
5. Perform the Experiments on TMS320 C6748 Processor using CCS.

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16ECC109

SEMINAR - 1

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of any Subject in Communication Engineering (related to the seminar topic) is required.

Course Objectives:

1. Awareness of how to use values in improving own professionalism
2. Learning about personal and communication styles
3. Learning management of values for personal and business development

Oral presentation and technical report writing are two important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in the advanced fields of Communication Engineering and related topics.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects for a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / LCD presentation
- Technical writing

Each student required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes time for presentation following by a 10 minutes discussion.
3. Submit a detailed technical report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule shall not be entertained.

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and technical report preparation as well as their involvement in the discussions.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Demonstrate effective writing skills and processes by employing the rhetorical techniques of academic writing, including invention, research, critical analysis and evaluation, and revision.
3. Effectively incorporate and document appropriate sources in accordance with the formatting style proper for the discipline and effectively utilize the conventions of standard written English.
4. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids.
5. Deliver well-rehearsed and polished presentations meeting time, content, and interactive requirements.

SOFT SKILLS

16 EG 104

Instruction	2 Hours per week	End Exam- Duration	-
Sessionals	Satisfactory/Unsatisfactory	End Exam- Marks	-

Prerequisite for the Course: - The students should be graduates with basic English proficiency and possess knowledge of both verbal and non-verbal communication skills.

Course Objectives:
To help the students

1. Participate in group discussions and case studies with confidence and to make effective presentations. To equip them with resume packaging, preparing and facing interviews.
2. Build an impressive personality through effective time management, leadership, self-confidence and assertiveness.
3. Understand what constitutes proper grooming and etiquette in a professional environment. To be competent in verbal aptitude.

Exercise 1
Group Discussion & Case studies – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
Elements of effective presentation – Structure of presentation – Presentation tools – Body language
Creating an effective PPT

Exercise 2
Interview Skills – Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets
Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 3
Personality Development – Effective Time Management, assertiveness, decision making and problem solving, stress management, team building and leadership.

Exercise 4
Corporate Culture – Grooming and etiquette, corporate communication etiquette.
Academic ethics and integrity

Exercise 5
Verbal Aptitude – Sentence correction, sentence completion, jumbled sentences and vocabulary. Reading comprehension.

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Course Outcomes:

The students will be able to

1. Be effective communicators and participate in group discussions and case studies with confidence. Also be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
4. Make the transition smoothly from campus to corporate. Also use media with etiquette and know what academic ethics are.
5. Correct and complete sentences, have a good vocabulary and comprehend passages confidently

Suggested Reading:

1. Leena Sen , "Communication Skills", Prentice-Hall of India, 2005
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
4. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989

16ECC102

MODERN DIGITAL SIGNAL PROCESSING

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Signals and systems is required.

Course objectives:
1. To design FIR and IIR filters.
2. To understand multi rate signal processing techniques and filter banks.
3. To learn Wavelet Transforms and its advantages compared to STFT.

Topics Covered:

UNIT I
Digital filters: Review of FIR and IIR filters, Optimal FIR filters Spectral or frequency transformation of IIR filters, cascaded and lattice structures of FIR and IIR filters, Comparison of FIR and IIR filters.

UNIT II
Multirate signal processing – Decimation by a integer factor , Interpolation by a integer factor , Sampling rate conversion by a rational factor , Design of practical sampling rate converters, Software implementation of sampling rate converters, Applications of Multirate signal processing.

UNIT III
Digital filter banks and Transmultiplexers: Digital filter banks, Maximally decimated DFT filter banks, Transmultiplexers, applications of transmultiplexers to digital communications modulation.

UNIT IV
Maximally decimated filter banks: Two- channel quadrature mirror filter banks, L–channel QMF banks, multi level filter banks, Two channel perfect reconstruction conditions, Design of perfect reconstruction filter banks with real coefficients, lattice implementation of orthonormal filter banks, application to an audio signal.

UNIT V
Introduction to wavelet transforms – Short time Fourier transform, Gabar transform, wavelet transform, Recursive multi resolution Decomposition, Haar wavelet, Digital filter implementation of the Haar wavelet, Digital Filtering interpretation.

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Course Outcomes:

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

1. Design and implement the required filter for the given specifications.
2. Analyze the given signals using multirate techniques.
3. Design and implement trans multiplexers.
4. Design QMF filter banks and M channel digital filter banks.
5. Analyze the signal using wavelet transforms.

Suggested Reading:

1. Proakis, JG and Manolakis, DG, 'Digital Signal Processing', PHI, 4th ed., 2006.
2. Roberto Cristi, Modern Digital Signal Processing, Thomson Books, 2004.
3. SK Mitra, Digital Signal Processing, TMH, 2006.
4. Emmanuel C. Ifeachor and Barrie W. Jervis, 'Digital Signal Processing- A practical approach, 2nd edition, Pearson Education, 2004.

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16ECC103

DETECTION AND ESTIMATION THEORY

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Digital signal processing is required.

Course Objectives:

1. To provide hypothesis testing, estimation and detection background for engineering applications.
2. To introduce the methods of detection and estimation techniques under different types of noises.
3. To impart knowledge about various filtering techniques such as K-B, W-K.

Topics Covered:

UNIT I
Elements of Hypothesis Testing: Introduction, Baye's Hypothesis Testing, Minimax Hypothesis Testing, Neyman – Pearson Hypothesis Testing and Composite hypothesis testing.

UNIT II
Signal Detection in Discrete Time: Models and Detector structures, Detection of deterministic signals in independent noise, Detection of deterministic signals in Gaussian noise. Detection of signals with random parameters. Detection of stochastic signals. Performance evaluation of signal detection procedures.

UNIT III
Elements of Parameter Estimation: Bayesian Parameter Estimation, MMSE, MMAE and MAP estimations. Non random parameter estimation. Exponential families, completeness theorem for exponential families. The information inequality. Maximum likelihood Estimation (MLE). Asymptotic normality of MLE's

UNIT IV
Elements of Signal Estimation: Introduction, Kalman – Bucy filtering. Linear estimation, Orthogonality Principle. Wiener – Kolmogrov filtering; Causal and non-causal filters.

UNIT V
Signal Detection in Continuous Time: Detection of deterministic and partly determined signals in Gaussian noise; Coherent detection. Detection of signals with unknown parameters.

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Course Outcomes:

Upon completion of course the students will able to learn

1. Classical and Bayesian estimation approaches.
2. Learn detection of signals in different types of noises. Detection of stochastic signals and performance evolution of detection procedures in discrete-time.
3. Learn about elements of parameter estimation such as Bayesian parameters estimation, MMSE estimation and maximum likelihood estimation etc.
4. Learn about elements of signal estimation techniques like Kalman-Bucy filtering, Wiener-Kolmogrov filtering, causal and non-causal filters etc.
5. Learn about detection of signals with unknown parameters. Coherent detection etc. in continuous time.

Suggested Reading:

1. H.V. Poor, "An Introduction to Signal Detection and Estimation", Springer – Verlag, 2nd edition, 1994.
2. M.D. Srinath & P.K. Rajasekaran, "An introduction to statistical signal processing with applications", Prentice Hall, 2002.
3. H.L. Vantrees, "Detection, Estimation & Modulation Theory", Part-I, John Wiley & Sons, 1968.

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16ECC104

WIRELESS MOBILE COMMUNICATION SYSTEMS

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Analog and Digital Communication Systems is required.

Course Objectives:

To introduce the knowledge of the following mobile and wireless communication concepts and technologies along with their applications to the students such as

1. The concepts of frequency reuse, handoff, channel assignment, interference and system capacity enhancement.
2. Methods to estimate large scale path loss and received signal strength in case of various outdoor and indoor wireless propagation conditions.
3. The concepts of small scale fading due to multipath, Doppler Effect, signal and channel bandwidth conditions.

Topics Covered:

UNIT I

Modern Over View wireless communication systems: 1G, 2G, 2.5G, 3G and 4G technologies WLL, WLAN, PAN and Bluetooth.
Cellular Concept: Frequency reuse, Channel assignment strategies, handoff strategies.

UNIT II

Interference and system capacity, near end and far end interference, effect of near end mobile units. Grade of service, improving coverage and capacity in cellular systems.

UNIT III

Mobile radio propagation : large scale propagation free space propagation model. Outdoor propagation models: longely Rice model, Durkin's model, A case study, okumura model, Hata model, PCS Extension to Hata model. Indoor propagation models: partition losses(same floor), partition losses(between floors), log distance path loss model, ericsson multiple breakpoint model, attenuation factor model, signal penetration into buildings.

UNIT IV

Small scale fading & multipaths: Factors influencing small scale fading, small scale multipath measurements, parameters of mobile multipath channel. Types of small scale fading. Spread Spectrum techniques,Multiple Access techniques: FDMA, TDMA, CDMA, CDMA Cellular radio networks.

UNIT V

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Modulation techniques for mobile radio, constant enevelop modulation AMPS, and ETACS, GSM.Intelligent network for wireless communication advanced intelligent network (AIN), SS7 network for ISDN & AIN. Wireless ATM networks.

Course Outcomes:

Upon the completion of the course, the student will be able to

1. Distinguish the major cellular communication standards (1G/2G/3G/4G systems)
2. Appreciate the tradeoffs among frequency reuse, signal-to-interference ratio, capacity, and spectral efficiency
3. Analyze large-signal path loss and shadowing and compare different outdoor and indoor propagation models.
4. Distinguish the merits and demerits of TDMA, FDMA and CDMA technologies used for mobile cellular communication.
5. Apply different modulation techniques to various wireless communication and networks.

Suggested Reading:

1. Rappaport, “Wireless Communication”, Pearson Education, 2nd edition, 2002.
2. William C. Y. Lee, “Mobile Cellular Telecommunications: Analog and Digital Systems”, 2nd edition, McGraw-Hill Electronic Engineering Series, 1995.
3. William C.Y. Lee, “Mobile Communication Engineering”, Mc-Graw Hill, 1997.
4. Mike Gallegher, Randy Snyder, “Mobile Telecommunications Networking with IS-41”, McGraw Hill 1997.
5. Kernilo, Feher, “Wireless Digital Communications”, PHI, 2002.

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IMAGE PROCESSING AND VIDEO PROCESSING

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Signal Processing is required.

Course Objectives:

1. To introduce the basic concepts and methodologies involved in image and video processing.
2. To understand the basic image transform techniques and use them in real time enhancement, segmentation and compression of images and videos
3. To provide a conceptual foundation that can be used as a basis for further study and research in this field.

Topics Covered:

UNIT I

Fundamentals of Image Processing and Image Transforms

Basic steps of Image Processing System, Sampling and Quantization of an image, relationship between pixels.

Image Transforms

2 D- Discrete Fourier Transform, Discrete Cosine Transform (DCT), Wavelet Transforms: Continuous Wavelet Transform, Discrete Wavelet Transforms.

UNIT II

Image Processing Techniques

Image Enhancement

Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

Image Segmentation

Segmentation concepts, Point, Line and Edge Detection. Thresholding, Region Based segmentation.

UNIT III

Image Compression

Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, Arithmetic coding, LZW coding, Run

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length coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, JPEG Standards.

UNIT IV

Basic concepts of Video Processing

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT V

2-D Motion Estimation

Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Course Outcomes:

Upon completion of this course, the student will be able to

1. To understand various Image Transforms and their applications.
2. Apply Image enhancement and segmentation techniques both in spatial and frequency domain.
3. To reduce the redundancy in both lossy and lossless compression models.
4. Apply 2D-Motion estimation algorithms and develop predictive coding.
5. Creatively apply contemporary theories, processes and tools in the development and evolution of solutions to problems related to image and video processing.

Suggested Reading:

1. Gonzaleze and Woods ,Digital Image Processing , 3rd ed., Pearson.
2. Yao Wang, Joem Ostermann and Ya–quin Zhang ,Video processing and communication, 1st Ed., PH Int.
3. M. Tekalp ,Digital Video Processing , Prentice Hall International

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16ECE113

SOFTWARE DEFINED AND COGNITIVE RADIO

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of signal processing, Communication and spectral knowledge is required.

Course Objectives:

1. To make the students understand the difference between Superhetrodyne Radio and Software defined Radio (SDR).
2. To differentiate between Cognitive Radio (CR) and SDR and study their architectures.
3. To make the students know about the CR signal processing Techniques and applications.

Topics Covered:

UNIT I

Introduction to SDR: What is Software-Defined Radio, The Requirement for Software-Defined Radio, Legacy Systems, The Benefits of Multi-standard Terminals, Economies of Scale, Global Roaming, Service Upgrading, Adaptive Modulation and Coding, Operational Requirements, Key Requirements, Reconfiguration Mechanisms, , Handset Model, New Base-Station and Network, Architectures, Separation of Digital and RF, Tower-Top Mounting, BTS Hoteling, Smart Antenna Systems, Smart Antenna System Architectures, Power Consumption Issues, Calibration Issues, Projects and Sources of Information on Software Defined Radio,

UNIT II

Basic Architecture of a Software Defined Radio: Software Defined Radio Architectures, Ideal Software Defined Radio Architecture, Required Hardware Specifications, Digital Aspects of a Software Defined Radio, Digital Hardware, Alternative Digital Processing Options for BTS Applications, Alternative Digital Processing Options for Handset Applications, Current Technology Limitations, A/D Signal-to-Noise Ratio and Power Consumption, Derivation of Minimum Power Consumption, Power Consumption Examples, ADC Performance Trends, Impact of Superconducting Technologies on Future SDR Systems.

UNIT III

Signal Processing Devices and Architectures: General Purpose Processors, Digital Signal Processors, Field Programmable Gate Arrays, Specialized Processing Units, Tilera Tile Processor, Application-Specific Integrated Circuits, Hybrid Solutions, Choosing a DSP Solution.

GPP-Based SDR, Non real time Radios, High-Throughput GPP-Based SDR, FPGA-Based SDR, Separate Configurations, Multi-Waveform Configuration, Partial Reconfiguration, Host Interface, Memory-Mapped Interface to Hardware, Packet Interface, Architecture for FPGA-Based SDR, Configuration, Data Flow, Advanced Bus Architectures, Parallelizing for Higher Throughput,

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Hybrid and Multi-FPGA Architectures, Hardware Acceleration, Software Considerations, Multiple HA and Resource Sharing, Multi-Channel SDR.

UNIT IV

Cognitive Radio : Techniques and signal processing History and background, Communication policy and Spectrum Management, Cognitive radio cycle, Cognitive radio architecture, SDR architecture for cognitive radio, Spectrum sensing Single node sensing: energy detection, cyclostationary and wavelet based sensing- problem formulation and performance analysis based on probability of detection vs SNR. Cooperative sensing: different fusion rules, wideband spectrum sensing- problem formulation and performance analysis based on probability of detection vs SNR.

UNIT V

Cognitive Radio: Hardware and applications: Spectrum allocation models. Spectrum handoff, Cognitive radio performance analysis.Hardware platforms for Cognitive radio (USRP , WARP), details of USRP board, Applications of Cognitive radio

Course Outcomes:

1. The students would learn the difference between the super hetrodyne receiver, Software Defined Radio and Cognitive Radio.
2. The different architectures of SDR and CR would be learnt by the student.
3. The various spectrum sensing methods should be understood.
4. Various signal processing techniques of CR would be known.
5. The facilities available in USRP and WARP boards are known.

Suggesting Reading:

1. “RF and Baseband Techniques for Software Defined Radio” Peter B. Kenington, ARTECH HOUSE, INC © 2005.
2. “Implementing Software Defined Radio”, Eugene Grayver, Springer, New York Heidelberg Dordrecht London, ISBN 978-1-4419-9332-8 (eBook) 2013.
3. “Cognitive Radio Technology”, by Bruce A. Fette, Elsevier, ISBN 10: 0-7506-7952-2, 2006.
4. “Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems”, Hüseyin Arslan, Springer, ISBN 978-1-4020-5541-6 (HB), 2007.

16ECE119

SELECTED TOPICS IN STRATEGIC ELECTRONICS

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Radar Engineering, communication and antenna concepts are required

Course Objectives

1. To explain the concepts of electronic intelligence using the fundamentals of radar and simple localization techniques along with appropriate mathematical analysis necessary for solving new problems.
2. To teach the position fixing techniques and communication EW systems along with standard methods for electronic jamming.
3. To present the concepts of DF antennas and shared aperture arrays necessary for complete understanding of both ELINT and COMINT systems.

Topics Covered:

UNIT – I: Electronics Intelligent

Electronic Intelligence Defined, The Importance of Intercepting and Analyzing Radar Signals, Limitations Due to Noise, Probability of Intercept Problems. Inferring Radar Capabilities from observed Signal Parameters, Receivers for Radar Interception. Major ELINT Signal Parameters,the Impact of LPI Radar on ELINT, Direction Finding, Instantaneous Direction Finding.Amplitude Comparison AOA Measurement, Phase Interferometers, Bearing Discriminators. Short Baseline TDOA for AOA.

UNIT – II: Emitter Location

Introduction, Emitter Location Estimation, Deriving the Location Covariance Matrix. Angle of Arrival Location Analysis, Time Difference of Arrival Location Analysis, Time/Frequency Difference of Arrival Location Analysis. Geometric Dilution of Precision, Incorporation of Measurement Error.

UNIT – III: **Position – Fixing Techniques**

Position – fixing algorithms: Eliminating Wild Bearings, Stansfield Fix Algorithm, Mean-Squared Distance Algorithm. Single-site location techniques: Fix accuracy, GDOP and fix coverage. Time

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difference of Arrival: Position-Fixing using TDOA Measurements, GDOP.Differential Doppler, Position-Fix Accuracy. Time of Arrival.

UNIT–IV: Communication EW Systems and Techniques for Electronic Jamming

Introduction, Information warfare, Electronic warfare: Electronic support, Electronic attack, Electronic Protect.Electron support: Low probability of detection/interception/exploitation.Typical EW System Configuration.Electronic attack: Introduction, Communication jamming, jammer deployment, narrow band / partial-band jamming, barrage jamming, follower jammer, jamming LPI targets.A General Description of the Basic Elements of Electronic Jamming. Mathematical Models of Jamming Signals: Fundamental Principles.

UNIT – V:DF Antennas and Shared aperture arrays

Omni-Directional Antennas: Omni-Directional Antenna Applications, Parameters for Omni-Directional Antennas, Directional Intercept Antennas. Linear arrays: Uniformly spaced line source of equal amplitude, array grating lobes, Beam width and band width of phased arrays. Array directivity, array SNR gain, mutual coupling between antenna elements.Electronic warfare arrays, Shared aperture arrays: the arguments for systems integration, the case for shared aperture systems, the case for independent systems and the ideal shared aperture arrays.

Course Outcomes

1. Students will be able to understand various parameters of Radar signals
2. Students will be capable of understanding the intricacies of any ELINT system
3. Students will be able to mathematically estimate emitter locations for simple cases
4. Students will be able to estimate the position of the COMINT system
5. Students will understand the concepts of antennas and should be able to tell which type of antenna is suitable for either ELINT or COMINT systems.

Suggested Readings:

1. Richard G. Wiley, “ELINT: The Interception and analysis of Radar Signals”, Artech House Inc., 2006
2. Richard A. Poisel, “Introduction to Communication Electronic Warfare Systems”, 2nd edition, 2008, Artech house, Inc.
3. Sergei A. Vakin, Lev N. Shustov, Robert H. Dunwell “Fundamentals of Electronic Warfare”, 2001, Artech House, Inc.
4. Nicholas Fourikis, “Advanced array systems, Applications and RF technologies, 2005, Academic Press.

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16ECC108

COMPUTER COMMUNICATION NETWORKS LAB

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of Data and Computer Communication Networks is required.

Course Objectives:

The main objective of this course is that the student shall develop an understanding of the underlying structure of the data and communication networks with special emphasis on the following concepts:

1. Fundamental concepts of computer networking like Stop & Wait protocol, Go to back N-protocol, Selective Retransmission protocols.
2. Concepts of Data encryption in data communication networks, Network Management and wireless LAN
3. Working of IEEE standards like token bus (IEEE 802.4 standard) and token ring (IEEE 802.5 standard)

List of Experiments Covered:

1. Data communication protocols
   a) Stop & Wait protocol
   b) Go to back N-protocol
   c) Selective Retransmission
2. PC to PC file transfer
3. Error detection codes in data communications
4. Study of LAN fundamentals
5. Data encryption in data communication networks
6. Point – to – Point communication in communication networks
7. Multicast / Broadcast communication
8. Study of Token bus – IEEE 802.4 standard

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9. Network / Token management

10. Client Sever Simulation

11. Study of wireless LAN

Experiments on Embedded Applications

12. Design and development of embedded application by using serial communication protocols (7-segement display, ADC and DAC)

13. Design and development of ARM based wireless embedded networking Applications (GSM, GPS and Zigbee)

14. Implementation of multitasking by using Vx-Works IDE

15. Implementation of IPC by using Vx-Works IDE

Note: The experiments will be decided and modified if necessary and conducted by the lecture concerned.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Analyze network performance through simulation.
2. Simulate a client server system and analyze data flow characteristics.
3. The course also includes a short introduction to Data encryption in data communication networks.
4. Configure a wireless LAN and compare its working with respective to a wired LAN.
5. Design and develop ARM (Micro controller) based wired and wireless networking applications.

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16ECC110

SEMINAR - 2

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of any Subject in Communication Engineering (related to the seminar topic) is required.

Course Objectives:

1. Awareness of how to use values in improving own professionalism
2. Learning about personal and communication styles
3. Learning management of values for personal and business development

Oral presentation and technical report writing are two important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in the advanced fields of Communication Engineering and related topics.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects for a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / LCD presentation
- Technical writing

Each student required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes time for presentation following by a 10 minutes discussion.
3. Submit a detailed technical report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule shall not be entertained.

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and technical report preparation as well as their involvement in the discussions.

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Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Demonstrate effective writing skills and processes by employing the rhetorical techniques of academic writing, including invention, research, critical analysis and evaluation, and revision.
3. Effectively incorporate and document appropriate sources in accordance with the formatting style proper for the discipline and effectively utilize the conventions of standard written English.
4. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids.
5. Deliver well-rehearsed and polished presentations meeting time, content, and interactive requirements.

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16ECC111

MINI PROJECT

Instruction		End Exam- Duration	-
Sessionals	--	End Exam- Marks	-

Prerequisite for the Course: - The Student s should have a prior knowledge of the core courses under curriculum.

Course Objectives:

Students are expected to:

1. Practice and experience the literature survey on the chosen field / topic.
2. Able to formulate the scope of the mini project.
3. Use simulation / analytic tool for implementing the mini project.

First year ME students will each do a 14-week mini project, each generally comprising about one week of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment (see assessment information below), Each student will be allotted to a Faculty supervisor for mentoring.

Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original. Mini projects should have inter disciplinary/Industry relevance. The students can select a mathematical modelling based/Experimental investigations or Numerical modelling. All the investigations are clearly stated and documented with the reasons/explanations. All the projects should contain a clear statement of the research objectives, background of work, Literature review, techniques used, prospective deliverables, benefit from this [line of] research, Detailed discussion on results, Conclusions and references.

Assessment:

1. 50% of marks for a scientific report on the project.

Regarding the formatting and structure, the report should be written as a journal article using the style file of a journal appropriate for the field of the research (which journal format is most appropriate should be agreed between student and supervisor). Regarding content, the report should be understandable by your fellow students, so the introduction and literature review could be a bit more detailed than in a research paper. The results and discussions are in elaborate form and at end conclusions and include references.

2. 50% of marks for an oral presentation which will take place at the end of the semester and evaluation by a committee consist of Supervisor, one senior faculty and Head of the department or his nominee.

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Outcomes:

Students are able to:

1. Formulate a specific problem after proper Literature Survey.
2. Develop model/models either theoretical/practical/numerical form.
3. Simulate / analyze/ conduct of experiment and obtaining the results.
4. Conclude and Correlate the results obtained.
5. Prepare and write the documentation in standard format.

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16ECC112

PROJECT WORK - PROJECT SEMINAR

Instruction		End Exam- Duration	-
Sessionals	100 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The overall objective of the project seminar is to help develop an emerging field at the intersection of multi-disciplinary understandings of engineering education

1. To prepare the students for the dissertation to be executed in 4th semester for the Post Graduate dissertation.
2. To explore new research from a range of academic disciplines which throws light on the questions unanswered.
3. To showcase a cutting edge research on engineering Problems.

The main objective of the Project Seminar is to prepare the students for the dissertation to be executed in 4th semester. Solving a real life problem should be focus of Post Graduate dissertation. Faculty members should prepare the project briefs (giving scope and reference) at the beginning of the 3rd semester, which should be made available to the students at the departmental library. The project may be classified as hardware / software / modeling / simulation. It may comprise any elements such as analysis, synthesis and design.

The department will appoint a project coordinator who will coordinate the following:

- Allotment of projects and project guides.
- Conduct project - seminars.

Each student must be directed to decide on the following aspects

- Title of the dissertation work.
- Organization.
- Internal / External guide.
- Collection of literature related to the dissertation work.

Each student must present a seminar based on the above aspects as per the following guidelines:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through OHP, PC followed by a 10 minutes discussion.
3. Submit a report on the seminar presented giving the list of references.

Project Seminars are to be scheduled from the 3rd week to the last week of the semester. The internal marks will be awarded based on preparation, presentation and participation.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Effectively incorporate and document appropriate sources in accordance with the formatting style, proper for the discipline and effectively utilize the conventions of standard written English.
3. Better understand the role that effective presentations have in public/professional contexts and gain experience in formal/informal presentation.
4. Identify and critically evaluate the quality of claims, explanation, support, and delivery in public and professional discourse, and understand the factors influencing a speaker's credibility.
5. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids. Deliver well-rehearsed and polished presentations meeting time requirements, content, and interactive requirements.

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16ECC113

PROJECT WORK AND DISSERTATION

Instruction	--	End Exam- Duration	--
Sessionals	100	End Exam- Marks	100

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The Objectives of the dissertation are to:

1. Put into practice theories and concepts learned on the programme and to provide an opportunity to study a particular topic in depth;
2. Show evidence of independent investigation;
3. Show evidence of ability to plan and manage a project within deadlines.

The students must be given clear guidelines to execute and complete the project on which they have delivered a seminar in the 3rd semester of the course.

All projects will be monitored at least twice in a semester through student's presentation. Sessional marks should be based on the grades/marks, awarded by a monitoring committee of faculty members as also marks given by the supervisor.

Efforts be made that some of the projects are carries out in industries with the help of industry coordinates.

Common norms will be established for documentation of the project report by the respective department.

The final project reports must be submitted two weeks before the last working day of the semester.

The project works must be evaluated by an external examiner and based on his comments a viva voice will be conducted by the departmental committee containing of HOD, two senior faculty and supervisor.

Course Outcomes:

On satisfying the requirements of this course, students will have the knowledge and skills to:

1. Plan, and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic, relevant to environment and society
2. Systematically identify relevant theory and concepts, relate them to appropriate methodologies and evidence, apply appropriate techniques and draw appropriate conclusions
3. Engage in systematic discovery and critical review of appropriate and relevant information sources
4. Appropriately apply qualitative and/or quantitative evaluation processes to original data\ Define, design and deliver an academically rigorous piece of research.
5. Appreciate practical implications and constraints of the chosen topic.

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16EC C201

MICROCONTROLLERS FOR EMBEDDED SYSTEMS DESIGN

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:
Upon completing this course, students will be able to:

1. Acquire an overview of Embedded architecture
2. Understand the architectures of different microcontrollers to design embedded applications
3. Program both in assembly and in high level language for various applications of microcontrollers.
4. Analyze and design real world applications by using on/off chip peripherals of different Microcontrollers.
5. Apply theoretical learning to practical real time problems for automation.

UNIT-I
Introduction to Embedded Systems: Review of Microprocessors and their features. Differences between Microprocessors and Microcontrollers, Application areas of Embedded Systems, Categories of Embedded Systems.Overview of Embedded System Architecture, Challenges & Trends of Embedded Systems, Hardware Architecture, Software Architecture.

UNIT-II
Architecture, Instruction Set, Addressing Modes, ALP, Timers and Counters, Serial Communication, Interrupt Programming of 8051. Interfacing with External Memory, Expansion of IO Ports.Introduction to embedded cross compilers.

UNIT-III
Interfacing 8051 with ADC, DAC, LCD and Stepper Motor.PIC 18 Family Overview, Architecture, Instruction Set, Addressing modes, Timers and Interrupts of PIC 18.

UNIT-IV
Capture/Compare and PWM modules of PIC 18.Introduction to RISC Concepts with ARM Processor.Embedded Software Development Tools, Host and Target Machines, Linkers/Locators for Embedded Software, Getting Embedded Software into the Target System.

UNIT-V
Debugging Techniques- Testing on your Host Machine, Instruction Set Simulators, Using Laboratory Tools.
Case Studies: Design of Embedded Systems using Microcontrollers – for applications in the area of communications and automotives. (GSM/GPRS, CAN ,Zigbee)

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Suggested Readings:

1. David.E.Simon , “An Embedded Software Primer” Pearson Education.
2. Mazidi M.A and Mazidi J.G, “The 8051 Microcontroller and Embedded Systems” , Pearson 2007.
3. Mazidi, MCKinlay and Danny Causey, “PIC Microcontrollers and Embedded Systems”, Pearson Education.
4. Raj Kamal,Embedded Systems – Architecture, Programming and Design ,2nd Edition, TMH, 2008.

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16EC C202

CMOS VLSI Design

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:

Students will be able to

1. Understand various VLSI design abstraction levels and logic styles
2. Know various advanced CMOS logic design techniques
3. Learn logic families and building blocks of Digital design
4. Analyze memory and programmable logic devices
5. Design and implement various Digital CMOS systems

UNIT I

Introduction: Introduction to VLSI System design hierarchical design – design abstraction – different levels of abstraction and domains. MOS Transistor theory- NMOS inverter and logic gates-CMOS inverter and logic –Transmission gate logic design-Differential CMOS logic circuits.

UNIT II

Advanced CMOS Logic Design: Static CMOS Digital Latches- dynamic CMOS latches-CMOS Flip-flops- pseudo NMOS and dynamic pre-charging, domino- CMOS logic, no race logic, single-phase dynamic logic, dynamic differential logic.

UNIT III

Logic Families and Building Blocks for Digital Design:

Emitter coupled logic gates - current mode logic gates - BiCMOS Logic gates, Building blocks for digital design: multiplexer, demultiplexer, decoder, encoder -Barrel Shifter-Counters-Digital Adders-Multipliers-Parity generators-Detectors-Comparators.

UNIT IV

Memory and Programmable Logic: CMOS design methods: Structured design strategies – Hierarchy, regularity modularity, SRAM-Sense amplifier-address buffer and decoder, DRAM, ROM, Logic Arrays- PLA, PAL, Gate Arrays-FPGA, Design for testability.

UNIT V

System Case Studies: Finite State Machine (FSM), Algorithmic State Machines (ASMS), synchronization failure and meta stability, CMOS System case study: Core of RISC Micro Controller ALU address architectures.

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Suggesting Readings:

1. Ken Martin, "Digital Integrated Circuit Design", Oxford University Press 2000.
2. Weste Kamran Eshraghian, Principles of CMOS VLSI design – a Systems Perspective by NEILHE, Pearson Education Series, Asia 2002.
3. John P. Uyemura, "Introduction to VLSI Circuits and systems", John Wiley & Sons, 2011.
4. Sung-Mo Ang& Yusuf Leblebigi , "CMOS Digital Integrated Circuits Analysis and Design"- Mc-Gra-Hill Higher Education, 2nd Edition2003.

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16EC C205

ANALOG AND MIXED SIGNAL IC DESIGN

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:
Students will able to:

1. Define the characteristics MOSFET, Differential amplifier, Operational Amplifier and Data Converters
2. Understand the behavior of Current Mirror, MOS as an Analog Element.
3. Apply the concepts Current Mirror in analyzing Differential Amplifier, Operational Amplifier.
4. Analyze Different Amplifiers and Operational Amplifier with Different Loads.
5. Compare, Create, Design, Develop different types of data converters amplifiers with different loads.

UNIT I

Brief Review of Small Signal and Large Signal Model of BJTs and MOSFETs.
Current Mirrors and Single Stage Amplifiers – Simple CMOS current mirror, common source amplifier, source follower, common gate amplifier, cascode amplifiers. Source degenerated current mirrors. High out impedance – current mirrors, cascode gain stage Wilson current mirror, MOS differential pair and gain stage. Bipolar current mirrors – bipolar gain stages. Differential pairs with current mirror loads MOS and bipolar widlar current sources,

UNIT II

Operational amplifiers, Basic two stage MOS Operational amplifier–Characteristic parameters, two stage MOS Op-Amp with Cascodes. MOS Telescopic-cascode Op-Amp.MOS Folded cascode op-amp.MOS Active Cascode Op-Amp.Fully differential folded cascode op-amp.Current feedback op-amps.Stability and frequency compensation of op-amps. Phase margin and noise in op-amps.

UNIT – III

Comparators: Op-Amp Based Comparators, Charge Injection Errors – Latched Comparators – CMOS and BiCMOS Comparators – Bipolar Comparators.
Switched capacitor circuits: Basic building blocks; basic operation and analysis, inverting and non inverting integrators, signal flow diagrams, first order filter.
Sample and hold circuits - Performance requirements, MOS sample and hold basics, clock feed through problems,

UNIT – IV

S/H using transmission gates, high input impedance S/H circuits, improved S/H circuits from the point of slewing time, clock feed through cancellations. Data converter fundamentals - performance characteristics, ideal D/A and A/D converters, quantization noise. Nyquist rate D/A converters – decoder based converter, binary-scaled converters.Thermometer code converters, current mode converters.

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UNIT – V

Nyquist rate A/D Converters: Integrated converters – successive approximation converters, cyclic A/D converters, Flash or parallel converters, Two step A/D converters, pipelined A/D converters.

Over sampling converters. Over sampling without noise shaping over sampling and with noise shaping, system architecture – digital decimation filters.

supply insensitive biasing, temperature insensitive biasing, band gap reference, band gap reference circuits.

Suggested Readings:

1. Paul.R. Gray & Robert G. Major, Analysis and Design of Analog Integrated Circuits, John Wiley & sons. 2004
2. David Johns, Ken Martin, Analog Integrated Circuit Design, John Wiley & sons. 2004
3. BehzadRazavi, Design of Analog CMOS Integrated Circuits, Tata McGrah Hill. 2002
4. Jacob Baker.R.et.al., CMOS Circuit Design, IEEE Press, Prentice Hall, India, 2000.

16EC E201

COMPUTER COMMUNICATION NETWORKS

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:
Upon completion of this course, the student will be able to

1. Explain the importance of data communications and each of the Computer Networks related communication protocols in a structured architecture.
2. Analyze the services and features at various layers of data communication network architecture such as switching methodologies, flow and error control mechanisms etc.
3. Select appropriate routing strategies and congestion control algorithms for various networks.
4. Distinguish the operation of UDP & TCP and IPV 4 and IPV6 in terms of features and concepts.
5. Analyze the features and operations of various technologies like ATM, ISDN and applications like Mail Transfer, network management etc.

UNIT – I
Data Communications Model, communication Tasks, basic concepts of Networking and Switching, Line/Networking configurations; Protocols, PDU, OSI and TCP/IP Architectures, Comparisons between OSI and TCP/IP;

UNIT – II
Flow Control, Sliding Window Flow Control, Error control, ARQ Protocols. Data Link Control, Bit stuffing, HDLC frame format, HDLC Modes and Operation; Circuit Switching concepts, Circuit SwitchElements, Three Stage Blocking type Space Division Switch**;**

UNIT – III
Packet Switching, Datagram and Virtual Circuit switching Principles, Effects of variable packet size. Control Signaling Functions, In Channel Signaling, Common Channel Signaling, Introduction to Signaling System Number 7 (SS7); Topologies, Choice of Topology, Ring and Star Usage, MAC and LLC, Generic MAC Frame Format; Hubs, Switches.Bridge, Bridge Operation, Bridges and LANs.

UNIT – IV
Routing, Routing strategies; Internetworking; Internet Protocol, IP address, IPv4, IPv6 comparison; Transport layer protocols, UDP Operation, TCP features, TCP/IP Addressing Concepts, Credit based Flow Control, Congestion Control.

UNIT – V
Wireless LAN, IEEE 802.11 Architecture, IEEE 802.11- Medium Access Control logic; ATM,

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features of ATM, Quality of Service in ATM; Security in the Internet Network Management System, SNMP.

Suggested Readings:

1) William Stallings, "Data and Computer Communications", Ninth Edition, Pearson Prentice Hall, 2011.
2) Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, Tata McGraw Hill, 2007.

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16EC E206

VLSI TECHNOLOGY

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:
Upon completion of this course, students will be able to:

1. Study of various structures of Passive and Active Components
2. Understanding of various fabrication process steps of oxidation, lithography, etc. VLSI technology
3. To understand the process of VLSI circuit fabrication.
4. Analyze Clean rooms and their importance in VLSI technology
5. To understand Die, Bonding ,Packaging and testing.

UNIT I

Introduction – Integrated Circuits Review of history of VLSI technology progress–. Electronic Functions – Components – Analog and Digital ICs.Basic Devices in ICs – Structures Resistors – Capacitors – Inductors.Diodes – Bipolar Junction Transistors – Field Effect Transistors.Isolation techniques in MOS and bipolar technologies.

UNIT II

Monolithic ICs – Silicon as the Base Material and its advantages, various Layers of ICs – Substrate – Active Layer -Oxide/Nitride Layers – Metal/Poly Silicon Layers – Functions of Each of the Layers. Process Flow for Realization of Devices.Description of Process Flow for Typical Devices viz., FET and BJT.

UNIT III

Silicon Wafer Preparation – Electronic Grade Silicon – CZ and FZ Methods of Single Crystal Growth – Silicon Shaping – Mechanical Operations, Chemical Operations – Prefabrication Processes.

Epitaxy: Growth Dynamics – Process Steps. Vapour phase, Solid phase and Molecular Beam Epitaxial Processes. Epitaxial Reactors.

Oxide Growth: Structure of SiO_2, Growth Mechanism and Dynamics – Oxide Growth by Thermal method.

UNIT IV

Deposition techniques Chemical Vapour Deposition (CVD) and associated methods like LPCVD and PECVD. PVD thermal evaporation and sputtering. Step coverage issues.

Lithography: Steps involved in Photolithography – Quality of the Pattern – photo resists and their characteristics, optical exposure systems contact and projection systems, steppers, X-ray – Electron Beam Lithography.

Etching: Chemical, Electro Chemical – Plasma (Dry Etching) Reactive Plasma Etching.

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UNIT V

Ion implantation: Range and Penetration Depth – Damage and Annealing – Ion Implantation machine.Diffusion: Constant and Infinite Source Diffusions – Diffusion Profiles – Diffusion Systems – Multiple Diffusions and Junction Formations. Packaging: die and Bonding and Packaging, Testing.Clean rooms and their importance in VLSI technology

Suggested Reading:

1. S.M. Sze,VLSI Technology, McGrawhill International Editions.
2. CY Chang and S.M. SZe , VLSI Technology, Tata McGraw-Hill Companies Inc.
3. J.D.Plummer, M.D.Deal and P.B.Griffin ,The Silicon VLSI Technology Fundamentals, Practice and modeling, Pearson Education 2009
4. Stephen A, The Science and Engineering of Microelectronic Fabrication , Campbell Oxford 2001

16EC E213

OPTIMIZATION TECHNIQUES

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Objectives:

This course aims to:

1. Differentiate between LPP and NLP problems.
2. Differentiate between local variables and global variables.
3. Introduce the concepts of Genetic algorithm.

Course Outcomes:

Upon completion of the course, the student will be able to:

1. Formulate simple OT problems to maximise the profit.
2. Apply the LPP techniques to obtain optimal solution.
3. Apply the concepts of Sensitivity analysis to update the optimal solution from time to time.
4. Solve simple NLP problems using the gradient based methods.
5. Understand and apply the GA algorithm to get global optimal solution.

UNIT I

Use of optimization methods.Introduction to classical optimization techniques, motivation to the simplex method, simplex algorithm, sensitivity analysis.

UNIT II

Search methods - Unrestricted search, exhaustive search, Fibonocci method, Golden section method, Direct search method, Random search methods, Univariate method, simplex method, Pattern search method.

UNIT III

Descent methods, Gradient of function, steepest decent method, conjugate gradient method. Characteristics of constrained problem, Direct methods, The complex method, cutting plane method.

UNIT IV

Review of a global optimization techniques such as Monte Carlo method, Simulated annealing and Tunneling algorithm.

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UNIT V

Generic algorithm - Selection process, Crossover, Mutation, Schema theorem, comparison between binary and floating point implementation.

Suggested Readings:

1. SS Rao, "Optimization techniques", PHI, 1989.
2. Zhigmiew Michelewicz, "Genetic algorithms + data structures = Evaluation programs", Springer Verlog - 1992.
3. Merrium C. W., "Optimization theory and the design of feedback control systems", McGraw Hill, 1964.
4. Weldo D.J., "Optimum seeking method", PHI, 1964.

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16EC C207

LAB-1 DESIGN AND SIMULATION LABORATORY-I

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Course Outcomes:

Students will able to:

1. Define the characteristics tool and design entry in the tool
2. Understand the design spics and library files of tool
3. Apply the concept of theory in the lab implementation and Analyze power and delay calculation from the graphs
4. Understand the usage of various debugging tools available to program microcontrollers
5. Analyze the hardware and software interaction and integration and Design & develop the 8051 based embedded systems for various applications

Note: all the experiments are to be carried out independently by each student with different specifications. At least 12 experiments are to be carried out.

(i) Design and simulation of combinational circuits

(ii) Design and simulation of sequential circuits

(iii) Design and simulation of mixed signal circuits

(iv) Microcontroller programming

a. Toggling the LEDs,

b. serial data transmission,

c. LCD and Key pad interface

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16EC C209

SEMINAR – 1

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of any Subject in Embedded System and VLSI Design (related to the seminar topic) is required.

Course Objectives:

1. Awareness of how to use values in improving own professionalism
2. Learning about personal and communication styles
3. Learning management of values for personal and business development
4. Increase knowledge of Emotional Intelligence

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Demonstrate effective writing skills and processes by employing the rhetorical techniques of academic writing, including invention, research, critical analysis and evaluation, and revision.
3. Effectively incorporate and document appropriate sources in accordance with the formatting style proper for the discipline and effectively utilize the conventions of standard written English.
4. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids.
5. Deliver well-rehearsed and polished presentations meeting time, content, and interactive requirements.

Oral presentation and technical report writing are two important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in the advanced fields of Embedded System and VLSI Design and related topics.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects for a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / LCD presentation
- Technical writing

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Each student required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes time for presentation following by a 10 minutes discussion.
3. Submit a detailed technical report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule shall not be entertained.

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and technical report preparation as well as their involvement in the discussions.

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SOFT SKILLS

16 EG 104

Instruction	2 Hours per week	End Exam- Duration	-
Sessionals	Satisfactory/Unsatisfactory	End Exam- Marks	-

Prerequisite for the Course: - The students should be graduates with basic English proficiency and possess knowledge of both verbal and non-verbal communication skills.

Course Objectives:
To help the students

1. Participate in group discussions and case studies with confidence and to make effective presentations. To equip them with resume packaging, preparing and facing interviews.
2. Build an impressive personality through effective time management, leadership, self-confidence and assertiveness.
3. Understand what constitutes proper grooming and etiquette in a professional environment. To be competent in verbal aptitude.

Exercise 1
Group Discussion & Case studies – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
Elements of effective presentation – Structure of presentation – Presentation tools – Body language
Creating an effective PPT

Exercise 2
Interview Skills – Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets
Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 3
Personality Development – Effective Time Management, assertiveness, decision making and problem solving, stress management, team building and leadership.

Exercise 4
Corporate Culture – Grooming and etiquette, corporate communication etiquette.
Academic ethics and integrity

Exercise 5
Verbal Aptitude – Sentence correction, sentence completion, jumbled sentences and vocabulary. Reading comprehension.

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16EC C203

RF IC DESIGN

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:

Students will able to:

1. Define the characteristics RF systems, Tuned circuits, LNA, Mixers
2. Understand the behavior of RF systems, Reflection Coefficient and Noise in the MOS device
3. Apply the concepts noise and to characterize the amplifiers (Unit I,V)
4. Analyze different Power Amplifiers at RF range (all units)
5. Compare Design, Develop and Improve the performance of LNA, Power amplifier, PLL

Unit I:

RF systems – basic architectures, Transmission media and reflections, Maximum power transfer, Passive RLC Networks, Parallel RLC tank, Q ,Series RLC networks, matching, Pi match, T match , Passive IC, Interconnects and skin effect, Resistors, capacitors, Inductors.

Unit II:

Review of MOS Device Physics, MOS device review , Distributed Systems ,Transmission lines, reflection coefficient, The wave equation, examples, Lossy transmission lines ,Smith charts – plotting gamma, High Frequency Amplifier Design, Bandwidth estimation using open-circuit time constants , Bandwidth estimation using short-circuit time constants.

Unit III:

Risetime, delay and bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers, tuned amplifiers Cascaded amplifiers Noise Thermal noise, flicker noise review, Noise figure, LNA Design .

Unit IV:

Intrinsic MOS noise parameters ,Power match versus noise match, Large signal performance, design examples & Multiplier based mixers, Mixer Design, Subsampling mixers, RF Power Amplifiers, Class A,AB,B, C amplifiers, Class D,E, F amplifiers, RF Power amplifier design examples.

Unit V:

Voltage controlled oscillators, Resonators , Negative resistance oscillators , Phase locked loops Linearized PLL models , Phase detectors, charge pumps, Loop filters, PLL design examples, Frequency synthesis and oscillator Frequency division, integer-N synthesis , Fractional frequency synthesis, Phase noise, General considerations , Circuit examples, Radio Architectures, GSM radio architectures, CDMA, UMTS radio architectures.

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Suggested Readings:

1. The Design of CMOS Radio-Frequency Integrated Circuits by Thomas H. Lee. Cambridge University Press, 2004.
2. RF Microelectronics by BehzadRazavi.Prentice Hall, 1997.

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16EC C204

EMBEDDED PROCESSORS AND ARCHITECTURE

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:

Students will be able to:

1. Understand the basic architectural needs of Programmable DSPs
2. Understand the advanced VLIW architecture of TMS320C54XX of Programmable DSPs
3. Compare and select ARM processor core based on requirements of embedded Application
4. Use different software development tools like Code Composer Studio to develop any DSP based embedded application
5. Design and Develop small applications on DSP processor based platform

UNIT I

Introduction to DSP Processors: Differences between DSP and other μp architectures, their comparison and need for special ASP^s , RISC & CISC CPUs. Number formats- Fixed point and Floating point formats, Dynamic range and precision.

UNIT II

Data Paths, Basic architectural features, DSP computational building blocks, Bus and Memory architecture, Address generation unit, speed issues, Synchronous serial interface, Multichannel Buffered serial port(McBSP).

UNIT III

Overview of DSP processor design: fixed point DSP^s – Architecture of TMS 320C 54X Processor , addressing modes, Assembly instructions, Pipelining and on-chip peripherals.

UNIT IV

DSP interfacing & software development tools: Interfacing memory and parallel I/O peripherals, DSP tools – Assembler, debugger, c-compiler, linker, editor, code composer studio.

UNIT V

ARM Processor families, Architecture-revisions, Registers, pipeline, exception, interrupts and the vector table; core extensions, introduction to ARM instruction set

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Suggested Readings:

1. Avatar Singh and S. Srinivasan, " Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2004.
2. Phil Lapsley, Jeff Bier, AmithShoham and Edward A Lee, "DSP Processor Fundamentals", S. Chand & Company Ltd, 2000.
3. B. Ventakaramani, M. Bhaskar, "Digital Signal Processes, Architecture Processing and Applications", Tata McGraw Hill, 2002.
4. Andrew N.SLOSS, DomonicSymes, Chris Wright "ARM System Developers Guide-Desisning and optimizing system software" ELSEVIER 1st Edition 2004.

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16EC C206

REAL TIME OPERATING SYSTEMS

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Objectives:

1. To understand the basic concepts of the UNIX operating system and POSIX Standards.
2. To know the importance of hard/soft Real-Time systems and to familiarize the use cases for tasks, semaphores, queues, pipes, and event flags.
3. To study the basics of the kernel objects and memory management in VxWorks and to know about real-time applications development tools.

Course Outcomes:

At the end of the semester, student will be able to:

1. Understand the Unix operating system and shell programming.
2. Know the standards of POSIX and its portability.
3. Illustrate the problems on scheduling in hard and soft real time systems.
4. Understand the in-depth knowledge on Real Time Operating System concepts and real time concepts using VxWorks .
5. Know about the software development tools and RTOS comparison.

UNIT I

Brief Review of Unix Operating Systems (Unix Kernel – File system, Concepts of – Process, Concurrent Execution & Interrupts. Process Management – forks & execution. Programming with system calls, Process Scheduling. Shell programming and filters).

Portable Operating System Interface (POSIX) – IEEE Standard 1003.13 & POSIX real time profile. POSIX versus traditional Unix signals, overheads and timing predictability.

UNIT II

Hard versus Soft Real-time systems – examples, Jobs & Processors, Hard and Soft timing constraints, Hard Real-time systems, Soft Real-time systems. Classical Uniprocessor Scheduling Algorithms – RMS, Preemptive EDF, Allowing for Preemptive and Exclusion Condition.

UNIT III

Concept of Embedded Operating Systems, Differences between Traditional OS and RTOS. Real-time System Concepts, RTOS Kernel & Issues in Multitasking – Task Assignment, Task Priorities, Scheduling, Intertask Communication & Synchronization – Definition of Context Switching, Foreground ISRs and Background Tasks. Critical Section – Reentrant Functions, Interprocess Communication (IPC) – IPC through Semaphores, Mutex, Mailboxes, Message Queues or Pipes and Event Flags.

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UNIT IV

VxWorks – POSIX Real Time Extensions, timeout features, Task Creation, Semaphores (Binary, Counting), Mutex, Mailbox, Message Queues, Memory Management – Virtual to Physical Address Mapping.

UNIT V

Debugging Tools and Cross Development Environment – Software Logic Analyzers, ICEs. Comparison of RTOS – VxWorks, µC/OS-II and RT Linux for Embedded Applications.

Suggested Readings:

1. Jane W.S.Liu, Real Time Systems, Pearson Education, Asia, 2001.
2. Betcnhof, D.R., Programming with POSIX threads, Addison - Wesley Longman, 1997.
3. Wind River Systems, VxWorks Programmers Guide, Wind River Systems Inc.1997.
4. Jean.J.Labrosse, MicroC/OS-II, The CMP Books.
5. Real Time Systems, C.M.Krishna and G.Shin, McGraw-Hill Companies Inc., McGraw Hill International Editions, 1997.

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16EC E210

VLSI PHYSICAL DESIGN AUTOMATION

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:

Upon completion of this course, students will be able to:

1. Study automation process for VLSI system design.
2. Fundamentals of VLSI Layout and design rules.
3. Demonstrate knowledge of combinational optimization techniques.
4. Understanding of fundamentals for various physical design CAD tools.
5. Develop and enhance the existing algorithms and computational techniques for physical design process of VLSI systems.

UNIT I

Scope of physical design – Components of VLSI – Various layers of VLSI – Typical structures of BJTS, MOSFETS, Resistors, capacitors, inductors, interconnects, brief review of technology, cost and performance analysis.

UNIT II

Basic concepts of Physical Design - layout of basic structures – wells, FET, BJT, resistors, capacitors, contacts, vias and wires (Interconnects). Mask overlays for different structures. Parasitics – latch up and its prevention. Device matching and common centroid techniques for analog circuits

UNIT III

Design rules – fabrication errors, alignment sequence and alignment inaccuracies, process variations and process deltas, drawn and actual dimensions and their effect on design rules– scalable design rules. Scalable CMOS (SCMOS) design rules, layout design, and stick diagrams, Hierarchical stick diagrams.

UNIT IV

Cell concepts – cell based layout design – Wein-berger image array – physical design of logic gates – NOT, NAND and NOR – design hierarchies. System level physical design, large scale physical design, interconnect delay modeling, floor planning, routing and clock distribution.

UNIT V

CAD Tools: Layout editors, Design rule checkers, circuit extractors – Hierarchical circuit extractors – Automatic layout tools, silicon compilers, modeling and extraction of circuit parameters from physical layout.

Suggested Readings:

1. Preas, M. Lorenzatti, “Physical Design and Automation of VLSI Systems”, The Benjamin – Cummins Publishers, 1998.
2. M. Shoji, “CMOS Digital Circuit Technology”, Prentice Hall, 1987.
3. John P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley & sons, Inc.
4. Modern VLSI Design (System on Chip), Woyne Wolf, Pearson Education, 2002.
5. R. Jacob Baker; Harry W.Li., David E. Boyce, CMOS Circuit Design, Layout and Simulation, IEEE Press, Prentice Hall of India.

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16EC E207

LOW POWER VLSI DESIGN

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand concepts of power and energy and design strategies for low power
2. Acquire knowledge of power estimation techniques at different abstractions of digital design
3. Analyse various power optimization techniques
4. Analyse energy recovery circuit designs
5. Understand the concepts of Software Design for Low Power

UNIT-I

Introduction and need of low power design, sources of power dissipation, MOS transistor leakage components, SOI technology, FinFET, Back gate FET, power and energy basics, power dissipation in CMOS circuits, Energy-delay product as a metric, design strategies for low power.

UNIT-II

Power Estimation Techniques: Circuit Level – Modeling of Signals, Signal Probability Calculations, Statistical techniques; High Level Power Analysis – RTL Power Estimation, Fast Synthesis, Analytical Approaches, Architectural Power Estimation.

UNIT-III

Power Optimization Techniques – I: Dynamic Power Reduction – Dynamic Power Component, Circuit Parallelization, Voltage Scaling Based Circuit Techniques, Circuit Technology – Independent Power Reduction, Circuit Technology Dependent Power Reduction; Leakage Power Reduction – Leakage Components, Design Time Reduction Techniques, Run-time Stand-by Reduction Techniques, Run-time Active Reduction Techniques Reduction in Cache Memories.

UNIT-IV

Power Optimization Techniques – II: Low Power Very Fast Dynamic Logic Circuits, Low Power Arithmetic Operators, Energy Recovery Circuit Design, Adiabatic – Charging Principle and its implementation issues.

UNIT-V

Software Design for Low Power: Sources of Software Power Dissipation, Software Power Estimation, Software Power Optimizations, Automated Low-Power Code Generation, Co-design for Low Power.

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Suggested Readings:

1. Kaushik Roy and Sharat Prasad, Low-Power CMOS VLSI Circuit Design, Wiley Inter-science Publications, 2000.
2. Christian Piguet, Low Power CMOS Circuits Technology, Logic Design and CAD Tools, 1st Indian Reprint, CRC Press, 2010.
3. J. Rabaey,Low Power Design Essentials, 1st Edition, Springer Publications, 2010.

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16EC E204

CPLD & FPGA Architectures and Applications

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:
Upon completion of this course, students will be able to:
1. Explain the concepts of PLDs, CPLDs and FPGAs.
2. Analyze and compare the various architectures of CPLD and FPGA and its programming technologies.
3. Implement various logic functions on PLDs, CPLDs and FPGAs.
4. Understand the concepts of placement and routing algorithms and classifying ASICs.
5. Demonstrate VLSI tool flow for CPLDs and FPGAs.

UNIT I
Programmable logic: Programmable read only memory (prom), programmable logic array (pla), programmable array logic (pal). Sequential programmable logic devices (splds). Programmable gate arrays (pgas), CPLD and FPGA, design flow using FPGA, programming technologies.

UNIT II
FPGAs: Field Programmable Gate Arrays – Logic blocks, routing architecture, Logic cells and features of commercially available FPGA's- XILINX XC4000, virtexII FPGA's, XILINX SPARTAN II, Alteras Act1, Act2, Act3 FPGA's, Actel FPGA's, AMD FPGA.

UNIT III
CPLD's: complex programmable logic devices, logic block, I/O block, interconnect matrix, logic blocks and features of altera flex logic 10000 series CPLD's , max 7000 series CPLD's, AT & T – ORCA's (Optimized Reconfigurable Cell Array), cypres flash 370 device technology, lattice plsi's architectures.

UNIT IV
Placement: objectives, placement algorithms: Mincut-Based placement, iterative improvement placement,simulated annealing.
Routing: objectives, segmented channel routing, Maze routing, Routability estimation, Net delays, computing signal delay in RC tree networks.

UNIT V
Digital Front End and back End tools for FPGAs & ASICs, FPGA implementation steps.
Verification: introduction, logic simulation, design validation, timing verification.
Testing concepts: failures, mechanisms and faults, fault coverage, ATPG methods, programmability failures.

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Suggested Reading:

1. P.K. Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Pearson Education 2009.
2. S. Trimberger, Edr., Field Programmable Gate Array Technology, Kluwer Academic Publications, 1994.
3. J. Old Field, R. Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, 1995.
4. S. Brown, R. Francis, J. Rose, Z.Vransic, Field Programmable Gate array, Kluwer Publn, 1992.
5. Manuals from Xilinx, Altera, AMD, Actel.

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16EC C208

LAB 2 DESIGN AND SIMULATION LABORATORY-II

(Synthesis, Backend and Embedded Systems Laboratory)

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Course outcomes:

Students are able to:

1. Design, simulate and synthesis combinational circuits
2. Design, simulate and synthesis sequential circuits
3. Design, simulate and draw layouts for CMOS designs
4. Develop the scheduling algorithms programming, on Real Time Operating systems.
5. Develop the programs on message queues, semaphores and mailbox for real time data.

Note: all the experiments are to be carried out independently by each student with different specifications. Atleast 12 experiments are to be carried out.

(i) Synthesis of combinational circuits (4 to 6 MSI digital blocks).

(ii) Synthesis of sequential circuits (4 to 6 MSI digital blocks).

(iii) Schematic simulation, layout, DRC, LVS, parasitic extraction for cells (inverter, NAND gate, NOR gates).

(iv) Programming using real time operating systems

a. Multi tasking using round robin scheduling

b. IPC using message queues

c. IPC using semaphore

d. IPC using mail box

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16EC C210

SEMINAR - 2

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of any Subject in Embedded System and VLSI Design (related to the seminar topic) is required.

Course Objectives:

1. Awareness of how to use values in improving own professionalism
2. Learning about personal and communication styles
3. Learning management of values for personal and business development
4. Increase knowledge of Emotional Intelligence

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Demonstrate effective writing skills and processes by employing the rhetorical techniques of academic writing, including invention, research, critical analysis and evaluation, and revision.
3. Effectively incorporate and document appropriate sources in accordance with the formatting style proper for the discipline and effectively utilize the conventions of standard written English.
4. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids.
5. Deliver well-rehearsed and polished presentations meeting time, content, and interactive requirements.

Oral presentation and technical report writing are two important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in the advanced fields of Embedded System and VLSI Design and related topics.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects for a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / LCD presentation
- Technical writing

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Each student required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes time for presentation following by a 10 minutes discussion.
3. Submit a detailed technical report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule shall not be entertained.

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and technical report preparation as well as their involvement in the discussions.

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16EC C211

MINI PROJECT

Instruction		End Exam- Duration	-
Sessionals	--	End Exam- Marks	-

Prerequisite for the Course: - The Student s should have a prior knowledge of the core courses under curriculum.

Course Objectives:

Students are expected to:

1. Practice and experience the literature survey on the chosen field / topic.
2. Able to formulate the scope of the mini project.
3. Use simulation / analytic tool for implementing the mini project.

First year ME students will each do a 14-week mini project, each generally comprising about one week of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment (see assessment information below), Each student will be allotted to a Faculty supervisor for mentoring.

Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original. Mini projects should have inter disciplinary/Industry relevance. The students can select a mathematical modelling based/Experimental investigations or Numerical modelling. All the investigations are clearly stated and documented with the reasons/explanations. All the projects should contain a clear statement of the research objectives, background of work, Literature review, techniques used, prospective deliverables, benefit from this [line of] research, Detailed discussion on results, Conclusions and references.

Assessment:

1. 50% of marks for a scientific report on the project.

Regarding the formatting and structure, the report should be written as a journal article using the style file of a journal appropriate for the field of the research (which journal format is most appropriate should be agreed between student and supervisor). Regarding content, the report should be understandable by your fellow students, so the introduction and literature review could be a bit more detailed than in a research paper. The results and discussions are in elaborate form and at end conclusions and include references.

2. 50% of marks for an oral presentation which will take place at the end of the semester and evaluation by a committee consist of Supervisor, one senior faculty and Head of the department or his nominee.

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Outcomes:

Students are able to:

1. Formulate a specific problem after proper Literature Survey.
2. Develop model/models either theoretical/practical/numerical form.
3. Simulate / analyze/ conduct of experiment and obtaining the results.
4. Conclude and Correlate the results obtained.
5. Prepare and write the documentation in standard format.

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16EC C213

PROJECT WORK -PROJECT SEMINAR

Instruction	--------	End Exam- Duration	-
Sessionals	100 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The overall objective of the project seminar is to help develop an emerging field at the intersection of multi-disciplinary understandings of engineering education

1. To prepare the students for the dissertation to be executed in IV semester, solving a real life problem should be focus of Post Graduate dissertation
2. To explore new research from a range of academic disciplines which throws light on the questions unanswered.
3. To showcase cutting edge research on engineering from outstanding academic researchers.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Effectively incorporate and document appropriate sources in accordance with the formatting style, proper for the discipline and effectively utilize the conventions of standard written English.
3. Better understand the role that effective presentations have in public/professional contexts and gain experience in formal/informal presentation.
4. Identify and critically evaluate the quality of claims, explanation, support, and delivery in public and professional discourse, and understand the factors influencing a speaker's credibility.
5. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids. Deliver well-rehearsed and polished presentations meeting time requirements, content, and interactive requirements.

The main objective of the Project Seminar is to prepare the students for the dissertation to be executed in IV semester. Solving a real life problem should be focus of Post Graduate dissertation. Faculty members should prepare the project briefs (giving scope and reference) at the beginning of the III semester, which should be made available to the students at the departmental library. The project may be classified as hardware / software / modeling / simulation. It may comprise any elements such as analysis, synthesis and design.

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The department will appoint a project coordinator who will coordinate the following:

- Allotment of projects and project guides.
- Conduct project - seminars.

Each student must be directed to decide on the following aspects

- Title of the dissertation work.
- Organization.
- Internal / External guide.
- Collection of literature related to the dissertation work.

Each student must present a seminar based on the above aspects as per the following guidelines:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through OHP, PC followed by a 10 minutes discussion.
3. Submit a report on the seminar presented giving the list of references.

Project Seminars are to be scheduled from the 3rd week to the last week of the semester. The internal marks will be awarded based on preparation, presentation and participation.

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16EC C214

PROJECT WORK AND DISSERTATION

Instruction	--	End Exam- Duration	--
Sessionals	100	End Exam- Marks	100

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The Objectives of the dissertation are to:

1. Put into practice theories and concepts learned on the programme
2. Provide an opportunity to study a particular topic in depth;
3. Show evidence of independent investigation;
4. Combine relevant theories and suggest alternatives;
5. Enable interaction with practitioners (where appropriate to the chosen topic);
6. Show evidence of ability to plan and manage a project within deadlines

Course Outcomes:

On satisfying the requirements of this course, students will have the knowledge and skills to:

1. Plan, and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic, relevant to environment and society
2. Systematically identify relevant theory and concepts, relate them to appropriate methodologies and evidence, apply appropriate techniques and draw appropriate conclusions
3. Engage in systematic discovery and critical review of appropriate and relevant information sources
4. Appropriately apply qualitative and/or quantitative evaluation processes to original data\ Define, design and deliver an academically rigorous piece of research.
5. Appreciate practical implications and constraints of the chosen topic.

The students must be given clear guidelines to execute and complete the project on which they have delivered a seminar in the III semester of the course.

All projects will be monitored at least twice in a semester through student's presentation. Sessional marks should be based on the grades/marks, awarded by a monitoring committee of faculty members as also marks given by the supervisor.

Efforts be made that some of the projects are carries out in industries with the help of industry coordinates.

Common norms will be established for documentation of the project report by the respective department.

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The final project reports must be submitted two weeks before the last working day of the semester.

The project works must be evaluated by an external examiner and based on his comments a viva voice will be conducted by the departmental committee containing of HOD, two senior faculty and supervisor.

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16 EG C103

SOFT SKILLS LAB

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

Course Objectives: The objectives of the course are to:

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

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

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

Exercise 1

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

Elements of effective presentation – Structure of presentation – Presentation tools – Bodylanguage

Creating an effective PPT

Exercise 2

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

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

Exercise 3

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

Exercise 4

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

Exercise 5

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

Suggested Readings:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007
2. Leena Sen , "Communication Skills", Prentice-Hall of India, 2005
3. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
4. Edgar Thorpe and Showick Thorpe , "Objective English", 2nd edition, Pearson Education, 2007
5. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
6. Gulati and Sarvesh, " Corporate Soft Skills", New Delhi: Rupa and Co. , 2006
7. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004.
8. Covey and Stephen R, "The 7 Habits of Highly Effective People", New York: Free Press, 2016.

16MB C108

INFORMATION TECHNOLOGY APPLICATIONS FOR BUSINESS

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

Course Objectives: The objectives of this course are:

1. To provide an insight of basic features of computers.
2. Enable students to acquire knowledge on information systems and its various categories.
3. To focus on planning and development of information systems.
4. To understand the difference between hardware and software systems.
5. To discuss the underlying principles of computer security.
6. To analyze the different concepts of information systems applications.

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

1. Understand the features of information systems.
2. Demonstrate detailed knowledge of the role of information system and its categories.
3. Gain knowledge on information system development.
4. Distinguish between the hardware and software systems.
5. Analyze various computer security mechanisms.
6. Understand applications of information technology for business.

Unit – I

Information Systems for Business

Need for Information Systems – Business in the Information age, Information systems Concepts, Computer Based Information Systems – Categories of Information Systems- Operational Support Systems- Management Support Systems- Strategic Information Systems. Functional Information Systems – IS support to Business Functions – Accounting and Finance, Marketing and Sales, Production and Logistics, and Human Resources Management Systems.

Unit – II

Information Systems Planning and Development

Systems Planning - Traditional System Development Life Cycle (SDLC) - alternate methods for System development - System development outside the system.

Software: System and Application Software, Compilers, Interpreters and Assemblers. Computer Languages: Levels of languages, generation and their features. Number System: Introduction to number system, binary, decimal and their inter conversions and their uses in computer.

Unit – III

Information Technology Infrastructure

Computer Hardware- I/O Devices, Memory Devices, Processor, Multimedia – Definition, Characteristics, Elements of Multimedia, Multimedia Applications. Data Communication and Computer Network – Definition, Types – Network Topologies-Network Devices, Wireless Networking. The Internet, Intranet.

Unit – IV

Computer Security

Need For Security - Security Threat and Attack- Malicious Software, Hacking, Security Services-Security Mechanisms - Cryptography, Digital Signature, Firewall- Types of Firewall-Identification and Authentication – Biometric Techniques – Other Security Measures - Security Policy.

Unit – V

Information Systems Application

Inter organizational- Global Information systems, Electronic Data Interchange (EDI), Electronic Funds Transfer (EFT) –Extranets, E-Commerce Overview- E-commerce Applications, M-Commerce Services and Applications, SMN, M-Analysis E-Governance- Emerging Trends in Computing – Cloud Computing, Grid Computing (Concepts only).

Text Books:

1. Turban, Rainer and Potter, "Introduction to Information Technology", John & Wiley Sons, 2002.
2. Anita Goel, "Computer Fundamentals", Pearson, 2013.
3. Ralph M. Stair&George W. Reynolds, "Principles of Information Systems", Thomson Course Technology", 2016.

Suggested Readings:

1. Ramesh Behl, "Information Technology for Management", McGraw-Hill Companies, 2009.
2. Ken Laudon, Jane Laudon & Rajnish Dass, "Management Information System", 11nd Ed. Pearson, 2010.
3. B. Muthukumaran, "Information Technology for Management", Oxford, 2010.

16MB C110

ORGANISATION BEHAVIOUR

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

Course Objectives: The objectives of the course are to:

1. Define basic organizational behavior principles and analyse how these influence behavior in the workplace.
2. Analyse the influence of perceptions and personality on individual human behavior in the workplace.
3. Discuss the theories of Motivation and Leadership.
4. Provide knowledge on different organizational structures; and concepts of culture, climate and organizational development.
5. Describe the interpersonal and their intrapersonal reactions within the context of the group and also demonstrate effective communication and decision making skills in small group settings.
6. Familiarize the students with the basic understanding of individual behavior and explore issues of power, politics, conflict and negotiation.

Course Outcomes: After completion of this course, students will be able to:

1. Enable the students to practically implement the Organizational Behavior principles and practice in real time situations.
2. Analyze the behavior, perception and personality of individuals and groups in organizations in terms of the key factors that influence organizational behavior.
3. Acquire knowledge in applying motivational theories to resolve problems of employees and identify various leadership styles and the role of leaders in decision making process.
4. To examine various organizational designs and explain concepts of organizational culture, climate and organizational development.
5. To explain group dynamics and skills required for working in groups and identify the processes used in developing communication and resolving conflicts.
6. Analyze organizational behavioral issues in the context of power, politics, conflict and negotiation issues.

Unit – I

Introduction

Organizational behavior – Nature and levels of organizational behavior – Individuals in organization – Individual differences – Personality and Ability – The Big 5 Model of personality – Organizationally relevant personality traits. The nature of perception – characteristics of the perceiver, target and situation – perceptual problems.

Unit – II

Organization Structure

Organizational Designs and Structures – Traditional and Contemporary organizational designs. Organizational culture and ethical behavior – factors shaping organizational culture– creating an ethical culture. Concepts - Organizational Climate, Organization Conflict, and Organization Development.

Unit – III

Motivation and Leadership

Motivation–early and contemporary theories of motivation. Leadership – early and contemporary approaches to leadership.

Unit – IV

Group Dynamics

Groups and group development – turning groups into effective teams. Managing change – process, types and challenges. Communicating effectively in organizations – communication process–barriers to communication–overcoming barriers to communication–persuasive communication–communication in crisis situations.

Unit – V

Power, Politics, Conflict and Negotiations

Power, Politics, Conflict and Negotiations–Sources of individual, functional and divisional Power. Organizational politics. Conflict – causes and consequences – Pondy's model of organizational conflict–conflict resolution strategies.

Text Books:

1. Jennifer George and Gareth Jones "Understanding and Managing Organizational Behavior", Pearson Education Inc., 2012.
2. Jon L Pierce and Donald G. Gardner, "Management and Organizational behavior", Cengage Learning India (P) Limited, 2001.
3. Richard Pettinger, "Organizational Behaviour", Routledge, 2010.

Suggested Readings:

1. Stephen P. Robbins, Jennifer George and Gareth Jones, "Management and Organizational Behaviour", Pearson Education Inc., 2009.
2. K. Aswathappa, "Organizational behavior", Himalaya Publishing House, 2013.
3. John Schermerhorn, Jr., James G. Hunt and Richard N. Osborn, "Organizational Behaviour",10t edition, Wiley India Edition, 2009.

16MB C111

BUSINESS ENVIRONMENT AND ETHICS

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

Course Objectives: The Objectives of the course are:

1. To familiarize the students with various aspects of economic, social, political and cultural environment of India.
2. To enable the students to understand the various industrial policies developed in the post-independence period and need for the same.
3. To provide an insight into the mechanism of fiscal policy implementation, structure of union budget, link between monetary policy and banking.
4. To provide an understanding about the changes in the growth of National Income, concept of Inflation in India.
5. To acquaint students with essence of WTO agreements and its implications, understand EXIM policies and changes in FEMA, and about the FDI and MNCs in emerging countries.
6. To make students to understand the ethical dilemmas facing managers; and the concept of corporate governance.

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

1. Gain a deeper understanding of the environmental factors influencing Indian business organizations.
2. Understand the issues related to the industrial policy and regulation and their amendments from time to time.
3. Understand the Union Budget, fiscal policy, monetary policy and banking.
4. To understand the changes in the growth of National Income, concept of Poverty, Unemployment and inflation and its causes and measures to control Inflation in India.
5. Take decisions to ensure growth and sustainability of the organizations through the knowledge gained by the students on capital markets, RBI guidelines; trade, EXIM policy and Foreign Exchange Management Act.
6. Develop thinking and analytical skills using ethical framework.

Unit-I

Introduction

Business Environment – Meaning, Importance, Environmental Factors; Planning in India – Planning Commision – Liberalisation and Planning; Industrial Policy and Regulatory Structure- Industrial Policy- Industrial

Licensing Policy- Five Year Planning- Industrial Policy 1991; Small Scale Industries (SSI)- Industrial Finance- Foreign Direct Investment (FDI).

Unit-II

Indian Financial System

Economic Policies: Fiscal Policy- Latest Union Budget- Reforms Undertaken - Role of Government. Monetary Policy- Basic Concepts- Monetary Policy in the 21st Century- Banking Sector Reforms. Role of regulatory institutions in Indian Financial system – RBI and SEBI, Capital Market Institutions- Stock Indices- Derivatives Market- Global and Indian Scenario.

Unit-III

Economic Growth

National Income, Foreign Trade and Balance of Payment, Poverty in India, Unemployment in India, Inflation, Human Development, Rural Development, Problems of Growth.

Unit-IV

India's Trade Policy

Policy changes and Issues- sector wise trade policies: recent developments- GATT- WTO-agreements and implications. EXIM policies and FEMA: India's new EXIM policy-legal framework-initiatives, FEMA –Multi-national companies and FDI.

Unit-V

Business Ethics

An Overview, concepts and theories of Business ethics, Ethical Dilemmas, Sources and their Resolutions, Ethical Decision-making in Business, Globalization and Business Ethics, creating an Ethical Organization, Corporate ethics: Good Governance.

Text Books:

1. Justin Paul " Business Environment: Text & Cases" ,3/eTMH, 2012.
2. Gaurav Datt and Ashwani Mahajan, "Indian Economy", 72 ed, S.Chand, 2016.
3. A.C.Fernando, "Business Ethics", 1st Edition, Pearson, 2011.

Suggested Readings:

1. Francis Cherunilam "Business Environment: Text & Cases", HPH, 2012.
2. V.K.Puri and S.K.Misra, "Indian Economy", HPH, 2014.

16MB C101

PRINCIPLES OF MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To familiarize the students to the basic concepts of management in order to aid in understanding how an organization functions.
2. Enable the students to analyze and understand environment of the organization and significance of Decision-Making process.
3. To educate students on different structures in an organisation and delegation of authority.
4. To describe staffing and direction as a management function.
5. To discuss significance of Co-ordination in organizations.
6. To discuss and apply the control processes.

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

1. Practice the process of management functions and understand how management evolution affects future managers.
2. Explain why planning is needed in organizations, why objectives are necessary for successful planning and identify essential characteristics of decision-making.
3. Explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment.
4. Differentiate between the various types of organizational structures and patterns, and explain the importance of delegation in organizations.
5. Analyze the requirement of human resource and effective direction.
6. Recognize the link between planning and controlling and understand how to control by comparing performance with objectives.

Unit-I

Introduction to Management

Concept of Management, Nature and Functions of Management, Difference between Management and Administration, Evolution of Management Thought: Scientific Management-Frederick W.Taylor - Henry Fayol's Principles - Human Relations Approach -Elton Mayo's Hawthorne experiments - Douglas McGregor's Theory 'X' and Theory 'Y' and William Ouchi's Theory 'Z' - The Behavioural Approach - Contingency Approach.

Managerial Roles, Levels of Management - Managerial Skills, Social Responsibilities of Business, Contemporary management issues and challenges.

Unit-II

Planning

Nature and Purpose of Planning, Planning Process, Types of Plans, Environmental Scanning – SWOT and PEST analysis, Objectives, Managing by Objectives (MBO), Strategies – Types of Strategies, The Strategic Planning Process, The TOWS (Threats, Opportunities, Weaknesses and Strengths) Matrix, The Portfolio Matrix, Three Generic Competitive, Strategies by Porter, Effective Implementation of Strategies. Policies- Types. Decision Making – Types of Decision, Decision Making Process, Rational Decision Making Process, Decision Making under different Conditions.

Unit-III

Organizing

Importance and Principles of Organizing, Organization Structure – Functional Structure, Product Structure, Geographical Structure, Entrepreneurial Structure, De-centralised Structure, Strategic Business Struture, Matrix Structure, Team Structure, Virtual Structure, Line and Staff Structure. Departmentation, Span of Control, Centralization and Decentralization, Delegation of Authority.

Unit-IV

Staffing and Directing

Nature and scope of Staffing, Manpower Planing, Selection and Training, Performance Appraisal. Principles and elements of direction, Requirement of Effective Direction – Functions of Direction –Supervisor and his Qualities – Supervisor's Role and Functions – Effective Supervision.

Unit-V

Controlling

Concept, Process of Controlling, Types of control – Budgetary and non-budgetary control techniques – Requirements for effective control.

Significance of Co-ordination in Organizations, Co-ordination versus Co-operation, Barriers in Co-ordination, ways to achieve effective co-ordination.

Text Books:

1. Andrew J. Dubrin, "Essentials of Management", 9th edition, Thomson Southwestern, 2012.

2. Harold Koontz and Heinz Weihrich, "Essentials of management: An International & Leadership Perspective", 9th edition, Tata McGraw-Hill Education, 2012.
3. Charles W.L Hill and Steven L McShane, "Principles of Management", Special Indian Edition, McGraw Hill Education, 2007.

Suggested Readings:

1. Don Hellriegel, Susan E. Jackson and John W. Slocum, "Management- A competency-based approach", 11th edition, Thompson South Western, 2008.
2. Heinz Weihrich, Mark V Cannice and Harold Koontz, "Management- A global entrepreneurial perspective", 12th edition, Tata McGraw Hill, 2008.
3. Stephen P. Robbins, David A.De Cenzo and Mary Coulter, "Fundamentals of management", Prentice Hall of India, 2012.

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16MB C102

MANAGERIAL ECONOMICS

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

Course Objectives: The Objectives of the course are:

1. To integrate the basic concepts of managerial economics and their role in decision making.
2. To focus on the demand and supply functions and analyse the concepts of elasticity of demand.
3. To execute the least cost combination of inputs through production function.
4. To analyse the role of cost, revenue and profit in decision making and Compute break even point.
5. To test price-output determination under different market conditions.
6. To apply Pricing methods and contemporary practices.

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

1. Defend the role of basic concepts of managerial economics in decision making.
2. Recommend the demand and supply functions and assess the elasticity of demand.
3. Conclude on the least cost combination of inputs through production analysis.
4. Compare different cost concepts and Predict the breakeven point.
5. Examine pricing decisions under different market conditions.
6. Formulate the Price for a given product or service.

Unit – I

Introduction

Nature and Scope of Managerial Economics, Definition, Fundamental Concepts of Economics: Opportunity Cost, Discounting principle, Time perspective, Incremental reasoning, Equi-marginal concept. Theories of firm- profit maximization theory, Baumol's sales revenue maximizing model, Berle-Means-Galbraith model of corporate power structure, Penrose's theory of firm, Simon's model of satisficing behaviour. Economics of information: Risk, Uncertainty, Asymmetry of information, Adverse Selection, Market Signalling. Economic optimization: profit maximization by the total revenue and total cost approaches, optimization by marginal analysis, optimization by substitution.

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Unit – II

Demand and Supply Analysis

Definitions, Determinants of demand and supply, Demand and supply functions,demand and supply curves, Market equilibrium. Consumer behaviour and rational choice: cardinal and ordinal approaches of consumer utility. Maximization of consumer utility: technique of indifference curves and budget lines. International convergence of tastes.

Demand Sensitivity Analysis: Price, Income and cross elasticity's of demand. Managerial applications of elasticity of demand. (with simple numerical problem)

Unit – III

Production Analysis

Meaning of Production, Production Function; Laws of diminishing returns to a factor. Isoquants: meaning, types and properties, isoquant map, ridge lines, input prices and isocost line, Optimal combination of input factors: Expansion path and Returns to scale, Estimation of production function: Cobb Douglas and CES Production functions, Economies and Diseconomies of scale.

Unit- IV

Cost Analysis

Concepts of costs, theory of cost, cost-output function, determinants of cost function, relationship between production and cost, short run cost function, long run cost function, relationship between short run and long cost curves; Cost Volume Profit Analysis. (with simple numerical problem)

Unit – V

Market Structure and Modern Pricing Practices

Different types of market structure and its importance. Price determination under: perfect competition. Monopoly, Oligopoly and Monopolistic competition; sophisticated market pricing: price discrimination–using coupons and rebates, Peak load pricing, Pricing of multiple products; Transfer pricing: A perfectly competitive market for upstream product. The global use of transfer pricing, Pricing of Multiple products.

Text Books:

1. Dominik Salvatore, "Managerial Economics",7th edition, Oxford University Press, 2014
2. P.L.Mehta., "Managerial Economics-Analysis, Problems and Cases", 13th edition Sulthan Chand & Sons, 2014.
3. V.L.Mote, S.Paul and G.S.Gupta, "Managerial Economics Concepts and Cases",11th edition, Tata Mc Graw Hill Pvt. Ltd., 49th Reprint 2010.

Suggested Readings:

1. Geethika, Piyoli Ghosh, and P.R. Chaudhary "Managerial Economics", 2nd edition McGraw Hill, 2015
2. R.L.Varshney &K.L.Maheswari, "Managerial Economics",22nd Edition, Sultan Chand & sons, 2014.
3. Barry Keating & J.Holten Wilson, "Managerial Economics", 2nd Edition, Bizmantra, 2009.

16MB C103

FINANCIAL ACCOUNTING AND ANALYSIS

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

Course Objectives: The Objectives of the course are:

1. To generate the basic inputs on maintaining books of accounts and to monitor and test the accuracy of books of accounts through Trial Balance.
2. To construct the financial statements.
3. To critically evaluate financial statements through Ratio Analysis and interpretation.
4. To judge the flow of funds/cash through funds flow and cash flow statements.
5. To focus on IAS-IFRS-USGAAP.
6. To identify how to value the human resources in an organisation.

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

1. Maintain books of accounts.
2. Construct the financial statements.
3. Analyse and interpret financial statements through Ratio Analysis.
4. Critically identify sources and application of funds or cash.
5. Apply accounting standards while preparing the financial statements.
6. Carryout valuation of human resources of an organisation.

Unit–I

Introduction to Financial Accounting

Meaning and Definition of Financial Accounting - Accounting as a business information system; Parties interested in accounting information; Accounting Concepts and Conventions, their implications on accounting system; Double entry system: Recording of business transactions-classification of accounts-Accounting process-accounting cycle-primary entry (Journal Proper) – Ledger posting - preparation of Trial Balance, Suspense account.

Unit- II

Preparation and presentation of financial statements

Distinction between Capital and Revenue Expenditure - Measurement of business income, Preparation of Profit and Loss account, and Balance Sheet.

Concept of Depreciation - Methods of providing depreciation and its impact on measurement of business income.

Unit –III:

Financial Statement Analysis

Meaning of Financial statement analysis- tools of financial statement analysis- Ratio analysis-meaning, uses and limitations of ratio analysis-calculation and interpretation of ratios- Liquidity ratios-Profitability ratios-Solvency ratios- Leverage and Turn over ratios.

Unit-IV:

Funds flow and Cash flow analysis.

Concept of Fund- meaning of Funds flow, preparation of statement of changes in Working Capital, Funds from operations, statement of sources and applications of Funds. Funds Flow Statement. Cash flow statement-cash from operations- preparation of cash flow statement. Difference between funds flow and cash flow statements.

Unit-V:

Contemporary issues in Accounting

Accounting standards: Meaning and definition of accounting standards-their importance in accounting environment-IAS-IFRS-USGAAP.

Human Resources Accounting: concept and importance, objectives of HR accounting- Methods of Valuation.

Text Books:

1. Ambarish Gupta, "Financial Accounting for Management- An Analytical Perspective", Pearson, 2015
2. S.N Maheshwari and S.K. Maheswari: "Financial Accounting", Vikas, 2016.
3. Grewal T. S., "Introduction to Accounting", S. Chand, 2016.

Suggested Readings:

1. Earl k Stice and James. D. Stice, "Financial accounting-Reporting and Analysis", Cengage Learning, 2015
2. Carl S Warren, James. M. Reeve, Jonathan. E. Duchac, "Financial accounting, concepts, Methods and Applications",Cengage Learning, 2014
3. Alic C Lee, John C Lee, "Financial analysis, Planning & Forecasting", Cambridge, 2014.

16MB C104

MARKETING MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To provide an understanding of marketing evolution, concepts, environment and marketing strategy.
2. To enable students to identify and select effective segmentation, targeting and positioning strategies.
3. To focus on how a marketer can effectively utilize the marketing mix elements to attract and retain the customer.
4. To understand the importance of Strong branding and how to generate brand equity.
5. To determine how various marketing control techniques helps to effectively utilize marketing budget.
6. To focus on contemporary issues in Marketing.

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

1. Know the various philosophies of marketing, environment and strategy, and implement best marketing strategies through application of analytical concepts and decision making tools.
2. Understand various segmentation, targeting and positioning strategies to make their products as market leaders.
3. Design the marketing mix effectively in order to achieve the organizational goals and objectives.
4. Know the essential Branding strategies to conquer the market.
5. Control unproductive marketing expenditures.
6. Understand the contemporary issues and develop marketing strategies to sustain the business.

Unit- I

Introduction

Marketing, Market, Marketing Management, Tasks, Philosophies, Marketing Mix, Expanded Marketing mix, Marketing Program and Marketing Strategy, Managing marketing effort, Marketing environment Company's Micro and Macro environment, Marketing interface with other Functional areas.

Unit -II

Market Segmentation, Targeting and Positioning

Levels and bases for Segmentation, Segmenting Consumer markets,

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Segmenting Business markets, International markets, Market targeting-Evaluating and selecting Market segments, Differentiation- Positioning strategies, Competitive strategies.

Unit – III

Marketing Mix and Control

Decisions involved in Product, Packaging, Product line and mix decisions, New product development, Product life cycle, Pricing strategies, Distribution channels, Channel management decisions, Promotion mix-Advertising, Sales promotion, Public relations, Personal selling, Online marketing.

Marketing Control, Annual plan Control, Efficiency Control, Profitability Control and Strategic Control, Marketing Audit.

Unit – IV

Branding

Concept of Brand – Definition, Importance of Branding in Marketing commodity vs. Brand name, Brand Positioning and Repositioning. Brand Sponsorship – National Brands, Licensing, Co-branding, Brand development – Line extension, Brand extension, Multi brands, New brand. Managing brands – Brand loyalty, Brands equity, Brand cannibalization, Brand management practices.

Unit – V

Contemporary Issues in Marketing

Customer Relationship Marketing (CRM), Global marketing, e-marketing, marketing engineering, Green marketing, Societal Marketing, Viral marketing.

Text Books:

1. Kotler Philip, Garyarmstrong, Prafullay, Agnihotri, EU Haque, "Principles of Marketing", 13th Ed, Pearson Education Prentice Hall of India, 2010.
2. Rajan Saxena, "Marketing Management", 4th Ed. Tata McGraw Hill, 2009.
3. Ramaswamy V.S. Namakumari S, "Marketing Management", The Global perspective-Indian Context Macmillan India Ltd., 2009.

Suggested Readings:

1. Paul Baines, Chris fill, Kelly page, "Marketing Management", 1st ed. Oxford Univesity Press, 2009.
2. Roger j. best, "Market-Based Management", 1st Ed/ PHI Learning Pvt. Ltd., 2009.
3. Kurtz and Boone, "Principles of Marketing", 12th Ed. Cengage Publications, 2010.

16MB C105

STATISTICS FOR MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To provide an insight into the concepts and tools of Statistics.
2. To enable the students to understand measures of Central tendency and Measures of Dispersion.
3. To make students understand the concept of probability and apply different types of probability distributions.
4. To enable the students to decide the appropriate sampling techniques to be used for a given problem.
5. To facilitate for formulation of hypotheses and applying the parametric statistical tools to test the same and also interpret the results.
6. To enable the students to apply different forecasting techniques namely, correlation, regression and time series analysis.

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

1. Calculate measures of central tendency and measures of dispersion.
2. Apply principles of probability and different types of probability distribution.
3. Articulate the appropriateness of different types of sampling techniques.
4. Formulate hypotheses and test the same using appropriate parametric tools and interpret the results.
5. Test the given hypotheses using Chi-square and ANOVA and interpret the results.
6. Apply forecasting techniques using correlation, regression or time series analysis and analyse the results.

Unit –I

Introduction

Overview, origin and development of Statistics, Managerial applications of statistics. Measures of central tendency: Mean- Harmonic mean, Geometric mean , Median, Mode, Measurement Dispersion: Range and quartile deviation, mean deviation, standard deviation. Skewnes and Kurtosis.

Unit-II

Probability

i) Concepts and Definitions of probability. Additive and multiplicative Law of probability, Baye's theorem, Statistical independence. (simple numerical problems only)

ii) Random variables: Expectation and variance of a random variable, Probability distribution function, properties of discrete and continuous probability distribution functions.

1. Discrete probability distributions: Binomial distribution, Properties and applications - Poisson distribution, Properties and applications.
2. Continuous probability distributions: Normal distribution, Standard normal distribution, Properties and applications of Normal distribution.

Unit-III

Sampling and Estimation

1. Sampling theory: Sampling procedures-Random and Non-random methods, Sample size determination, standard error, Sampling error.
2. Statistical estimations: Point and interval estimation, Properties of good estimator, confidence interval.

Unit-IV

Hypothesis testing

1. Testing of Hypothesis: Type I and Type II errors, Statistical significance. Large sample tests-Test for one and two proportions, Test for one and two means, Test for two Standard deviations.
2. Small sample tests: t- distribution- Properties and applications, Testing for one and two means, paired t- test.
3. Analysis of variance -one way and two way ANOVA (With and without interaction).
4. Chi-square distribution: Test for goodness of fit, Test for independence of attributes.

Unit – V:

Correlation, Regression and Time Series

i) Correlation analysis –Positive and negative correlation-limits for Coefficient of Correlation- Karl Pearson's coefficient of correlation- spearman' rank correlation.

ii) Regression Analysis-concept –two lines of regression-Properties of regression coefficients.

iii) Time series analysis-Components of time series-Models of time series-Trend analysis-Free hand curve method- Method of semi averages-method of moving averages- Least Squares method.

Text Books:

1. S.P.Gupta, "Statistical Methods", Sultan Chand & Sons, 2014 .
2. S.C.Gupta, "Fundamental of statistics", Himalaya, 2016.
3. R.I. Rubin S. David, "Statistics for Management", Pearson, 2014 .

Suggested Readings:

1. PN.Arora, Sumeet Arora, S.Arora"Comprehensive statistical methods", S.Chand co., 2015.
2. J.K.Sharma, "Business Statistics", Pearson, 2015.
3. Beri, GC, "Business Statistics", McGraw-Hill, 2015.

16MB C106

BUSINESS COMMUNICATION

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

Course Objectives: The Objectives of the course are:

1. To demonstrate knowledge of communication theory and application.
2. To empower the students with the necessary skills and techniques of business communication to handle business-related issues efficiently and effectively.
3. To familiarise the students with formal writing, construct appropriate messages, and build effective business relations through an effective communication.
4. To deliver appropriate communication skills across various business settings, purpose, and audience.
5. To focus on media relations and crisis communication.
6. To emphasize on technological, legal and ethical dimensions in business communication.

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

1. To enhance competence in various Business communication patterns.
2. Construct effective written messages in various formats to audience.
3. Demonstrate the ability to effectively deliver formal presentations before a variety of audiences.
4. Communicate competently in groups and organizations and demonstrate appropriate and professional ethical behavior.
5. Build better relations with appropriate messages.
6. Communicate effectively leveraging technology in various settings and contexts.

Unit-I

Introduction

The role of and process of communication, Objectives of communication - gateways to effective communication – Organizational communication. Multi cultural and Global communication ; Listening process – Elements of good listening – improving listening competence. Importance of feedback – Principles of feedback.

Unit-II

Written Communication

Types of reports – Structure of reports – Individual and committee reports – Essentials of good report writing. Business letters – Drafting letters relating to enquiries and replies; orders and replies; complaints and claims. Effective business correspondence.

Unit-III

Presentation Skills

Presentations – elements of presentation, presenter, analyzing audience and content- non-verbal dimension of presentations- effective presentation strategies. Methods of speaking, speeches for commemorative occasions. Negotiations – Approaches to negotiations – preparing for and conducting negotiations.

Unit-IV

Non Verbal Communication

Characteristics, Importance, Types and functions of non verbal communication – preparing for job: Drafting a resume, participating in a Group discussion, job interview, types of interview, strategies for success at interviews – Business Etiquette, basic rules of Business etiquette.

Unit-V

Public Relations, Trends and Dimensions in Business Communication

Media relations – Building better relations with media. Investor relations – Framework for managing investor relations. Managing government relations – ways and means of managing governing power. Crisis communication. Do's and don'ts in the wake of a crisis.

Advances and Trends in Communication Technology, Legal and Ethical Issues in Business Communication. Social Media Communication.

Text Books:

1. Lesikar, R.V. and M.E.Flatley, "Basic Communication", New York, McGraw Hill, 2014.
2. P.D.Chaturvedi and Mukesh Chaturvedi, 'Business communication', Pearson education, 2012.
3. CSG Krishnamacharyalu and L.Ramakrishna, "Business Communications", Himalaya publishing house, 2014.

Suggested Readings:

1. Penrose, Rasberry and Myers, "Business Communication for Managers", Cengage Learning, 2007.
2. U S Rai & S M Rai, "Business Communication', Himalaya publications, 2014.
3. Mary Munter, "Guide to Managerial Communiciation" Pearson Education, 2013.

16MB C107

BUSINESS LAW

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

Course Objectives: The objectives of this course are:

1. To give an overview of legal issues that they deal within their professional and personal life.
2. To provide knowledge on general contracts.
3. To educate the students on special contracts, sale and negotiable instruments.
4. To discuss the formation of company, process, and dissolution.
5. To elaborate the rights of consumers and redressal mechanism.
6. To enlighten students on Intellectual property rights, competition law, cyber laws and legal environmental issues.

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

1. Identify legal issues and provide potential solutions to legal problems within the business environment.
2. Understand the legal principles of business law; apply such principles of law to problems associated with businesses and business transactions.
3. Understand special contracts and reflect on current legal issues; and how to use various negotiable instruments for various business transactions.
4. Understand the various provisions of Companies Act.
5. Claim the rights as a consumer and know the redressal mechanism.
6. Understand legal provisions contained in competition Law and Cyber Laws and the process in Intellectual Property Rights and RTI, and legal environmental issues.

Unit- I

Introduction

Definition of Contract and Agreement – Classification of Contracts, Essential elements of a valid Contract – Offer - Acceptance - Consideration - Capacity to Contract - Free consent-Performance of Contract – Remedies for breach of Contract - Quasi Contracts.

Unit - II

Law Relating to Special Contracts

Special Contracts - Salient features of Contract of Agency, Bailment and Pledge, Indemnity and Guarantee.

Sale of Goods Act – Distinction between Sale and Agreement to sell - Conditions and Warranties.

Negotiable Instruments Act – Definition, Characteristics, Essential elements and distinctions between Promissory Note, Bill of Exchange, and Cheques - Types of crossing.

Unit- III

Companies Act

Definition of Company – Characteristics - Classification of Companies- Formation of Company - Memorandum and Articles of Association – Prospectus - Share holders meetings - Board meetings - Law relating to meetings and proceedings- Company Management - Qualifications, Appointment, Powers, and legal position of Directors - Board - M.D and Chairman - Their powers, Prevention of Oppression and Mismanagement, Winding-up of a company.

Unit- IV

Consumer Protection Act

Consumer Protection Law: Introduction to consumer protection law in India - Rights of consumers – Right to Information - Consumer awareness - Consumer councils - Redressal machinery.

Unit-V

Miscellaneous Laws

Intellectual Property Rights – Patents, Copyright, Trademark. Competition Law. Cyber laws. Right to Information Act. Legal Environmental issues.

Text Books:

1. N.D. Kapoor, "Elements of Mercantile Law", 34th ed., Sultan Chand & Co.,2013.
2. K.R. Bulchandani, "Business Law for Management", 6th ed, HPH , 2014.
3. Akhileshwar Pathak, "Legal Aspects of Business", 3rd Ed. Tata McGraw Hill. 2007.

Suggested Readings:

1. PPS Gogna, "A Text Book of Company Law", S. Chand, 2010.
2. Satish B. Mathur, "Business Law", Tata Mc Graw Hill, 2010.
3. D.Chandra Bose, "Business Law", PHI,2010.

16MB C109

INFORMATION TECHNOLOGY – LAB

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

Course Objectives: The objectives of the course are:

1. To equip students with the usefulness of MS OFFICE in their work place.
2. To provide an insight of basic concepts of MS-EXCEL.
3. To understand different concepts using Charts for analyzing the data.
4. To Acquire knowledge on the various Statistical and Financial tools used in MS-EXCEL.
5. To understand the basic concepts of MS- ACCESS and MS-POWERPOINT for presentations.
6. To gain knowledge on web based tool-HTML.

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

1. Effectively integrate MS-Office modules in the work environment.
2. Analyze the basic concepts of MS-Excel and its computing requirements.
3. Apply statistical tools in their projects, research work also also in real life situations.
4. Demonstrate detailed knowledge on MS- Access.
5. Design various presentations with the help of MS-Power Point.
6. Engage in continuing professional development with web based tool.

Unit – I

Introduction to MS-EXCEL

Introductory concepts of MS-EXCEL spreadsheet: File options, Home options, Alignment of data, Defining the columns, Formatting – Table, Cell. Filtering techniques, Insert options – PIVOT table, Image, Special Symbols, Clipart. Charts – Line, Bar, Pie, Scatter. Page Layouts. Advanced Options of MS-EXCEL: a) Statistical tools – use statistical functions such as Mean, Median, Mode, Average, Standard Deviation, ANOVA, etc. b) Financial Tools – use of Financial Functions such as NPV, IRR etc. c) Date Functions d) Building Simple Macros.

Unit II

MS-Access and MS-Powerpoint

Introduction to MS-ACCESS: Creating a database and tables by different methods- Entering and Editing data- Sorting, Filtering and displaying data. Creating and querying using forms. Creating and printing reports and labels. Transfer of data between Excel and Access. MS- PowerPoint: Creating a presentation with themes, smart art, hyperlinks, styles, animation.

Unit III

Web Based Tool

Introduction to HTML: Simple HTML using Heading elements, Text Elements, Logical Styles, Physical Styles, Ordered, Unordered and Definition list, Hyper Links, Image Link to page containing Images and Videos File

Text Books:

1. David Whigham, "Business Data Analysis Using Excel", Indian Edition, Oxford University Press, 2010.
2. Steven Holzer, "HTML",Paraglyph press,Indian Edition, 2000.
3. Paul Cornell, "Accessing & Analyzing DATA with MS-EXCEL", 2003.

Suggested Readings:

1. R & D, "IT Tools and Applications", Macmillan India Ltd.
2. D.P. Apte, "Statistical Tools for Managers – using MS Excel", Excel Books, 2009.
3. P. Sudharsan & J. Jeyabalan, "Computers Systems & Applications", Jaico Student Edition- Jaico Publishing House.

3. K.Ashwathappa "Essentials of Business Environment: Text, Cases& Exercises" HPH, 2011.

16MB C112

HUMAN RESOURCE MANAGEMENT

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

Course objectives: The objectives of this course are:

1. To provide the basic concepts of Human Resource Management.
2. To make the students understand the process of recruitment and selection.
3. To introduce the concept of performance appraisal and its methods.
4. To understand the basics of Industrial Relations and its importance.
5. To enable the students in having a basic knowledge of Labour laws.
6. To introduce the ongoing contemporary issues in Human Resource Management.

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

1. Understand and apply the knowledge of basic concepts in working environment.
2. Implement good and innovative practices in recruitment and selection.
3. Involve in and Implement the process of Performance Appraisal in Organizations.
4. Maintain sound and updated Industrial Relations practices at workplace.
5. Involve in suggesting and implementing various labour acts as applicable.
6. Design and develop new trends in Human Resource Management practices.

Unit – I

Introduction

HRM- Definition, Evolution, Organization of HR department, Objectives, Scope and Functions of HRM – Role and responsibilities of HR Manager - HR Policies and Procedures - Competitive Challenges of HRM - Competency Framework for HR Professionals - Stakeholders and Integrated Models of HRM - Jobs and careers in HRM.

Unit – II

Human Resource Planning

Job analysis- meaning and importance, process, methods of collecting Job data, writing Job description and Job specification- Job design- meaning, factors, approaches - Job evaluation - meaning and methods- HR Planning - Gallagher HR Estimator - Recruitment- Yield-Ratio Analysis - Process of selection - Types of Interview- Placement and Orientation – HRD - Training Methods - Kirkpatrick and Pecuniary Utility Models of Training.

Unit – III

Performance Appraisal

Performance Appraisal – Meaning, Importance and methods - Basic components of Compensation Management - Towers Perrin Model of Total Reward - Career planning – Greenhaus Career Development Model - Psychological Contract: Functions and Types – HR Utility Framework – Markov Employee Transition.

Unit – IV

Industrial Relations

Industrial Relations - Definition, Importance, Basics of Industrial Acts - Factory Act 1948, Trade Union Act 1926, Employee State Insurance Act 1948, Workmen Compensation Act 1923, Industrial Employment (Standing orders) Act 1946, Industrial Disputes Act 1947, Minimum Wages Act 1948 - Dunlop's IR Model – Quality of work life - Grievance management - Collective Bargaining - Negotiation– Labor Turnover and stability indices – Worker's Participation in Management– Bate's brand wheel for employer brand – Employee Engagement Index – Employee Value Proposition – Absence Management – Brad factor.

Unit – V

Contemporary Issues in Human Resources Management

Introduction to Change Management - HR outsourcing , HR issues in mergers and acquisitions - Work life integration – Introduction to International HRM, Strategic HRM in a Changing Environment - HRIS: Three Levels - Diversity Management - Succession Planning - Stress Management - Ethics in HRM, Interpersonal relations in the workplace - HR Research.

Text Books:

1. Gary Dessler, "Human Resources Management", Pearson, 2015.
2. Decenzo, "Human resources Management", Wiley, 2015.
3. Michael Armstrong, "Human Resource Management", Kogan Page, 2015.

Suggested Readings:

1. David Lepak, Mary Gower, "Human Resource Management", Pearson, 2015.

16MB C113

FINANCIAL MANAGEMENT

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

Course Objectives: The objectives of this course are:

1. To explain the nature and scope of finance function and calculate time value of money.
2. To evaluate capital budgeting techniques based on profitability.
3. To analyse the sensitivity of EPS to PBIT under different capital structures.
4. To determine the cost of capital.
5. To analyse how dividend decisions influence financing decisions.
6. To estimate working capital requirements and manage current assets.

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

1. Judge time value of money in terms of annuity, present value for even and uneven cash flows.
2. Assess the feasibility of capital budgeting proposals based on profitability.
3. Evaluate the capital structure decisions.
4. Compare cost of equity, debt and weighted average cost of capita.
5. Argue the dividend decisions and explore their role in financing decisions.
6. Assess working capital requirements with particular reference to cash, debtors, inventory management.

Unit-I

Introduction

Nature and scope; finance function; Goals of finance- profit maximizing vs wealth maximization, Risk- Return trade off; Agency problem: managers vs shareholders goals; concept of Time value of Money- future value : single cash flows, annuity; present value: single cash flows, annuity, uneven cash flows, multi period compounding. (simple problems)

Unit-II

Investment Decision

Investment Decision Process, Developing Cash Flows; Evaluation techniques-Traditional and DCF techniques. Capital budgeting under risk and uncertainty: Risk adjusted discount rate, Certainty Equivalents, Probability Tree approach. (Problems and cases), capital rationing. (theory)

Unit-III

Financing Decision

Sources of finance; Leverage-concept of leverage-operating leverage-financial leverage- combined leverage; EBIT-EPS analysis.

Capital structure theories- Net Income approach- Net operating Income approach- Traditional view- MM hypothesis.

Cost of Capital: cost of debt-cost of preference capital- cost of equity capital- cost of external equity- cost of retained earnings- weighted average cost of capital. (problems and cases)

Unit-IV

Dividend Decisions

Forms of dividend- cash and Bonus shares; Dividend theories: relevance and irrelevance dividends- Walter's model- Gordon's Model- MM Hypothesis; Dividend policies of Indian Companies. (problems and cases)

Unit-V

Working Capital Management

Concept of working capital- Determinants of working capital; Estimation of working capital requirements, working capital policy; Management of current assets: Cash Management, Receivables Management and Inventory management. (problems and cases)

Text Books:

1. I. M. Pandey, "Financial Management", 11th edition Vikas Publishing House, 2015
2. Khan, M.Y. & Jain P.K "Financial Management", 7th edition McGraw Hill, 2016.
3. Prasanna Chandra, "Financial Management Theory and Practice", 9th edition McGraw Hill, 2015.

Suggested Readings:

1. Brigham, E. F. and Ehrhardt. M. C., "Financial Management Theory and Practice", 11th edition Thomson South-Western, 2015.
2. Jonathan Berk, Peter DeMarzo, Ashok Thampy, "Corporati Finance", 4th edition, Pearson, 2014.
3. Ross Westerfield Jaffe, "Modern Financial Management",10th edition, McGraw-Hill, 2015.

16MB C114

BUSINESS RESEARCH METHODS

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

Course Objectives: The objectives of this course are:

1. To provide understanding and application of appropriate research designs, research statistics, and the use of the computer for data analyses, and report writing and presentation.
2. To develop understanding of the basic framework of research process, designs and review of literature.
3. To identify and select various sources of data, sampling methods and be able to construct an effective questionnaire.
4. To acquaint students with the basic ideas, applicability, and methods of nonparametric tests.
5. To provide students with a working knowledge of the basic concepts underlying the most important multivariate techniques.
6. To provide guidance on how to write a report so that the information is easy to understand.

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

1. Gain knowledge of the business research methods and able to formulate the research problem, develop research design, analyze the data, draw interpretations and present the research findings.
2. Students will understand the research process, gap, and to compare and contrast various research design methods.
3. Students will be able to design the sample and assess measurement and scaling options to determine appropriate measures required to address specific research questions.
4. Apply and interpret the different type's of non-parametric statistical techniques.
5. Students will gain insights on how the methods are developed and gain ability to analyze multivariate data with appropriate methods.
6. Effectively communicate research in a written report and presentation.

Unit – I

Introduction

Business Research - Meaning and Importance. Review of Literature, Research gaps. Research design- Exploratory, Causative, Conclusive and Experimental designs.

Unit – II

Sampling and Data Collection

Sources and methods of gathering information. Sampling design and Sample size determination. Design of Questionnaire. Concept of Measurement and Scaling – Nominal, Ordinal, Interval and Ratio Scales, Attitude scales Thurstone's, Likert's, Guttman's, Semantic differential. Reliability and Validity of scales.

Unit – III

Data Analysis

Non-parametric statistics in research - McNemar, Sign Test –One and Two samples, Run test, Wilcoxon Matched pairs test, Mann-Whitney test, Kolmogorov – Simronov D test, Kruskal –Wallis tests.

Data Representation: Tabulation and Graphical presentation of data.

Unit – IV

Multi -Variate Analysis

Structural and Functional methods- Factor analysis, Cluster analysis, Discriminate analysis, Conjoint analysis, Multi Dimensional Scaling. Multiple Regression (Numerical with two independent variables).

Unit – V

Report Writing

Preparation of the Report- Evaluation of the Research Report. Presentation of report: Plagiarism- Communicating the Research results.

Text Books:

1. Donald R Cooper and Pamela S Schindler, "Business Research Methods",11/e, TMH, 2013.
2. J.K.Sharma, "Business Statistics-Problems and Solutions", Pearson, 2010.
3. Deepak Chawla and Neena Sondhi,"Research Methodology Concepts and Cases", Vikas Publication, 2016.

Suggested Readings:

1. William G.Zikmund, "Business Research Methods", 8th Edition, Sengage Publishers, 2003.
2. Alan Bryman and Emma Bell, "Business Research Methods", 2nd Ed. Oxford Press, 2009.

16MB C115

OPERATIONS RESEARCH

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

Course Objectives: The objectives of this course are:

1. To provide an insight into the concepts and tools of Operations Research.
2. To apply the concept of linear programming and simplex method to a given situation with certain constraints.
3. To explain how the transportation and assignment problems can be solved with a focus on optimisation.
4. To determine the expected monetary value and expected value of perfect information in different business situations such as risk and uncertainty.
5. To explain how the probability of completing the project within given time for a given PERT Network and also analyse how to determine the total cost of crashing for a given project.
6. To apply a) queing theory as part of assessing the quality of service b) simulation techniques for evaulating variety of models and systems c) game theory to identify the winning strategies.

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

1. Apply Linear Programming and Simplex method to a given situation with certain constraints.
2. Solve the transportation and assignment problems.
3. Determine the expected monetary value and decide on expected value of given information in different business situations such as risk and uncertainty.
4. Determine a) the probability of completing the project within given time for a given PERT Network and b) the total cost of crashing for a given project.
5. Assess the quality of service interms and reduce the idle time using the concepts underlying queing theory.
6. Evaluate the simulation models and foromulate the winning strategies using game theory.

Unit – I

Introduction to Operations Research and Linear Programming
Operations Research : Introduction,origin, nature, definition, managerial applications and limitations.

Linear Programming: Mathematical model, Formulation of LPP, assumptions, solution by the graph, LP Problem -Simplex Method-Maximization and Minimization cases. Formulation of Dual to Primal.

Unit – II

Transportation and Assignment
Transportation: Formulation of Transportation Problem Mathematical model, IBFS using Northwest Corner Rule, Row and Column Minimum methods, Least Cost Method (LCM) and Vogel's approximation method, Unbalanced TP, Degeneracy, Optimality Test.

Assignment: Formulation of Assignment Problem (AP): Mathematical model, Balanced and Unbalanced Assignment problems, Restricted AP, Hungarian method. Travelling salesman problem, Managerial applications.

Unit – III

Statistical Decision Theory
Decision Theory-Decision making under Certainty, Risk, Uncertainty, Criteria of Decision making - Pessimism, Realism, Optimism, Regret, Equi-probable, EMV, EOL, Cost and value of information, Determination of EVPI utility as a concept of Decision Making.

Unit – IV

Network Analysis
Network fundamentals - scheduling the activities - PERT Vs CPM – Three time estimates - Beta distribution - Identifying Critical Path – Probability of Completig the project with in given time, Critical Path Method – Direct costs and indirect costs - cost slope- Crashing,

Unit – V

Queuing, Simulation and Game Theory
Queuing Theory - Concepts of Queue/Waiting Line - General structure of a Queuing system - Operating characteristics of Queues, deterministic Queuing models - Probabilistic Queuing Model – Single Channel Queuing model - Poisson arrival and exponential service times with infinite population.

Simulation - Process of simulation, Applications of simulation to different management Problems. (Theory only)

Game Theory - concepts, saddle point, Dominance, Zero-sum game, two, three and more Persons games, analytical method of solving two person zero sum games, graphical solutions for (m x 2) and (2 x n) games.

Text Books:

1. A C S Kumar, "Operations Research", Yesdee, 2015.
2. Levin, "Quantitative Approaches to Management" McGraw-Hill, 2015.
3. J.K. Sharma, "Operations Research Theory and Applications" , Macmillan, 2015.

Suggested Reading:

1. N.D. Vohra, "Quantitative Techniques in Management", McGraw-Hill, 2015.
2. Prem Kumar Gupta & others, "Operations Research", S. Chand, 2015.
3. Pannerselvam, R, "Operations Research", PHI, 2015.

16MB C116

OPERATIONS MANAGEMENT

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

Course Objective: The objectives of this course are:

1. To gain an understanding and appreciation of the principles and applications relevant to the planning, design, and operations of manufacturing or service firms.
2. To familiarize the concepts of operations management to students and make them understand the functions of inter related activities and decisions involved therein for effective operations management.
3. To gain some ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making on operations management and strategy.
4. To develop skills necessary to effectively analyze and synthesize the many inter-relationships inherent in complex socio-economic productive systems.
5. To understand how Enterprise Resource Planning and MRP II systems are used in managing operations.
6. To emphasize on the international operations management.

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

1. Apply knowledge of fundamental concepts of operations management for operational performance improvement.
2. Identify the operational and administrative processes in organizations and the boundaries of an operations system, and recognize its interfaces with other functional areas within the organisation and with its external environment.
3. Develop an integrated framework for strategic thinking and decision making to analyze the enterprise as a whole with a specific focus on the wealth creation processes.
4. Emphasize on the work study and measurement of work.
5. Give a clear knowledge on how materials and stores management are handled.
6. To identify future challenges and directions that relate to operations management to effectively and efficiently respond to market changes.

Unit – I

Introduction

Introduction to Operations Management - The historical evolution of operations management- scope of Operations Management - Interface between the operation systems and systems of other functional areas, Process planning and Process Design. Production Planning and Control: Basic functions of Production Planning and Control, Production Cycle, characteristics of process technologies- Project, Job Shop, Assembly, batch and Continuous flow –Productivity-Measuring productivity-Ways of improving productivity -Emerging trends and implications for operations.

Unit – II

Scheduling and control of Production Operations

Aggregate planning, Master Production Schedule (MPS), Operations scheduling, Product sequencing: Sequencing of products in multi- product multi-stage situations –By using Johnson rule and CDS method - Plant Capacity and Line Balancing - Plant Layout- Different types of layouts-location and the factors influencing location. Maintenance Management: Objectives, Preventive and Breakdown maintenance, failure concept, Reliability, Replacement policies.

Unit – III

Work Study and Measurement

Work Study - Method Study and Work Measurement - Objectives of Work Study - Relationship of Time and Motion Study to Work Study- Basic Work Study procedure - various techniques in the Methods Study for identifying the most appropriate method. Work measurement - its uses and different methods, computation of allowance and allowed time.

Unit – IV

Materials and Stores Management

Objectives of Materials management-Materials Requirement Planning [MRP-I], Manufacturing resource planning [MRP-II] - Sources of Supply of Materials -selection, evaluation and Performance of suppliers-make or buy decisions and its implications under various circumstances Vendor rating - determinants of vendor rating. Objectives of Stores Management – Management of Stores - safety stock Inventory Control - Different Systems of Inventory Control, Types of Inventory. Costs- Systems of inventory control. Value Analysis: importance in cost reduction – concepts and procedures.

Unit – V

Quality Management

Quality -Need for quality - Evolution of quality, Quality Dimensions – Product and Service. The concept of TQM, Evolution of TQM – TQM

Framework – Conventional vs total quality management. Service Quality-significance. Quality Costs.

Note: Problems to be discussed in Units-2 & 4.

Text Books:

1. Stevenson J. William, "Operations Management", 11th Ed., Tata McGraw-Hill, 2012.
2. Mahadevan. B, "Operations Management", 2nd Ed, Pearson Education, 2010.
3. Dale H. Besterfield, Carol Besterfield - Michna, Glen H Besterfield and Mary Besterfield-sacre, "Total Quality Management", 3rd Ed., PHI, 2006.

Suggested Readings:

1. Robert S. Russel, Bernard W III Taylor, "Operations Management", 7th Ed Hoboken, Wiley, 2011.
2. Lee J., Krajewski,"Operations Management",9 edition, PHI, 2009
3. Everett. Adam, Jr. and Ronald J. Elbert, "Production and Operations Management Concepts", 5th Ed,Prentice-hall, 2006.

16MB C117

BUSINESS ANALYTICS

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

Course Objectives: The objectives of this course are:

1. To provide in-depth knowledge of handling data and business analytics tools that can be used for decision-making.
2. Understand the role of business analytics within an organisation.
3. To acquire knowledge on data warehousing concepts.
4. Analyse data mining techniques and understand relationships between the underlying business process of an organisation.
5. Acquire knowledge on prescriptive analytics.
6. To understand the various applications of business analytics on different domains.

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

1. Have a clear idea about the basic concepts of business analytics in an organisation.
2. Demonstrate detailed knowledge about the role of business analytics in decision making.
3. Distinguish between descriptive, predictive and prescriptive analytics.
4. Gaining knowledge on dataware housing and data mining concepts.
5. Understand the usefulness of business analytics in various functional areas of an organisation.
6. Understand the future directions for business analytics.

Unit- I

Introduction

Introduction to Analytics, data science, Big data. Business analytics-challenges from outside and within, BASP (Business analytics success pillars) framework, Applications of Analytics to different domains, Data, Information, and Knowledge, Analyst's Role in the BA Model - Three Requirements the Analyst Must Meet , Required Competencies for the Analyst , Hypothesis-Driven Methods, Data Mining with Target Variables , Explorative Methods.

Unit- II

Descriptive analytics

Descriptive analytics-Data warehousing-concepts, characteristics, Data marts, Meta data and process of data warehousing, Business Reporting, Visual Analytics and Business performance measurement, Why a Data Warehouse, Architecture and Processes in a Data Warehouse, Tips and Techniques in Data Warehousing.

Unit- III

Predictive analytics

Introduction, Data mining concepts and Applications, Data mining process, methods, classification techniques. Text mining-introduction, text analytics and sentiment analytics. Web mining-introduction, Web analytics and social analytics.

Unit- IV

Prescriptive analytics

Introduction- categories of models- optimisation, simulation, heuristics, predictive models, other models. Automated decision systems and Expert systems, Knowledge Management and collaborative systems.

Unit-V

GIS

Nature of Geographic data, Spatial Objects and Data Models, Getting map on Computers, GIS standards and Standardization Process of GIS development, Implementation and Deployment phases, Big Data, Defining Big Data, Big Data Landscape, Business Implications of Big Data, Technology Implications of Big Data, Big Data Technologies, Management of Big Data.

Text Books:

1. Ramesh sharada, Dursun Delen, Efraim Turban, "Business intelligence and analytics", Pearson, 2015.
2. Jean paul isson, Jesse S.Harriot, "Win With Advanced Business Analytics", Wiley and Sas, 2012.

Suggested Readings:

1. Gert H.N. Laursen, Jesper Thorlund, "Business Analytics for Managers", JohnWiley & Sons Inc., 2010.
2. George B. Karte, "The GIS Book".

16MB C118

STATISTICAL SOFTWARE LAB

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

Course Objectives: The Objectives of the course are:

1. To familiarise the students about the data summarisation and presentation.
2. To describe the concepts of measures of central tendency and dispersion.
3. To determine hypotheses formation and testing.
4. To educate how parametric and non-parametric tests are applied.
5. To focus on the importance of ANOVA.
6. To educate how forecasting techniques can be used and find trends values.

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

1. Analyze the data to draw inference for decision making.
2. Understand application of statistical measures of central tendency.
3. Test given set of hypotheses.
4. Understand the applications of parametric and non-parametric test.
5. Understand application of ANOVA.
6. Forecast unknown variable and analyze trends.

Unit –I

Introduction to MS-Excel

Components of an Excel spreadsheet- Entering Data and Formatting, Performing Calculations, Presenting Results, Numerical Skills Revision, Visualizing and Presenting Data-The Different Types of Data Variable, Graphical Representation of Data.

Unit-II

Averages and Measures of Dispersion

Measures of Central Tendency - Mean, median, and mode; Measures of Dispersion -The range, the interquartile range and semi interquartile range, standard deviation and variance, Coefficient of variation, Population Confidence Intervals.

Unit-III

Parametric and Non-Parametric Hypothesis Testing

3.1. Z Test, T Test, F Test, Chi Square Tests - independence of attributes

3.2. The sign test, Wilcoxon signed rank sum test and Mann-Whitney U test for two independent samples.

Unit-IV

Factorial Experiments and Correlation

4.1. Single-Factor Experiments - Single-factor ANOVA (or one-way ANOVA) and Kruskal-Wallis test.

4.2. Correlation Analysis - Scatter plot, Covariance, Pearson's correlation coefficient, testing the significance of Pearson's correlation coefficient, Spearman's rank correlation coefficient.

Unit-V

Regression and Time Series Analysis

Fitting a straight line using sample data, Time series: forecasting Method of least squares, moving average method. Inference and discussion of results.

Text Books:

1. Glyn Davis & Branko Pecar "Business Statistics Using Excel" Oxford University Press, 2012.
2. D P Apte, " Statistical Tools for Managers USING MS EXCEL", Excel, 2012.
3. David M Levine, David. F. Stephan & Kathryn A. Szabat, "Statistics for Managers – Using MS Excel", PHI, 2015.

Suggested Readings:

1. Bruce Bowerman, "Business Statistics in Practice", 5/e,TMH, 2012.
2. Shelly, "MS Office, 2007", Cengage, 2009.
3. Ajai.S.Gaur, Sanjaya S.Gaur, "Statistical Methods For Practice and Research", Response, 2009.

16MB C120

STRATEGIC MANAGEMENT ACCOUNTING

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

Course Objectives: The objectives of the course are to develop the knowledge and understanding of:

1. Strategic Management Accounting and application of marginal costing for decision making.
2. Strategic Planning and standard costing and variance analysis.
3. Concepts of Budgetary Planning and Control System.
4. Activity based Costing and Customer account profitability analysis.
5. Identify the costs involved at different stages of the life cycle.
6. Target cost in manufacturing and service industries.

Course Outcomes: After completion of the course, students should be able to:

1. Gain knowledge on Management accounting concepts and its function.
2. Utilize a variety of costing techniques in a range of practical business situations.
3. Understand the standard setting process and the ability to calculate, interpret and analyse appropriate variances.
4. Apply ABC and CAP techniques in planning, control and decision making situations.
5. Analyse the implications of lifecycle costing on pricing, performance management and decision-making.
6. Analyse the implications of using target costing on pricing and cost control.

Unit – I

Introduction

Meaning – Nature, Scope and Strategic importance of Strategic Management Accounting-Management function and management accounting. Marginal costing and its uses for decision-making, Make or buy–Profit planning- Acceptance of Export order- Optimization of sales mix/product mix–Discontinuation of product line.

Unit – II

Strategic Planning and Accounting for Control

Strategic Planning: Management Control and Operational Control–Meaning, Concept and Purpose. Standard costing - concept and purpose of standards- Types of standards. Variance analysis: Material variances, Labour variances, Overhead variances, Sales and profit variances.

Unit – III

Budgetary control and Responsibility Accounting

Budgetary control – Meaning and purpose – Essentials of effective budgeting program–Preparation of functional budgets: Sales budget, Production budget, Material Vs Purchase budget - Flexible budget - Zero based budgeting. Responsibility accounting - Meaning- Responsibility Centres, Types of responsibility centres – Need for divisionalization, Segmented Performance evaluation of divisions.

Unit – IV

Activity Based Costing and Customer Account Profitability Analysis

Activity Based Costing systems – Meaning – Types of Cost drivers – Activity based Management – Activity Based Costing vs Traditional costing. Customer Account Profitability analysis – Meaning and need for CAP analysis, Managing Customer Profitability.

Unit – V

Strategic decisions for Product life cycle and Competitor analysis

Product life cycle costing – PLC assessment – Cost assessment – Pricing and evaluation criteria for products at different stages of PLC. Competitor Analysis – Concept and Importance.

Text Books:

1. Ward. K, "Strategic Management Accounting", Butterworth Heinemann, New Delhi, 2010.
2. Hansen & Mowen, "Management Accounting", Cengage Learning, New Delhi, 2013.
3. Prof. Jawaharlal, "Advanced management accounting", 3rd ed., S.chand, 2009.

Suggested Readings:

1. Ronald.W.Hilton, G.Ramesh & M.Jayadev, "Managerial Accounting", Tata McGraw-Hill, 2008.
2. Edward J. Blocher, Kung H. Chen, Gary Cokins and Thomas W. Lin, "Cost Management-A strategic Emphasis", Tata McGraw Hill, 2006.
3. Khan M.Y. and Jain. P.K., "Management Accounting – Text, Problems and cases", 4th edition, Tata McGraw Hill, New Delhi, 2007.

16MB C122

STRATEGIC MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To help the students to understand the process of strategic management and strategic intent.
2. To enable the students to analyze internal and external environment and the strength of portfolio of the firm.
3. To develp the students to formulate strategies at the corporate level.
4. To make the students to craft business level strategies.
5. To provide knowledge on implementation of the strategies.
6. To create an awareness on how to take care of control and feedback.

Course outcomes: After completion of the course, students will be able to:

1. Display a knowledge of process of strategic management.
2. Appreciate the importance of strategic analysis in formulating strategy.
3. Generate and evaluate strategic alternatives at the corporate level.
4. Generate and evaluate strategic alternatives at the business level.
5. Construct strategy-implementation plans at the corporate level with appropriate controls and governance processes.
6. Construct strategy-implementation plans at the functional level with appropriate controls and governance processes.

Unit: I

Introduction

Nature, Scope, and process. Benefits and Limitations of strategic management. Levels of strategy- Developing strategic intent: vision, mission, goals and objectives, policies. Elements of strategy: the strategic position, strategic choices and strategy in action.

Unit: II

Strategic Analysis

External Environment analysis: key drivers of change, Porter's Five Forces Model. Industry and Competitive Analysis: Strategic groups, SWOT Analysis. Internal Analysis: Strategic capabilities, core and distinctive competencies, Creating and Sustaining Competitive Advantage, Porter's value chain; ~~Portfolio Analysis:~~ BCG Matrix, Ansoff's matrix, ADL matrix and GE model.

Unit: III

Corporate Level Strategic Alternatives

Stability Strategies: Maintenance of status quo strategy, Sustainable growth strategy, Pause/Proceed with caution strategy, No change strategy and Profit strategy. Growth Strategies: Internal growth strategy, Concentration strategy, Merger and Acquisition strategy, Diversification, Joint Ventures. Retrenchment Strategies: Turnaround strategy, Captive company strategy, Transformation strategy, Divestment strategy and Liquidation strategy. Combination/Portfolio Restructuring Strategy. Strategic Alliance.

Unit: IV

Business Unit Level Strategic Alternatives

Michael Porter's Generic Strategies: Cost Leadership, Differentiation and Focus strategies; Grand Strategies: Stability, expansion, retrenchment and combination. Offensive and Defensive Strategies. Industry Life Cycle Stages: Strategic Implications. Tailoring strategy to fit specific industry and company situations-Strategies for competing in Emerging industries, Turbulent and high velocity markets, Maturing industries, Stagnant industries, and Fragmented industries. Strategies for Industry leaders, Runner-up firms, weak and crisis ridden Business.

Unit V

Implementation, Control and Feedback

Matching organization structure and strategy. Behavioral Implementation: Culture and Strategy. Strategy and Leadership, Organization Development and Strategy. Functional Implementation: Role of Finance, Marketing, Human Resource, Production, Research and Development and Information Technology Departments. Types of Control: Preliminary, Concurrent, and feedback. Corporate Governance for Sustainable Development.

Text Books:

1. Arthur A Thompson Jr, Strickland A.J., John E. Gamble and Arun K. Jain, "Crafting and Executing Strategy - The Quest for Competitive Advantage - Concepts and Cases", Tata McGraw Hill Education Private Limited, New Delhi, 2015.
2. Azhar kazmi and Adela kazmi,"Strategic Management", McGraw-Hill, 2016.
3. Arabinda Bhadari and Raghunath Prasad Verma,"Strategic Management—A Conceptual Framework", McGraw Hill Education, 2013.

Suggested Readings:

1. Gerry Johnson, Kevan Scholes, Richard Whittington, "Exploring Corporate Strategy", 8th ed., Pearson, 2008.
2. Michael Hitt, Ireland, Hoskission, "Strategic Management", 9th ed, Cengage Learning, 2016.
3. Fred R. David, "Strategic Management – Concepts and Cases", 12th ed., PHI Learning, 2009.

16MB C124

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To facilitate the students to plan a career in business to get benefitted from a clear understanding of the field of Logistics and Supply chain management.
2. To make the students understand the importance of supply chain management for the success of any organization.
3. To focus on the role of logistics in the success of supply chain of an organization.
4. To elucidate how warehousing and transportation contribute for the success of any supply chain.
5. To facilitate students understand the strategic issues of supply chain.
6. To expound the role of other functional areas for an effective supply chain.

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

1. Equipped with the concepts of supply chain management to set their business successfully.
2. Learn the strategic importance of good supply chain design, planning and operation and also able to understand how supply chain can be a competitive advantage of a firm.
3. Understand how to manage the logistics for the success of an organization.
4. relate the importance of managing warehousing and transportation in a good supply chain.
5. Make strategic decision through alliances, collaborations and bench making practices.
6. Integrate various functional areas in order to have an effective supply chain.

Unit - I

Introduction

Introduction to Supply Chain Management (SCM) - Concept, evolution, Objectives, importance and function of SCM, conceptual framework of SCM, process view of supply chain , supply chain strategies, drivers and metrics of SC. Strategic fit, Achieving strategic fit and obstacles. Service Supply Chain Management

Unit - II

Logistics Management

Logistics Management, Inbound, Internal and Outbound Logistics in SCM, Logistics organization, development of integrated logistics strategy, 3PL, 4PL, Reverse Logistics. Role and importance of inventory in SC, JIT, VMI, Outsourcing, Factors influencing the decision making process of outsourcer.

Unit - III

Transportation and Warehousing

Transportation in SC, Transportation formats, Modes of Transportation, Transportation performance factors, modes of transport, Fleet Management, multi model transport, Containerization, Vehicle Scheduling and routing, Milk run and cross docking.Warehousing- types of warehouses, warehousing operations, Warehouse management systems.

Unit - IV

Strategic Issues in Supply chain

Strategic Partnerships, Alliances and Collaborative advantage, Strategic relationships in-logistics, Supply Chain Coordination, Bullwhip effect, Bench marking - Issues and problems in Bench Marking, types of bench marking, methods of BM, Process of BM. Lean Manufacturing, Agile Manufacturing.

Unit - V

Supply Chain Interface

SC Network Design, Distribution network in SC, Channel design, factors influence design, Models in distribution network, SC integration - Internal and external, Role of IT and HR in SCM, Retailing and SCM.Pricing and Revenue Management, Green Supply chain Management

Text Books:

1. Chandrasekaran. N, "Supply Chain Management process, system and practice", Oxford, second Impression, 2012.
2. B. Rajashekar and G.V.R.K. Acharyulu, "Logistics and Supply chain Management", 1st edition Excel Books, 2009.
3. K. Shridhara Bhat, "Logistics and Supply Chain Management", 1st Ed. Himalaya Publishing House, 2016.

Suggested Readings:

1. Sunil Chopra, Peter Meindl& D.V.Karla, "Supply Chain Management, Strategy, Planning and Operations", 5th Edition, Pearson, 2013 .
2. Shah, J, "Supply Chain Management, Text and Cases", 2ndEd., Pearson, 2011.
3. Crandall, Richard E & others, "Principles of Supply Chain Management", 2nd edition CRC Press, 2010.

16MB C125

ENTREPRENEURIAL DEVELOPMENT

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

Course objectives: The Objectives of the course are to:

1. to sensitise the students about the concept and functions of entrepreneur with particular reference to women entrepreneur and financial inclusion.
2. to educate on how to identify the business opportunities and provide orientation to social entrepreneurship and Entrepreneurship Development Programmes.
3. to provide insight on how to formulate business model and revenue model.
4. to explain how to optimize risk and return while leveraging technology.
5. to create an awareness on how to raise funds from the appropriate institutional sources under suitable schemes.
6. to enable the students to understand the role of venture capitalists in entrepreneurship development.

Course Outcomes: After completion of the course, student will be able to:

1. Understand the concept of entrepreneurship and its close relationship with enterprise and owner-management.
2. Identify the business opportunities.
3. Learn the concepts of innovation and creativity and the roles that both play in entrepreneurship and business development.
4. Manage the enterprise with a focus on project management.
5. Explore the avenues for institutional finance.
6. Identify the appropriate agencies for venture capital funding.

Unit–I

Introduction

The Concept and characteristics of Entrepreneur–Entrepreneur Vs.Intrapreneur– Functions of an Entrepreneur–Theories of Entrepreneurship- Role of Small Enterprises in Economic Development, Their problems -Women Entrepreneurship, Issues and Challenges of women Entrepreneurs – Entrepreneurs and Financial Inclusion - Select case studies.

Unit–II

Identification of Business Opportunities

Sources of business or product ideas steps in identification of business opportunity, Entrepreneurship Development Programmes (EDPs) - Digital Entrepreneurship – Social Entrepreneurship – Serial entrepreneurs - Rural Entrepreneurship. Business Plan, Development, Preparation and Evaluation.

Unit – III

Managing Enterprise

Interface with Functional areas. Strategies to set and achieve goals- Formal and non-formal aids - dealing with Government/non - Government organisations. Micro and Small, medium and large Enterprises (MSME Act) – Definition, Characteristics, Selection of business opportunities – formulating business and revenue models – Leveraging Technology - Optimising the risk and return.

Unit – IV

Institutional Finance

Definition, Characteristics, Government Policy, State and Central Government Initiatives need and importance, Institutional finance from IDBI, IFCI, LIC, UTI, NABARD, SFCs, SIDC s, EXIM Bank. Role of NSIC, SSIB, SSICs. Social Inclusion.

Unit – V

Startup andVenture Capital

Startup Basics – Opportunity, Ideation, Customer Discovery, Market Analysis. Business Incubation centres.

Venture Capital Financing Concept and features. Structure and regulatory framework of venture capital financing in India. Investment process and evaluation- Structuring venture capital financing. Exit Strategies of Venture capitalists.

Text Books:

1) E. Gordon & K.Natarajan,"Entrepreneurship Development", Himalaya, 2017.
2) Coulter,"Entrepreneurship in Action", PHI, 2008.
3) S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Ltd, 2007.

Suggested Readings:

1) Vijay Sathe, " Corporate Entrepreneurship" 1st edition, Cambridge, 2009.
2) Vasanth Desai, "Dynamics of Entrepreneurial Development and Management", HPH,Millenium Edition, 2007.

3) P. Narayana Reddy, "Entrepreneurship – Text and Cases", 1st Ed. Cengage Lerning, 2010.
4) David H. Hott, "Entrepreneurship New Venture Creation", PHI, 2004.

16MB E101 (F)

INVESTMENT MANAGEMENT

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

Course Objectives: The objectives of the course are:

1. To provides an in-depth analysis of the securities industry.
2. To provide the basic concepts of investment and its various investment opportunities.
3. To enable the students to acquire knowledge on investment analysis like fundamental and technical anlaysis.
4. To focus on the basics of bonds and world of fixed income investing.
5. To emphasis on the basis of the analysis and valuation of common stocks.
6. To provide an insight of portfolio theories and evaluation.

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

1. Pursue a career in the investment field, the course will prove useful for personal investing as well.
2. Have a clear idea about the investment management.
3. Gain knowledge on various investment avenues.
4. Analyse various techniques and tools in fundamental and technical analysis.
5. Allocate investments into stocks and bond portfolio's in accordance with a person's risk preference.
6. Understand various portfolio theories and its evaluation.

Unit – I

Introduction

Investment decision process; Concept; Real vs. Financial assets; Sources of investment-information; Investment vs. Speculation; Factors to be considered in investment decision.The concept and measurement of return-The concept and Measurement of Risk and Return-Range, Standard Deviation and Co-Efficient of Variation.Ex-ante and ex-post returns. Risk-return trade-off.

Unit – II

Investment Analysis

Approaches to Investment analysis-Fundamental Analysis-Economy, industry and company analysis –Factors of EIC analysis, Technical Analysis

- Dow theory, charts, moving averages, Relative strength, Efficient Market Hypothesis.

Unit – III

Fixed Income Securities

Features and types of debt instruments, Bond indenture, factors affecting bond yield. Bond yield measurement - Current yield, holding period return, YTM, AYTM and YTC. Bond duration- Macaulay's duration and modified Macaulay's duration.Bond convexity. Bond portfolio management strategies - active and passive.

Unit – IV

Common Stocks - Analysis and Valuation

Basic Features of Common Stock, Approaches to valuation – Balance sheet model, dividend capitalization models; earnings capitalization models; Security Market Indexes, their uses; computational procedure of Sensex and Nifty.

Unit – V

Portfolio Theory and Evaluation

Concept of portfolio. Portfolio return and risk. Harry Markowitz's Portfolio theory, construction of optimal portfolio, the single-index model. Capital market theory: Introduction of risk-free asset, Capital Market Line (CML), Separation theorem. Capital asset pricing model (CAPM): Security Market Line (SML). Arbitrage Pricing Theory (APT): The Law of one price, two factor arbitrage pricing. A synthesis of CAPM and APT. Introduction to Mutul Funds. Performance measures - Sharpe's reward to variability index, Treynor's reward to volatility index, Jensen's differential index, Fama's decomposition of returns.

Text Books:

1. Charles P.Jones, "Investments Principles and Concepts",11th edition, Wiley India edition.
2. Prasanna Chandra, "Investment Analysis and Portfolio Management", TMH, 2010.
3. V.K.Bhalla , "Investment Management", 19th edition, S.Chand publications.

Suggested Readings:

1. Alexander. G.J, Sharpe.W.F and Bailey, J.V, "Fundamentals of Investments", 3rd ed, PHI.
2. Donald E. Fischer & Ronald .J.Jordan, "Securities Analysis and Portfolio management", 6th ed., McGraw Hill.
3. Harileela Vemula, "Security analysis & Portfolio management", Paramount Publishing House, New Delhi, 2014.

16MB E102 (F)

INTERNATIONAL FINANCE

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

Course Objectives: The Objectives of the course are:

1. To provide an extensive view of International Monetary Systems.
2. To enable the students understand the foreign exchange markets.
3. To give insights about how exchange rates are calculated in the spot and forward markets.
4. To focus on how financial decisions are made by MNCs in the global market.
5. To equip the students with the hedging techniques to manage the risk in the MNCs.
6. To provide basic platform on tax structures of MNCs in the International scenario.

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

1. Do business in a global setting by understanding the international monetary system.
2. Have insights about the structure and operations of foreign exchange markets.
3. Find exchange rates of any currency with respect to any other currencies.
4. Equip with the concepts of financial decision making in the MNCs.
5. Apply various tools for hedging to manage the risks faced in the international scenario.
6. Enrich with risk management techniques and tax environment in global environment.

Unit - I

Introduction

Evolution of International financial system–gold standard, Breton woods standard, floating exchange rate; currency board, sterilized and unsterilized intervention; Global financial institutions–IMF, Bank for International Settlements; International financial instruments–euro CP, Eurobonds, foreign bonds, global bonds, euro equity, ADR, GDRs.

Unit - II

Foreign Exchange Market and International Parity Relationships

Participants in Foreign exchange market, structure of Foreign exchange market in India; Foreign Exchange rates: quotes in spot and forward market, Cross rates, triangular arbitrage; Foreign Exchange Management Act ; BOP, BOP trends in India; Parity Conditions- Purchasing Power Parity, Interest Rate Parity, International Fisher Effect, Unbiased Forward Rate Theory.

Unit - III

Multinational Corporate Decisions in Global Markets

Foreign investment decision-Foreign direct investment (FDI)–motives, Modes of foreign investment–licensing, management contracts, joint venture, Greenfield investment, acquisition, strategic alliance, evaluation of overseas investment proposal using APV; International cash management, multinational capital structure decision, cost of capital.

Unit - IV

Risk Management in Multinational Corporations

Types of risk-currency risk, transaction exposure, translation exposure, accounting standard for translation exposure in India, economic exposure; risk management through hedging - natural hedges, hedges with currency derivatives – forward market hedge, options market hedge, money market hedge, hedging through invoice currency.

Unit - V

International Tax Environment

Types of tax–income tax, withholding tax, value added tax, Tobin tax; taxation methods – worldwide approach, territorial approach; tax havens, offshore financial centres, Tax treaties-Double taxation Avoidance agreement, multilateral tax treaties; foreign tax credit, tax neutrality tax equity, taxes and the location of foreign operations, tax implications of dividend remittance by overseas affiliate, Taxation of foreign source income in India; Transfer pricing (TP) and tax planning– TP methods, TP rules in India

Text Books:

1. Eun C.S., Resnick B.G., "International Financial Management", 4th ed. Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2008, reprint 2010
2. Shailaja G, "International Finance", Universities press, 2nd Ed. Orient Black'swan Pvt.Ltd., 2010.
3. Apte P.G., "International Finance", 2nd Ed. Tata McGraw Hill, 2009.

Suggested Readings:

1. Alan. C. Shapiro., "Multinational Financial Management", 9th Ed. PHI Pvt. Ltd., 2009.
2. Levi M., "International Finance", 5th Ed. Routledge, Taylor & Francis Group, 2009.

3. Madura J., "International Financial Management", 4th Ed. Cengage Learning, 2010.

16MB E103 (HR)

PERFORMANCE AND COMPENSATION MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To develop an understanding of the complexities in deciding compensation of employees.
2. To understand the importance of linking performance appraisal in determining compensation.
3. To discuss the importance of performance benchmarking in improving individual and organizational performance.
4. To understand the concept of compensation management and its importance in employee retention.
5. To introduce various methods of designing compensation system.
6. To make the students aware about the legally required and discretionary employee benefits.

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

1. Involve and in the future lead the process of performance planning.
2. Effectively use the existing performance appraisal methods at their workplace as an HR professional.
3. Set a standard performance benchmarks to influence the performance of organizational members.
4. Influence the stakeholders of compensation and also integrate compensation with other HR initiatives in line with organizational realities.
5. Design a new set of compensation system in the organization.
6. Maintain a proper balance of legally and discretionary benefits in the organisations.

Unit – I

Introduction

Definition, concerns and scope of Performance Management (PM). Determinants of job performance. Mapping, process, sequence and cycle of PM. Performance planning and Role clarity. KPAs - Performance Targets. Trait, Behavior and Results approaches to measuring performance. The impact of HRM practices on performance.

Unit – II

Performance Appraisal

Assessment center - Psychometric tests: Aptitude or Ability tests and Personality tests. Role Play – Self-appraisal - 360 Degree appraisals - Rating-less appraisals for the future of Performance Management System (PMS). Critical incidents worksheet, Combining behavior and outcomes, Attribution theory-Causal matrix

Unit – III

Performance Bench marking

Diagnosis and Performance improvement - Performance measures pyramid -Direction of trouble shooting with Behavior model – Mager and Pipes trouble shooting model - European Foundation for Quality Management (EFQM) Excellence model – Diagnostic and Process bench marking. PM Audit, PM pathway analysis. The impact of Performance Management on Line managers and Employees.

Unit - IV

Strategic Compensation Management Concepts

Compensation as an offshoot of performance- Concept of compensation- Exploring and defining the compensation context – System of compensating – compensation dimensions – Role of compensation in Organization - stake holders of compensation-factors influencing compensation- Aligning Compensation Strategy with HR Strategy and Business Strategy- New trends in compensation management – The 3- P compensation concept.

Unit-V

Designing Compensation System - Employee Benefits Management

Bases for Traditional Pay System and Modern Pay System – Establishing Pay Plans – Seniority and Longevity pay - Linking Merit Pay with Competitive Strategy-Incentive Pay-Person focus to Pay – Team Based Pay. Fringe Compensation - Legally required Benefits- Discretionary Benefits. International Compensation- Executive Compensation Packages

Text Books:

1. Michael Armstrong, "Performance Management", Kogan Page, 2010.
2. Robert L Cardy, "Performance Management", PHI, 2008 .
3. Joseph J.Martocchio, "Strategic Compensation", Pearson Ed Richard I, 3rd Ed., 2006.
4. Dr. Kanchan Bhatia, "Compensation Management", Himalaya Publishing House, 2009.

Suggested Readings:

1. T.V. Rao,"Performance Management & Appraisal System", Sage, 2008.

2. A.M. Sarma, "Performance Management systems", HPH,2010.
3. Handerson, "Compensation Management in a Knowledge Based World", 9th Ed., Pearson, 2007.
4. Milkovich & New Man, "Compensation", Tata McGraw –Hill, New Delhi, 2005.

16MB E104 (HR)

ORGANIZATIONAL DEVELOPMENT AND CHANGE MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To provide knowledge on Organization Development concepts and its evolution.
2. To educate the students about the different stages in the process of Organization Development.
3. To introduce the concept and provide knowledge on OD interventions and its types.
4. To discuss the practical approach of implementing OD interventions.
5. To explain the basics of change management and its process.
6. To provide knowledge on various change models and their importance in practice.

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

1. Solve a business problem from an organizational development perspective as an OD practitioner.
2. Involve, assist or lead the process of Organization Development.
3. implement the existing Organization Development interventions at their workplace.
4. Design and implement a new set of Organization Development interventions at their workplaces.
5. Successfully deal with change processes using tools like diagnostic models.
6. Apply change models and develop newer models in an organization for development.

Unit - I

Introduction

Definitions of OD-Growth and Relevance Of OD - A Short History of OD and its Evolution - Characteristics of OD-The Organization Development

Practitioner – Competencies of an Effective Organization Development Practitioner.

Unit- II

The Process of Organization Development

Entering and Contracting - Diagnosing Organizations - Diagnosing Groups and Jobs-Collecting and Analyzing Diagnostic Information - Feeding Back Diagnostic Information - Designing Interventions - Leading and Managing Change - Evaluating and Institutionalizing Organization Development Interventions.

Unit - III

OD Interventions

Human Process Interventions: Coaching and Training, Process Consultation,Third Party Intervention,Team Building, Organization Confrontation Meeting, Inter Group Relations, Large-Group Interventions. Technostructural Interventions: Structural Design, Downsizing, Reengineering, Parallel Structures, High Involvement Organizations, Total Quality Management, Work Design.HRM Interventions: Goal Setting, Performance Appraisal, Reward Systems, Career Planning and Development, Managing Workforce Diversity, Employee Wellness.Strategic Interventions: Integrated Strategic Change, Mergers And Acquisitions Integration, Alliances, Networks, Culture Change, Self Designing Organizations, Organization Learning and Knowledge Management.

Unit – IV

Change Management Concepts and Process

Defining Organizational Change, Forces for Change, Resistance, Responses and Reactions to Change, Overcoming Resistance to Change, Types of Changes, Diagnostic Models For Organizational Change – The Six Box Model, The 7s Framework, The Star Model, The Congruence Model, The Burke- Litwin Model, The Four Frame Model, Diagnosis By Image. Steps In Change Process.

Unit - V

Models of Change

Lewin's Change Model, Warfield 6-3-5 method - Rosemary Stewart's model-Tony Buzan's mind maps - Edward de Bono's six thinking hats - Johari window - Nadler and Tushman's congruence model - Scenario analysis - powerinterest matrix-Kotter's 8 - step change model - Pendlebury, Nadler, Kanter and Taffinder's planned change models. Dunphy Contingency Model of Change.

Text Books:

1. Thomas G. Cummings, Christopher G Worley, "Theory of Organization Development and Change", 9th Ed Cengage Learning, 2012.
2. Wendell French, Cicil, H. Bell, Jr., "Organization Development", 6 ed., Prentice Hall of India.
3. Kavita Singh, "Organisation Change and Development", Excel Publications, 2010.
4. Palmer,Dunford,Akin, "Managing Organizational Change", 7th edition, Tata Mc Grawhill, 2011.

Suggested Readings:

1. Reider Dale, "Organization & Development — Strategies, Structures, and Process", Sage Publications, New Delhi, 2006.
2. R. Sullivan, Gary Mclean, Jossey Bass. Brown, "Practising Organization Development", Pearson Education, 2006.
3. Nilanjan Sengupta, Mousumi S. Bhattacharya, R.N.Sengupta, "Managing Changes in Organizations", 2nd edition, PHI learning, 2009.
4. John Hayes, "The Theory and Practice of Change Management", 4th ed., Palgrave, 2014.

16MB E105 (M)

PRODUCT AND BRAND MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To provide an understanding of process, theories and models of New Product Development.
2. To understand the strategies for growth and product portfolio planning of multi business or multi product company.
3. To learn a professional approach to product development.
4. To understand the usage of market maps and its benefits.
5. To understand the importance of strong branding and branding decisions.
6. To create an awareness on how to generate brand equity and conduct a brand audit.

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

1. Understand new product development process and various theories and models of new product development to generate new products and translate them into new product concepts.
2. Design the portfolio strategies of multi business or multiproduct company.
3. Know how to develop the new products professionally.
4. To understand perceptual maps and various models of preference choice market maps.
5. Know the essential Branding strategies to conquer the market.
6. Understand and conduct the measurement of brand equity and brand performance.

Unit - I

Introduction

Product, Policy, objectives, Product Mix, Product line, Packaging, Product Modification and Deletion. New Product Development: Innovation and New Product Development (NPD) - Theories, Models, Generic Product Development Process.

Unit-II

New Product Introduction

New Product Introduction, Growth Strategies Intensive, Interactive, Diversification strategies. Product Portfolio analysis BCG, GE, Ad little, Shell International. Idea generating device. Role of R & D. Product Maps, Market Maps and Joint Space Maps. Idea- Screening. Product Concept generation, concept selection, and Concept Testing, Product architecture, Design for manufacturing, Prototype Product.

Unit-III

Brand Management

Brand vs commodity, understanding brands, benefits of branding, brand attributes, Branding decisions, Brand awareness, Brand Image, Brand Personality, Brand positioning and repositioning . Brand Extension, Line extensions Brand Licensing, Franchising and global branding.

Unit-IV

Perceptual mapping - Preference choice models

Perceptual mapping, Preference – choice models, Wind Robertson Market Model, BRANDAID model and Defender model, DESIGNR, and PREFMAPS–flow charts and concepts. Innovation diffusion and adoption process.

Unit-V

Crafting, measuring and managing Brand Equity

Creating Brand Equity, models of brand equity – Brand Asset Valuator, Aaker model, Brandz and Brand Resonance, measuring brand equity, Brand Audits, Tracking Valuation Managing Brand Equity- Brand worth, Reinforcement, Revitalization and Brand Crisis

Text Books:

1. Pessemier Edgar, "Product Management:, John Wiley & Sons, 1982 .
2. Ulrich K T, Anitha Goyal, "Product Design and Development", McGraw Hill, 2010 .
3. Chunnawala, "Compedium of Brand Management", Himalaya Publishing House, 2008.

Suggested Readings:

1. Dr. Anandan, "Product Management", Tata McGraw Hill, 2010.
2. Kavin Keller, "Strategic Brand Management", Pearson Education, 2008.
3. U C Mathur, "Product and Brand Management", Excel Books, New Delhi, 2009.

16MB E106 (M)

PROMOTION AND DISTRIBUTION MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To enlighten the students on the various facets of Marketing communications and Distribution Management.
2. To create an integrated marketing communications plan which includes promotional strategies and measures of effectiveness.
3. To understand the importance of personal selling process.and appreciate the role of media planning and strategies.
4. To communicate the unique marketing mixes and selling propositions for specific product offerings.
5. To provide an insight into the operation of marketing channels and logistics.
6. To understand the various facets of E-Business Framework.

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

1. Apply the integrated marketing communication and its application in the challenging marketing environment.
2. Choose the right media for effective marketing decision.
3. Splendid role of Personal selling and approach in the era of digital marketing.
4. Analyse the complexities of the Channel Management and make a right choice among the various channels of distribution.
5. Collect,process and analyse consumer information to make informed marketing decisions.
6. Understand various E-Business technologies.

Unit-I

Introduction

The nature of marketing communications. The integration of marketing communication, Integrated marketing communication planning process. Model of marketing communications decision process. Establishing objectives and budgeting for the promotional programme.

Unit – II

Developing Integrated Marketing Communications and Media plan

Creative strategy development. Process of execution of creative strategy: Appeals, execution styles and creative tactics. Media planning and Strategy: Developing Media Plans and Strategies and Implementation with Integrated Marketing Communication (IMC) perspective.

Unit – III

Promotion Mix

Role of personal selling in IMC programme. Integration of personal selling with other promotional tools.Personal selling process and approaches. Evaluating, motivating and controlling sales force effort. Sales Promotion - objectives, consumer and trade oriented sales promotion. Coordinating Sales promotions and advertisement. Support media – Elements of Support media and their role. Direct marketing, the internet and Interactive Marketing, publicity and public relations. Monitoring, evaluating and controlling promotion programme.

Unit – IV

Logistics and Channel Management

Logistics: Concept, Scope and Significance. Physical distribution of marketing channel system, Functions and Flows in Marketing Channels, Design of Distribution Channel , Concept, Characteristics, Role of channel decisions, components, Wholesaling, Retailing, Channel Planning,Channel Organisation, Channel Conflict, Co operation and Competition, Vertical marketing system, Horizontal Marketing system.

Unit-V

E-Business Frameworks

E-Selling, E - Buying, E-Procurement, E-Payments, E-Banking and E-CRM and E-tailing.

Text Books:

1. Shimp "Advertising and Promotion", Cengage Learning, 2007 .
2. Shah and D'souza, "Advertising & Promotion", Tata McGraw Hills, 2010.
3. Murthy CSV,"E-Commerce-Concepts,Models and strategies",Mumbai,Himalaya Publishing House, 2009.

Suggested Readings:

1. S.A. Chunnawalla, K.C.Sethia "Advertising", HPH, 2010.
2. Dr. S. Gupta, "Sales and Distribution Management",2nd ed., Excel Publications, 2010.
3. Bharath Bhasker, "Electronic commerce-Frameworks, Technologies and Applications", 3rd edition,New Delhi,Tata McGraw hill Publishing company Ltd., 2009.

16MB E107 (OM)

TOTAL QUALITY MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To make students analyse various perspectives on quality and various contributions of quality.
2. To explain the concepts and principles of Total Quality Management.
3. To provide an in-depth analysis on various quality control Tools.
4. To create awareness on quality control techniques.
5. To identify the framework for implementing TQM in service sectors.
6. To create awareness of quality awards, guidelines and the concept of six sigma.

Course Outcomes: After completion of the course, student will be able to:

1. Apply the management skills involved in quality assurance.
2. Develop the total quality management system in any sector.
3. Make use of the quality control tools and techniques.
4. Design and implement safety aspects of industrial plants.
5. Work in a quality framework that qualifies for quality awards.
6. Understand how six sigma systems are implemented in the industries.

Unit-I

Introduction

Introduction - Evolution of TQM- The concept and Principles of TQM- Inspection, SQC, QA and TQM, TQM Framework - Contributions of Deming, Juran and Crosby. Traditional Vs Modern perspectives on Quality Management- Benefits and Costs of TQM – Organising for TQM – System Approach- Teams for TQM – Self Managed Teams for TQM.

Unit – II

Tools of TQM

Measurement Tools: Check Sheets, Histograms, Run Charts, Scatter Diagrams, Cause and Effect Diagrams, Pareto's Chart, Process Capability Measurement. Analytical Tools: Process Mapping, The Five Why's, Overall Equipment Effectiveness. Improvement Tools and Techniques: Kaizen, JIT, Quality Circles, Forced field Analysis, Five S's. Control Tools: Gantt chart,Radar Chart, The PDCA cycle, Milestone Tracker Diagram and Earned Value Management.

Unit – III

Techniques of TQM

Quantitative techniques: Failure Mode Effect Analysis (FMEA), Statistical Quality Control (SQC): Control charts for average, range, fraction defectives, number of detects. Acceptance Sampling – Operating Characteristics Chart (OCC) - Quality Function Deployment (QFD), Design of Experiments (DOE), Quality by Design. Qualitative techniques: Benchmarking, Kanban. Taguchi methods: Quality loss function, Signal-to-Noise ratio: Nominal- the- best, Target-the-best, Smaller-the-best, Larger-the-best.

Unit –IV

TQM in the Service Sectors and Quality Accreditation

Implementation of TQM in service organization: Framework for improving service quality, Implementation of SERVQUAL in practice . Quality System Awards and Guidelines – ISO, Malcolm Baldrige National Quality Award (MBNQA), European Foundation for Quality Management (EFQM),Environmental Management Systems – ISO 14000 – Rajiv Gandhi International Quality Award instituted by Bureau of Indian Standards.

Unit – V

Six Sigma

The concept of Six Sigma, Objectives of Six Sigma, The frame-work of Six Sigma programme, Six Sigma Organization: roles and responsibilities, Six Sigma problem solving approach, Six Sigma Metrics: Cost of poor quality, Defects per million opportunities and First pass yield. Benefits and costs of Six Sigma.

Text Books:

1. Shridhara Bhat K, "Total Quality Management–Text and Cases", First Edition, Himalaya Publishing House, 2002.
2. Dale H. Besterfield, Carol Besterfield - Michna, Glen H Besterfield and Mary Besterfield-sacre, "Total Quality Management", 3rd Ed., PHI, 2006 .
3. Ron Basu, "Implementing Quality: A Practical Guide to Tools and Techniques", Thompson, 2006

Suggested Readings:

1. Howard S Gitlow, Alan J Oppenheim, Rosa Oppenheim and David M Levine, "Quality Management", 3rd Ed., Tata McGraw-Hill.
2. Poornima M Charantimath, "Total Quality Management", Pearson, 2003.
3. Mukherjee, P N, "Total Quality Management", PHI, 2007 .

16MB E108 (OM)

TECHNOLOGY MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To create awareness among the students about the range, scope, and complexity of technological innovation.
2. To explain the role of Technology Management in managing business operations.
3. To formulate technology strategies and link with business strategy.
4. To follow the steps in technology forecasting process.
5. To learn about issues in transfer of technology.
6. To develop an insight in technology assessment.

Course Outcomes: After completion of the course, student will be able to:

1. Apply knowledge of business concepts and various functions in an integrated manner.
2. Demonstrate knowledge about technology management.
3. Explain how to formulate technology strategies and link business strategies to them.
4. Illustrate steps in technology forecasting process.
5. Appreciate the issues in transfer of technology.
6. Evaluate and assess the strategies of technology investment.

Unit-I

Introduction

Definition, Role and Importance, Technology developments - Options and strategies, factors contributing to successful Technology, Technology change. Technology Life Cycle (TLC). Diffusion and Growth of Technology-Technology transformation, Technology alternatives, Technology Policy and Planning.

Unit-II

Technology Strategy

Meaning of Strategy. Formulation of Technology Strategy. Direction of strategy. Technology and the concept of Core competence integration. Linking Technology and Business Strategies. Creating the product – Technology – Business connection.

Unit-III

Technology Forecasting for Decision Making

The definition of Technology Forecasting, Forecasting and Technology innovation Chain, Forecasting System Inputs and Outputs, Classification of Forecasting Techniques and methods. Technology Audit.

Unit-IV

Technology Transfer

Dimensions and Routes of Technology transfer. Stages within the process of Technology transfer Modes of Technology transfer- Technology import in India, Government Initiatives. Benefits of Technology absorption.

Unit-V

Technology Assessment (TA)

Management of Technology Assessment. Strategic evaluation of Technology Investments. Organizational support System- Structural Imperatives of Technology Management, Building Organization Culture. The Organization as a Laboratory for Learning.

Text Books:

1. Tarek Khalil,"Management of Technology- The Key to Competitiveness and Wealth Creation", McGraw Hill, Boston, 2000.
2. V. K. Narayanan,"Managing Technology and Innovation for Competitive Advantage", Pearson Education, 2003.
3. P.N.Rastogi,"Management of Technology and Innovation", Sage Publications Inc, 1995.

Suggested Readings:

1. Norma Harrison and Danny Samson, "Technology Management", McGraw-Hill International, 2001.
2. Melissa A. Schilling, "Strategic Management of Technological Innovation", TMH, 2008.
3. Goel Cohen, "Technology Transfer", Sage Publication, 2004.

16MB E109 (SYS)

RELATIONAL DATABASE MANAGEMENT SYSTEM (RDBMS)

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

Course Objectives: The objectives of the course are to:

1. Understand the role of a database management system in an organization.
2. Study the physical and logical database designs, modeling, relational, hierarchical and network models.
3. Describe the concept of a database transaction and related database facilities.
4. Discuss advanced database topics such as distributed database systems and special database.
5. Understand and successfully apply logical database design principles, including E-R diagrams.
6. Construct simple and moderately advanced database queries using Structured Query Language (SQL).

Course Outcomes: After completion of this course, students will be able to:

1. Differentiate database systems from file systems by the features provided by database systems.
2. Define the features, classification and characteristics embodied in relational database systems.
3. Master sound design principles for logical design of databases, including the E R method.
4. Understand the basic issues related to transaction processing and concurrency control.
5. Master the basics of SQL and construct queries using SQL.
6. Master the basic concepts and appreciate the applications of database systems.

Unit- I

Database Concepts and Modeling

Introduction overview - Client/Server Technology: 3 Tier architecture, data modeling, hierarchical, network, object oriented. Introduction to distributed databases - Relational Data structure: tuple, attributes, set; relational algebra operators, entity relationship diagrams, design of E-R Schema. E-R Schema to tables.

Unit – II

Relational Languages and Relational Database

Functional dependence: normal forms, integrity constraints, domain, referential integrity, Codd's rules, elementary operations, set operations, aggregate functions, null values, nested sub queries, derived relations, views, joined relations, DDL, embedded SQL, QBE.

Unit- III

Transaction Processing

Transaction concepts: ACID Properties - Atomicity, Durability, Serializability, Isolation, transaction definition in SQL, Concurrency control, locking, deadlock handling, recovery systems.

Unit - IV:

Distributed and Special Database

Distributed data storage, network transparency, distributed query processing, commit protocols. Special Databases - spatial and geographical database, multimedia database, mobility and personal database.

Unit - V:

ORACLE

Introduction: SQL- characteristics, advantages, data types, SQL commands for data definition and data manipulation, views-procedures- indexing, PL/SQL. Forms design process, triggers.

LAB EXERCISES

- Creating Tables and Applying All Constraints
- Inserting Data into Tables
- Updating Tables
- Alias Table
- Deleting Data From Table
- Drop Table
- Working with All SQL Queries using functions (Number, string functions etc.)
- Working with sub queries
- Working with Joins
- Creating Views
- Creating Objects (i.e. Cluster, Synonyms, Indexes etc.)

Text Books:

1. Lee Chao. "Database Development and Management", 2010, Special Iodian Ed. Auerbach Publications.
2. Narayan S. Umanath & Richard W. Scamwell, "Data Modeling and Data Base Design",Thomson - India Edition, second edition.
3. Rob & Coronel, "Database Systems". Thomson, 1993.
4. Page, Jr. Special edition Using Oracle BIBi. Prentice Hall-India.

5. Abraham Shibershat.z, Henry F. Korth & S Sudershan- "Data Base System Concepts",McGraw Hill, 5th edition.
6. Lemme & Colby. "Implementing and Managing Oracle Databases", Prentice Hall of India.
7. Hansen & Hansen, "Database Management & Design", Prentice Hall.

Suggested Readings:

1. Database Systems: A Practical Approach to Design, Implementation and Management (4th Edition) , Thomas M. Connolly, Carolyn E. Begg, Pearson Education Publication.
2. Information Modeling and Relational Databases: From Conceptual Analysis to Logical Design (The Morgan Kaufmann Series in Data Management Systems), Published by Morgan Kaufmann

16MB E110 (SYS)

E-BUSINESS

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

Course Objectives: The Objectives of the course are:

1. To provide in depth knowledge on information systems and its usefulness in business.
2. To throw light on the impact of the Internet and Internet technology on business electronic commerce and electronic business.
3. enable the students to understand concepts of e-commerce and its applications in e-business.
4. To educate students to identify the major management challenges To building and using information systems and learn how to find appropriate solutions to those challenges.
5. To Cultivate skills and experience in the development and implementation of information systems projects in e-business payments and security.
6. To understand the legal and privacy issues in the usage of different e-business concepts.

Course Outcomes: After completion of the course, student will be able to:

1. Understand the basic concepts and technologies used in the field of management by e-commerce.
2. Analyze the processes of developing and implementing information systems in business.
3. Demonstrate an understanding of the foundations and importance of E-commerce.
4. Analyze the impact of E-commerce on business models and strategy.
5. Be able to understand the concepts of e-business payments and security.
6. Discuss legal issues and privacy in the usage of e-business applications.

Unit–I

Introduction

E-business, E-commerce, Economic forces – advantages – myths – e-business models, design, develop and manage e-business, Web 2.0 and Social Networking, Mobile Commerce, S-commerce.

Unit–II

Technology Infrastructure

Internet and World Wide Web, internet protocols - FTP, intranet and extranet, information publishing technology- basics of web server hardware and software.

Unit- III

Business Applications

Consumer oriented e-business – e-tailing and models - Marketing on web – advertising, e-mail marketing, affiliated programs - e-CRM; online services, Business oriented e-business, egovernance, EDI on the internet, Delivery management system, Web Auctions, Virtual communities and Web portals – social media marketing

Unit- IV

E-Business Payments and Security

E-payments - Characteristics of payment of systems, protocols, e-cash, e-cheque and Micro payment systems- internet security – cryptography – security protocols – network security.

Unit- V

Legal and Privacy Issues

Legal, Ethics and privacy issues – Protection needs and methodology – consumer protection, cyber laws, contracts and warranties, Taxation and encryption policies.

Text books:

1. Harvey M.Deitel, Paul J.Deitel, Kate Steinbuhler, "e-business and e-commerce for managers", Pearson, 2011.
2. Efraim Turban, Jae K. Lee, David King, Ting Peng Liang, Deborrah Turban, "Electronic Commerce –A managerial perspective", Pearson Education Asia, 2010.
3. Parag Kulkarni, SunitaJahirabadkao, Pradeep Chande, "e business", Oxford University Press, 2012.

Suggested Readings:

1. Hentry Chan &el , "E-Commerce – fundamentals and Applications", Wiley India Pvt Ltd, 2007.
2. Gary P. Schneider, "Electronic commerce", Fourth annual edition, Thomson course technology, 2007.
3. Bharat Bhasker, "Electronic Commerce-Frame work technologies and Applications", 3rd Edition. Tata McGrawHill Publications, 2009.

16MB E111(F)

FINANCIAL RISK MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To make the students understand the types of risks and how to identify the risks in a given scenario.
2. To focus on how to measure the risks and plan to manage them in a practical scenario.
3. To equip the students with the forward contracts as risk management technique.
4. To discuss the concept of futures contract and use it as a risk management tool.
5. To make the students understand how to use swaps as a tool for managing the risk.
6. To enable the student to understand the concept of options contract as a risk management tool.

Course outcomes: After completion of the course, student will be able to:

1. Understand various forms of risk an organization faces.
2. Measure the various risk an organization faces.
3. Employ Forwards as a tool for managing the risks.
4. Apply Futures Contracts concept to manage the risk that an organization faces.
5. Use SWAPS as a technique to manage the risk.
6. Understand Option contracts as a best tool for managing various risks.

Unit – I

Introduction to Risk Management

The concept of Risk, Nature, Source, Measurement, Identification and Evaluation of Risk. Types of risk. Possible Risk events, Risk Indicators, Risk Management Process–pre-requisites and fundamentals. Misconceptions of Risk. An integrated approach to Corporate Risk Management. Management of interest rate risk, liquidity risk, credit risk and exchange rate risk. Non-Insurance methods of Risk Management - Risk Avoidance, Loss Control, Risk Retention and Risk Transfer.

Unit – II

Derivatives -Forward contracts

A) The concept of Derivative and types of Derivatives. The role of Derivative securities to manage risk and to exploit opportunities to enhance returns.

B) Forward contracts: Definition, features and pay-off profile of Forward contract. Valuation of forward contracts. Forward Contracts to manage Commodity price risk, Interest rate risk and exchange rate risk. Limitations of Forward contract.

Unit – III

Futures contracts

Futures contracts: Definition. Clearing house, margin requirements, marking to the market. Basis and convergence of future price to spot price. Valuation of Futures contract. Differences between forward contracts and futures contracts. Risk management with Futures contracts – the hedge ratio and the portfolio approach to a risk – minimizing hedge.

Unit – IV

SWAPS Contracts

Definition, types of swaps, Interest rate Swaps: Mechanics of Interest rate swaps, Valuation of interest rate Swaps. Pricing of Interest rate swaps at origination and valuing of Interest rate swaps after origination.

Currency Swaps: Types of Currency Swaps. Valuation of currency swaps. Pricing of currency swap at origination and valuing of currency swap after origination.

Unit – V

Options Contracts:

Definition, Types of options: call option, put option, American option and European option. Options in the money, at the money and out of the money. Option premium, intrinsic value and time value of options. Pricing of call and put options at expiration and before expiration. Options on stock indices and currencies. The Binominal Option Pricing Model (BOPM): assumptions - single and two period models. The Black and Scholes Option Pricing Model (BSOPM): assumptions.

Text Books:

1. John C. Hull &SankarshanBasu, "Options, Futures and Other Derivatives", 10th Ed, Pearson Education, 2017.
2. S.K.Mishra, " Derivatives and Risk Management",2nd Ed., Everest Publishing House, 2010 .

3. David. A. Dubofsky & Thomas. W. Miller, Jr., "Derivatives Valuation and Risk Management", 1st edition Oxford University Press, 2002.

Suggested Readings:

1. R.Madhumathi,M. Ranganatham, " Derivatives and Risk Management", Pearson Education, 2012 .
2. Paul Hopkins, Kogan Page, "Fundamentals of Risk Management", 4th Ed., Institute of Risk Management, 2017 .
3. Jean-Philippe Bouchaud and Mark Potters, "Theory of Financial Risk and Derivative Pricing", 2nd Ed. Cambridge press, 2009.

CBIT (A) With Effect from the academic year 2016-17

16MB E112 (F)

BANKING AND INSURANCE

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

Course Objectives: The Objectives of the course are:

1. To provide conceptual and practical understanding of Banking Industry and Insurance.
2. To make students proficient in management of various Lending functions of banking.
3. To provide latest trends and regulations in banking arena.
4. To train and equip the students with the dextry of skills with which modern banking runs through Innovations.
5. To provide an in-depth knowledge in insurance as a Risk Management Technique.
6. To educate the students with various types of Life Insurance contracts, Health and General insurance.

Course Outcomes: After completion of the course, student will be able to:

1. Understand managerial issues in the banking and Insurance industry.
2. Develop a clear understanding and knowledge about the Lending functioning of bank.
3. Better understanding of various activities of banks including Regulation of Bank Capital.
4. Understands of banking system with new innovative products and services.
5. Enrich with knowledge of insurance and develop their specialties in the field of Insurance.
6. Understand the types of Life Insurance contracts, Health and General insurance.

Unit I

Introduction

Banking: Definition, Meaning, Kinds of Banking, Role of Banks in the development of economy, Evolution of Banking in India – origin, nationalization, reforms, RBI : Origin and growth – Functions , Analyzing banks' financial statements: CAMELS, Ratings, Key Performance indicators.

Insurance: Definition, terminology of insurance: Bound, Insurer, Insured, Premium, Policy, Exposure to loss, Insurance as a Risk Management Tool, classification of Insurance: Life, Marine, Fire, Aviation, Motor; Principles of Insurance, Role of Insurance in Financial System.

Unit –II

Sources and Uses of Bank Funds

Sources of Bank Funds, Deposits, Other sources and Banc-assurance. Features of Bank Credit, types of lending, steps to be followed in the assessment of credit worthiness of a prospective borrower, the credit process and financial appraisal for credit decisions, different types of loans and their features, Loan Pricing: The basic model, pricing fixed and floating rate loans, Hedging, matched funding, and price leadership model, cost-benefit loan pricing, Customer Profitability Analysis, NPA's:- The gross and net concept of NPA, causes, implications and recovery of NPA's.

Unit – III

Regulation and Innovations in Banking System

Regulation of Bank Capital: Need to regulate, concept of Economic Capital, Regulatory Capital, Basel Accords I, II and III- implementation, criticism.

Banking Innovations: Need, Core banking solutions, Retail Banking-Products and Services-Nature, Scope, Future and Strategies, Plastic Money and E-Money, National Electronic Funds Transfer, RTGS, ATM, Mobile Phone Banking, Net Banking and Security Issues in E-Banking, Green Banking, Mergers of Banks, Global Banking Activities.

Unit – IV

Regulatory Framework and Life Insurance

Functions of Insurers: Production, Underwriting, Rate Making, Managing Claims and Losses, Types of Insurers, An overview of IRDA.

The concept of Life Insurance, types, Tax treatment, Life Insurance Products Participating and Non participating Life Insurance, Classification of Life Insurance.

Unit – V

General Insurance and Reinsurance

General insurance – Concept, classification main players, types, Reinsurance: the concept, uses and advantages. Marketing channels: Agents and brokers professionalism, remuneration, responsibilities, classification, criteria for appointment and capital adequacy norms for broker.

Text Books:

1. Padmalatha Suresh & Justin Paul, "Management of Banking & Financial Services", 3rd Edition., Pearson Education, 2014.
2. Peter.S.Rose & Sylvia. C. Hudgins, "Bank Management & Financial Services', 8th Edition, Tata McGraw Hill, 2014.

3. K. Sriharsha Reddy & R.Nageswar Rao, "Banking & Insurance, First Edition, Paramount Publishing House, 2013.

Suggested Readings:

1. Vasant Desai, "Banks & Institutional Management", 2nd Edition, Himalaya Publishing House, 2010.
2. Emmett J. Vaughan & Therese M. Vaughan, "Fundamentals of Risk & Insurance", 11th Edition, Wiley, India, 2014 .
3. Mark. S.Dorfman, David A. Cather, "Introduction to Risk Management & Insurance", 10th Edition, Prentice - Hall of India Private Limited, 2012.

16MB E113 (HR)

INDUSTRIAL RELATIONS AND LABOUR LAWS

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

Course Objectives: The Objectives of the course are:

1. To develop an understanding of the basics of industrial relations and approaches.
2. To make students understand the concepts, importance and recognition of trade unions,recognition and standing orders .
3. To discuss the importance of labour laws, labour administration and labour policy.
4. To familiarize the students with various parties involved in labour administration.
5. To introduce various Acts related to employee benefits.
6. To make the students aware about the various Acts available related to wages.

Course Outcomes: After completion of the course, student will be able to:

1. Apply the knowledge of basics and approaches of industrial relations in real time situations.
2. Effectively use the dynamics of trade unions and their recognition for successful negotiations.
3. Suggest and involve in the process of labour administration and labour policy.
4. Deal properly with various parties involved in labour administration.
5. Implement and design various employee benefits both legally required and discretionary.
6. Involve in and Implement the provisions related to various wage acts at work places.

Unit-I

Industrial Relations Perspectives

Conceptual framework and approaches to Industrial Relations – Influence of Emerging socio Economic scenario on growth of Industrial relations in India-Factors influencing Industrial Relations in India - Differences in perspectives – Industrial relations and Employee relations. Future of Employee relations.Industrial conflict - Types and causes of Industrial disputes - Machinery for prevention and settlement of Industrial disputes. Recent Amendments.

Unit-II

Trade Unions

Structure, characteristics and Functions of Trade Union;Trade union Act-1926 - problems of Trade union recognition and government policy-Recognition of Trade unions as collective bargaining agents - Problems and issues involved in collective bargaining process - Role of collective bargaining in promoting Industrial amity and peace - Industrial Employment(standing orders) Act-1946. Recent Amendments.

Unit-III

Labour legislation Administration

Importance of Labourlaws, The classification of labour laws - Labour administration - Evolution of labour administration in India - Labour policy in India-Judiciary and the child labour - Right to education and child labour-Public interest litigation and child labour - Labour administrative machinery of the government - Role of ILO in Labour administration. Changing Business Environment and Labour Laws - WTO and social clause.Recommendations of II National commissioner on Labour. Recent Amendments.

Unit-IV

Employee Benefits

Defining and Exploring employee benefits - Employee benefits practice - Legal and discretionary benefits practice - The economics of employee benefits-Regulating employee benefits - social security legislations - The ESI Act-1948-The Maternity benefit Act - 1961-The workmen's compensation Act-1923 - The payment of gratuity Act -1972 - Employee provident fund and miscellaneous provisions Act1952. Recent Amendments.

Unit-V

Wage legislation and Administration

The need and importance of Wage legislation - Payment of Wages Act 1936 -The minimum wages Act 1948 -The payment of Bonus Act 1965-Equal Remuneration Act 1976 - The context and concept of wage - Wage administration in India - Components and the determinants of wage - Wage structure towards a wage policy. Recent Amendments.

Text Books:

1. P.N.Singh and Neerajkumar, "Employee Relations Management", Pearson Education, New Delhi, 2011 .

2. Joseph J.Mortocchio, "Employee Benefits", Tata McGraw Hill, New Delhi, 2010.
3. S.C.Srivatsava, "Industrial Relations and Labour Laws", Vikas Publishing House, New Delhi, 2008 .

Suggested Readings:

1. C.S.VenkatRathnam,"Industrial Relations",Oxford University Press - New Delhi.
2. R.SivarathnaMohan, "Industrial Relations and Labour Welfare", PHI Learning Pvt.Ltd., 2010.
3. P.K.Padhi,"Labour and Industrial Laws", PHI Learning Pvt. Ltd., 2009.

16MB E114 (HR)

TALENT AND KNOWLEDGE MANAGEMENT

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

Course Objectives: The Objectives of the course are to :

1. Understand the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
2. Appreciate the role and use of knowledge in organizations and institutions, and the typical obstacles that Knowledg Management (KM) aims to overcome.
3. Know the core concepts, methods, techniques, and tools for computer support of knowledge management.
4. Understand how to apply and integrate appropriate components and functions of various knowledge management systems.
5. Be prepared for further study in knowledge generation, engineering, and transfer, and in the representation, organization, and exchange of knowledge.
6. Critically evaluate current trends in knowledge management and their manifestation in business and industry.

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

1. Understand the importance of talent management and how to apply the theoretical approaches in the analysis of talent in the organization.
2. Understand the essential elements of a typical Talent Management System (TMS) and can learn about best TMSs.
3. Define KM, learning organizations, intellectual capital and related terminologies in clear terms and understand the role of knowledge management in organizations.
4. Identify and select tools and techniques of KM for the stages of creation, acquisition, transfer and management of knowledge.
5. Analyze and evaluate tangible and intangible knowledge assets and understand current KM issues and initiatives.
6. Evaluate the impact of technology including telecommunications, networks, and Internet/intranet role in managing knowledge.

Unit – I

Introduction

Talent management: Definition, Meaning, Importance, Scope, Key Processes, Implementing a Talent Management strategy, Key elements of TM strategy, Tools for Managing Talent.

Knowledge Management: Introduction, History, Concepts, Definition, Nature, Alternative views of knowledge, Types of knowledge, Location of knowledge, Rise of the knowledge worker, Characteristics of Individual Knowledge workers, Major Categories of KM Roles, The KM Profession, The Ethics of KM, Future Challenges for KM.

Unit – II

Talent Management

Designing and building a talent reservoir, Segmenting the Talent Reservoir, Talent Management Grid, Creating a talent management system, Institutional strategies for dealing with talent management, Importance of learning and development in TM.

Unit – III

Competency for Talent Management

Competency- Meaning- Characteristics- Types –Steps in developing valid competency model- Importance of competency in Talent Management- Talent management information systems- Developing a talent management information strategy- Bersin and Associates TM Model- Role of leaders in talent management- Global talent management.

Unit – IV

Approaches and Framework of Knowledge Management

Knowledge management framework of Hansen– Earl's seven schools of knowledge management– Alvesson and Karreman's knowledge management approaches- Features of knowledge intensive firm- Key processes in knowledge intensive firms- From Physical Assets to Knowledge Assets - The Knowledge Creation Process- Knowledge management solutions, mechanisms and systems. Knowledge management infrastructure. Issues and problems related to KM.

Unit – V

Knowledge management and Organisational Performance

Knowledge Application at Group and Organizational Levels - Knowledge Reuse - Knowledge Sharing Communities- Obstacles to Knowledge Sharing-Organizational impacts of knowledge management - on people, processes, products and organizational performance. Knowledge management assessment of an organization – Importance, Types and Timing. Knowledge discovery systems.

Text Books:

1. Ed by Lance A. Berger and Dorothy R Berger. "The Talent Management Handbook", Tata McGraw Hill edition, 2011.
2. KimizDalkir, "Knowledge Management in Theory and Practice", Butterworth – Heinemann, 2005.
3. Donald Hislop, "Knowledge Management in Organizations", Third edition, Oxford University Press, 2013.
4. Irma Becerra-Fernandez, Avelino Gonzalez and Rajiv Sabherwal "Knowledge Management", Pearson Education Inc., 2009.

Suggested Readings:

1. Ed by Larry Israelite, "Talent Management", ASTD Press, 2009.
2. Sajjad M Jasmuddin, "Knowledge Management", 1st Ed, Cambridge, 2009.
3. Stuart Barnes, "Knowledge Management Systems", Cengage Learning, 2001.

16MB E115 (M)

CONSUMER BEHAVIOUR

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

Course Objectives: The Objectives of the course are:

1. To give perspective of consumers and their buying behavior patterns.
2. To help the students to acquire knowledge to design market research studies for the mutual benefit of consumers and the organisations.
3. To address the importance of subculture and global consumer culture as marketing opportunities.
4. To make them aware of the consumer learning principles and their Marketing implications.
5. To enable them to understand the intricacies of consumer decision making process.
6. To create an awareness on principal factors that influence consumers as individuals and decision makers with an application to the buying decision process.

Course Outcomes: After completion of the course, student will be able to:

1. Apply theories of consumer behavior to the formulation of effective marketing strategy for better consumption behavior.
2. Recognise market trends based on current research related to consumer behavior.
3. Analyze the challenges that might influence the formulation of effective Marketing Strategies from a consumer behavior perspective.
4. Understand that the impact of socio cultural settings on the consumption behaviour.
5. Identify the dynamics of human behaviour and the basic factors that influence the consumers decision process.
6. Demonstrate how concepts may be applied to marketing strategy.

Unit-I

Introduction

Introduction, Definition, Evolution, Contemporary Dimensions of Consumer Behaviour, CB Research Process, Buyers and Users, Development of Marketing Concept, Consumer Behaviour and its Applications in Marketing, concepts of motivation and personality, perception and their marketing implications.

Unit-II

Learning Principles and Marketing Implications

Concept of learning, important aspects of learning Process, Concepts of conditioning, Important aspects of information processing theory; encoding and information retention, Retrieval of Information, Split – brain theory.

Unit-III

Environmental Influences on Consumer Behaviour

Social and cultural settings- Culture, subculture and Cross cultural Marketing practices. Family life cycle-1,2,3 and Reference groups-Personality- Theories, Life style Influences- AIO and VALS Framework. Ethno Centrism.

Unit-IV

Consumer Decision Making Process

Meaning of Decision Making, Different views, Buying Motives, Types of decision making process in buying, Consumer Information processing-Information search, Evaluation of alternatives, Purchasing Process, Post purchase behaviour, Consumer action and disposable of products.

Unit-V

Models of Consumer Behaviour

Models of Consumer Decision making Process, contemporary models, Generic Model of Consumer Behaviour, Howard Sheth Model, Engel Blackwell and Rao-Lilien model. Role of Consumerism.

Text Books:

1. Black-well, R.Miniard PW and Engel, "Consumer Behaviour", Thompson learning, 2010 .
2. David L. Loudon and Albert.J.Della Bitta, IVth Edition,"Consumer Behaviour",TMH, 2008.
3. Schiffman and Kannik "Consumer Behaviour" Pearson Edition, 2014/PHI, 2004.

Suggested Readings

1. Suja R .Nair, "Consumer Behaviour in Indian Perspective", HPH, 2013 .
2. Sheth and Mittal, "Consumer Behaviour", Thompson learning, 2015 .
3. MichealR.Solomon,"Consumer Behaviour", 7/e, PH, 2016.

16MB E116 (M)

SERVICES AND RETAIL MARKETING

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

Course Objectives: The Objectives of the course are:

1. To familiarize students with characteristics of services, their implications on service delivery and retail marketing concepts.
2. To make the students understand the concepts of services and retail industry.
3. To provide insight into the marketing mix for services and service quality.
4. To educate students on strategies to deal with characteristics of services and concept of services marketing traingle.
5. To create awareness on retail formats and theories.
6. To provide the issues relating to merchandise management and emerging concepts.

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

1. Understand overview of services and retail and its significance.
2. Understand concepts of service, challenges in delivering quality services and retail industry trends.
3. Apply suitable marketing mix for services depending upon sector.
4. Equip with strategies to succeed in dealing with characteristics of services and relationship among the stakeholders.
5. Develop retail formats considering the need of the customers.
6. Analyse consumer evaluations of retail offerings and apply retail concepts to real situations and formulate retail marketing strategies for the success of retail industry.

Unit – I

Introduction

Concepts, Scope of Services.Goods - Services Continuum. 4 I s of Services Goods and Services. Categorization. Industrial Services.

Retailing - Meaning, Types, significance of retail industry, Emergence of Organized Retailing, Indian vs. Global Scenario.

Unit – II

Service marketing Mix

Product, Pricing, Place, Promotion, People, Physical evidence and Process-Dimensions of Service Quality. Understanding Service Quality Management. Measuring Service Quality.

Unit – III

Strategies for Service Marketing

Overview, strategies for dealing with Intangibility, Inventory, Inconsistency and Inseparability. Loyalty, Switching, Intention to Stay, TAM (Technology Adoption Model). Service Marketing Triangle - External Marketing, Internal Marketing, Interactive Marketing.

Unit-IV

Retailing

Retail formats and Theories – Theories of retail development, concept of retail life cycle, classification of retail stores, role of franchising in retail, Technology in retail, Factors affecting retail. Retail Pricing - The concept of retail pricing and the factors affecting price,elements of retail price, developing a pricing strategy, adjustment to retail price.

Unit - V

Merchandise Management

Sources of Merchandise, Category Management, Store Layout, Design and Visual Merchandising, Retailing Strategy and Customer Service. CRM in retailing. E-tailing-Issues and Challenges

Text Books:

1. Rampal M. K and Gupta S. L, "Services Marketing Concepts, Applications and Cases", Galgotia Publishing Company – New Delhi, 2008.
2. S.M.JHA, "Services Marketing", HPH, Mumbai, 2009 .
3. AJLamba, "The Art of Retailing", TMH, 2009.
4. Levy and Weitz, "Retailing", TMH, 2009.

Suggested Readings:

1. Lovelock, Chatterjee, "Services Marketing People, Technology Strategy", Pearson Ed., 2011.
2. VinnieJauhari, KirtiDutta, "Services", Oxford University Press, New Delhi, 2009 .
3. David Gilbert, "Retail Marketing Management", 2nd edition, Pearson Education, 2003.
4. Patrick M.Dunne, Robert F.Lusch, and James R.Carver, Retailing, Cengage Learning, 2014 .

16MB E117 (OM)

SERVICE OPERATIONS MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To analyse the role of service sector in an economy and the service sector of an organisation.
2. To observe how to win customers through service strategies.
3. To develop an insight into design and development of new services.
4. To design services supply chain.
5. To learn about capacity management issues.
6. To learn about risk and security issue in financial services sector and the role of technology in handling these issues.

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

1. Demonstrate knowledge about the role of services sector in an economy and service strategy of an organization.
2. Use and explain the meaning of winning the customers through service strategies.
3. Apply the basic principle to design and development of new services.
4. Evaluate the design of given services supply chain.
5. Illustrate the cases where capacity management issues are well handled.
6. Identify the technology related issues in handling risk and security in financial services sector.

Unit-I

Introduction

Understanding Services Economy- Global trends in Services Sector; Changing paradigms in Competitiveness of services; Services – Manufacturing Continuum. Role of services in manufacturing firms.

Unit-II

Service Strategy

Developing an overall vision for the service system, Developing a service strategy, Service Positioning and Implications for Service Delivery Design, Service Enhancement using Internet, Pricing strategies in Services, Performance issues in service systems.

Unit-III

Design of Service Delivery Design

Capacity issues in service systems- Notion of capacity, Capacity build up strategies. Capacity Vs System Performance. Queueing Theory Applications in Service Systems. Simulation as a tool for design of services- Use of simulation software for modeling. Nature of design issues addressed using simulation. Simulation Applications in Service System Design. The services supply chain

Unit-IV

Application Domain in Services

Services Management in IT/ITES Sectors- Off-shoring / Outsourcing – Strategic dimension and Competitive advantage. Services Management in IT/ITES Sectors- Capacity Management Issues. Models for Manpower Planning.

Unit-V

Services Management in Financial Services

Risk and Security issues in Financial Services Sector: Role of technology, Technology Transfer.

Text Books:

1. B. Fitzsimmons, James A., and Mona J. Fitzsimmons, "Service Management: Operations, Strategy, and Information Technology", 7thEd., Tata McGraw-Hill Education Pvt. Ltd., 2014.
2. Robert Johnston, Graham Clark, MichealShulver, Service Operations Management- Improving Service Delivery, 4th Edition, Pearson, 2014.
3. Richard Metters, Kathryn King - Metters, Madeleine Pullman, Steve Walton Successful Service Operations Management, 2nd edition, South-Western/Cengage Learning, 2012.

Suggested Readings:

1. Bill Hollins and Sadie Shinkins, Managing Service Operations, 1st edition, Sage, 2006.
2. J.Nevan Wright and Peter Race, the management of service operations, 2nd edition, Thomson, 2004.
3. CengizHaksever, Barry Render, Roberta S. Russell, Rebert G. Murdick, Service Management and Operations, Pearson Education, 2000.

16MB E118 (OM/Systems)

ENTERPRISE RESOURCE PLANNING

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

Course Objectives: The objectives of the course are to:

1. familiarize the students with the business process of an enterprise.
2. provide an insight into the evolution, benefits and risks of Enterprise Resource Planning (ERP) systems.
3. acquaint students about the various functional modules of ERP.
4. grasp the activities related to the ERP Implementation lifecycle.
5. analyze the key success and failure factors of ERP implementation.
6. understand the emerging trends in ERP development.

Course Outcomes: After completion of this course, students will be able to:

1. acquire in-depth knowledge of ERP as a prime Application software product.
2. comprehend core and extended modules of ERP.
3. demonstrate detailed knowledge of ERP Implementation cycle.
4. understand the usefulness of maintenance post ERP implementation.
5. understand concepts of reengineering and how they relate to ERP implementation.
6. gain knowledge on the future trends in ERP.

Unit- I

Introduction

Enterprise Systems -An overview, Need, Evolution, Benefits & Risks, Issues in Planning, design and implementation of cross functional integrated ERP Systems.

Unit - II

ERP Solutions and Functional Modules

ERP software solutions – Overview, Business Process Reengineering (BPR), Business Process Management (BPM); ERP Functional Modules: Finance, Manufacturing, Human Resource, Supply Chain, Marketing and Customer Relationship Management.

Unit- III

ERP Implementation
Planning, evaluation and selection of ERP systems, Implementation life cycle, ERP implementation, Methodology and Frame work- Training – Data Migration. People, Organization in implementation – Consultants, Vendors and Employees.

Unit - IV

Emerging trends in ERP
Extended ERP systems and ERP add-ons - CRM, SCM, Business analytics - Future trends in ERP systems-web enabled, Wireless technologies

Unit - V

Post ERP Implementation
Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation. Feedback process.

Text Books:

1. Alexis Leon, Enterprise Resource Planning, Third edition, Tata McGraw-Hill, 2014.
2. Concepts in Enterprise resource planning, Fourth edition, Course Technology Cengage Learning, 2013.
3. Alexis Leon, ERP demystified, Third Edition Tata McGraw-Hill, 2014.

Suggested Readingss:

1. Sinha P. Magal and Jeffery Word, Essentials of Business Process and Information System, Wiley India, 2012.
2. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008.

16MB E119 (SYS)

CLOUD COMPUTING AND INTERNET OF THINGS

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

Course Objectives: The Objectives of the course are to:

1. To upgrade the students with the trending software technologies.
2. To understand basics of cloud computing for business management.
3. To analyze the implementation and usage and control of cloud computing in business.
4. To explain the applications of cloud services.
5. To understand the basics on Internet of things.
6. To analyze the applications of Internet of things in various streams.

Course Outcomes: After completion of the course, student will be able to:

1. To gain Knowledge of various applications on cloud for efficient business management.
2. To choose the appropriate technologies, algorithms, and approaches for the related issues.
3. To articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
4. To explain the core issues of internet of things and its technologies.
5. To identify the usage of IOT in different streams.
6. To provide the appropriate cloud computing and internet of things solutions and recommendations according to the applications used.

UNIT- I

Introduction

Introduction to Cloud Computing: Evolution - Cloud Computing, Hardware, Internet and Software, Virtualization, Web Services on Cloud. Introduction to Internet of things: Definitions and Characteristics of IOT, Physical Design of IOT-Things in IOT.

UNIT –II

Implementation and Control

Privacy and its relation to Cloud-based Information Systems, Security in the Cloud, Common Standards in the Cloud, End-User Access to the Cloud Computing, legal and ethical dimensions.

UNIT- III

Applications of Cloud Services

Applications – Online Planning and Task Management – Event Management – CRM- Cloud service development tools - word processing, databases, storing and file sharing on cloud.

UNIT-IV

Internet of Things (IOT)

IOT Protocols, IOT Communication Models, IOT Enabling Technologies - Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems

Unit-V

Applications of IOT

Domain Specific IOTs: Various types of IOT Applications in Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Life Style-Wearable Electronics. Case Study on IOT System for Weather Monitoring.

Text Books:

1. John W. Rittinghouse and James F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, Taylor & Francis Group, Boca Raton London New York, 2010.
2. Kumar Saurahb, Cloud Computing – Insights into new era infrastructure, Wiley India, 2nd Edition, 2012.
3. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.

Suggested Readings:

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, 2009.
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.
3. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC, 2007.
4. Bunker and Darren Thomson, "Delivering Utility Computing", John Wiley & Sons Ltd., 2006.
5. George Reese, "Cloud Application Architectures", O'reilly Publications, 2009.

16MB E120

ORGANIZATIONAL BEHAVIOUR

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

Couse Objectives: The objectives of the course are to:

1. define basic organizational behaviour principles and analyse how these influences behaviour in the workplace.
2. analyse the influence of perceptions and personality on individual human behaviour in the workplace.
3. provide knowledge on different organisational structures; and concepts of culture, climate and organisational development.
4. discuss the theories of Motivation and Leadership.
5. describe the interpersonal and their intrapersonal reactions within the context of the group and also demonstrate effective communication and decision making skills in small group settings.
6. familiarize the students with the basic understanding of individual behaviour and explore issues of power, politics, conflict and negotiation.

Course Outomes: After completion of this course, students will be able to:

1. enable the students to practically implement the Organisational behaviour principles and practice in real time situations.
2. analyse the behaviour, perception, and personality of individuals and groups in organisations in terms of the key factors that influence organisational behaviour.
3. to examine various organisational designs and explain concepts of organizational culture, climate and organisational development.
4. acquire knowledge in applying motivational theories to resolve problems of employees and identify various leadership styles and the role of leaders in decision making process.
5. to explain group dynamics and sklls required for working in groups and identify the processes used in developing communication and resolving conflicts.
6. analyze organizational behavioural issues in the context of power, politics, conflict and negotiation issues.

Unit – I

Introduction

Organizational behavior – Nature and levels of organizational behavior – Individuals in organization – Individual differences – Personality and Ability – The Big 5 Model of personality – Organizationally relevant personality traits. The nature of perception – characteristics of the perceiver, target and situation – perceptual problems.

Unit – II

Organization Structure
Organizational Designs and Structures – Traditional and Contemporary organizational designs. Organizational culture and ethical behavior – factors shaping organizational culture– creating an ethical culture.

Unit – III

Motivation and Leadership
Motivation–early and contemporary theories of motivation. Leadership – early and contemporary approaches to leadership.

Unit – IV

Group Dynamics
Groups and group development – turning groups into effective teams. Managing change – process, types and challenges. Communicating effectively in organizations – communication process–barriers to communication–overcoming barriers to communication–persuasive communication–communication in crisis situations.

Unit – V

Power, Politics, Conflict and Negotiations
Power, Politics, Conflict and Negotiations – Sources of individual, functional and divisional Power. Organizational politics. Conflict – causes and consequences – Pondy's model of organizational conflict – conflict resolution strategies.

Text Books:

1. Jennifer George and Gareth Jones "Understanding and Managing Organizational Behavior", Pearson Education Inc., 2012.
2. Jon L Pierce and Donald G. Gardner, "Management and Organizational behavior", Cengage Learning India (P) Limited, 2001.
3. Richard Pettinger, "Organizational Behaviour", Routledge, 2010.

Suggested Readings:

1. Stephen P. Robbins, Jennifer George and Gareth Jones, "Management and Organizational Behaviour", Pearson Education Inc., 2009.
2. K. Aswathappa, "Organizational behavior", Himalaya Publishing House, 2013.
3. John Schermerhorn, Jr., James G. Hunt and Richard N. Osborn, "Organizational Behaviour", 10th edition, Wiley India Edition, 2009.

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, Cauchey'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 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.

I/c HEAD
Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

18PY C05

PHYSICS
(for Chemicaland 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, Fraunhoferand 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-Mossotti equation, 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.

I/c HEAD
Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

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.

I/c HEAD
Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad–75.

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-IUnderstanding 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 Chemicaland 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/

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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.
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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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 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, 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.
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, 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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Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

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.
3. R.C. Hibbeler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press, 2006.

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Gandipet, Hyderabad-75.

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 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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Gandipet, Hyderabad-75.

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
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

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.
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", DhanpatRai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and comnpany, 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: Chemical Engineering

Chaitanya Bharathi Institute of Technology (A)

Chaitanya Bharathi (P.O), Gandipet

Hyderabad-500075, Telangana State.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
Choice Based Credit System
B.Tech (Chemical Engineering)

SEMESTER – III

S.No.	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of See in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16MT C03	Engineering Mathematics-III	3	-	3	30	70	3
2	16CH C01	Chemical Technology	3	-	3	30	70	3
3	16CH C02	Fluid Mechanics	3	-	3	30	70	3
4	16CH C03	Material and Energy Balance	3	-	3	30	70	3
5	16CY C07	Physical Chemistry	3	-	3	30	70	3
6	16MB C01	Engineering Economics and Accountancy	3	-	3	30	70	3
PRACTICALS								
7	16CH CO4	Chemical Technology Lab	-	3	3	25	50	2
8	16CY C08	Physical Chemistry Lab	-	3	3	25	50	2
9	16ME C13 /16EE C05	Basics of Mechanical and Electrical Engg. Lab	-	3	3	25	50	2
		Total	**18**	**9**	**-**	**255**	**570**	**24**

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

CIE - Continuous Internal Evaluation SEE - Semester and Examination

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AssessmentProcedures for Awarding Marks

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

Course (in terms of credits)	CIE	Semester end Examination(Marks)	Remarks	Duration of SemesterEnd Examination
Three(3) Credits/ Four(4) Credits	30*	70**	Theory Course/ Engg.Graphics	3 Hours
Two(2) Credits	20*	50***	Theory	2 Hours
Two(2) Credits	25	50	Lab Course/ Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
Two(2) Credits	50	—-	Project Seminar/ Seminar	——
Six(6) Credits	50	100	Project	Viva-Voce
One(1) Credit	—-	50***	Environmental Studies,Profess-ional Ethics and Human values	2 Hours
One(1) Credit	50		Mini Project	——-

CIE: Continuous Internal Evaluation

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

**The question paper will be in two parts, Part-A and Part-B. Part A is for Ten(10) questions and is compulsory, covers the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

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

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

A candidate has earned the credits of a particular course, if he/she secures not less than the minimum marks/grade as prescribed. Minimum pass marks for theory course is 40% of total marks i.e., CIE plus semester end examinations where as for the lab course/project is 50%.

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16MT C05

ENGINEERING MATHEMATICS-III

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

Course objectives:

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

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

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

UNIT – I

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

UNIT-II:

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

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UNIT - III

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

UNIT - IV

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

UNIT - V

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

Text Books:

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

Suggested Reading:

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

16CH C01

CHEMICAL TECHNOLOGY

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

Course Objectives: This course helps the students to understand the:

1. Concept of unit operations and unit processes in chemical process industry.
2. Flow diagrams that explain the conversion of raw materials to finished products.
3. Exposure to organic and inorganic processes.
4. Understanding process limitations and scale-up information.

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

1. Estimate the chemical industry growth and opportunities.
2. Differentiate between unit operation and unit processes.
3. Develop flowdiagrams of different processes.
4. Classify between inorganic and organic processes.
5. Design processes based on conditions, space time, yield, conversion, recycle methods, temperature, pressure.
6. Predict the process limitations and propose a model to overcome the limitations.

UNIT – I

Classification of Indian Chemical Industry, Introduction to unit operations and unit processes. Metallurgical Industry overview – classification of metals, manufacturing of pig Iron by blast furnace, methods of steel making – steel alloys. Manufacturing of copper and types of copper alloys, Manufacturing of Aluminum and types of alloys, Manufacturing of graphite and its applications.

UNIT – II

Manufacturing of H_2 by steam reforming of hydrocarbons. NH_3 Synthesis - methods and manufacturing. Urea manufacturing by total recycle.

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Manufacturing of Diammonium Phosphate. Manufacturing of Triple super Phosphate, Mixed and Bio Fertilizers.

UNIT – III

Ceramic industry overview, ceramic raw materials manufacturing of porcelain ware. Manufacturing of refractory's & applications, Cement: Raw materials, Manufacturing of Portland cement, Cement types and composition. Glass: Raw materials - Manufacturing – Types of glasses – uses.

UNIT – IV

Classification of plastics, Manufacturing of Phenol formaldehyde resin, PVC, PVA, Synthetic fibers Manufacturing of Nylon–6-6, Polyester Fiber Classification of rubbers and Manufacturing of SBR.

UNIT – V

Pulp and Paper Industry: Methods of pulping production. Recovery of chemicals from black liquor.Production of paper. Oils, Soaps, Detergents: Definitions, constituents of oils, Extraction and expression of vegetable oil. Refining and Hydrogenation of oils. Continuous process for the production of Fatty acids and Soap.

Text Books:

1. Shreve, R. N, "Chemical Process Industries", 4th Ed., McGraw Hill Book Company Inc., New York, U.S.A., 1977.
2. Rao, M. G. and Sittig, M., "Dryden's Outlines of Chemical Technology for the 21st Century, 3rdEd., Affiliated East-West Press, New Delhi, 1998.

Suggested Reading:

1. Andreas Jess and Peter Wasserscheid, "Chemical Technology: An Integral Textbook", John Wiley and Sons, Inc., New York, 2000.
2. Faith, W. L., Keys, D. B. and Clark, R. L., "Industrial Chemicals", 4th Ed., John Wiley, 1980.
3. Fertilizer Association of India, "Handbook of Fertilizer Technology", 2nd Ed.,Scientific Publisher, NewDelhi, 2009.

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16CH C02

FLUID MECHANICS

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

Course Objectives: This course helps the students to understand the:

1. Fluid flow phenomena for incompressible and compressible fluids.
2. Conservation of momentum principles to fluid flow.
3. Flow in Pipes, Channels and flow past immersed bodies.
4. Fluidization phenomena and methods for transporting the fluids

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

1. Differentiate different types of fluids.
2. Identifyequipments to be used to measure fluid flow based on their properties.
3. Design the piping for flow of fluids under different conditions useful for industry.
4. Apply the phenomena of fluidization applications in petroleum, chemical and allied industries.
5. Calculate the energy losses during the transport of fluids through pipes.
6. Deicide the types of pumps for different fluids under different conditions such as toxic, acidic, slurry type.

UNIT – I

Fluid Flow Phenomena and Fluid Statics: Definition of fluid, shear rate and shear stress, Newtonian and Non-Newtonian fluids, Time dependent flow, viscosity and momentum flux, compressible, incompressible, real and ideal fluids, viscosities of gases and liquids, Laminar and Turbulent flows, Reynolds experiment, Boundary layers, Hydrostatic equilibrium, U-tube manometer, inclined manometer and two fluid manometer and inverted manometer.

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UNIT – II

Basic Equations of Fluid Flow: path lines, stream lines and stream tube, mass balance–equation of continuity, one dimensional flow, mass velocity, differential momentum balance- equations of motion, coquette flow, macroscopic momentum balances, momentum of stream and momentum correction factor, layer flow with free surface. Mechanical energy equation-Bernoulli equation- corrections for effects of solid boundaries, kinetic energy correction factor, corrections for fluid friction, pump work in Bernoulli equation.

UNIT – III

Incompressible Flow in Pipes and Channels and Frictional Losses: Shear stresses and skin friction, fanning friction factor, flow in noncircular channels, laminar flow of Newtonian and Non-Newtonian fluids, velocity distribution, Hagen-Poiseuille equation, Turbulent flow, universal velocity distribution, Roughness, Moody's friction factor chart. Pipes and valves, fittings.Friction losses due to sudden expansion and contraction, Effects of fittings and valves, form frictional losses in the Bernoulli Equation.Dimensional analysis and Buckingham -theorem and Rayleigh theorem– its applications and limitations.

UNIT – IV

Compressible Fluids and Non Newtonian fluids (with Differential Pressure estimation) Flow past immersed bodies and Fluidization: Motion of particles through fluids – Free settling and hindered settling, Drag and drag coefficient, Flow through packed beds of solids – Kozeny-Carman equation, Burke-Plummer equation and Ergun equation. Fluidization and conditions for fluidization, Minimum fluidization velocity, particulate and bubbling fluidizations, Expansion of fluidized beds, Applications of fluidization.

UNIT – V

Transportation and Metering of Fluids: Centrifugal and Positive Displacement Pumps, Characteristics of pumps, suction lift and cavitation, NPSH, Flow meters- Venturi meter, orifice meters, Pitot tube, Rota meters and Notches and Weirs, Compressors and blowers.

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Text Books:

1. W. L. McCabe, J. C. Smith and P.Harriott , Unit Operations of Chemical Engineering, 7th Ed., Tata-McGraw Hill Chemical Engineering Series, New Delhi, 2005.
2. C.J.Geankopolis, "Transport processes and unit operations", 3rd Ed., Prentice Hall Publishers, USA, 1993.

Suggested Reading:

1. James O. Wilkes, "**Fluid Mechanics for Chemical Engineers with Microfluids and CFD", 2nd Ed.**, University of Michigan, Prentice Hall Intl., 2006.
2. Kurmi, R.S., "Hydraulics, Fluid Mechanics and Hydraulic Machines", 20th Ed., S. Chand and Company Pvt.Ltd., New Delhi, 2014.

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16CH C03

MATERIAL AND ENERGY BALANCES

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

Course objectives: This course helps the students to understand the:

1. fundamental aspects of chemical engineering problem solving.
2. mass and energy balance relations for chemical processes.
3. mass balance of unit operations and processes without and with chemical reactions.
4. energy balance over different unit operations.

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

1. differentiate between mass and volume relations.
2. develop material balance equations for the processes involving unit operations.
3. write material balance equations for the process involving chemical reactions.
4. develop material balance equations for recycle and bypass operations.
5. write energy balance equations for chemical processes.
6. apply this knowledge to solve advanced chemical engineering problems.

UNIT – I

Basic concepts - Mass and volume relations, Stoichiometric and composition relations - Ideal gas law, partial pressure - Vaporpressures of pure components, Raoult's law and Henry's law, Vapor pressure of miscible and immiscible liquids and solutions.

UNIT – II

Material Balance Without Chemical Reaction Solubility and crystallization (single solute systems) – Material balance in Unit Operations like absorption, distillation, evaporation, crystallization, leaching, extraction, drying and mixing units under steady state conditions.

UNIT – III

Material Balance With Chemical Reaction Material balances over units involving reactions including combustion- Proximate and ultimate analysis of coal and analysis of flue gas.

UNIT – IV

Material balances for by-pass, recycle and purge Operations.

UNIT-V

Energy Balances Heat capacity, sensible and latent heat – Heat balances in operations involving phase change – Heat balance over heat exchangers, dryers and simple evaporation systems / Heat balances calculation in processes without chemical reaction- Heat of reaction, Heat of formation, Heat of combustion- Heat balance in reactions, Adiabatic reaction, temperature of products-Heating values of fuels.

Text Books:

1. O.A.Hougen, K.M Watson and R.A Ragatz, Chemical Process Principles, 2nd Ed, John Wiley and Sons, 2004.
2. Felder, M. Richard, Ronald, W. R., Newell, A. J., "Elementary Principles of Chemical Processes", 4th Ed., John Wiley and Sons, U.S.A., 2016.

Suggested Reading:

1. David M.Himmelbleauand James B Riqqs, Basic Principles and Calculations in Chemical Engineering", 7th Ed, PHI Learning, New Delhi, 2003.
2. K.V.Narayananand B.Lakshmikutty, Stoichiometry and Process calculations, Prentice Hall of India, New Delhi, 2006.
3. B.I Bhatt and S.B.Thakone, "Stoichiometry", 5th Ed. Tata Mc.Graw Hill, New Delhi, 2010.

16 CY CO7

PHYSICAL CHEMISTRY

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

Course Objectives: This course helps the students to:

1. Realize the industrial importance of electro chemical processes and optimize the processes to make it industrially viable.
2. Study the effect of colligative properties of dilute solution.
3. Know the kinetics of chemical reactions.
4. Understand the effect of catalyst on a reaction.
5. Deal the properties of molecules and their structure determination using spectroscopy.
6. Appraise the students about the importance and role of physical chemistry in the field of chemical engineering.

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

1. Describe the operation of electrochemical system for the production of electric energy.
2. Apply fundamental concepts of dilute solutions to engineering problems.
3. Identify the kinetics of a reaction and offer reaction mechanisms.
4. Design a new catalytic material.
5. Operate instruments for studying the structure of chemical compounds.

UNIT I: Electrochemistry

Types of electrolytes,Specific, equivalent and molar conductance and their determinations. Laws of electrolysis and its applications. Ionic mobility, Ionic conductance and relative speed of ions – Hittorf's theoretical device. Transport number and its determination by Hittorf method. Kohlrausch's law statement and its applications - Determination of degree of dissociation of a weak electrolyte, equivalent conductance at infinite dilution for weak electrolyte and solubility products of sparingly soluble salts. Concentration cells with and without transference.

Numerical problems.

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UNIT II: Dilute Solutions

Colligative properties: Raoult's law, lowering of vapour pressure - measurement of lowering of vapour pressure by Ostwald and walker's Dynamic method. Elevation of boiling point - Determination of molecular mass from elevation of boiling point and its measurement by Cottrell's method. Depression of freezing point - Determination of molecular mass from depression of freezing point and its measurement by Beckmann's method. Osmotic pressure and its determination by using Berkeley - Hartley's method.Van'thoff theory of dilute solutions- abnormal colligative properties.

Numerical problems.

UNIT III: Chemical Kinetics

Introduction – Definition of rate, rate constant, order and molecularity. Derivation of expression for the rate constant of a first order, second order and third order reactions. Expression for half-life time of a first order, second order and third order reactions. Determination of order of reaction using integrated rate equation, half-life period and Ostwald's Isolation method. Theories of reaction rates: Effect of temperature on rate of reaction, Arrhenius equation, determination of activation energy of reaction. Collision theory of bimolecular reactions and transition state theory.

UNIT IV: Catalysis

Introduction – Definition of catalysis, positive and negative catalyst. Types of catalysis - Homogeneous and heterogeneous catalysis with examples. Characteristics of catalytic reactions.Catalytic promoters, catalytic poisoning and autocatalysis. Acid-base catalysis – Kinetics of acid – base catalyzed reactions and its mechanism. Enzyme catalysis – Mechanism and kinetics of enzyme catalyzed reaction (Michaelis – Menten equation). Factors effecting enzyme catalysis (temperature, salt concentration and pH). Characteristics of enzyme catalysis.

Numerical problems.

UNIT V:Physical properties and molecular spectroscopy

Physical properties: Additive and constitutive properties. Dipole moment– its determination and applications.Rotational spectra of diatomic molecules – principles and relationship between internuclear distance and moment of inertia.Expression for rotational energy. Criterion for absorption of radiation-selection rule and its applications.InfraRed Spectroscopy – Principles, Molecular vibrations, vibrational frequency and its applications.Atomic absorption spectroscopy- Principle, instrumentation

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(Block Diagram only) and its applications.Estimation of Nickel by Atomic absorption spectroscopy.

Numerical problems.

Text Books:

1. ArunBahl, B.S. Bahl and G.D.Tuli,, Essentials of Physical Chemistry, S.Chand & company Ltd, New Delhi 2009.

Suggested Books:

1. Puri, Sharma and Pathania , Principles of Physical Chemistry , Vishal Publishing company 2013.
2. G.M.Barrow, Physical Chemistry , McGraw Hill (2008).
3. K.L.Kapoor, A text book of Physical Chemistry , volume 1, 2, 3 & 4 Macmillan 2001.
4. T. Navneeth Rao, Problems in Physical Chemistry, Macmillan India Ltd., Hyderabad 2001.

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16MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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

Course Objectives: TheObjectives of the course are:

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

Course Outcomes: After completion of the course, student will be able to:

1. apply fundamental knowledge of Managerial economics concepts and tools.
2. understand various aspects of demand analysis and forecasting.
3. understand price determination for different markets.
4. study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
5. analyze different opportunities and come out with best feasible capital investment decisions.
6. apply accountancy concepts and conventions, Final accounts and financial analysis.

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UNIT-I:Introduction to Managerial Economics

Introduction to Economics and its evolution - Managerial Economics -its scope, importance, Its usefulnesstoengineers-Basicconceptsof Managerial economics.

UNIT-II: DemandAnalysis

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

UNIT-III: Production and Cost Analysis

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

UNIT-IV: Accountancy

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

UNIT-V: Capital Budgeting

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

Text Books:

1. MehtaP.L.,"Managerial Economics–Analysis, Problems and Cases", Sultan Chand & Son'sEducational publishers, 2013.
2. MaheswariS.N. "Introduction to Accountancy", Vikas Publishing House, 2013.
3. Panday I.M. "Financial Management", Vikas Publishing House, 11th edition, 2015.

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Suggested Readings:

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

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16CH C04

CHEMICAL TECHNOLOGY LAB

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

LIST OF EXPERIMENTS

(Minimumof**EIGHT** experiments in the list is to be performed selecting at least **FOUR**from each cycle.)

Cycle –I

1. Analysis of Iron Ore.
2. Analysis of Copper Ore.
3. Estimation of Borax.
4. Estimation of carbonates and bicarbonates ions.
5. Estimation of Dissolved Oxygen in Water.
6. Estimation of Chlorine in Water Sample.
7. Estimation of Calcium Ions in Natural Water.

Cycle – II

1. Estimation of Urea.
2. Estimation of Acid Value of oils.
3. Estimation of Formaldehyde in formalin solution.
4. Estimation of Glucose.
5. Preparation of Nitro-benzene.
6. Preparation of Meta dinitro benzene.
7. Preparation ofAcetanilide.

Text Books:

1. Harris, C. H., “Quantitative chemical analysis”, 7th Ed., W. H. Freeman, New York, 2006.
2. Willard, H. H.,andMeritt, L. L., “Instrumental methods of Analysis”, 7th Ed., ACS Publications, 1989.

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Suggested Reading:

1. Skoog, A. D., Holler, F. J., Stanley, R. C., "Principles of Instrumental Analysis", 7th Ed., Brookes Cole, 1997.
2. S.K.Bhasin and Sudha Rani, "Laboratory manual in engineering chemistry", Dhanpathrai Pub. Company, 2009.

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16CY C08

PHYSICAL CHEMISTRY LAB

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

Course Objectives: This course helps the students to:

1. Give hands on experience in application of theoretical concepts in experimentation.
2. Develop laboratory skills and ability to work independently.
3. Deepen the student's understanding of the principles of spectroscopy, electro chemistry and kinetics through experimentation.
4. Analyze the materials and estimate various metals.
5. Use various instruments in analytical methods.

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

1. Analyze the efficient management of any industrial processes.
2. Ability to understand, explain and select instrumental techniques for analysis.
3. Demonstrate chemical and analytical methods.
4. Apply chemical principles in science and technology as well as on multidisciplinary designteams.
5. Ability to analyze and interpret the experimental data.
6. Gain ability in handling experiments and design new experiments.

List of Experiments

(Minimum of 08 experiments in the list are to be performed)

1. Determination of order of the reaction of hydrolysis of methyl acetate in dilute hydrochloric acid.
2. Determination of order of the reaction between potassium persulphate and potassium iodide.
3. Determination of distribution coefficient of I_2 between CCl_4 and water.
4. Determination of distribution coefficient of benzoic acid between water and toluene.

5. Estimation of amount of HCl and CH_3COOH present in the mixture of acids conductometrically using NaOH solution.
6. Verification of Ostwald's dilution law by determining the dissociation constant of a weak acid Conductometrically.
7. Potentiometric redox titration between Fe^{2+} and $K_2Cr_2O_7$.
8. Potentiometric precipitation titration between KCl and $AgNO_3$.
9. Verification of Beer-Lambert's Law for $CuSO_4$ solution colorimetrically.
10. Estimation of Fe (III) using Potassium thiocyanate solution colorimetrically.
11. Estimation of amount of HCl and CH_3COOH present in the mixture of acids pH metrically using NaOH solution.
12. Determination of pKa of a weak acid pH metrically.

Text Books:

1. B.D.Khosla, V.C. Garg and AdarshKhosla , Senior practical physical chemistry, R.Chand& company, New Delhi (2012).

Suggested Books:

1. J.Mendham and Thomas , Vogel's text book of quantitative chemical analysis, Pearson Education Pvt. Ltd. New Delhi, 6th edition. (2002).
2. S.K.Bhasin and SudhaRani , Laboratory manual in engineering chemistry, Dhanpathrai Publishing Company (2008).
3. MERITT & WILLARD, Instrumental methods of Chemical Analysis, East-West Press (2001).

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16ME C13/16EE C05

BASICS OF MECHANICAL AND ELECTRICAL ENGINEERING LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

MECHANICAL ENGINEERING LAB

Course Objectives: Student will be able to

1. acquire knowledge in evaluating material characterization and the performance of I.C. Engines.
2. demonstrate this knowledge in tuning of simple components.
3. distinguish between various manufacturing processes.

Course Outcomes: students are able to

1. Evaluate the properties of material by tensile testing and performance of diesel engine.
2. Produce the parts by simple turning process.
3. Understand the concepts of welding, casting (moulding) process.

List of Experiments:

1. To characterize the material by simple tensile testing using UTM.
2. To conduct performance test on four-Stroke single cylinder Diesel Engine.
3. Practice on simple turning on Lathe machine.
4. Moulding practice for simple patterns.
5. Making a straight bead with arc welding.

ELECTRICAL ENGINEERING LAB

Course Objectives:

1. To acquire the knowledge of different types of electrical elements.
2. To verify the basic electrical circuit laws.
3. To determine the parameters and power factor of a coil.

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Course Outcomes: The student will be able to

1. Find out the resistance of the given resistor.
2. Understand the voltage division and current division rules.
3. Determine the parameters of the given coil.
4. Measure the power factor of a coil using different methods.

LIST OF EXPERIMENTS

1. Study of different types of resistors, inductors and capacitors.
2. Verification of Ohm's law.
3. Verification of KVL & KCL.
4. Verification of Voltage and current division rules.
5. Measurement of power factor of a coil using 3 ammeters.
6. Measurement of power factor of a coil using 3 volt meters.
7. Determination of the parameters of a coil.

Note: At least **FOUR** Experiments should be conducted in the semester.

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Choice Based Credit System
B.Tech (Chemical Engineering)

SEMESTER – IV

S.No.	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of See in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CH C05	Chemical Engineering Thermodynamics - I	3	-	3	30	70	3
2	16CH C06	Chemical Reaction Engineers - I	3	-	3	30	70	3
3	16CH C07	Material Science for Chemical Engineers	3	-	3	30	70	3
4	16CH C08	Mechanical Unit Operations	3/1	-	3	30	70	4
5	16CH C09	Process Heat Transfer	3/1	-	3	30	70	4
6	---	**Elective - I**	3	-	3	30	70	3
PRACTICALS								
7	16CH C10	Fluid Mechanics Lab	-	3	3	25	50	2
8	16MT C07	Programming Laboratory for Numerical Methods	-	2	2	15	35	1
9	16EG C03	Soft Skills and Employability Enhancement Lab	-	2	2	15	35	1
		Total	**20**	**7**	**-**	**235**	**540**	**24**

S.No.	Elective-I Course Code	Title of Elective-I Course (Inter Disciplinary and program specific Elective options)
1.	16CY E01	Advanced Organic Chemistry
2.	16MT E01	Numerical Techniques and Statistical Methods
3.	16CH E01	Fertilizer Technology

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

CIE - Continuous Internal Evaluation SEE - Semester End Examination

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AssessmentProcedures for Awarding Marks

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

Course (in terms of credits)	CIE	Semester end Examination(Marks)	Remarks	Duration of SemesterEnd Examination
Three(3) Credits/ Four(4) Credits	30*	70**	Theory Course/ Engg.Graphics	3 Hours
Two(2) Credits	20*	50***	Theory	2 Hours
Two(2) Credits	25	50	Lab Course/ Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
Two(2) Credits	50	—-	Project Seminar/ Seminar	——
Six(6) Credits	50	100	Project	Viva-Voce
One(1) Credit	—-	50***	Environmental Studies,Profess-ional Ethics and Human values	2 Hours
One(1) Credit	50		Mini Project	——-

CIE: Continuous Internal Evaluation

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

**The question paper will be in two parts, Part-A and Part-B. Part A is for Ten(10) questions and is compulsory, covers the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

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

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

A candidate has earned the credits of a particular course, if he/she secures not less than the minimum marks/grade as prescribed. Minimum pass marks for theory course is 40% of total marks i.e., CIE plus semester end examinations whereas for the lab course/project is 50%.

16CH C05

CHEMICAL ENGINEERING THERMODYNAMICS – I

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

Course Objectives: This course helps the students to understand the:

1. basic thermodynamic laws and principles.
2. concept of energy conservation through the study of the first and second laws of thermodynamics.
3. concept of entropy and its importance in energy conversion.
4. identify, formulate and solve chemical engineering problems involving various types of systems and processes.

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

1 use the fundamentals and differentiate between relations of measurable nature of P, V, T and the un-measurable nature of H, U, A, G.

2 estimate thermodynamic properties of real gases using equations of state, correlations and tables.

3 analyze processes involving ideal gases, such as isothermal, isobaric, isentropic, cyclic.

4 reiterate the first and second laws of thermodynamics and apply their practical implications in engineering design.

5 apply energy balances to open and closed systems and to evaluate the thermodynamic efficiency of nozzles, compressors, turbines.

6 analyze steam power cycles; refrigeration cycles and liquefaction and calculate relevant system efficiencies for the processes.

UNIT – I

The First Law and Other Basic Concepts: Joule's Experiments - Internal Energy - Formulation of the first law of the thermodynamics - the thermodynamic state and state functions - Enthalpy - The steady state flow processes; equilibrium - the phase rule - The Reversible process - Constant V and constant P processes and heat capacity. Volumetric Properties of

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Pure Fluids: PVT behavior of pure substances, the Ideal gas, virial equations and their use in the calculation of P-V-T Properties; use of Cubic equations of state, generalized correlations for gases.

UNIT– II

Second law of thermodynamics: Statement of the second law, heat engines, thermodynamic temperature scales, thermodynamic temperature and ideal-gas scale, entropy, entropy changes of an ideal gas, mathematical statement of the second law, the third law of thermodynamics, entropy from the microscopic view point.

UNIT – III

Thermodynamic properties of fluids: Relationships among thermodynamic properties for a homogenous phase of constant composition; Residual properties; Two-phase systems. Thermodynamic diagrams; generalized property correlations for gases.

UNIT – IV

Conversion of Heat into Work by Power Cycles: Steam power plants, Carnot cycles, Rankine cycle,refrigeration and Liquefaction, vapor-compression cycle, comparison of refrigeration cycles, the choice of refrigerant, absorption refrigeration, the heat pump; various processes for liquefaction.

UNIT – V

Thermodynamics of Flow Processes: Energy balances for steady state flow process; Adiabatic and isothermal flow of compressible fluids through pipes of constant cross-section with and without friction; expansion process involving flow through nozzles and turbines, throttling process; compression processes - compressors and pumps; calculation of ideal work and lost work for flow processes.

Text Books:

1. Octave Levenspiel, “Chemical Reaction Engineering”, 3rd Ed, Wiley India Pvt.Ltd, New Delhi, 2006.
2. H.ScottFogler, “Elements of Chemical Reaction Engineering”, 3rd Ed., Prentice Hall Pvt. Ltd., New Delhi, 2002.

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Suggested Reading:

1. J.M. Smith, “Chemical Engineering Kinetics”, 3rd Ed., McGraw-Hill,New York, 1981.
2. K.A.Gavhane, “”Chemical Reaction Engineering-1",NiraliPrakashan Publishers, Pune, India, 2011.

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16CH C06

CHEMICAL REACTION ENGINEERING – I

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

Course Objectives: This course helps the students to understand the:

1. Classification of reactions, rates and forms of rate expressions.
2. Procedure to interpret the data relating moles, concentration, extent of reaction and conversion.
3. Experimental kinetic data and reaction mechanisms andconcepts of non-ideal reactors.
4. Factors to choose applicable reactor among single, multiple, recycle reactors etc.

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

1. Derive performance equations of batch, and continuous reactors from general material balances.
2. Analyse reactor performance for homogeneous and heterogeneous reactions.
3. Apply the concepts of heat effects on reactions.
4. analyse multiple reactions.
5. Designdifferent types of chemical reactors for batch and continuous operation like CSTR and Tubular.
6. Determinereactor behavior for non-ideal flow.

UNIT – I

Introduction: Classification of Reactions, Definition-Variables affecting the rate of reaction. The rate equation and Stochiometric relations for a single phase reaction aA+bB ’! rR+sS. Single and multiple reactions, Elementary and non-Elementary reactions, Molecularity and order of Reaction, Specific reaction rate constant, Testing kinetic models – Steady

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state approximation, Equilibrium treatment, Fitting a rate law for the given reaction mechanism, predictability of reaction rate from theory. Temperature dependency from Arrhenius' law, Collision theory and Transition state theory.

UNIT – II

Interpretation of Batch Reactor Data: Constant volume batch reactor: Analysis of total pressure data, conversion. Integral method of Analysis of data for single reaction, multiple reactions, Homogeneous catalyzed reactions, Auto catalytic reactions, reversible reactions, and reactions of shifting orders. Half life method, Partial analysis of the rate equation.Differential method of analysis of data. Variable Volume Batch Reactor: Fractional change in volume of the system, Differential method of analysis, Integral method of analysis.

UNTI – III

Reactor Design: Introduction, Ideal Reactors for a Single Reaction, Space time – space velocity, Steady state mixed flow reactor, Steady state plug flow reactor, Holding time and space time for flow reactors. Design for single reactions, Size comparison of single reactors, multiple reactor systems, Recycle reactor, Auto catalytic reactions – optimum recycle operation, Reactor combinations.

UNIT – IV

Design for Multiple Reactions: Introduction to multiple reactions, Qualitative discussion about product distribution for Parallel, Series and Series-parallel reactions. Quantitative treatment of product distribution and of reactor size for irreversible simple reactions of parallel, and Series only. Temperature and Pressure effects for single reactions, Heat of reaction from thermodynamics, Heat of reaction and Temperature, Equilibrium constants and equilibrium conversions from Thermodynamics. General graphical design procedure, Optimum temperature progression. Heat effects, Adiabatic Operations, Non adiabatic operations. Exothermic reactions in mixed flow reactors – a qualitative treatment.

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UNIT – V

Non-Ideal flow: Basics, residence time distribution (R T D), State of aggregation of the flowing stream, earliness of mixing, Role of R T D, state of aggregation and earliness of mixing in determining reactor behaviour. Exit age distribution of fluid, Experimental methods for finding E – pulse, step experiments, Relationship between F and E curves. The convolution integral.Conversion in non- ideal flow reactors.

Text Books:

1. Octave Levenspiel, "Chemical Reaction Engineering", 3rd Ed, Wiley India Pvt.Ltd, New Delhi, 2006.
2. H.ScottFogler, "Elements of Chemical Reaction Engineering", 3rd Ed., Prentice Hall Pvt. Ltd., New Delhi, 2002.

Suggested Reading:

1. J.M. Smith, "Chemical Engineering Kinetics", 3rd Ed., McGraw-Hill,New York, , 1981.
2. K.A.Gavhane, "Chemical Reaction Engineering-1", Nirali Prakashan Publishers, Pune, India, 2011.

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16CH C07

MATERIAL SCIENCE FOR CHEMICAL ENGINEERS

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

Course Objectives: This course helps the students to understand the:

1. criteria involved in identifying materials for chemical engineers.
2. concept of phase-transformations that occur during material manufacture and vis-à-vis the effect on properties.
3. significance of different properties for selecting material under different combinations of process conditions.
4. possible and latest alternatives available for standard engineering materials.

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

1. apply the basic fundamentals of engineering for material selection.
2. developTime–Temperature–Transformation (T-T-T) relations of materials.
3. apply phase equilibrium diagrams for heat treatment of steels.
4. select the right materials for design and fabrication of process equipment.
5. select materials for high and low temperature applications.
6. identify new or alternate materials for development and operation of process industry.

UNIT – I

Introduction to Engineering Materials: Classification – metals, non-metals, alloys; Introduction to metallic materials: Ferrous metals and alloys – Iron and steel, types of steels like mild steel, carbon steel and stainless steel, Common grades of steel (304, 316); Non-Ferrous metals and alloys of Aluminum, Copper and Nickel; Introduction to non-metallic materials: Polymers, Ceramics, Refractories and Composites; Criteria for material selection.

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UNIT – II

Phase Diagrams: Phase rule, Definition and construction of phase diagrams, Basic types of binary phase diagrams: Cu-Au, Al-Si, Al-Cu, Mg-Sn, Cu-Zn. Iron-Iron carbide equilibrium diagram. Applications of Phase Equilibrium Diagrams: Time–Temperature–Transformation (T-T-T) relations of steels, Zone refining, Heat treatment of steels.

UNIT – III

General Properties of Engineering Materials: Mechanical Properties: Stress-strain diagram, Elastic, Plastic, Anelastic and Viscoelastic behavior, Hardness, testing, Deformation – hot and cold working, Creep, Fatigue and Fracture strengthening mechanisms. Thermal Properties: Conductivity, Expansion, Protection, Diffusivity, Stresses and Shock resistance.Optical Behavior: Light & electro-magnetic spectrum, Luminescence, stimulated emission of Radiation, Lasers, Optical fibers. Magnetic Behavior: Magnetism, Susceptibility, Anisotropy and Hysteresis, Ferro-, Para, -and Dia- Magnetism soft and hard magnetic materials.

UNIT – IV

Materials for High and Low Temperature Applications: Ceramics and Refractories – Classification, advantages, general properties and engineering applications. Introduction to Superalloys.Electrical Materials–Different types like conductors, semiconductors and superconductors; general properties and engineering applications. Polymers and Elastomers – Classification, advantages, general properties and engineering applications.

UNIT–V

New Materials: Composite materials - Classification, advantages over alloys, general properties and applications. Nano-materials: Introduction, carbon nanotubes, nanosensors. Biomaterials: Need of ceramics, Interaction with bioenvironment, Biocompatibility, Types of biomaterials - Nearly inert ceramics, surface active ceramics, resorbable ceramics.

Text Books:

1. Raghavan, V., “Elements of Materials Science and Engineering- A first course”, 5th Ed, PHI learning pvt.ltd., 2006.
2. Rajput, R. K., A Textbook of Material Science and Engineering, 2nd ed., S.K.Kataria and Sons, 2013.

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Suggested Reading:

1. Callister, W. D., "Materials Science and Engineering", 5th Ed, John Wiley and Sons. Inc., 2002.
2. Krishan K. Chawla, "Composite Materials: Science and Engineering", Springer-Science Media, USA, 1987.

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16CH C08

MECHANICAL UNIT OPERATIONS

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

Course Objectives: This course helps the students to understand the:

1. principles of size reduction using various equipments.
2. techniques for separating solids based on size by different methods.
3. different kinds of filtration units.
4. various aspects of Mixing and Agitation of solids and liquids.

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

1. decide the transport of solids based on their properties.
2. select equipment for industrial application with respect to size reduction.
3. design equipment for industrial application with respect to separation of solids.
4. decide the necessary equipment to screen different particles based on their properties.
5. Apply the different filtration techniques for industrial application.
6. identify the suitable technique for blends and mixing of liquids and solids.

UNIT – I

Particle Technology: Characteristics of solid particles – screen analysis, Differential and cumulative mean diameters for mixture of particles, properties of particulate masses. Handling and transport of solids, storage equipment for mechanical conveyors and elevators, pneumatic transport. Communition – principles of Communition laws and energy requirements. Size reduction - Description and working of crushing and grinding equipment – jaw, Gyratory and Roll crusher, Hammer mill, Rod mill and Ball mill, Ultra fine grinders. Cutting machines – Open and closed circuit grinding.

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UNIT – II

Size separation: Industrial screening equipment – Grizzlies, Tromels and gyratory. Capacity and effectiveness of screen.Flotation, Frothing and dispersing agents' magnetic separation, electrostatic precipitators. Particle dynamics: Principles of motion of particles through fluids, drag coefficient for spheres, motion of spherical particles. Free and hindered settling.Classifiers, jigging.Sorting classifiers – Heavy medium and differential settling methods.Principle and working of cyclones and hydro cyclones.

UNIT – III

Solid-liquid separation operations: Flocculation – Batch sedimentation – Thickeners – Thickener design. Principles of centrifugal sedimentation – Centrifugal classifiers and decanters – tubular, disc, bowl and scroll centrifuges.

UNIT – IV

Filtration:Equations for batch filtration. Description of plate and frame filter press, shell and leaf filters. Rotary vacuum drum filters. Membrane filtration, Centrifugal filters. Filter aids, Theory of constant rate and centrifugal filtration.

UNIT – V

Mixing and Agitation: Agitation equipment for liquids – Circulation velocities and power consumption in agitated vessels. Scale up of agitation equipment – Equipment for blending and mixing of liquids – Suspension of solid particles. Critical speed – Dispersion of gas in liquids.Gas holdup and power requirement.Dispersion of liquids in liquids.Equipment for mixing of solids and pastes – Mixers for dry powders – mixing index.

Text Books:

1. W. L. McCabe, J. C. Smith and P.Harriott , Unit Operations of Chemical Engineering, 7thEd., Tata-McGraw Hill Chemical Engineering Series, New Delhi, 2005.
2. Foust A.S, Wenzel L.A., "Principles of Unit Operations", 2nd Ed., John Wiley and sons, NewYork, 1981.

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Suggested Reading:

1. Coulson, J. M., and Richardson, J. F., "Chemical Engineering Series", Vol. 2, 4th Ed., Pergamon Press Oxford, UK, 1991.
2. C M Narayanan and B C Bhattacharya, "Mechanical Unit Operation for Chemical Engineering", Khanna Publishers, 3rd Ed, 2011.

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16CH C09

PROCESS HEAT TRANSFER

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

Course Objectives: This course helps the students to understand the:

1. overall view of different modes of heat transfer applicable to process industries.
2. heat transfer to fluids without and with phase change.
3. concept and functioning of different heat exchangers.
4. Fundamentals of heat transfer by conduction, convection and radiation.

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

1. Distinguish between different types of heat transfer
2. Analyze the concepts of heat exchanger
3. Calculatethe rate of heat transfer with and without change of phase.
4. Decide the type of evaporator required for a specific purpose.
5. Identify the effect of combined heat transfer by conduction, convection and radiation.

UNIT - I

Modes of Heat Transfer – derivation of heat conduction equation in rectangular co-ordinates – one dimensional heat conduction without heat generation through plane, cylindrical and spherical walls – Resistance concept - situations involving conduction and convection – critical and optimum insulation thickness – Numerical problems on unsteady heat conduction through semi-infinite slab, infinite slab and cylinder – lumped capacity systems.

UNIT - II

Heat Transfer to Fluids Without Phase Change – forced convection in laminar flow over plates and in tubes – dimensional analysis. Correlations for heat transfer in turbulent flow, natural convection, Agitated vessels,

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packed beds – Analogy between heat and momentum transfer – Reynolds, Prandtl and Colburn analogies.

UNIT - III

Heat Transfer to Fluids With Phase Change – heat transfer from condensing vapors – Drop wise and Film wise condensation – Derivation and practical uses of Nusselt equation. Boiling of saturated liquid – maximum heat flux and critical temperature drop, minimum flux and film boiling. Typical heat exchange equipment – counter and parallel flows,

energy balances, log-mean temperature difference and correction for mixed and cross flow – Rating of single and multiple heat exchangers – Description of extended surface heat exchangers.

UNIT - IV

Evaporators - Types– capacity and economy of evaporators – material and energy balances in evaporation – multiple effect evaporation and methods of feeding – Barometric leg, steam traps – heat transfer coefficients in evaporators – Description and working of crystallizers.

UNIT - V

Radiation - Fundamentals of radiation heat transfer, laws of black body radiation, radiating heat exchange between non-black surfaces, combined heat transfer by conduction, convection and radiation, radiation shields.

Text Books:

1. W. L. McCabe, J. C. Smith and P.Harriott, "Unit Operations of Chemical Engineering", 7th Ed., Tata-McGraw Hill Chemical Engineering Series, New Delhi, 2005.
2. Donald Q.Kern, "Process Heat Transfer", 1st Ed., McGraw-Hill publishers, New York, 2001.

Suggested Reading:

1. Hollman, J.P., "Heat Transfer", 10th Ed., McGraw-Hill publishers, 2011.
2. Coulson, J. M., and Richardson, J. F., "Chemical Engineering Series", Vol. 1, 4th Ed., Pergamon Press Oxford, UK, 1991.
3. B.K.Dutta, "Heat Transfer Principles and applications", PHI learning Pvt. Ltd.,New Delhi, 2004.

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16CY E01

ADVANCED ORGANIC CHEMISTRY

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

Course Objectives: This course helps the student to

1. impart knowledge of organic chemistry to chemical engineering students.
2. learn nomenclature and isomerism of organic molecules in a better way which forms the basis of our life.
3. gain knowledge in designing new synthetic processes.
4. learn various separation techniques useful for research purpose.
5. learn the latest techniques of instrumental analysis.

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

1. identify organic functional groups using chemical processes.
2. classify the types of isomerism in various organic molecules.
3. illustrate the mechanism of a reaction using oxidizing and reducing agents.
4. design separation techniques commonly used in research industries.
5. analyze the molecules using data from spectroscopic techniques.

UNIT I:

Nomenclature and functional groups

Review of nomenclature of organic compounds. IUPAC system.Chemical reactions (without mechanism) of a) Alcohols – with HX, H_2SO_4, heating/ H+, oxidation and reduction. b) Ethers – with HX c) Carbonyl compounds (aldehydes/Ketones) – with RMgX, NH_3 and its derivatives, oxidation (with $KMnO_4$), reduction (with ZnHg/HCl), hydrazine) d) Carboxylic acids – acidic character, PCl_5, $SOCl_2$, NH_3, esterification, oxidation and reduction e) Amines – basic character, carbylamine reaction, acetylation (difference between 1°, 2° and 3° amines) and diazotization.

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UNIT II:

Isomerism and Stereochemistry

Definition of isomerism.Types of isomerism – structural and stereoisomerism.Structural isomerism with examples (chain, positional, functional isomerism and tautomerism). Stereoisomerism conformational and configurational isomerism (Newmann projection formula) – definition, n-butane as example. Geometrical isomerism – cis/trans or E/Z isomerism with one example each. Optical isomerism – Introduction to optical activity, plane polarized light, causes of optical activity. Optical activity in compounds containing one asymmetric (lactic acid) and two similar (tartaric acid).Enantiomers and Diastereomers – definition.Relative (DL) and absolute (RS) configuration of simple molecules like glyceraldehyde, glyceric acid, sec-butyl alcohol. Sequence rules.

UNIT III:

Named reagents and reactions in organic synthesis

Reagents in organic synthesis – Introduction, oxidizing reagents: potassium permanganate (with 2-butene), potassium dichromate (with 1°,2° alcohols) and lead tetraacetate (with 1,2 diol) with mechanism. Reducing reagents: reagents in catalytic reactions – H_2/Pd (to reduce alkenes and alkynes) with any two examples; reagents in chemical reactions – $LiAlH_4$, $NaBH_4$ with two examples (without mechanism). Named reactions – Aldol condensation, Hoffmann degradation and Perkin reaction with mechanism and example.

UNIT IV:

Chromatographic techniques

Introduction – Types of chromatography, TLC and column – principles, processes and applications. HPLC – principle and application.

UNIT V :

Spectroscopic analysis of organic compounds.

IR spectroscopy: Instrumentation, application of IR spectroscopy for identification of organic molecules containing – OH,-NH2,>C=O, -C ≡C-, -CN, phenyl, -C-O-C-, -$CONH_2$, -COOH and –COOR.UV spectroscopy: Basic principles, types of excitation, bathochromic and hypsochromic shift, Instrumentation. Application to simple molecules (1,3-butadiene, stilbene and benzaldehyde).

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Text Books:

1. R.T.Morrison and R.N.Boyd ,Organic chemistry, 6th edition, Prentice Hall, New Delhi, 1999.
2. Y.R.Sharma, Elementary organic spectroscopy , 5thedition , S. Chand and Co., 2013.

Suggested Books:

1. G.L. David Krupadanam, Analytical chemistry, Orient Longman, A.P., 2004.
2. T. W. Graham Solomons, Organic chemistry, 6th edition, 2007.
3. William Kemp, Organic spectroscopy, 3rd edition, Palgrave, New York, 2005.

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16MT E01

NUMERICAL TECHNIQUES AND STATISTICAL METHODS

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

Course Objectives: This course helps the students to understand the:

1. To find the roots of the non-linear equation using the different methods.
2. To identify the solution for Initial Value Problem using numerical techniques.
3. To estimate the statistical averages/ensemble averages of the probability functions.
4. Probability distributions for random phenomenon of the physical data.
5. Statistical hypothesis and assumptions for testing the data.

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

1. Solve the non-linear equations for generating the roots.
2. Solve the first order ordinary differential equations using numerical techniques.
3. Analyse the probability function with the help of statistical averages.
4. Fit the probability distribution (discrete and continuous) for the random phenomenon.
5. Formulate the statistical hypothesis for the statistical data.
6. Interpret the random behaviour of physical data.

UNIT – I

Solution of linear and non-linear equations: Numerical Solution of linear simultaneous equations by Gauss-elimination direct method, Gauss-Jordan direct method, Gauss-Seidel iteration method. Solution of Transcendental (non-linear) equations by Bisection method, Regula-Falsi method and Newton-Raphson method.

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UNIT – II

Numerical solutions of ordinary differential equations: Numerical solutions of ordinary differential equations by Euler's Method, modified Euler's method, Taylor's method and Runge-Kutta fourth order method.

UNIT – III

Random variables: Mathematical Expectation, Variance, Co-Variance, and its properties, Probability function, Moments, moment generating function, cumulative generating function and its properties.

UNIT – IV

Probability Distribution: Discrete distribution: Binomial, Poisson distributions, finding Mean and Variance through moment generating function. Continuous distribution: Normal distribution and Exponential distributions.

UNIT – V

Testing of Hypothesis: Null and alternative Hypothesis, Types of errors, Level of significance, testing the single mean (small).Testing the chi-square, Goodness of fit for independents of attributes, equality of population variances.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2015.
2. M.K.Jain, S.R.K Iyengar and R.K.Jain: Numerical methods for Scientific and Engineering Computation. New Age International publications, 2008.
3. S.C Gupta and V.K.Kapoor, "Fundamentals of Mathematical statistics", S.Chand and Co Publishers, 2006.

Suggested Reading:

1. N P Bali, Manish Goyal, "A Text Book of Engineering Mathematics", 9th Edition, Laxmi publishers, 2016.
2. Kanti B. Datta, "Mathematical Methods of Science and Engineering", CENGAGE Learning publishers, 2014.
3. Miller and Freund, "Probability and Statistics for Engineers", Pearson publishers, 2005.
4. S.S.Shastry, "Introductory Methods of Numerical Analysis", 5th Ed, EEE publishers, 2014.

16CH E01

FERTILIZER TECHNOLOGY

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

Course objectives: This course helps the students to understand the:

1. Use of fertilizers in improving soil productivity and crop yield.
2. Different types of the nitrogenous, phosphatic and potash fertilizers.
3. Various fertilizer application methods.
4. Different organic fertilizer production methods.

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

1. Identify the different nutrients and significance of feed stocks for the production of fertilizers.
2. Identify methods for the production of various nitrogenous fertilizers.
3. Apply different manufacture methods for various phosphorous fertilizers.
4. Production methods for potassium and mixed complex fertilizers
5. Differentiate the need, application techniques and uses of new variety of fertilizers.
6. Design effluent treatment methods and impact of fertilizers on environment.

UNIT – I:

Introduction: Fertilizer Technology, Plant Nutrients, Role of essential elements for plant growth. Availability of feed stocks.Nitrogen Fertilizers - Feed stocks for the production of Ammonia, Ammoniasynthesisby – Haber and Kellogg processes.By-productammonia recovery by direct and indirect methods.

UNIT –II

Manufactureof Urea: Manufacture of urea and othernitrogenous fertilizerssuchas ammoniumsulfate, ammonium nitrate, calciumammoniumnitrate, ammoniumchloride. Manufacture of nitric acid.

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UNIT – III

Phosphorous fertilizers: manufacture of single and triple super phosphate. Production of ammoniumphosphates – mono-, Di- and nitro-phosphates, Manufacture of phosphoric acid by wet process and thermal process.

UNIT –IV

Introduction to new variety of fertilizers: Potassium fertilizers, mixed and NPK fertilizers.Liquid fertilizers.Bio fertilizers – introduction, advantages over chemical fertilizers, types and uses.

UNIT –V

Fertilizer application techniques: different soil controlled release fertilizers. Effluent treatment methods for various fertilizer plants.Environmental impact of fertilizer plants on Ecosystem. IndianFertilizer industry – production Economics and future plans.

Text Books:

1. Brahma Mishra, "Fertilizer Technology and Management", IK International Publishing House Pvt. Ltd., New Delhi, 2012.
2. Dr. ShaliniSuri, "BioFertilizers and Biopesticides", 1st Ed., APH publishing Corporation, New Delhi, 2011.

Suggested Reading :

1. Fertilizer Association of India, "Fertilizer Handbook", 2nd Ed., Scientific Publisher, New Delhi, 2009.
2. UNIDO, "Fertilizer Manual", 3rd edition, Kluwer Academic Publishers, New Delhi,1998.

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16CH C10

FLUID MECHANICS LAB

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

LIST OF EXPERIMENTS

Note:Minimumof**EIGHT** experiments are to be performed.

1. Determination of discharge coefficient of orifice meter and Venturimeter and their variation with Reynold's number.
2. a) Determination of weir meter constant K for V-notch and rectangular notch.

   b) Calibration of rotameter and study of variation of flow rate with tube to float diameter.
3. Determination of viscosity of Glycerol – water solution at different temperatures.
4. Determination of friction factor for flow of water through annulus using Fanning's and Darcy's equations.
5. Determination of friction factor for flow through straight pipes of different diameters and study of variation of friction factor with Reynolds number.
6. Determination of friction losses in pipe fittings.
7. Determination of clearance volume and efficiency of an air compressor.
8. Determination of characteristic curves for centrifugal pumps.
9. a) Determination of friction factor for packed beds.

   b) Determination of minimum fluidization velocity.
10. Determination of pressure drop through helical coils.
11. Determination of velocity profile of air in pipe by pitot tube.
12. Determination of critical velocity by Reynolds Experiments.

Text Books:

1. C.J.Geankopolis, "Transport processes and unit operations", 3rd Ed., Prentice Hall Publishers, USA, 1993.
2. BireswarMajumdar, "Fluid Mechanics with laboratory manual", PHI Learning Pvt. Ltd., New Delhi, 2011.

Suggested Reading:

1. Gupta, V. P., "Laboratory manual of Fluid Mechanics and Machines" 3rd Ed., CBS Publishers, New Delhi, 2011.

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16 MT C07

PROGRAMMING LABORATORY FOR NUMERICAL METHODS

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

LIST OF EXERCISES

CYCLE – I: Introduction to MATLAB programming techniques

1. Introduction to 'MATLAB Programming technique'.
2. MATLAB code writing - variables, operators, arrays, loops.
3. MATLAB code writing- functions, input/output statements, plotting.
4. Writing and running programs - learning the 'Built-in functions' in MATLAB software useful for problem solving.

CYCLE – II: Application of MATLAB Programming

5. Numerical Solution of linear simultaneous equations by direct methods:
   i. Gauss-elimination direct method.
   ii. Gauss-Jordan direct method.
6. Numerical Solution of linear simultaneous equations by indirect methods:
   i. Jacobi method.
   ii. Gauss-Seidel indirect method.
7. Solution of non-linear equations by:
   i. Bisection method.
   ii. Newton-Raphson method.
8. Numerical solutions of ordinary differential equations by:
   i. Euler's Method.
   ii. Runge-Kutta fourth order method.
9. Interpolation and Curve fitting by Linear Least square analysis.
10. Interpolation and Curve fitting by Non-linear Least square analysis.

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Textbooks:

1. RudraPrathap, “Getting Started with MATLAB: A quick Introduction for Scientists and Engineers”, New York, Oxford University Press, 2010.
2. B. S. Grewal, “Numerical Methods in Engineering & Science with programs in C, C++ and MATLAB”, Khanna Publishers, 2014.
3. JaanKiusalaas, “Numerical Methods in Engineering with MATLAB”, Cambridge University Press, U.S.A., 2005.

Suggested Reading:

1. M. K. Jain, S. R. K. Iyengar and R. K. Jain, “Numerical methods for Scientific and Engineering Computation”,

   New Age International publications, 2008.
2. DukkipatiRao.V, “Applied Numerical Methods using MATLAB”, New Age International (P) Ltd. Publishers,

   New Delhi, 2011.
3. Timmy Siauw and Alexander Bayen, “An Introduction to MATLAB Programming and Numerical Methods for Engineers”, 1st Ed., Elsevier Publications, Academic Press, USA, 2014.

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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 manage time effectively and deal with stress.
4. Make the transition smoothly from Campus to Corporate. Also use media with etiquette and know what academic ethics are.
5. To do a live, mini project by collecting and analyzing data and making oral and written presentation of the same.

Exercise 1

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

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Elements of effective presentation, Structure of presentation, Presentation tools, Body language,

Creating an effective PPT.

Exercise 2

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

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

Exercise 3

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

Exercise 4

Corporate Culture: Grooming and etiquette, communication media etiquette,

Academic ethics and integrity.

Exercise 5

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

Suggested Reading:

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

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Scheme of Instruction and Syllabi
of
Choice Based Credit System (CBCS) of

BE / B.TECH V AND VI SEMESTERS
OF
FOUR YEAR DEGREE COURSE
IN

CHEMICAL ENGINEERING

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email: principal@cbit.ac.in; Website: www.cbit.ac.in Ph : 040-24193276 / 277 / 279

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

B.Tech (Chemical Engineering)

SEMESTER -V

S.N	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Periods per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	16CH C11	Chemical Reaction Engineering - II	4	--	3	30	70	4
2.	16CH C12	Mass Transfer Operations – I	4	--	3	30	70	4
3.	16CH C13	Process Instrumentation	3	--	3	30	70	3
4.	--	Elective-II	3	--	3	30	70	3
5.	--	Elective-III	3	--	3	30	70	3
PRACTICALS								
6.	16CH C14	Mechanical Unit Operations Lab	--	3	3	25	50	2
7.	16CH C15	Process Heat Transfer Laboratory	--	3	3	25	50	2
Elective-II Labs.								
8.	16CH E 06	Surface Coating Technology Lab.	--	3	3	25	50	2
	16CH E07	Technology Of Vegetable Oils And Fats Lab.	--	3	3	25	50	2
Total			**17**	**9**	**--**	**225**	**500**	**23**

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

SNO	ELECTIVE-II Course Code	Title of Elective –II Course
1	16CH E 02	Surface Coating Technology
2	16CH E 03	Technology of Vegetable Oils and Fats

SNO	ELECTIVE-III Course Code	Title of Elective –III Course
1	16CH E 04	Corrosion Engineering
2	16CH E 05	Mineral Processing Technology

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16CH C 12

CHEMICAL REACTION ENGINEERING - II

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

Course Objectives:

1. To understand various models in non-ideal reactors.
2. To understand properties of solid catalysts.
3. Develop rate laws for reactor design based on reaction data from a reactor or set of reactors in heterogeneous systems.
4. To understand concepts of catalysts deactivation.
5. To develop kinetics for solid – fluid and fluid – fluid reactions.

Course Outcomes: On successful completion of this module, students should be able to

1. Predict conversions in non-ideal reactors using various models.
2. Understand phenomena for catalytic activity and determine various properties of catalysts.
3. Describe the steps in a catalytic mechanism, derive a rate law theoretically and the effects of pore diffusion.
4. Derive rate equations and other kinetics parameters of catalytic reactions from experimental data.
5. Analyze performance of catalysts when deactivating.
6. Understand the concepts of fluid-fluid and fluid particle reaction kinetics.

UNIT - I

Analysis of Non ideal Reactors - Basic concepts, Compartment models - hints, suggestions and possible applications. Dispersion number from C and F curves, Conversion using dispersion and tanks in series models for the first order irreversible reaction.

UNIT - II

Solid Catalysts - Adsorption, adsorption isotherms, surface area, void volume and solid density, pore volume distribution. Theories of heterogeneous catalysis,

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classification of catalysts, catalyst preparation, promoters and inhibitors.(to the extent covered in J.M. Smith only).

UNIT - III

Solid Catalyzed Reactions - Introduction; Development of rate expressions from L- H - H - W models for reaction A + B R + S under adsorption, surface reaction and desorption controlling condition. Pore diffusion resistance combined with surface kinetics (Single cylindrical pore, first order reaction) Porous catalyst particles. Experimental methods for finding rates.

UNIT - IV

Catalyst deactivation- Mechanisms of catalyst deactivation, the rate and performance equations: The rate equation from experiment, determining the rate for batch solid in contact with fluid in batch, mixed flow and plug flow modes for independent deactivation. Effect of pore diffusion resistance.

UNIT - V

Kinetics of fluid - fluid reactions: The rate equation for straight mass transfer of A (absorption). The general rate equation and the rate equation for reaction with mass transfer.

Kinetics of fluid-particle reactions: selection of a model, PCM, SCM, comparison of models with real situations. Shrinking core model for spherical particles of unchanging size: Diffusion through gas film controls, Diffusion through ash layer controls, chemical reaction controls. Rate of reaction for shrinking spherical particles.

Text Books:

1. Octave Levenspiel, Chemical Reaction Engineering, John Wiley & Sons - Third edition, 1999.
2. J M Smith, Chemical Engineering kinetics, McGraw - Hill, Third Edition, 1981.

Suggested Reading:

1. H Scott Fogler, Elements of Chemical reaction Engineering, Prentice - Hall, Fourth edition, 2005.
2. Gavhane, Chemical Reaction Engineering-II, Nirali Prakashan.

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16CH C 12

MASS TRANSFER OPERATIONS – I

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

Course Objectives: This course help the students to understand

1. The rate equations
2. Mass transfer coefficients,
3. Interphase Mass transfer
4. Humidity, Enthalpy of Vapor-gas Mixture(Air- water vapor)
5. Various unit operations viz., absorption, humidification, drying.

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

1. Write rate equations for any mass transfer operations.
2. Calculate the mass transfer coefficients using different corelations.
3. Calculate the resistances offered by gas-phase and liquid phase.
4. Design Absorber/Stripper by equilibrium method to find the number of theoretical Stages.
5. Design Cooling towers(able to find the height of packed bed required).
6. To find the total time required in in-direct heating tray dryers.

UNIT - I

Diffusion and Mass Transfer – Mass transfer operations & their applications. Molecular diffusion –Fick's first law – steady state molecular diffusion in binary mixtures of gases, liquids and solids – Determination of diffusivity in gases by Stefan-Maxwell method: estimation of diffusion coefficients in binary mixtures of liquids and gases by correlation.

Eddy diffusion – Basic concepts of mass transfer theories – Film mass transfer coefficients for the cases of equimolar counter diffusion and diffusion of one component (A) in stagnant component (B) - Correlation's for mass transfer coefficients and Reynolds & Colburn analogies.

UNIT - II

Interphase Mass Transfer – overall mass transfer coefficients – Two resistance theory – Gas phase and liquid phase controlled situations. Gas – liquid contact: Description of Continuous and stage wise contact equipment, packing for packed

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columns – Liquid distribution. Mass transfer coefficients in packed columns, Flooding in packed and plate columns, Ideal stage, Murphree, Point and Overall column efficiency, Comparison of packed and plate columns.

UNIT - III

Absorption and Stripping: counter current and co-current isobaric absorption and stripping of single component – Operating Lines – Minimum flow rates – Determination of number of plates – absorption factor.Determination of number of transfer units and height of a continuous contact packed absorbers. Kremser – Brown equation for tray towers and packed towers.

UNIT - IV

Humidification: Vapour, gas mixtures – Humidity and relative saturation. Dew point adiabatic saturation and wet bulb temperatures – psychrometric charts – Enthalpy of gas vapor mixtures.Humidification and Dehumidification – Operating lines and design for water cooling tower . Equipments of Water- Cooling towers and Spray chambers.

UNIT - V

Drying:Equipments for Drying, moisture contents of solids – equilibrium, bound and unbound moisture.Design conditions – Rate of batch drying under constant drying conditions – Mechanism of batch drying – total time for batch drying.

Text Books:

1. R.E. Treybal, “Mass Transfer operations”, 3rd Edition, McGraw Hill Book Co., 1981

Suggested Reading:

1. Christie John Geonkoplis “Transport Processes and Separation Process Principles”, 4th edition. PHI, New Delhi., 2009.
2. J Coulson and Richardson,”Fluid Flow, Heat and Mass Transfer”, Volume 1, 6th Edition, Pergoman Press, 2009.

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16CH C 13

PROCESS INSTRUMENTATION

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

Course Objectives: This course helps the students to understand the:

1. Fundamental elements of industrial instruments and their characteristics.
2. Different types of temperature measuring instruments and their industrial applications.
3. Different types of pressure measuring instruments.
4. Methods applied for composition analysis in process industries
5. Different types of flowmeters and level measuring devices.

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

1. Identify and select instruments based on their purpose and function as required in process industry.
2. Select temperature measuring instrument based on the range of operation.
3. Select pressure measuring instrument based on their application.
4. Identify and apply different methods of composition analysis in process industry.
5. Select flow measuring instrument based on type of fluids.
6. Select level measuring instrument based on their need in process industry.

Unit I: Importance of industrial instrumentation

Need, significance, applications and classification. Functional units – elements of instruments and their functions as sensors, transducers, transmitters and receivers. Static and dynamic characteristics of instruments.

Unit II: Temperature measurement

Expansion thermometers – types, mercury in glass, bimetallic, pressure spring type, drawbacks for industrial applications. Industrial thermocouples – types and range of operation, lead wires, need of thermowells.

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Industrial resistance thermometers – types of sensors, Resistive Temperature Detectors [RTD], Thermistors. Infrared thermometry – pyrometers, radiation receiving elements, radiation pyrometer, optical pyrometer.

Unit III: Pressure measurement

Manometers types – U-tube, well type, enlarged leg, inclined leg, ring balance type. Elastic transducer elements – bourdon, bellow and diaphragm.

Electrical pressure transducers – Linear variable differential transformer (LVDT) and strain gauge. Introduction to standard vacuum gauge – McLeod gauge and Pirani gauge.

Unit IV: Flow and Level measurement

Flowmeters – head type, area type, mass flowmeter, electromagnetic flowmeters. Level measurement – hydrostatic head, float type, RF capacitance, Radar type.

Unit V: Analytical Techniques

Spectroscopic analysis, absorption type – infrared, UV, X-ray and NMR. Emission and Mass spectroscopy.

Analysis of moisture in gases (humidity) by psychrometer, hygrometer, dew point methods. Introduction to chromatography – types, uses, Gas Liquid Chromatography, Thin layer Chromatography.

Text Books:

1. Principles of industrial instrumentation, D. Patranabis, 2nd ed., Tata-McGraw Hill Edu. (India) Pvt.Ltd., New Delhi, 2013.
2. Industrial Instrumentation, Donald P. Eckman., CBS pub & distr. Pvt. Ltd., New Delhi, 2004.

Suggested Reading:

1. Instrumentation operation, measurement, scope and application, N. V. S. Raju, B S Pub., Hyd., 2016.
2. Introduction to measurements and Instruments, Arun K. Ghosh, PHI learning Pvt. Ltd., New Delhi, 2013.

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16 CH E 02

SURFACE COATING TECHNOLOGY
(ELECTIVE –II)

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

Course Objectives:

1. To give fundamental concepts in paints (including industrial paints and domestic paints)
2. Basic properties, uses of main ingredients like pigments, extenders, binders, solvents.
3. To know more about paint application systems (both air drying paints and stoving paints of liquid paints and power paints).
4. Study of paint formulation including manufacturing of different types of paints and special paints.
5. Study about quality of paints (including paint tests and paint defects).

Course Outcomes:

1. To identify the suitable paints for domestic and Industries.
2. To study more about specific paint manufactures.
3. To know main ingredients of paints,their manufacturers and properties.
4. To come across the usage of different types of solvents for both industrial paints and domestic paints and also about paint solid structures (Resins).
5. To identify the suitable application methods for powder and liquid paints and also to develop paint testing Lab.
6. The student can differentiate between normal paints and special paints and their applications and uses.

UNIT-I

Introduction: Surface coatings- Scope, properties, applications & uses. Major components of surface coatings. Fundamentals of film formation

Classification of Paints: Air drying paints, stoving paints, their properties and uses. Liquid paints & powder paints, their properties & uses.

Manufacture of Paints: Distempers- Manufacture, properties & uses. Powder Paints- Manufacture, properties & uses. Enamel - Manufacture, properties & uses.

UNIT – II

Pigments: Importance of pigments - their basic properties, uses & their applications. Classification of pigments: Inorganic & organic pigments.

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Special properties of pigments: Criteria for selection of color, tinting strength, fastness to light, bleeding, hiding power, refractive index, particle size & anti-corrosive properties.
Manufacture of Pigments: Titanium di-oxide, red lead, Ultramarine blue.

UNIT – III
Extenders: Importance, properties & significance.
Manufacture of Extenders: Blanc fixe, China clay, Gypsum, Mica & talc.
Solvents: Importance, uses & their properties,
Manufacture of solvents: Turpentine, Alcohols- Methyl Alcohol, Ethyl Alcohol, n-Propyl Alcohol .
Natural Resins: Rosin & shellac. Synthetic Resins: Alkyd resins, phenolic resins, amino resins.

UNIT – IV
Application methods of paints: Air drying paints, industrial liquid stoving paints & industrial stoving powder paints. Brush application, Roller coating, spray application, electrostatic spray application.
Testing of Paints: Wet paint & dry paint testing film like thickness, adhesion, resistance ,gloss, impact & paint coverage. Defects in paints & paintings & their remedies: defects in grinding skinning, sagging, bleeding, flooring, floating, brushing, orange peel, fish eye, brush marks, lifting.

UNIT – V
Special Coatings: Importance, Significance & their applications.
Powder Coatings, Water soluble coatings, aluminum coatings, water proof coatings, heat resistant coatings, automobile coatings, fire retardant coatings, space, air craft coatings, swimming pool coatings and Anti Micro growth Paints (Marine Paints).

Text Books:

1. W.M. Morgans, “Outline of Paint Technology”, Edward Arnold Publishers, London, 1990
2. R. Lambourne& T A Strivens, “Paint & Surface coatings”, Second edition, 1999

Suggested Reading:

1. Patton Temple, “C Pigment Flow & Pigment Dispersion”, Wiley Inter science, 1979
2. Swaraj Paul, “ Surface Coatings science and technology” , 1995

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16CH E 03

TECHNOLOGY OF VEGETABLE OILS AND FATS
(ELECTIVE –II)

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

Course Objectives:

1. To impart knowledge about sources, types and composition of oils and fats
2. To comprehend the physicochemical characteristics
3. To familiarize the students about extraction and processing
4. To study the production of value added products from oils and fats
5. To study the methods of preparation of soaps and detergents

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

1. Analyze the various properties of fats and oils to determine their use in food, soap and other industries
2. Identify unit operations involved in extraction of oils
3. Know the methods of purification of oils and fats
4. Know about the degradation occurring during storage of oils and fats and prevention methods
5. Understand the mechanism Hydrogenations of oils
6. Know the techniques involved in the preparation of soaps

UNIT – I

History and general introduction: Oils, fats, waxes,essential oils, their sources and composition. Natural glyceride constituents of oils and fats: Triglycerides, fatty acids, their nomenclature, and structural formulas. Distribution of fatty acids among glyceride molecules : Even and Random Distribution theories .Non-Glyceride Components: Phosphatides, sterols, pigments, tocopherols, tocotrienols, oryzanol, β-carotene

UNIT – II

Classification of Oils and Fats with Examples, Physical and chemical properties, iodine value, saponification value, hydroxyl value of oil and fats. Detailed glyceride composition of the following oils – palm, palm kernel, coconut, cotton seed, peanut, sunflower, safflower, sesame, rice bran and mustard, linseed (flax seed), soya been,

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Tung, castor oil, lard, tallow and fish oils. Industrial applications of Non Traditional oils - Neem, Karanja and Jatropa

UNIT– III

Chemical Reactions of Oils and Fats:

Reactions in the fatty acid chain - Hydrogenation, Oxidation reactions, .Esterification and Interesterification, Saponification, formation of metal soaps, Hydrogenolysis, formation of fatty amines, fatty amides and fatty chlorides, Halogenation, Addition of Maleic anhydride, sulfation, sulfonation Chemical oxidation(hydroxylation), atmospheric oxidation (rancidity), Polymerization, Isomerisation.

Reaction of hydroxyl groups

UNIT – IV

Storage, Pre-treatment of Oil Seeds, Mechanical expression of oils, Solvent extraction of oils, Fat splitting (chemical and enzymatic methods)

UNIT – V

Chemical and Physical Refining: De-gumming, neutralization, refining losses, Miscella refining, Bleaching, dewaxing, and Deodorization.

Partial and Total Hydrogenation: Mechanism, selectivity, continuous process, preparation of Raney Nickel catalysts.

Soap Manufacture: Selection of raw materials, Full boil process, INS factor and Solubility ratio.

Text Books:

1. Ed. D Swern, “Bailey’s Industrial Oils and Fats Products” , Wiley Inter Science publication, N.Y. John Wiley and Sons ,6th Edition, 2006

Suggested Reading:

1. M M Chakrabarty , “Chemistry and Technology of Oils and Fats”, Allied Publishers Pvt.Ltd., 1st Edition, 2007
2. O P Narula, “Treatise on fats,Fatty acids and Oleochemicals”, Vol I and II, Industrial Consultants (India), 1994
3. R J Hamilton , “Recent Advances in Chemistry and Technology of Fats and Oils”, Elsevier Applied Science 1987
4. Chemistry and Technology of Oils and Fats, 2003, Edited by M.M. Chakraborty

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16CH E 04

CORROSION ENGINEERING
(ELECTIVE " III)

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 helps the students to understand the:

1. Definition and classification of corrosion.
2. Principles of corrosion, common corrosion forms,
3. Different corrosion testing methods.
4. Corrosion control methods and material selection for cost reduction.
5. Modern theories to explain corrosion

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

1. Identity the type of corrosion.
2. Correlate the damage with the cause of corrosion.
3. Identify the correct method of testing any corrosion.
4. Select the appropriate preventive method to avoid corrosion.
5. Select the significant coating for corrosion prevention.
6. Apply modern method of corrosion measurement.

UNIT–I: Introduction:

Definition, corrosion environments, damage, classification of corrosion. Principles and corrosion rate expressions. Environmental effects such as velocity, temperature, galvanic coupling. Metallurgical and other aspects

UNIT– II: Different forms of corrosion:

Uniform attack, galvanic corrosion, crevice corrosion, fitting corrosion, inter–granular corrosion, selective leaching, erosion corrosion, stress corrosion and hydrogen damage. Pitting: pit shape and growth, velocity, metallurgical variables, evaluation of pitting damage, prevention.

UNIT– III: Corrosion testing methods:

Classification, purpose, surface preparation, measuring and weighing, duration, plant interval test, NACE test methods, slow – strain rate test and paint test.

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Composites testing: Exposure techniques, Huey test, Sea water test, Stress corrosion, Corrosion of palstics, Invivo corrosion.

UNIT–IV: Corrosion prevention methods:

Selection of metals and alloys–Cast iron, steel, Al, Mg, Ti, Composites and Refractory metals. Non-metallics: Thermosetters, laminates and reinforced plastics, Rubbers, Wood, Ceramics, Carbon and Graphite. Alteration of environment such as changing mediums, lowering temperature, design rules, design of cathodic and anodic protection, selected coating techniques to prevent corrosion; Failure analysis. High temperature corrosion.

UNIT – V: Advanced techniques:

Modern theory–principles and applications, electrode kinetics, predicting corrosion behavior, corrosion prevention, Corrosion rate measurements in Petroleum Industry with examples.

Text Books:

1. Pierre R. Roberge, " Handbook of Corrosion Engineering", 2nd edition, MCGraw-Hill, Newyork, 2012
2. Zaki Ahmad, "Principles of Corrosion Engineering and Corrosion Control", Butterworth-Heinemann, 2006.

Suggested Reading:

1. Pierre R Roberge, "Corrosion Engineering – Principles and Practice, MCGraw-Hill, 2008
2. Pierre R. Roberge, Corrosion Basics: An Introduction, NACE International, 2006.

Web resources :

1. www.academia.edu/5491377/corrosion_engineering_mars_g._fontana

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16CH E 05

MINERAL PROCESSING TECHNOLOGY

ELECTIVE - III

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

Course objectives:

1. Review all unit operations in mineral processing technology and the mineral concentration processes.
2. Introduce students to the importance and principles of materials handling in the mineral processing plant with special emphasis on feeding and conveying of bulk material.
3. Provide students the opportunities to acquire practical skills in concentrates handling, grade.
4. Determination, recovery and loss calculation and participatory laboratory experiments.

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

1. Understand the principles governing a range of processes applied in the mineral industry.
2. Describe typical unit processes and flow-sheets for production of a number of metals.
3. Apply basic engineering principles to the design of mineral processes.
4. Produce conceptual designs for simple extraction processes.
5. Understand the operation of beneficiation units for coal and mineral.

UNIT – I: Introduction to Mineral Processing, Scope and importance. Properties and Types of Minerals

Ore handling: removal of harmful materials - sampling of ores: moisture sampling, assay sampling, sampling systems, sample division methods.

UNIT – II:

Mineral Liberation, degree of liberation, concentration, measures of assessing metallurgical performance viz., recovery, ration of concentration, grade, enrichment ratio.

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Laboratory sizing: particle size and shape, sieve analysis, sub sieve techniques, centrifugal methods (warman cyclosizer), microscopic sizing, online particle size analysis.

UNIT – III:
Classification: Principle, types of classifiers – Gravity concentration: principle, concentration in vertical surren (Jigging), Jigs, types of Jigs viz., Harz Jig, circular and radial jigs, coal jigs (Baum and Batac jigs) – Gravity concentration in streaming currents: pinched sluice, cones, spirals, shaking tables.

UNIT –IV:
Heavy medial separation: Principle, liquids and suspension for heavy media separation.
Separation vessels : Gravitational vessels (Wemco Cone separator, Drum separator)
Centrifugal separators: (Vorsyl separator, LARCODEMS, Dyna whirlpool separator) DMS cyclone DMS circuits.

UNIT – V:
Floatation – History and theory: contact angle, work of adhesion; Floatation Reagents: collectors, frothers, regulators; and their action – Floatation practice: ore and pulp preparation, reagents and conditioning- Flotation Machines: pneumatic (Davcra cell, flotation column, Jameson cell, froth separators) and mechanical (Denver cell, Wemco cell) electro flotation, skin flotation, Case studies: i) Coal Beneficiation process. ii) Different methods for fine particles collections(Copper, Iron, Au).

Text Books:
1. B.A.Wills – "Mineral Processing Technology " –7th edition Maxwell International Edition - 1987.
2. S.K.Jain "Ore Processing"Oxford and TBHY Publishing Co. (P) Ltd., India (1986).
3. S. K. Jain, Ore Processing, Oxford- IBH Publishing Company, 2005.

Suggested Reading:
1. Ashoka Gupta & Denis Yen, "Mineral Processing Design and Operations", 1st Edition, Elsevier Publishers.

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16CH C 14

MECHANICAL UNIT OPERATIONS LAB.

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

Course Objectives:

1. To provide student the opportunity to acquire practical skills in mechanical unit operations.
2. To introduce students the importance and principles of material handling.
3. To provide an overall view of size reduction equipments.
4. To know the techniques of separating solids based on size by different methods.
5. To impart the concept and functioning of filtration unit.

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

1. Understand mechanical unit operations and their role in chemical engineering industries.
2. Understand the nature of solids, their characterization, handling and the processes involving solids.
3. Analyze the performance of size reduction equipment and calculate the power and efficiency requirements.
4. Understand the solid-fluid separation process and operation.

LIST OF EXPERIMENTS

(Minimum of 8 Experiments in the list are to be performed)

1. Verification of the laws of size reduction using Jaw crusher.
2. Verification of the laws of crushing using drop weight crusher and determination of work index.
3. Determination of laws of crushing in a pulverizer.
4. Verification of the comminution laws and critical speed of a ball mill
5. Analysis of various sizes of given material by sieve analysis and determination of cumulative and differential analysis.

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6. Determination of the specific cake resistance and medium resistance in a vacuum filter or plate and frame filter press.
7. Calculation of the effectiveness of screen in horizontal and inclined position (vibrating screens)
8. Determination of separation factors of air and hydraulic classifiers.
9. Determine settling rate classification of particles using cyclone separator and to determine the efficiency
10. Determination of the froth flotation characteristics in mineral concentration.

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16CH C 15

PROCESS HEAT TRANSFER LABORATORY

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

Course Objectives:

1. To make students to understand the basic concepts of fundamentals of heat transfer modes.
2. To make students learn the applications of modes of heat transfer.

Course Outcomes:

1. At the end of the semester the students will be in a position to know the principles involved in different modes of heat transfer.
2. They will be in a position to design and analyze heat exchangers such as shell and tube, extended surface exchangers etc.
3. Thermal conductivity of insulating materials can be found by them involving conduction mode. Emissivity of given surfaces will be found based on radiation phenomenon.

LIST OF EXPERIMENTS

(Minimum of 8 Experiments in the list are to be performed)

1. Determination of Thermal conductivity of given insulating powder under steady state conditions.
2. Determination of interface temperatures in composite wall under steady state conditions.
3. Determination of heat transfer coefficient in Natural convection.
4. Determination of overall heat transfer coefficient in unsteady conditions
5. Determination of inside heat transfer coefficient in coil heat exchangers
6. Determination of overall heat transfer coefficient and effectiveness of a Double pipe heat exchanger

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7. Determination of heat transfer area in a 1-2- shell and tube heat exchangers
8. Determination of heat transfer coefficient on a single tube by film wise and drop wisecondensation.
9. Determination of emissivity and Boltzmann's constant of a sample body
10. Determination of heat transfer coefficient in forced convection.
11. Determination of fin efficiency of longitudinal fins of extended surface
12. Determination of peak flux and critical temperature drop in pool boiling of saturated liquid
13. Determination of heat transfer coefficient of a pin fin under free convection.
14. Determination of heat transfer coefficient of a pin fin under forced convection

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16CH E 06

SURFACE COATING TECHNOLOGY LAB
(ELECTIVE – II LAB)

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

Course Objectives : To make the students

1. understand the theoretical concepts of organic surface coating technology (Paints)
2. perform the experimental procedures on paints to determine various properties.
3. practice various application systems of powder paints and liquid paints

Course Outcomes :

1. Students are able to understand the importance of Organic surface coatings.
2. Students are able to perform different paint tests and analyze the quality of paints.
3. Student can differentiate between lacquers , varnishes and paints.

LIST OF EXPERIMENTS

(Minimum of 8 experiments are to be performed)

1. Preparation of panels for painting (power coating or liquid paints)
2. Powder particles size analyser
3. Determination of apparent viscosity of paints (only liquid paints)
4. Determination of resistance to scratching under a specified load of a dried film of paint
5. Measurement of paint film thickness using dry film thickness gauge (finish paint)
6. Determination of flexibility and adhesion of the paints (as per 101 BS 3960 m and size ¼ inch)
7. Determination of impact resistance of the painted panel
8. Measurement of hardness of magnesium phosphate coating or zinc phosphate coating
9. Measurement of gloss of painted film at 45 degree angle

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10. Determination of drying consistency of different paints
11. Determination of coverage or spreading capacity of different paints
12. Salt Spray Test (only for Powders)

Text Books:

1. Industrial Hand Books
   a). Berger Protection Protective Coatings – Product Data Manual
   b). Goodlass Nerolac Paints Product Data Manual
2. ICI Paints Quality Manual Book

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16CH E 07

TECHNOLOGY OF VEGETABLE OILS AND FATS LABORATORY (ELECTIVE -II)

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

Course objectives: - To make students to understand the

1. Theoretical concepts by performing the practicals on some of the important physical and chemical properties of oils and fats.
2. Procedure involved in knowing the characteristics of different oils and fats.

Course Outcomes: - At the end of the semester the students will be in a position

1. to analyze the different oil samples
2. to carry out various techniques used to determine quality oils and fats.

Technology of vegetable oils and fats laboratory (Elective II -Lab)

1. Determination of Acid value of given samples
2. Determination of percentage of free fatty acid present in the given sample and its acid value
3. Determination of Iodine value of given sample
4. Determination of saponification value of given oil samples
5. Determination of the hydroxyl value of given samples
6. Determination of unsaponifiable matter of given oil sample
7. Determination of melting point of fats.
8. Determination of the percentage of moisture and volatile matter under the conditions of test
9. Determination of total fatty matter (TFM) in soaps

Note: - A minimum of 8 experiments should be performed

Reference Books and suggested readings:

1. BIS specifications; IS- 548, part I,II & III
2. A text book of oil and fat analysis By Cocks & Reid
3. Modern Technology in Oils and Fats Industry, Vol-II, OTAI (NZ)

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

B.Tech (Chemical Engineering)

SEMESTER -VI

S.NO	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Periods per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16CH C16**	Bio Chemical Engineering	3	--	3	30	70	3
2.	**16CHC 17**	Chemical Engineering Thermodynamics – II	4	--	3	30	70	4
3.	**16CH C18**	Chemical Process Safety	3	--	3	30	70	3
4.	**16CH C19**	Process Dynamics and Control	4	--	3	30	70	4
5.	**16CH C20**	Process Modeling Simulation And Optimization	4	--	3	30	70	4
6.	--	Elective-IV	3	--	3	30	70	3
PRACTICALS								
7.	**16CH C 21**	Chemical Reaction Engineering Laboratory	--	3	3	25	50	2
8.	**16CH C 22**	Process Dynamics And Control Laboratory		3	3	25	50	2
9.	**16CH C23**	Process Modeling Simulation Laboratory	--	3	3	25	50	2
Total			**21**	**9**	**--**	**255**	**570**	**27**

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

SNO	ELECTIVE-IV Course Code	Title of Elective –II Course
1	16CH E 08	Energy Engineering.
2	16CH E 09	Fluidization Engineering.
3	16CH E 10	Pharmaceutical Technology

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

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16CH C 16

BIO CHEMICAL 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 functions of living cells
2. To apply the principles of Chemical Engineering to bioprocesses.
3. Conduct analysis on the biological factors that are important in the design, operation, performance, and/or monitoring of a biological process
4. To understand the significance of microbes
5. To understand the applications of different bio processes

Course Outcomes: On successful completion of this module, students should be able to

1. Describe the basic structure and function of cells & Relate cell function to products and processes useful to man
2. Understand classification, growth concepts and various types of interactions in microbes
3. Significance of enzymes as biocatalysts.
4. Identify and explain the basic features of bioreactors
5. Describe the principles of the various separation procedures involved in the downstream processing of products
6. Understand various other aspects of bioprocess technology viz, fermentation types, media formulation, environmental biotechnology and commercial aspects.

UNIT – I Basic Concepts of Biochemical Engineering, Molecular Biology& Bio Chemistry

Biochemical Engineering Principles, Biophysics and cell doctrine:

Atomic Theory and Cell Theory, Important cell types, structure and functions of a typical cell and their components, Transport across cell membranes: Passive and facilitated diffusion, Active transport.

Structure and functions of Bio Molecules:

Carbohydrates, lipids, Nucleotides to Nucleic Acids – RNA and DNA, Amino acids to Proteins - the building blocks of biochemical life.

Biosynthesis and Metabolic Pathways:

Biosynthesis of Small and Macro Molecules Introduction of metabolic pathways and end products of glucose metabolism

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UNIT – II Introductory Microbiology

Introduction to Microbiology: Classification and Industrial uses of Microorganisms Growth and Reproduction of Microbes: Growth cycle phases for batch cultivation. Monod's growth kinetics – Growth Rate dependant classification of Microorganisms Microbial Genetics: Recombinant DNA technology and mutant populations. Multiple Interacting Microbial populations: Neutralism, Mutualism, Commensalism, Amesanalism, Predatism and Parasitism

UNIT – III Enzyme Technology

Enzymology: Enzymes as Biocatalysts - The enzyme substrate complex and enzyme action and Classification of Enzymes based on Functions.

Kinetics of Enzyme Catalyzed Reactions: Simple enzyme kinetics with one and two substrates. Determination of rate constants, substrate activation and inhibition, modulation and regulation of enzyme activity / effect of PH and temp on enzyme activity

Immobilized Enzyme Technology: Types of Enzyme immobilization, Immobilized enzymes in industrial processes, Cofactors, Apo-enzymes and Coenzymes utilization and regeneration

UNIT – IV Bioreactors and Down Stream Techniques - Introduction

Design and Analysis of Biological Reactors: Batch and Continuous Stirred Tank Reactors, Enzyme reactors Ideal Reactors for kinetic measurements: The ideal batch reactor / The ideal continuous flow stirred tank reactor - Alternate bio-reactor configurations

Separation Processes: Filtration, Centrifugation, Adsorption, Reverse osmosis, Dialysis, Electrophoresis, Sedimentation and Extraction Purification Processes: Precipitation, Crystallization, and Chromatography

UNIT – V Bioprocess Technology

Fermentation Technology: Types of Fermentation ,Medium formulation and Culture Propagation, Environmental biotechnology: Effluent treatment.

Industrial Biotechnology: Commercial enzymes, Antibiotics and single cell protein

Text Books:

1. James, E Bailey and David F Ollis, “Biochemical Engineering fundamentals”, 2ndEdition, McGraw-Hill Internal Edition.1986

Suggested Reading:

1. Michael L Shuler and Fikret Kargi, “Bioprocess Engineering: Basic Concepts”. Second Edition Prentice Hall, 2002
2. Coulson & Richardson's' Chemical Engineering” Vol 3, Third Edition, Elsevier Publishers, 2006
3. D.G., Rao, “Introduction to BioChemcial Engineering” Second Edition, TMGH Pvt Ltd, 2010

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16CH C 17

CHEMICAL ENGINEERING THERMODYNAMICS – II

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

Course Objectives: This course helps the students to understand about

1. The concepts of Partial and Molar properties, Chemical Potential, Fugacity& Fugacity coefficients.
2. The concepts of fugacity in mixtures and various methods to obtain Fugacity Coefficient in mixtures.
3. Phase Rule and Various models used to determine the activity coefficients.
4. Calculation procedure to generate Vapor- Liquid equilibrium (VLE) in form of T-X-Y or P-X-Y for miscible binary mixtures.
5. Methodology adopted to determine equilibrium constant.

Course Outcomes: The students will be able to

1. Calculate the Partial Properties and Fugacity coefficients using various equations.
2. Calculate Fugacity and Fugacity Coefficients for miscible binary Mixtures.
3. Calculate and determine the activity coefficients by various models.
4. Calculate the Vapor- Liquid equilibrium (VLE) in form of T-X-Y or P-X-Y for miscible binary mixtures using various models.
5. Generate the Vapor- Liquid equilibrium (VLE) in form of T-X-Y or P-X-Y for miscible binary mixtures using various models.
6. Calculate and determine equilibrium constant and composition of product mixture at given temperature and pressure.

UNIT - I

Criterion of Phase Equilibrium: Fundamental property relations, Chemical potential, Gibss -Duhem equation, Partial Properties, Relation between Partial Properties and Molar properties, Chemical potential equation for an ideal gas, Fugacity, Fugacity Coefficients, Determination of Fugacity Coefficient by equations of states (Virial, Vander Waal, R.K. equation.)

UNIT - II

Solution Thermodynamics: Fugacity of pure liquids, Fugacity for Mixtures, Poynting factor, Residual Properties, Excess Properties, Lewis Randall Rule, Activity Coefficients.

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UNIT - III

The Nature of Phase Equilibrium: The Phase Rule, Duhem's Theorem, Models to calculate Activity Coefficients (Margules Equation, Van-laar, Wilson), Introduction to UNIQUAC, UNIFAC. Method to get activity coefficients (Margules and Van laar) by using Excess Gibbs Free Energy models.

UNIT - IV

Application of Phase Equilibrium: To get T-x-y, P-x-y, Using Raoult's law, Modified Raoult's law for miscible binary mixtures, following methods of BUBBL-T, Dew-T, BUBBL-P, DEW-P. Algorithm to find VLE by Peng- Robinson, R-K- Equation.

UNIT - V

Chemical Reaction Equilibrium: Reaction Coordinate, Equilibrium criteria for chemical reactions, equilibrium constant and effect of temperature , temperature and pressure effects on conversion, Calculation of equilibrium conversion for single reactions in homogenous systems, Duhem's Theorem for reacting systems.

Text Books:

1. J M Smith and H C VanNess, "Introduction to Chemical Engineering Thermodynamics", McGraw Hill, International Edition,Fourth edition, 1987.

Suggested Reading:

1. Pradeep Ahuja, "Chemical Engineering Thermodynamics", PHI Publishers, EEE, 2009
2. YVC Rao, "Chemical Engineering Thermodynamics" Universities Press, 2003.

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16CH C 18

CHEMICAL PROCESS SAFETY

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

Course Objectives: This course helps the students to understand the:

1. Importance of safety culture in process industry.
2. Disregard for ethical decision making based on numerous case studies.
3. Interaction and implementation of trade-offs concept in chemical plant operation.
4. Examples of problems that can occur with inadequate process design, improper process modification.
5. Different case studies related to industrial processes

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

1. Evaluate effect of chemical hazards and risks of toxicants.
2. Analyze chemical incidents and possible consequences to plant facilities, workers, and the general public.
3. Apply the technique of safe process design.
4. Analyze fire and explosion hazards.
5. Integrate safety concepts into chemical plant design.
6. Follow the ethics during process plant operation.

UNIT – I

Introduction: Process industrial safety –definition, importance. Safety awareness – Safety aspects of site selection, plant planning and layout, check list, inline arrangement of tower drums, exchangers, pumps and main pipelines.

Case studies of major disasters due to safety violations: Chernobyl disaster, Bhopal disaster, recent oil spills. Chemical hazards and workers safety, industrial process case studies.

UNIT – II

Organized labor interest in safety: Involvement of unions in accident prevention, recommendation of occupational health committees. Work Policy of MCA in accident prevention at process industries. Risk assessment procedures (HAZOP) and typical operational practices. Necessary precautionary measures (OSHA).

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Hazards: Identification and operability studies. Involvement of chemical criminals in process industries and their prevention. DOW Fire and explosion index, calculation of the DOW Fire and EI. Chemical safety data sheets and guides.

UNIT – III

Safety education and training: Training of personnel, on- the- job and job instructed training, meeting and instructional presentations. Effects of toxic Agents, chemicals and smoke on skin, eyes, respiratory tract, digestive tract. Primary protection equipment (PPE) – types, significance and applications. Measuring safety effectiveness: criteria for effective measurement, disabling (Lost-time) injuries, frequency rate, severity rate. Problem related safe-t-score. Involvement of inspector of factories in accident prevention. The technique of safe process design, separation sections, materials handling, storage sections, flowsheet review.

UNIT – IV

Fires and explosions: Definition of fire, fire triangle, Classification of fires as Class - A, B, C and D. Reaction of fires. Fire extinguishers: Portable fire extinguishers applications and their uses, Construction and working of water, Mechanical foam, CO_2, stored powder, ABC powder. Automatic multiple CO_2 extinguishers in chemical process industries.

UNIT – V

Emergency preparation and accident investigation: On-site and off-site emergency plan and infrastructure, learning from accidents, layered investigation, equipments aiding in diagnosis. Safety audit: Introduction, essentials, requirements, programs and procedures.

Text Books:

1. D. A. Crowl and J.F. Louvar, “Chemical Process Safety”, Prentice Hall, New Delhi, 2011.
2. Howard H. Fawcett and W. S. Wood, “Safety & Accident prevention in chemical operations”, 2nd Ed., John Wiley and Sons Inc, 1982.

Suggested reading

1. Coulson and Richadson, “Chemical Engineering Design”, 3rd ed., Vol 6, TMH, 1999.
2. Fulekar M.H, “Industrial Hygiene and Chemical Safety”, I.K. International Publisher, 2006.
3. Sanders R.E., “Chemical Process Safety: Learning from case Histories”, Butterworth-Heinemann (Elsevier) pub, 2005.

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16CH C 19

PROCESS DYNAMICS AND CONTROL

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

Course Objectives: To provide a conceptual and methodological framework to

1. Analyze the transient behavior of simple chemical processes (using mathematical modeling from first principles and Laplace transforms)
2. Feedback control of processes - concepts, terminology, methods, and performance
3. Linearise relative to steady state
4. Obtain solution of linear dynamic problems in the laplace domain
5. Understand advanced control strategies with industrial examples

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

1. Characterize and analyze the dynamic behavior of linear systems (1^{st} and 2^{nd} order)
2. Understand the importance of various modes of control
3. Construct block diagrams for simple chemical processes
4. Analyze stability of simple feedback control systems
5. Analyze and tune process controllers to achieve desired performance
6. Empirically identify process dynamics

UNIT – I

Introduction: Response of First order system, Transfer Function, Transient response to step, impulse, sinusoidal forcing function, physical examples of first order systems, liquid level, mixing process, concept of time constant, linearization, response of first order systems in series, interacting and non-interacting systems

UNIT – II

Response of Second Order Systems: Transient response of under damped, critically damped, over damped systems to step, impulse and sinusoidal forcing functions. Transportation lag

Control Systems: Negative and Positive feedback control systems, Servo and Regulatory control problems, Development of Block diagram, Controllers and final control elements, Ideal transfer functions of P, PI, PD and PID controllers

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UNIT – III

Control system block diagrams and Stability: Reduction of physical control systems to block diagrams. Closed loop transfer functions for servo & regulator problems. Overall Transfer functions for multi loop control systems. Transient response of simple control systems for servo and regulator problems, measurement lags. Stability of a control system by Routh's Criterion

UNIT – IV

Root Locus: concept of root locus, plotting of the root locus diagram for feedback control systems, Transient response of control system from root locus plot.
Frequency response: Bode diagrams for first order, first order system in series, second order systems and for controllers and transportation lag. Bode stability criterion. Gain margin and phase margin

UNIT – V

Advanced Control Strategies: Cascade Control, Feed Forward Control, Ratio control
Controller Tuning and Process Identification: ISE, ITAE, IAE, Ziegler-Nicholas and Cohen-Coon tuning methods, process identification by step, frequency and pulse testing
Control valves: Construction, sizing, Characteristics and valve positioner (only theoretical aspects)

Text Books:

1. Donald R Coughanowr , Steven E LeBlanc, "Process Systems Analysis and Control", 3rd ed., McGraw Hill Inc, 2009

Suggested Reading:

1. George Stephanopoulos , "Chemical Process Control: An Introduction to Theory and Practice", PHI, 1984
2. Michael L Luyben, William L Luyben, "Essentials of Process Control", McGraw-Hill, 1997
3. Seborg, Edgar, Mellichamp and Doyle, "Process Dynamics and Control", 3rd Edition, Wiley India Pvt. Ltd., 2014

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16CH C 20

PROCESS MODELING SIMULATION AND OPTIMIZATION

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

Course Objectives: This course helps the students to understand the:

1. Fundamental laws of mass and of energy.
2. Uses and types of mathematical models.
3. formulate linear and non-linear process models.
4. formulate ODE process models and curve-fitting.
5. significance of optimization principles.
6. open-loop simulation and design of chemical processes.

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

1. formulate a process model by applying fundamental laws of mass and energy balance.
2. formulate linear and non-linear process models for chemical processes and apply numerical methods and MATLAB codes to solve them.
3. formulate ODE process models and solve by numerical methods and MATLAB coding.
4. fit polynomial functions as process models and solve by regression analysis and MATLAB coding.
5. optimize using different elimination methods of non-linear programming.
6. design and simulate chemical processes.

Note: Use of "MATLAB" programming techniques for problem solving.

UNIT – I: Formulation of process models

Definition of mathematical modeling, process models, types and uses, principles of formulation. Fundamental laws of mass and energy. Application of laws and process models to develop – Total continuity equation, component continuity equations, energy equation, momentum equation.

UNIT – III: Numerical solutions of linear and non-linear process models

Formulation of linear simultaneous process models and solutions by direct methods of Gauss-Elimination and Gauss-Jordan methods and indirect Gauss-Seidel method.

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Understanding the concept of ill-conditioning. Formulation of non-linear process models and solutions by Bisection, Regula-falsi and Newton Raphson methods.

UNIT – II: Curve-fitting and numerical solutions of ordinary differential process models

Curve-fitting and engineering problem solving by linear and nonlinear least square analysis. Formulation of ordinary differential process models and solutions by Euler's method and Runge-Kutta fourth order method.

UNIT – IV: Chemical process optimization

Introduction, engineering applications, statement of an optimization problem, design constraints, objective function, classification of optimization problems.
Non-linear programming – elimination methods like unrestricted search, exhaustive search, dichotomous search, Fibonacci method, golden-section method.

UNIT – V: Simulation of chemical processes

Application of mathematical modeling and open loop simulation and design of gravity flow tank, two-heated tanks, three CSTRs in series, batch reactor, binary distillation column.

Textbooks:

1. Applied numerical methods with MATLAB for engineers and scientists, Steven C. Chapra, 3rd ed., Tata-McGraw Hill Edu. (India) Pvt.Ltd., New Delhi, 2012.
2. Process Modeling, Simulation and Control for Chemical Engineers, by William L. Luyben, 2nd ed., McGraw Hill Pub. Co., New Delhi, 1990.
3. Engineering optimization, theory and practice, Singiresu S. Rao, 3rd ed., New-age Intl. Pvt. Ltd., Hyderabad, 1999.

Reference books:

1. Numerical methods for chemical engineering: Applications in MATLAB, Kenneth J. Beers, Cambridge Univ. press., New York, 2007.
2. Numerical methods in engineering and science (with programs in C, C++ and MATLAB), B. S. Grewal, 10th ed., Khanna pub., Nagpur, 2014.
3. Applied mathematical methods for chemical engineers, Mickley H.S., Sheerwood T.K., Reed C.E., McGraw Hill book Co., New York, 1957.

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16CH E 08

ENERGY ENGINEERING (ELECTIVE IV)

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

Course Objectives:

1. To impart knowledge on various energy sources and their applications
2. To introduce emerging technologies viz., fuel cells, bio fuels etc.
3. To know the process of crude fuels
4. To understand the advantages and disadvantages of various energy sources
5. To familiarize the concepts of energy audit and conservation

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

1. The significance and classification of energy sources.
2. The basic principles and fundamentals of conventional energy sources
3. The basics and applications of various non-conventional energy sources.
4. The production and future perspectives of bio fuels
5. The significance of future energy resources
6. The importance of energy auditing and conservation

UNIT – I

Introduction: Introduction to conventional and non conventional energy sources, alternative energy sources, their significance & availability, consumption patterns in India. Energy survey and policies for India

UNIT – II

Conventional Energy Sources:

Wood and wood Charcoal, products of wood carbonization Coal and Coal derived fuels, characteristics, production methods and uses. Oil and Gases: Fuels derived from oil and gases, Characteristics, production methods and uses. Technology for combustion of fuels derived from oil and gas. Shale oil and gas, oil sands

UNIT – III

Non conventional Energy Sources:

Solar Energy: Basics, Types of Solar Energy Collectors, Applications- Solar Distillation, pumping, production of hydrogen.

Photo Voltaic Cells: Introduction, Types of photo voltaic Cells, Applications, Electrical Storage and Future developments

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Wind-Energy: Introduction, Basic principles of wind energy conversion. Types of wind machines.

UNIT – IV

Bio Fuels: Introduction, Bio mass conversion technologies- Wet processes, dry processes, Bio-gas generation. Factors affecting bio-digestion, Classification of biogas plants Production methods, characteristics, uses of bio-diesel, bio-butanol and bio-ethanol, Second generation bio-fuel feed stocks.

Fuel Cells: Working principle, Types, Advantages, Current and Future Applications.

Nuclear Energy: Nuclear fission and fusion fuels processing, nuclear reactions and nuclear reactors.

UNIT - V

Energy Auditing and Conservation: Short term, medium term, long term schemes, energy conversion, energy index, energy cost, representation of energy consumption, Sankey diagram, energy auditing. Conservation methods in process industries, theoretical analysis, practical limitations.

Text Books:

1. G D Rai, "Non -conventional energy sources," Khanna Publishers, 4th edition, 2000.
2. Samir Sarkar, "Fuels and Combustion", Universities Press, 3rd Edition 2009.

Suggested Reading:

1. Om Prakash Gupta, "Fundamentals of Nuclear Power Reactors", Khanna Publishers S Srinivasan, "Fuel Cells: From Fundamentals to Applications", Springer, 2006.

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16CH E 09

FLUIDIZATION ENGINEERING
(ELECTIVE IV)

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

Course Objectives: This course helps the students to understand:

1. Basic fundamentals of fluidization and fluidized bed behavior.
2. Minimum fluidization and pressure drop across the bed.
3. Various models to analyze the behavior and mixing patterns.
4. Heat and mass transfer aspects of fluidized bed.
5. Concepts of fluidized bed combustion chamber.

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

1. Calculate the minimum fluidization velocity and optimum operating fluidization velocity.
2. Design the cooling tube length for required heat transfer area.
3. Design the fluidized bed in terms of pressure drop across the bed.
4. Design the distributors, TDH, height, diameter, power consumption of compressor for air.
5. Distinguish between boiler and furnaces, methods of starting up.
6. Calculate the amount of chemicals required to control the emission like SO2.

UNIT – I

INTRODUCTION:

Processes involving contact between solid particles and a Fluid, Packed Beds, Fluidized Beds advantages and disadvantages of fluidized beds for industrial applications. Fundamental fluidized bed behavior, Fast fluidization, circulating fluidized beds. Particles and Fluidization: Physical properties of solid particles, size and shape, size range, surface area of particles in a bed, Bed voidage, classification of particles according to Fluidization characteristics, pressure drop across packed beds, minimum fluidization velocity and its determination.

UNIT – II

TWO – PHASE THEORY OF FLUIDIZATION:

Bubbles and Fluidization Regimes, Bubble rise velocity, Bed expansion, Bubble growth and slugging, Mixing, Elutriation and Transport of solids, General mechanism

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of mixing of particles, mixing and segregation of particles, Terminal velocity of particles, Elutriation, transport disengaging height, solids transport. Davidson's Model, Diffusion model, Bubbling bed model ideal mixing stage model, two regime models.

UNIT – III

FLUIDIZED BED HEAT TRANSFER:

Heat Transfer in Beds of Particles, Gas -to- particle heat transfer, Bed – to- surface heat transfer, particle convection component, interphase gas connective component, Radioactive component, Estimation of Bed–to surface Heat Transfer coefficient, Heat Transfer between the Bed-Distributor, side walls, immersed tubes or components, Heat Transfer to surfaces located above the Bed, Free surface, Design for physical operation, Batch and continuous operation for Mass & Heat Transfer and Drying of solids.

UNIT IV

DESIGN OF SIMPLE FLUIDIZED BEDS:

Introduction, Estimation of Bed Dimensions and Fluidizing velocity, Transport disengaging Height, Distributors, Heat removal from fluidized beds from cooling tubes in the bed, optimum size of a fluidized bed reactor. Power consumption.

UNIT – V

FLUIDIZED BED COMBUSTION:

Introduction, combustion systems for solid fuels combustors and the first law of thermodynamics, fluidized Bed combustion of solid fuels size of fluidized bed combustion system, size of inert particles in the bed, turndown efficiency of fluidized bed combustion, Equipment, combustion of fuel particles in a fluidized bed, Distinguish between boiler and furnaces, methods of starting up, circulating or fast fluidized bed combustion systems, control of emission of SO_x ,CO and CO_2

Text Books:

1. J.R. Howard Adam Hilger, "Fluidized Bed Technology -Principles & Applications", IOP, Pub Ltd., NY. 1989.

Suggested Reading

1. Diazo Kuni & Octave Levenspiel, " Fluidization Engineering", 2nd Edition, John Wiley and Sons, 2002.
2. John M. Matsen, Grace John R , "Fluidization", Springer-Verlag New York Inc., 1980.

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16CH E 10

PHARMACEUTICAL TECHNOLOGY
(ELECTIVE IV)

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

Course Objectives: The students will able to understand

1. Grade of chemicals, Principles & Various Tests.
2. Preparation & testing of Pharmaceuticals & final chemicals.
3. The Concepts & Principles to draw the flow sheets.
4. Methods & equipment used for Tablets, Capsules Preparation
5. Sterilization methods.

Course Outcomes: At the end of the Course Students will able to

1. Get a know how about the grades, Identify the Impurities & limit tests.
2. Prepare & test the Properties of Pharmaceuticals & fine Chemicals.
3. Draw flow sheets for Manufacturing Pharmaceuticals.
4. Draw flow sheets for Manufacturing Chemicals.
5. Have a theoretical knowledge about tablet & Capsule making.
6. Know various sterilization methods.

UNIT I

Introduction : A brief outline of grades of chemicals, sources of impurities in chemicals, principles (without going into details of individual chemicals) of limit test for arsenic, lead, iron, chloride and sulfate in Pharmaceuticals.

UNIT II

Outlines of Preparation, properties, uses and testing of the following Pharmaceuticals - sulfacetamide, paracetamol, riboflavin, nicotinamide, Outlines of Preparation, properties, uses and testing of the following fine chemicals - Methyl orange, fluorescence, procaine hydrochloride, para amino salicylic acid, isonicatinic acid hydrazide.

UNIT III

Study of Manufacture & Production of Pharmaceuticals – aspirin, penicillin, calcium gluconate with uses Properties flow sheets and testing Methods.

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UNIT IV

Study of Manufacture & Production of Chemicals with flowsheets, properties uses and testing of the following: ferric ammonium citrate, pthallic anhydride and phenol flourobenzene process and benzene sulfate process, other processes in outline only.

UNIT V

Tablet making, coating, granulation and granulation equipments Preparation of capsules, extraction of crude drugs. Sterilization: introduction, risk factor, methods of sterilization, heat (dry and moist), heating with bactericide, filtration, gaseous sterilization and radiation sterilization, suitable example to be discussed.

TEXT BOOKS:

1. Remington's Pharmaceutical Science,16th ed, Mac publishing company, 1980.
2. Industrial Chemicals, 3rd ed., Faith, Kayes and Clark, John Wiley & Sons,. 1965.

Suggested Reading:

1. Blently's Text Book of Pharmaceutical Chemistry, 8th ed, H A Rawlins, B Tindell and Box,. Oxford University Press, London, 1977.

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16CH C 21

CHEMICAL REACTION ENGINEERING LABORATORY

Instruction	3Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: Students will be able to understand

1. Reaction kinetics in homogenous systems.
2. Reaction kinetics in heterogeneous systems.
3. Behavior of non Ideal reactors.

Course Outcomes: Students will able to

1. Find rate equations in batch reactor, mixed flow reactor, PFR, packed bed Reactor.
2. understand the concept of reaction and mass transfer in a liquid –liquid and solid-liquid system.
3. Predict conversion in adiabatic reactor.
4. Determine the extent of non –ideality in tubular reactor.

LIST OF EXPERIMENTS
(Any Eight Experiments to be performed)

1. Studies in Batch Reactor: To find the Arrhenius form of temperature dependency of reaction
2. Studies in Mixed Flow Reactor (CSTR) : To find kinetics from reactor performance of CSTR
3. Studies in Tubular Reactor: To determine the rate constant and to verify the order of reaction
4. Mass Transfer with Chemical Reaction: (Liquid – Liquid Reaction System) To find out the mass transfer coefficient in a stirred cell: With chemical reaction and without chemical reaction
5. Mass Transfer with Chemical Reaction: (solid – Liquid Reaction System) To find the mass transfer co-efficient without chemical reaction and with chemical reaction.
6. R.T D Studies in Packed bed reactor: To determine the axial mixing (axial dispersion) in the packed column.

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7. R T D Studies in Tubular Column To determine the variance of residence time distribution and the dispersion number in a tubular column.
8. Studies in Batch Reactor: With Equimolar Feed (M = 1) : To determine the rate constant and to verify the order of reaction by differential & integral methods of analysis.
9. Studies in Batch Adiabatic Reactor: to determine the kinetics of an exothermic reaction from the Temperature of the reaction system.
10. Studies in Mixed Flow Reactors in series: To compare the actual & ideal performances of a Reaction system.
11. Studies in Packed bed: To determine the rate constant and to verify the order of reaction from performance of the reactor.

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16CH C 22

PROCESS DYNAMICS AND CONTROL LABORATORY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: Students will be able to understand

1. Dynamic response of first and second order processes
2. The difference between interacting and non-interacting systems
3. Characteristics of various controller modes
4. Method and significance of controller tuning
5. Relation between valve stem position and the fluid flow through a control valve

Course Outcomes: Students will able to

1. Evaluate the step response and frequency response of first order systems
2. Identify the difference between closed loop and open loop operations
3. Choose the controller mode for a particular requirement in the system
4. Determine the characteristics of a second order under damped system
5. Determine the controller parameters using tuning rules
6. Analyze the stability of a system using Frequency response (Bode Plots)

LIST OF EXPERIMENTS

(Minimum of EIGHT experiments has to be performed)

1. Determination of order and time constant of a first order system
2. Determination of frequency response of a first order system
3. Determination of Bode plot from dynamic studies of first order system
4. Study the effect of PID controller parameters on closed loop servo response
5. Feedback controller tuning by Zeigler-Nicholas method
6. Feedback controller tuning by Cohen-Coon method
7. Determination of dynamics of interacting liquid level system
8. Determination of dynamics of non-interacting liquid level system
9. Determination of dynamics of a first order system (thermometer)

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10. Determination of second order under damped characteristics from the dynamics of second order system (manometer/thermo well)
11. Determination of pneumatic valve characteristics
12. Study of cascade control system

Note: Experiments (1 to 5) can be designed on any of the following computer controlled systems.

a. Liquid-Level
b. Flow
c. Temperature
d. Pressure

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16CH C 23

PROCESS MODELING SIMULATION LABORATORY

Instruction	3 hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives: This practical course helps the students to understand the:

1. Application of their MATLAB coding skills learnt in previous semesters, as a prerequisite for problem solving.
2. Formulation of a process models leading to ODE.
3. Formulation of a process models leading to linear equations.
4. Formulation of a process models leading to non-linear equations.
5. Open-loop simulation through MATLAB coding for simple chemical processes.

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

1. Develop and solve ODE for chemical processes and apply numerical methods to solve them using MATLAB.
2. Develop and solve linear equations and apply numerical methods to solve them using MATLAB.
3. develop and solve non-linear equations and apply numerical methods to solve them using MATLAB.
4. Fit polynomial functions to given data and solve by regression analysis using MATLAB.
5. Solve the process models developed for open-loop simulation of selected unit operations in chemical engineering using MATLAB.

LIST OF EXERCISES

Note: The Programs are to be written in "MATLAB"

PART – A: Chemical engineering problem solving [All exercises are compulsory]

1. Solution of ordinary differential equations by Euler's method, Runge-Kutta fourth order method
2. Solution of set of linear simultaneous equations by Gauss-elimination, Gauss-Jordan and Gauss-Seidel methods

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3. Solution of non-linear equations by bisection, Newton Raphson andRichmond iteration methods

4. Curve fitting by Linear Least square analysis.

PART – B: Application for open loop simulation(Any four process systems)

1. Two-heated Tanks in series
2. Three CSTRs in series at isothermal, constant holdup condition
3. Batch Reactor
4. Vapor Liquid Equilibrium
5. Ideal Binary distillation
6. Gas-Phase Pressurized CSTR

PART – C: Demonstration of process simulators

Application of process simulation software packages. Understanding the basicconcepts and steps involved for developing process flowsheet.

Suggested Reading:

1. Applied numerical methods with MATLAB for engineers and scientists, Steven C. Chapra, 3rd ed., Tata-McGraw Hill Edu. Pvt.Ltd., New Delhi, 2012.
2. Process Modeling, Simulation and Control for Chemical Engineers, by William L. Luyben, 2nd ed., McGraw Hill Pub. Co., New Delhi, 1990.
3. Numerical methods in engineering and science (with programs in C, C++and MATLAB), B. S. Grewal, 10th ed., Khanna pub., Nagpur, 2014.

CH421 **PLANT DESIGN AND ECONOMICS**

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

Course objectives: This course helps the students to understand the:
1. fundamentals of investments and engineering economics.
2. flowsheet synthesis and integrate with process equipment design.
3. design concepts with principles of process economics.
4. methods to quantify concepts such as fixed capital investment, cash-flow analysis, profitability analysis and decision making.

Course outcomes: After completion of the course student should be able to:
1. calculate the time value of money and depreciation.
2. estimate fixed and working capitals and operating costs for process plants.
3. calculate the Rate of return and payout time for design of any process plant.
4. evaluate the profitability of process industry projects using measures such as ROI, NPV and DCF
5. identity and apply the selection criteria for design of flowsheets, equipment and material.
6. design the piping specifications as per standards.

UNIT – I

Economic equations. Present and future worth. Equivalence and value for money. Nominal and effective interest rates. Capitalized cost, sinking fund, definition of bond and problems. Types of depreciation and problems.

UNIT - II

Capital requirements by Chilton and Lang, Schweyer, Cost indices methods. Total investment schedule. Sources of capital. Balance sheet and problems. Economic charts. Problems on break even, variable cost, fixed cost. Estimation of profit and capital ratios.

UNIT - III

Selection of alternative equipment or plants by annual cost. Present cost and Capitalized cost methods. Replacement of existing equipment. Rate of return and payout time methods and problems.

UNIT – IV

Process evolution. Stages of process design. Types of flowsheets. Selection criteria of process equipment - material handling (solids, liquids & gases) - separation equipment (solid - solid sold - liquid, liquid - solid etc), Size reduction equipment, agitators, drying equipment filtration equipment, reactors. Procedure for material selection.
Introduction to Design and Automation of process plants. Examples.

UNIT – V

Piping and tube specifications, pipe fabrication methods, piping material, principles of piping layout, piping stresses, stress design and supports. Pressure drop in pipe lines, piping friction factor, design of pipe lines for natural gas, selection of valves. Introduction to P & ID Diagrams.

Text Books:

1. Max. Peters, K Timmerhaus and Ronal West, “Plant Design and Economics for Chemical Engineers”, 5th Ed., McGraw Hill Publications, 2003.
2. C.Vilbrandt and Dryden C.E, “Chemical Engineering Plant Design”, 4th Ed, MGH Book Co., Reprints 2015..

Suggested Reading:

1. Seider W.D., Seader J.D. & Lewin D.R., “Product and Process Design principles: Synthesis, Analysis and Evaluation”, John Wiley & Sons, Inc., 2nd ed., 2010
2. J.M. Coulson and J.F Richardson, “Chemical Engineering”, Vol.6, 5th ed. Pergamon and ELES, 2003.
3. H.E.Schweyer., “Process Engineering Economics”, MGH Book Co, NewYork, 2001.

CH 422

TRANSPORT PHENOMENA

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

Course Objectives: Introduces the students to
1. Fundamentals to solve flow problems involving transport of momentum, energy and mass using a unified approach.
2. The analogy between momentum, mass and energy transport.
3. The turbulent phenomena and the methods of characterizing the turbulent fluxes
4. Equations of change for isothermal and non-isothermal systems and multi-component mixtures.

Course Outcomes: At the end of the course, student will be able to
1. Apply the first principles to solve various chemical engineering problems.
2. Compare various flow phenomena
3. Develop expressions for steady state velocity, temperature and concentration profiles using shell balance method
4. Apply equations of change to solve flow problems.
5. Develop expressions for unsteady state isothermal and non-isothermal flows
6. Time smooth equations of change.

UNIT – I

Introduction – Mechanism of molecular transport of momentum, heat and Mass Transfer. Flux equations – Newton‟s, Fouriers‟ and Fick‟s laws - Similarities and differences

Non-Newtonian fluids, transport properties – estimation, temperature and pressure dependence, estimation of transport properties of binary gaseous mixtures

Velocity distributions in laminar flow – shell momentum balances – Flow of falling film – flow of fluids through circular tubes, annulus and Immiscible fluids between parallel plates. Creeping flow around sphere

UNIT – II

Temperature distributions in solids and in laminar flow – shell balances - Heat conduction with electrical, Nuclear, viscous and chemical heat source

Heat conduction through composite walls, and cooling fin; Forced convection and free convection

UNIT – III

Concentration distributions in solids and in laminar flow - shell mass balances, diffusion through a stagnant gas film, Diffusion with homogenous chemical reaction and heterogeneous chemical reaction. Diffusion into a falling liquid film-chemical reaction inside a porous catalyst

UNIT – IV

Equations of change for isothermal systems – Equation of continuity, Equation of Motion, Equations of change in curvilinear coordinates, use of equations of change to set up steady flow problems. Equations of change for non-isothermal systems – Equation of energy – use of equations of change to set up steady state flow problems. Equation of change for a binary mixture – Equation of continuity of a component in curvilinear coordinates

UNIT – V

Unsteady state problems in momentum, energy and Mass Transfer operations; Turbulence - Time smoothing of equations of change of momentum, energy and Mass Transfer; Eddy properties - Intensity of turbulence Reynolds stresses; Semi empirical expressions for turbulent –Momentum – energy and mass fluxes

Text Books:
1. R.B.Bird, W.E.Stewart, and E.N.Lightfoot , “Transport Phenomena”, John Wiley & sons, 1960
2. R.B.Bird, W.E.Stewart, and E.N.Lightfoot , “Transport Phenomena”, John Wiley & Sons. Inc. 2002

Suggested Reading:
1. R.S.Broadkay, “Introduction to Transport Phenomena”, McGraw Hill Publications, 1980.
2. J. R. Welty, C. E Wicks and R. E. Wilson, Fundamentals of Momentum, Heat and Mass Transfer, 3rd Ed., 1984
3. Geankoplis, “Transport Processes and Separation Processes Principles”. 4th Edition, Prentice Hall, 2003

CH 471

CORROSION ENGINEERING
(ELECTIVE – III)

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

Course Objectives: This course helps the students to understand the:
1. definition and classification of corrosion.
2. principles of corrosion, common corrosion forms,
3. different corrosion testing methods.
4. corrosion control methods and material selection for cost reduction.
5. modern theories to explain corrosion

Course Outcomes: At the end of the course, student will be able:
1. identity the type of corrosion.
2. correlate the damage with the cause of corrosion.
3. identify the correct method of testing any corrosion.
4. select the appropriate preventive method to avoid corrosion.
5. select the significant coating for corrosion prevention.
6. apply modern method of corrosion measurement.

UNIT– I: Introduction:
Definition, corrosion environments, damage, classification of corrosion. Principles and corrosion rate expressions. Environmental effects such as velocity, temperature, galvanic coupling. Metallurgical and other aspects

UNIT– II: Different forms of corrosion:
Uniform attack, galvanic corrosion, crevice corrosion, fitting corrosion, inter– granular corrosion, selective leaching, erosion corrosion, stress corrosion and hydrogen damage.
Pitting: pit shape and growth, velocity, metallurgical variables, evaluation of pitting damage, prevention.

UNIT– III: Corrosion testing methods:
Classification, purpose, surface preparation, measuring and weighing, duration, plant interval test, NACE test methods, slow – strain rate test and paint test.
Composites testing: Exposure techniques, Huey test, Sea water test, Stress corrosion, Corrosion of palstics, Invivo corrosion.

UNIT –IV: Corrosion prevention methods:
Selection of metals and alloys–Cast iron, steel, Al, Mg, Ti, Composites and Refractory metals.
Non-metallics: Thermosetters, laminates and reinforced plastics, Rubbers, Wood, Ceramics, Carbon and Graphite. Alteration of environment such as changing mediums, lowering temperature, design rules, design of cathodic and anodic protection, selected coating techniques to prevent corrosion; Failure analysis. High temperature corrosion.

UNIT –V: Advanced techniques:
Modern theory–principles and applications, electrode kinetics, predicting corrosion behavior, corrosion prevention, Corrosion rate measurements in Petroleum Industry with examples.

Text Books:
1. Pierre R. Roberge, " Handbook of Corrosion Engineering", 2nd edition, MCGraw-Hill, Newyork, 2012
2. Zaki Ahmad, "Principles of Corrosion Engineering and Corrosion Control", Butterworth-Heinemann, 2006.

Suggested Reading
1. Pierre R Roberge, "Corrosion Engineering – Principles and Practice, MCGraw-Hill, 2008
2. Pierre R. Roberge, Corrosion Basics: An Introduction, NACE International, 2006.

Web resources :
1. www.academia.edu/5491377/corrosion_engineering_mars_g._fontana

CH 472 **FLUIDIZATION ENGINEERING**
(ELECTIVE – III)

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

Course Objectives: This course helps the students to understand:
1. Basic fundamentals of fluidization and fluidized bed behavior.
2. Minimum fluidization and pressure drop across the bed.
3. Various models to analyze the behavior and mixing patterns.
4. Heat and mass transfer aspects of fluidized bed.
5. Concepts of fluidized bed combustion chamber.

Course Outcomes: At the end of the course, the students will be able to:
1. Calculate the minimum fluidization velocity and optimum operating fluidization velocity.
2. Design the cooling tube length for required heat transfer area.
3. Design the complete fluidized bed in terms of pressure drop across the bed a
4. Design the distributors, TDH, height, diameter, power consumption of compressor for air.
5. Distinguish between boiler and furnaces, methods of starting up.
6. Calculate the amount of chemicals required to control the emission like SO2.

UNIT – I INTRODUCTION:
Processes involving contact between solid particles and a Fluid, Packed Beds, Fluidized Beds advantages and disadvantages of fluidized beds for industrial applications. Fundamental fluidized bed behavior, Fast fluidization, circulating fluidized beds.
Particles and Fluidization: Physical properties of solid particles, size and sharp, size range, surface area of particles in a bed, Bed voidage, classification of particles according to Fluidization characteristics, pressure drop across packed beds, minimum fluidization velocity and its determination.

UNIT – II TWO – PHASE THEORY OF FLUIDIZATION:
Bubbles and Fluidization Regimes, Bubble rise velocity, Bed expansion, Bubble growth and slugging, Mixing, Elutriation and Transport of solids, General mechanism of mixing of particles, mixing and segregation of particles, Terminal velocity of particles, Elutriation, transport disengaging height, solids transport. Davidson‟s Model, Diffusion model, Bubbling bed model ideal mixing stage model, two regime models.

UNIT – III FLUIDIZED BED HEAT TRANSFER:
Heat Transfer in Beds of Particles, Gas -to- particle heat transfer, Bed – to- surface heat transfer, particle convection component, interphase gas connective component, Radioactive component, Estimation of Bed–to surface Heat Transfer coefficient, Heat Transfer between the Bed-Distributor, side walls, immersed tubes or components, Heat Transfer to surfaces located above the Bed, Free surface, Design for physical operation, Batch and continuous operation for Mass & Heat Transfer and Drying of solids.

UNIT IV DESIGN OF SIMPLE FLUIDIZED BEDS:
Introduction, Estimation of Bed Dimensions and Fluidizing velocity, Transport disengaging Height, Distributors, Heat removal from fluidized beds from cooling tubes in the bed, optimum size of a fluidized bed reactor. Power consumption.

UNIT – V FLUIDIZED BED COMBUSTION:
Introduction, combustion systems for solid fuels combustors and the first law of thermodynamics, fluidized Bed combustion of solid fuels, pressurized fluidized bed combustion, size of fluidized bed combustion system, size of inert particles in the bed, turndown efficiency of fluidized bed combustion, Equipment, combustion of fuel particles in a fluidized bed, Distinguish between boiler and furnaces, methods of starting up, circulating or „fast‟ fluidized bed combustion systems, control of emission of SO2.

Text Books:
1. J.R. Howard Adam Hilger, "Fluidized Bed Technology -Principles & Applications", IOP, Pub Ltd., NY. 1989.

Suggested Reading
1. Diazo Kuni & Octave Levenspiel, " Fluidization Engineering", 2nd Edition, John Wiley and Sons, 2002.
2. John M. Matsen, Grace John R , "Fluidization", Springer-Verlag New York Inc., 1980.

CH 473 **POLLUTION CONTROL IN PROCESS INDUSTRIES**
(ELECTIVE – III)

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

Course objectives: This course helps the students to understand:
1. effects of pollution on environment and ecosystems
2. types and sources of pollution from process industries,
3. measurement of air and water pollution in process industries
4. the essential principles and equipment used in industrial pollution abatement

Course outcomes: At the completion of this course, students will be able to:
1. differentiate the types of wastes generated in an industry, their effects on living and non-living things
2. analyze the effect of climate changes, atmospheric dispersion of air pollutants, and operating principles.
3. design and calculate the required particulate control devices.
4. quantify and analyze industrial wastewater and its treatment.
5. identify appropriate unit operations & unit processes for conversion of polluted water to bearable standard limits.
6. analyze the hazardous and nonhazardous solid wastes and select the treatment and disposal methods.

UNIT - I Introduction:
Definition and types of pollution from chemical industries. Effects of pollution on environment and ecosystems - global warning - greenhouse effect. Laws and standards for pollution. Sources, types, characteristics and effects of air pollutants, liquid effluents, solid wastes in process industries.

UNIT – II Air Pollution:
Meteorological aspects of pollution dispersion, adiabatic and environmental lapse rate, Turbulence and stability of atmosphere. Indoor air pollution - smoke and hydrocarbons. Richardson Number, Plume raise, plume behavior and characteristics, effective stack height.
General Control Methods and Equipment**:** removal of sulphur dioxide, oxides of nitrogen and carbon, organic vapors from gaseous effluents. Removal of particulate matter - principle and working of settling chambers cyclone separators solid traps, fabric and fiber filters, electro-static precipitators.

UNIT – III: Water pollution
Concepts and estimation of oxygen demands - DO, BOD, COD, TOD. Oxygen sag curve, BOD curves and modeling. Wastewater Treatment – Concept, significance and classification as Primary, Secondary, Tertiary methods. Principle, working mechanism and applications of biological treatment techniques like stabilization ponds, Aerated lagoons, conventional activated sludge process, aerobic and anaerobic methods, suspended and attached growth processes, fluidized bed contractors. Trickling filters.

UNIT - IV Solid waste management:
Industrial solid wastes – Types, classification, properties, management and general disposal methods. Hazardous industrial solid wastes – environmental effects and disposal methods commonly practiced.
Methods practiced in chemical, paper and textile industries.

UNIT - V Pollution control practices in Process Industries
Principle, working mechanism and application of tertiary treatment methods like carbon adsorption, Ion-exchange, Reverse Osmosis, Ultra Filtration in process industries.
Sludge treatment and disposal methods like Incineration and land filling. Pollution control in petroleum and fertilizer industries

Text Books:
1. C.S.Rao, “ Environmental Pollution Control Engineering ”, 2nd Ed, New Age International, 2007.
2. S.P.Mahajan, “ Pollution control in process industries”, 27th Ed, McGraw Hill Pub., 2002.

Suggested Reading
1. Metcalf and Eddy, “ Wastewater Engineering: Treatment and Reuse”, 4th Edition , MGH publishing, 2004.
2. M.N Rao and H.V.N Rao, “Air Pollution”, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2000.
3. Peavy, H.S., Rowe, D.R. and Technobanolous, G., “Environmental Engineering”, McGraw Hill, 1985.

CH 474

SUGAR TECHNOLOGY
(ELECTIVE – III)

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

Course Objectives: This course helps the students to understand:
1. the performance measures of different types of unit operations in sugar processing
2. applications, advantages and limitations of the processing procedure
3. the competence and optimization of advanced technology in sugar processing.
4. the possible byproducts of any sugar industry and production of salable derivatives.

Course Outcomes: At the end of the course, student will be able to apply the
1. principles and skills of work in sugar cane milling, processing and refining in practical settings.
2. analyze the composition of different types of sugars by volumetric and gravimetric determination.
3. different unit operations for effective processing of cane juice.
4. batch and continuous methods for an efficient operation of sugar industry.
5. concepts of quality assurance and control in industry as per Indian regulations and practices.
6. methods to reclaim byproducts.

UNIT - I

Importance of sugar industry. Different raw materials for sugar manufacturing, composition of raw materials, history, origin and distribution of sugarcane, production and productivity of sugarcane in India. Indian sugar industry on global screen. Manufacturing processes of raw sugar and crystalline white sugar. Reducing sugars - composition, volumetric and gravimetric determination methods.

UNIT - II

Conveying of raw materials - cane carrier and feeding table working principles. Cane preparation – objective, sieving, preparation index, cane knives, crushing and shredding applications. Extraction of cane juice by milling operation - basic concept of roller mills, working principles, conditions for good milling operation, milling efficiency, maceration and imbibitions – importance, effect, method, objective and efficiency. Cane juice clarification – simple, compound and neutral defaction procedures. Sulphitation and carbonation - batch and continuous methods. Single and double carbonation process, De-Hans" process, comparison of different clarification modern techniques.

UNIT - III

Juice heaters - construction and working principles. Juice filtration - plate and frame filter presses, RVDF, types of filter cake washing. Evaporation- multiple effect evaporators - construction and operation. Steam economy and capacity. Vacuum pan boiling - construction, types of pans, speed of circulation, heating surface to volume ratio, pan boiling techniques, different boiling schemes.

UNIT - IV

Crystallization – nucleation, graining methods, advantages and disadvantages of graining. Theory of crystallization, crystallization zone, crystal growth. centrifuge –construction & working, factors influences on time of curing. Advantages and disadvantages of batch / continuous centrifugal machine. Separation of molasses-different molasses conditioning methods, precautions during molasses conditioning.

Sugar drying -various aspects regarding drying and cooling, rotary dryer. Packing of sugar -types of sugar grader, dilution indicator, quality and safety factors, location and stalking of sugar bags.

UNIT - V

Sugar byproducts: bagasse, pressmud and molasses- their composition and applications. Production of bio-gas, fibre board, furfurol filter mud, extraction of cane wax, manure, industrial alcohol and rectified spirit. Sugar scales and normal weight.

Text Books:

1. Meade and Chen, " Hand of book of cane sugar", 11th Ed , Wiley Interscience, New York, 2001.
2. James C.P Chen, "Cane Sugar Hand book", 12th Ed, Elsevier Pub. Co., New York, 1993.

Suggested Reading:

1. R B L Mathur, Hand Book of Cane Sugar Technology", 2nd Ed, Oxford & IBH, 1978.
2. John H. Payne, "Unit operation in cane sugar production", Sugar series book 4, Elsevier Pub. Co., New York, 1982.

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Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

CE 422

DISASTER MITIGATION AND MANAGEMENT
(ELECTIVE – IV)

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

Course Objectives:

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. To impart knowledge in students about the nature, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro metrological and geological based disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.
4. To equip the students with the knowledge of various chronological phases in the disaster management cycle.
5. To create awareness about the disaster management framework and legislations in the context of national and global conventions.
6. To enable students to understand the applications of geospatial technologies like remote sensing and geographical information systems in disaster management.

Course Outcomes:

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at local level
2. Ability to choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Ability to understand various mechanisms and consequences of natural and human induced disasters for the participatory role of engineers in disaster management.
4. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans
5. Ability to understand various participatory approaches/strategies and their application in disaster management
6. Ability to understand the concepts of remote sensing and geographical information systems for their effective application in disaster management.

UNIT-I:

Introduction to Natural, human induced and human made disasters – Meaning, nature, types and effects; International decade of natural disaster reduction (IDNDR); International strategy of natural disaster reduction (ISDR)

UNIT-II:

Natural Disasters– Hydro meteorological disasters: Causes, impacts, Early warning systems, structural and non-structural measures for floods, drought and cyclones; Tropical cyclones: Overview, cyclogenesis, drought monitoring and management.; Geographical based disasters: Earthquakes and Tsunami- Overview, causes, impacts, zoning, structural and non-structural mitigation measures; Tsunami generation; Landslides and avalanches: Overview, causes, impacts, zoning and mitigation measures. Case studies related to various hydro meteorological and geographical based disasters.

UNIT III:

Human induced hazards: Risks and control measures in a chemical industry**,** Causes, impacts and mitigation measures for chemical accidents, chemical disaster management, current status and perspectives; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents and traffic accidents .

UNIT IV:

Use of remote sensing and GIS in disaster mitigation and management; Scope of application of ICST (Information, communication and space technologies in disaster management, Critical applications& Infrastructure; Potential application of Remote sensing and GIS in disaster management and in various disastrous conditions like earthquakes, drought, Floods, landslides etc.

UNIT V:

Concept of Disaster Management: Introduction to disaster management, Relationship between Risk, vulnerability and a disaster, Disaster management cycle, Principles of disaster mitigation: Hazard identification and vulnerability analysis, Early warning systems and forecasting; Infrastructure and development in disaster management; Disaster management in India: National disaster management framework at central, state, district and local levels. Community based disaster management.

Text Books:

1. Rajib, S and Krishna Murthy, R.R, "Disaster Management Global Challenges and Local Solutions" Univ. Press Hyd., 2012.
2. Notes / Reading material published by National Disaster Management Institute, Ministry of Home Affairs, Govt. of India.

Suggested Reading:

1. Navele, P & Raja, "C.K. Earth and Atmospheric Disasters Management, Natural and Manmade". B.S. Pub., Hyd., 2009.
2. Fearn-Banks, K, "Crises computations approach: A case book approach", Route ledge Pub., Indian Edu., New York 2011.
3. Battacharya, T., "Disaster Science and Management", Tata McGraw Hill Company, New Delhi, 2012.

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Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

ME 464

ENTREPRENEURSHIP
(ELECTIVE – IV)

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

Objectives:

1. To understand the essence of Entrepreneurship
2. To know the environment of industry and related opportunities and challenges
3. To know the concept a procedure of idea generation
4. To understand the elements of business plan and its procedure
5. To understand project management and its techniques
6. To know behavioral issues and Time management

Outcomes: After completing this course, students will be able to:

1. Apply the entrepreneurial process
2. Analyze the feasibility of a new business plan and preparation of Business plan
3. Evaluate entrepreneurial tendency and attitude
4. Brainstorm ideas for new and innovative products or services
5. Use project management techniques like PERT and CPM
6. Analyze behavioural aspects and use time management matrix

UNIT-I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II

Identification and characteristics of entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III

Business plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT-IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V

Behavioral aspects of entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House, 1997.
2. Prasanna Chandra, “Project-Planning, Analysis, Selection, Implementation and Review”, Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, “Entrepreneurial Development”, S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, Tata Me Graw Hill Publishing Company Ltd., 5lh Ed., 2005
2. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster Publication, 1994.
3. Sudha G.S., “Organizational Behavior”, National Publishing House, 1996.

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Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

PE 484

NANO MATERIALS AND TECHNOLOGY
(ELECTIVE – IV)

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

Objectives:

1. Students are able to understand the nanotechnology approach and challenges
2. To give the student familiarities about materials of nanotechnology
3. Students are able to understand the nano structurers
4. Students are able to learn nano fabrication
5. Students are able to understand special nano materials
6. Students are able to understand bio materials

Outcomes: At the end of the course

1. Understand the developments and challenges in nano technology
2. Understand synthesis and properties of nanostructured materials
3. Analyze magnetic and electronic properties of nano materials
4. Analyze nano fabrication methods and their applications
5. Understand the characterization of nano and bio materials and their use
6. Analyze the synthesis and characterization of nano wires and tubes

Unit I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nanotechnology, Bottom-up and Top-down approaches, challenges in nanotechnology, proximal probe technologies.

Unit II

Materials of Nanotechnology: Introduction, Si-based materials, Ge-based materials, Ferroelectric materials, Polymer materials, GaAs& InP (HI-V) group materials, Nanotribology and materials, characterization using Scanning Probe Microscope, AFM, FFM

Unit III

Nano Structures: Zero dimensional Nanostructure (Nano particles), synthesis procedure, characterization techniques, properties and applications of Nano particles

One dimensional Nanostructures (Nano Wires, Nano Tubes), various Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires, Types of Nano Tubes, Synthesis procedure, characterization properties and applications of Nano Tubes

Unit IV

Nano Fabrication: Introduction, Basic fabrication techniques (Lithography, thin film deposition, and doping), MEMS fabrication techniques, Nano fabrication techniques (E-beam Nano-imprint fabrication, Epitaxy and strain engineering, Scanned probe techniques).

Unit V

Special Nano Materials: Nano Composites: Introduction, Synthesis procedures, various systems (metal-polymer, metal-ceramics and Polymer-ceramics), Characterization procedures, applications, Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, principles involved, applications

Text Books:

1. A.K. Banopadyay, „Nano Materials‟, New Age Publications
2. T. Pradeep, „Textbook of Nanoscience and Nanotechnology‟, McGraw Hill Edu. (India) Pvt Ltd., New Delhi
3. Dieter Vollath, Nanomaterials: An Introduction to Synthesis, Properties and Applications,Wiley, 2013

Suggested Reading:

1. Carl C. Koch, „Nano Materials Synthesis, Properties and Applications‟, Jaico Publishing House
2. Willia Tllsey Atkinson, „Nano Technology‟, Jaico Publishing House
3. George W. Hanson, „Fundamentals of Nanoelectronics‟, Pearson Education, 2009
4. T. Pradeep, „Nano: Essentials-understanding Nano Science and Technonology‟, TMH, 2007
5. Sabu Thomas, Nandakumar Kalarikkal, A. Manuel Stephan, B. Raneesh, "Advanced Nanomaterials: Synthesis, Properties, and Applications", Apple Academic Press

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Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

CH 481

NUCLEAR ENGINEERING
(ELECTIVE – IV)

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

Course Objectives: This course helps the students to understand:
1. fundamentals of nuclear fission reactions and products.
2. types of nuclear fuel materials, properties, characteristics.
3. nuclear fuel separation and enrichment methods along with flowsheets.
4. non-fuel materials required for design of the reactor structure, cladding and for moderation.
5. different types of reactors, concepts of heat removal, control and safety systems.
6. spent fuel management.

Course Outcomes: At the end of the course, student will be able to apply the:
1. identify the various radioactive elements based on the mechanism of fission process.
2. processing and handling techniques for enrichment of fuel materials.
3. properties and radiation effects of materials for design of cladding structure.
4. concepts of fuel source, heat removal, control and safety needs for operation of nuclear reactors .
5. design and working of fast breeder reactors.
6. techniques practiced for handling, storage and reprocessing of spent fuel.

UNIT – I: Nuclear fission
Atomic structure and isotopes of radioactive material, nuclear elements, nuclear binding energy, radioactive nuclides and nuclear stability, radioactivity, radioactive decay - alpha decay, beta decay, gamma rays.
Neutron reactions, fission cross-sections, fission rate and reactor power, prompt and delayed fission neutrons, fission products.

UNIT – II: Nuclear fuel materials
Types of fuel materials, properties and significant characteristics, fuel cycle, pre-reactor fuel operations, isotopic enrichment, isotopic separation requirements. Nuclear fuel utilization – breeding ratio, Uranium, Thorium and Plutonium utilization.

UNIT – III: Non-fuel reactor materials
Classification, mechanical properties, radiation effects of materials, corrosion of metals, structural and cladding materials, moderator and reflector materials.

UNIT – IV: Nuclear fission reactors
General features, classification, reactor development for power production. Design features, concepts of heat removal, control and safety systems for: pressurized water reactors (PWR), boiling water reactors (BWR). Heavy water moderated reactors (HWMR) and Fast breeder reactors (FBR).

UNIT – V: Spent fuel management
Characteristics of spent fuel, storage, disposal, reprocessing of spent fuel, solvent extraction separation process, other possible separation processes.

Text Books:
1. Samuel Glasstone and Alexander Sesonske, "Nuclear Reactor Engineering", 3rd Ed, CBS Publishers and distributors, New Delhi, 1986.

Suggested reading:
1. Benjamin M. MA, "Nuclear reactor materials and applications", Van Nostrand Reinhold Co., New York, 1975.
2. John R. Lamarsh, "Introduction to Nuclear Engineering", Addison-Wesley publishing Co., Philippines, 1975.
3. Raymond L. Murray, "Nuclear Energy", Pergamon Press, New York, 1975.

CH 423

SEMINAR

Instruction	3L Periods per week
Sessionals	25 Marks
Credits	**1**

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of state of the art topics in a broad area of his /her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to following aspects of seminar presentations.

- Literature survey
- Consolidation of available information
- Power point Preparation
- Technical writing

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Give twenty(20) minutes presentation through OHP/ PPT/ Slide Projector followed by Ten(10) minutes discussion
3. Submit a report on the seminar topic with list of references and hard copy of the slides.

Seminars are to be scheduled from 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.

CH 901

PROJECT

Instruction	6L Periods per week
University Examination	Viva-voce
University Examination	100 Marks
Sessionals	50 Marks
Credits	9

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Sessional marks should be based on the marks, awarded by a project monitoring committee of faculty members as well as the marks given by the guide.

Common norms are established for final documentation of the project report, the students are directed to download from the website regarding the guidelines for preparing the project report and the project report format.

The project report shall be evaluated for 100 Marks by the External Examiner.

If the project work found inadequate in the end examination, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.

Break up for 100 Marks in the end examination:

1.	Power point presentation	20 Marks
2.	Thesis/Report preparation	40 Marks
3.	Viva-voce	40 Marks

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Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

16CE C03

SURVEYING

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

Course Objectives :

1. To enable the student understand the basic principles of surveying and its role in civil engineering.
2. To make the student understanding about the levelling operations and methods of computations for finding areas and volumes.
3. To enable the student to get acquainted with simple angular measurements and understanding the operations of modern instruments like Total station and GPS instruments .
4. To make the student to know about the computation data required for setting curves like simple ,compound and reverse curves.
5. To enable the student to understand the role of transition curve and the data necessary for setting vertical curves.

Course out comes:

1. To use the instruments like chain, compass and plane table and gets an idea about the circumstances in which they can be used in field.
2. To know the methods of levelling along with developing of contours and use the contours in civil engineering related problems.
3. To get exposure to the modern instruments like Total station and GPS instruments.
4. To be in a position to set various horizontal curves .
5. To be able to compute the data required for setting vertical curve and able to understand the difference between transition curve and other horizontal curves.

UNIT1:

Principles of surveying, objectives of surveying and classifications of surveying, Basic principles of Chain surveying, types of chains and accessories required for chain surveying various lines used in chain survey, computation of areas using offsets, principles of compass survey, concepts of meridians, bearings and systems of measuring bearings and computations of angles from bearings. Principles of Plane table surveying accessories required for plane table survey, Radiation, intersection and concepts of resection.

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UNIT-II:

Levelling : Concepts of levelling, terms used in levelling, reduction of levels, types of levelling, corrections in levelling, errors in levelling, Contours- definition, contour interval, characteristics, methods of contouring and interpolation and uses of contours, estimation of volumes using Trapezoidal and Simpson's method.

UNIT-III:

Theodoiite- introduction, terms used , fundamental lines, uses ,traversing - types, checks, plotting, consecutive coordinates- Total coordinates, balancing of traverse, Gale's traverse table, Errors in theodolite survey, omitted measurements, Total station - working principle and its applications in surveying. Fundamental principles of tachometry, concepts of fixed hair method of tachometric survey. GPS survey - working principles, methods of GPS survey.

UNIT-IV:

Curves- types, designation of curves, terms used in curves, elements of curves, Angular methods of setting of simple curves, elements of reverse and compound curves.

UNIT-V:

Transition curves- principles, fundamental equation of transition curve , length of transition curves-arbitrary gradient, time rate, rate of change of radial acceleration, ideal transition curve- modified, cubic parabola and spiral curves. Vertical curves- types, chord gradient method and tangential correction methods of finding elevations.

Text Books:

1. C. Venkata Ramaiah, "A Text book of Surveying", University press, Hyderabad, 1997.
2. B.C. Punmia "Surveying vol. I and II", Laxmi Publications, 1994.

Suggested Reading:

1. T.P. Kanetker and S.V.Kulkarni Surveying and Levelling, PuneVidyarthi Gruha Prakashan, Pune,1994.
2. AM. Chadra, "Plane Surveying", New Age International", 2007.
3. Dr. K.R. Arora, "Surveying", Standard Book House, 2011.
4. R. Subramanyam, " Surveying and leveling", 2nd edition oxford university press, New Delhi.

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16CE C04

BUILDING MATERIALS PLANNING & CONSTRUCTION

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

Course Objectives: To enable the student

1. To study about the basic building materials, properties and their applications.
2. To know the smart building materials, types of paints and varnishes.
3. To understand different types of masonries and their applications
4. To acquire concepts in building planning, arrangement of windows, doors, electrical and plumbing services.
5. To acquire ability to draw, plan, section, elevation of buildings with a flat /sloped roof.

Course outcomes:

At the end of the course the student is able

1. To identify various building materials and select suitable type for given situation.
2. To know different types of masonry, types of bonds used in construction of walls of buildings.
3. To know the different types of doors, windows , roofs, stair used in building works.
4. To plan suitable types of building for given requirement including arrangement of electrical and plumbing services.
5. To prepare plan, section and elevation of building with flat / sloped roof of client requirement.

UNIT-I:

Traditional Building Materials: Properties, Types, Applications and testing of traditional building materials, Mud, Stone, Timber & Brick, Cement Fly Ash Sand, Aggregate Mortar, Concrete and Steel.

UNIT-II:

Emerging Building Materials: Smart and Eco Friendly materials - Sustainable materials - Recycled materials.

Miscellaneous Materials: Paints, Varnishes and Distembers - Water proofing materials and other construction chemicals.

UNIT - III:

Building Elements: Walls - Brick and Stone Masonry Walls **Brick Bonds:** Plan and isometric view of wall junctions for half brick wall ; one and one and a half brick wall. Brick masonry courses for odd and even courses of English and Flemish bond.

Stone Masonry: Elevation, sectional plans and cross sections of walls of Ashlar , CRS I and II sorts, URCS and RR stone masonry.

Doors and Windows: Various types and advantages - Introductory concepts and types of Roofs, beams, columns, Foundations and stairs. Different types of steel sections and roof trusses.

UNIT-IV:

Concepts of Building Planning: Types of Buildings, Functional needs and differences in their planning requirements - Introduction to building byelaws - Provisions of National Building code - Conventional Representation of building materials and elements in plans and sections - Representations of electrical and plumbing services - planning a single storied residential building with one, two and three bedrooms - preparation of drawings.

UNIT-V:

Drawing of plans, sections and elevations and sections of a single storey 1,2 and 3- bed room residential buildings and an industrial shed with steel roof trusses mounted on steel stanchions.

Text Books:

1. Sushil kumar, "Building Construction", Standard Publishers,1992.
2. S.P.Arora & S.P.Bindra, "A text book of Building Construction", Dhanpat Rai Publications.

Suggested Reading:

1. P.C. Vergiees -Building materials and construction.
2. CBRI Rookee, "Advance in Building Materials and construction".
3. NIIT, Chandigarh - Civil Engineers Material.
4. National Building Code of India, 2006.

16CE C05

STRENGTH OF MATERIALS - I

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

Course Objectives: To enable the student

1. Understand the basic concept of the stress and strain and stress - strain behaviour of different materials.
2. Draw shear force and bending moment diagrams for statically determinate beams.
3. Understand bending stress and shear stress.
4. Comprehend compound stresses, direct and bending stresses in beams.
5. Analyze thin and thick cylinders for fluid pressure and /or shrink fit pressures and to analyze perfect frames by different methods.

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

1. Evaluate the strength of various Civil Engineering materials, against structural actions such as compression, tension, shear and bending.
2. To compute Shear force and Bending moment of statically determinate beams.
3. To suggest suitable material and sections from among the available, for use in Civil Engineering context.
4. To evaluate the behaviour and strength of Civil Engineering materials under the action of compound stresses and thus understand failure concepts.
5. To design thin and thick cylinders for resisting internal and external pressures and to evaluate forces in the members of truss / frames.

UNIT-I:

Simple Stresses and Strains: Various types of stresses and strains. Hooke's law, Modulus of Elasticity. Stress-Strain curve for ductile & brittle materials. Working stress and factor of safety. Deformation of bars of uniform, varying and tapering sections under axial loads. Elongation of bars due to self weight. Bars of uniform strength. Compound bars and temperature stresses. Statically indeterminate problems in tension and compression.

Elastic Constants: Poisson's ratio, volumetric strain and derivation of relationship between elastic constants.

UNIT-II:

Shear force and Bending moment: Different types of beams and loads- Shear force and bending moment diagrams for cantilever, and simply supported beams with and without over hangs subjected to different kinds of loads viz, point loads, uniformly distributed loads, uniformly varying loads and couples- Relation between loading, shear force and bending moments.

UNIT-III:

Bending stresses in Beams: Assumptions in theory of simple bending- Derivation of bending equation, Moment of resistance -Calculation of stresses in statically determinate beams for different loads and different types of structural sections.

Shear stresses in Beams: Equation of shear stresses, distribution across rectangular, circular, triangular, I, T, H and diamond sections .

UNIT-IV:

Direct and bending stresses : Basic concept, Eccentric loading, limit of eccentricity - core of sections-rectangular and circular, solid and hollow sections.

Compound Stresses and Strains: Stresses on oblique planes, principal plane and principal stresses. Ellipse of stress and Moh's circle of stress.

UNIT-V:

Thin cylinders: Thin cylinders subjected to internal fluid pressure. Volumetric change Wire winding of thin cylinders.

Thick cylinders & spheres: Lame's equations, stresses under internal and external fluid pressure. Compound cylinders-shrink fit pressure.

Analysis of perfect frames / truss: Analysis of trusses by method of joints and method of sections.

Text Books:

1. B.C.Punmia, Mechanics of Materials, Laxmi publishers, Delhi, 2011.
2. S.Ramamrutham, Strength of Materials, Dhanpat Rai & Sons, Delhi, 2012.

Suggested Reading:

1. S.B. Junnarkar, Mechanics of structures (Vol-I & Vol-II), Charotar Publishing house.
2. D.S. Prakash Rao, Strength of Materials-A Practical Approach, Universities Press, Hyd 1999.
3. E.P. Popov, Engineering Mechanics of solids, 1993.
4. G.H. Ryder, Strength of Materials, 3^{rd} Edition in SI units, Macmillan India Ltd,
5. A.Pytel and F.L.Singer, Strength of Materials , Harper & Row , 4^{th} Edition, New York,1987.

16CE C06

ENGINEERING GEOLOGY

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

Course Objectives :

1. Enable the student know about various types of rocks, their orgin, formation and geological structures.
2. Enable the student understand the occurrence and movement of ground water and know the provinces of ground water in India.
3. Enable the student understand the engineering properties of rocks and their stress-strain behaviour.
4. Enable the student get the concepts of geological investigations on a site.
5. Enable the student understand the geology of dams, tunnels and also get the awareness of geological hazards.

Course Outcomes:

1. To identify various types of rocks, their properties, utility and suitability for construction purposes.
2. To identify various rock deposits in India and thus suggest suitable types of foundation.
3. To implement the geological investigations on site.
4. To suggest suitable measures for the construction of Dam and Tunnels.
5. To suggest suitable preventive / remedial measures as part of mitigation and management of geological Hazards.

UNIT-I

Rocks: Distinguishing feature of Igneous, Sedimentary and Metamorphic Rocks, Geological description of Granite, Basalt, Dolerite, Gabbro, Laterite, Sandstone, Shale, Limestone, Slate, Gneiss, Quartzite and Marble, Khondalite and charnocite.

Geological Structures: Folds , Fractures (joints)and faults - Fundamental types, mechanism, originand classifications, field identification and Engineering analysis of folds, Fracture (joints) and faults as mechanical defects of rock masses.

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UNIT-II

Rock weathering: Processes and end products of weathering, Susceptibility of rocks to weathering, assessment of the degree of weathering, Tests of weather ability, and engineering and Engineering classifications of rock weathering.

Geology of Soils: Formation of soils, nature of parent materials, relative stability of minerals, important clay minerals, geological classification ,description and engineering types of soils and Uses.

Hydrogeology: Hydrological Cycle, water table, aquifers, occurrence of ground water in various lithological formations, Ground water movement, springs, ground water exploration, Ground water provinces of India.

UNIT-III

Rock Mechanics: Engineering properties of rocks, Stress - strain behaviour of rocks.

Site Investigation and Geo techniques: Geological maps and aerial photographs. Electrical Resistivity and seismic refraction methods, Bore hole drilling., suspension, Ground anchors.

UNIT-IV

Rocks as a construction material: Geological considerations in the selection of concrete roofi aggregate, Highway and Runway aggregates, Building stones, Decorative Facing stones. Geology of Dams and **Reservoirs:** Types of dams, Dam foundation and reservoirs, Engineering geological investigations for a masonry dam site; analysis of dam failures in the past .Engineering Geology of major dam sites of India.

UNIT-V

Tunnels: Stand-up time of different rocks, Engineering geological investigations of tunnels in rock, problems in tunneling, pay line and over break, logging of tunnels and Geology of some well known tunnels.

Geological Hazards: Geographical aspects of earthquake, tsunamis and landslides. Disaster prevention Mitigation and management.

Text Books:

1. Parbin singh, "A Text Book of Engineering and General Geology", Eighth revised edition, S.K. Kataria & Sonce, 2010.
2. Chenna Kesavulu.N, "A Text Book of Engineering Geology", Macmillan, 2004.
3. Dugal S.K etal.,"Engineering Geology",McGraw Hill Education(India) (P)Ltd., 2014.

Suggested Reading:

1. Fundamentals of Engg. Geology, F.G.Bell, Butterworths Publications, 1980, Aditay Books Pvt Ltd., New Delhi, 1992.
2. Krynine& Judd, Principles of engineering Geology & Geotechnical, CBS Publishers and Distributors, First Edition, 1998. Additional Reading.
3. P.B.Attewell and I.W. Farmer, Principles of Engineering Geology, Chapman and Hall 1976.
4. Officers of the Geological Survey of India, 'Engineering Geology Case Histories MiscilleaneousPublication No. 29, 1975.
5. K.S.Valdiya, 'Environmental Geology', Tata McGraw Hill, 1987.
6. R.V.G.K. Gokhale, Engineering Geology, BS publishers, 2005.

16MT C05

ENGINEERING MATHEMATICS-III

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

Course objectives:

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

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

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

UNIT - I

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

UNIT-II:

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

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UNIT - III

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

UNIT - IV

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

UNIT - V

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

Text Books:

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

Suggested Reading:

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

16MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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

Course Objectives: The Objectives of the course are:

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

Course Outcomes: After completion of the course, student will be able to:

1. apply fundamental knowledge of Managerial economics concepts and tools.
2. understand various aspects of demand analysis and forecasting.
3. understand price determination for different markets.
4. study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
5. analyze different opportunities and come out with best feasible capital investment decisions.
6. apply accountancy concepts and conventions, Final accounts and financial analysis.

UNIT-I:

Introduction to Managerial Economics

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

UNIT-II:

Demand Analysis

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

UNIT-III:

Production and Cost Analysis

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

UNIT-IV:

Accountancy

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

UNIT-V:

Capital Budgeting

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

Text Books:

1. Mehta P.L., "Managerial Economics - Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2013.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 2013.
3. Panday I.M. "Financial Management", Vikas Publishing House, 11th edition, 2015.

Suggested Readings:

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

16CE C07

SURVEYING LAB - I

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To know the use of simple survey instruments in the field.
2. To develop topo maps from the field data.
3. To be in a position to choose the appropriate methods for the solution of field problems.
4. To be in a position to obtain data precisely.
5. To know how to create north and mark in the field and use it for obtaining bearings.

Course Out comes : At the end of the course the student should have learnt

1. To locate the objects, measure the distances and areas and transfer the same on to the drawings.
2. To suggest suitable solution for practical field problems such as two point and three point problems.
3. To develop L.S and C.S for road works, Canal works, using Auto levels.
4. To attain skill and expertise in traversing works using Theodolite by various methods.
5. To understand and apply the necessary checks and practicing to choose appropriate method for balancing a traverse.

<u>LIST OF EXPERIMENTS</u>

1. Practicing of direct and indirect ranging and measuring the distance using Chains and tapes.
2. Location of objects using a chain and tape and plotting the same.
3. Use of prismatic compass for measuring the area of a given land.
4. Introduction to plane table work. - Radiation and inter section methods.
5. Solution to resection by Two point problem.
6. Solution to resection by Three point problem using trial and error method and tracing paper methods.
7. Introduction to levelling - Fly levelling using Dumppy level.
8. Development of L.S. and C.S after obtaining levels by using Auto levels.

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9. Measurement of horizontal angles by Repetition method using Theodolite.
10. Measurement of horizontal angles by Reiteration method using theodolite.
11. Traversing by theodolite and balancing of traverse.

Suggested Readings:

1. C. Venkata Ramaiah, "A Text book of Surveying", University press, Hyderabad, 1997.
2. B.C. Punmia "Surveying vol. I and II", Laxmi Publications, 1994.

16CE C08

ENGINEERING GEOLOGY LAB

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

Course Objectives:

1. To enable the student understand the properties of minerals and characteristics of various rocks.
2. To enable the student study various structural models of rocks and understand the concepts of folds, faculty and unconformities.
3. To enable understand the electrical resistivity behaviour of rocks, soils and waters.
4. To enable the student know the distribution of building stones across India.
5. To enable the student understand the geological, geomorphologial and seismo ectonic aspects of the state and the country.

Course Out comes : At the end of the course the student should have learnt

1. To identify various types of minerals and rocks by their properties and characteristics.
2. To identify the folds, faults and unconformities in rocks and suggest necessary steps.
3. To suggest suitable measures before the construction of important structures like Dams, Bridges, Nuclear power plants, Sky scrapers across India, giving due reference to the distribution of various foundation rocks of that part of India.
4. To suggest on the ground water aspects, keeping in view the electrical resistivity aspects of soil/rock in that locality.
5. To contribute for the prediction of earthquakes, with the knowledge of seismo tectonic aspects of the country.

LIST OF EXPERIMENTS

1. Identification and Description of physical properties of minerals.
2. Identification and Description of Geotechnical characteristics of Rocks IS code:123(1975).
3. Determination of Apparent Specific gravity and Porosity and Water Absorption of different Rocks IS Code: 1124 (1974).
4. Study of Structural Models (folds, faults and unconformities).

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5. Measurement of strike and dip of joints in granites using clinometer Compass- a field experiment.
6. Measurement of Electrical Resistivity of rocks, Soils and waters - a lab. Expt.
7. Vertical Electrical sounding - a filed Expt.
8. Study of Geological Maps of Andhra Pradesh and India w.r.t. the distribution of Building Stones.
9. Study of Geological Map of India and Geomorphologic Map of India.
10. Study of Hydro geological Maps of Andhra Pradesh and India.
11. Study of tectonic Map of India, Seismo tectonic Atlas of India and Seismic Zoning Map of India.
12. Study of Maps and Sections pertaining to the Foundation Geology of Major Dam sites of India.
13. Study of Topographic maps.
14. Study of maps showing geological consideration of dams, Bridges, nuclear power plants, sky scrapers.

Suggested Reading:

1. Parbin singh, "A Text Book of Engineering and General Geology", Eighth revised edition, S.K. Kataria & Sonce, 2010.
2. Chenna Kesavulu.N, "A Text Book of Engineering Geology", Macmillan, 2004.
3. Dugal S.K etal.,"Engineering Geology",McGraw Hill Education(India) (P)Ltd. 2014.

16CE C09

COMPUTER AIDED CIVIL ENGINEERING DRAFTING LAB

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

Course Objectives:

1. To enable the student learn the fundamentals of computer aided drafting.
2. To enable the student create Civil Engineering drawings such as plans and elevations of buildings.
3. To enable to student learn different styles of defining such as tests, icons, insertion of building elements etc.
4. To enable the student learn the aspects of dimensioning, hatching etc.
5. To enable the students to develop survey maps using different features in CAD.

Course Out comes : At the end of the course the student should have learnt

1. To use basic drafting tools and create Civil Engineering drawings.
2. To adopt different commands in creation of objects.
3. To acquaint various techniques for faster implementation with different combinations of commands.
4. To improve the presentation of the drawing by using defining tools, dimensioning, hatching etc.
5. To draw detailed schemes and working drawings up to 2-D single storey buildings.

LIST OF EXPERIMENTS

1. **CAD :** Introduction to Computer Aided Drafting - features and Environment.
2. **Coordinates and Basic Drafting Tools:** Exercises pertaining to basic building elements to illustrate use of absolute coordinates, relative Cartesian coordinates. Object tools, such as SNAP and GRID.
3. **Display Commands:** Drawing Scale & View magnification, zooming and panning Commands.

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4. **Creating and Editing 2D Geometry:** Creating LINE objects, creating CIRCLE, ARC, ELLIPSE and VARIUOS POLYGONS. Introduction to POLYLINE. Use of editing and modifying commands.
5. **Construction Techniques:** Tools to assist drafting - Creating Offsets, Trimming and extending of lines, Filtering of corners, creating multiple objects through Mirroring and Array Generation.
6. **Managing Object Properties:** Concept Significance of Layers and its applications in building drawing - Use of different types of lines and their weightages.
7. **Creating Text and Defining Styles:** Exercises in adding text to the drawing. Management of text styles.
8. **Introduction to Blocks:** Significance of blocks in drawing - creating blocks of common building elements and their insertion.
9. **Dimensions and Hatching:** Addition of dimensions to the drawing - Dimension style management - Hatching of sections - styles of hatch.
10. 2-D Single story building plan.

Suggested Reading:

1. M.G. Shah, C.M. Kale and S.Y. Patki, Building Drawing , Tata Mc Graw-Hill Book Co., 2002.
2. Mastering Autocad, BPB Publications, 2000.
3. A. Balagopal and T.S. Prabhu, Building Drawing and Detailing, Spades publishers, Calicut, 1987.

16CE C10

TRANSPORTATION ENGINEERING

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

Course Objectives: To enable the student

1. Understand the design concepts of the highways, the quality of the materials required for the construction of highways and different techniques used in construction of flexible and rigid pavements.
2. Know how to collect the field data for the evaluation of traffic patterns.
3. To get an idea about the concepts of designing flexible and rigid pavements.
4. Know the requirements for designing the railway tracks and the material required for the construction of permanent way.
5. Get an idea for the planning of airports and fixing of run way orientation and also applying the various corrections.

Course Outcomes: At the end of the course, the student

1. Know how to apply various IRC Standards for the Geometric design of highways.
2. Applies the Pavement design concepts to different types of pavement and analyze the collected field data and carries out the process for design of traffic management techniques.
3. Takes precautions required for the execution of construction of pavements and applies relevant IRC standards.
4. Is able to apply the design concepts of super elevation of railway curves and knows the requirements for the permanent way.
5. Knows how to select a site for airport construction and also knows how to fix the run way orientation and the circumstances in which the corrections to the run way length are to be applied.

UNIT-I:

Highway alignment and geometric design: History of highway engineering, factors to be considered for highway alignment, engineering surveys, obligatory points. Geometric design - Highways classification as per IRC and its standard dimensions, carriageway, shoulders, medians, right of way, footpaths, cycle tracks, service roads, frontage roads, sight distance, stopping sight distance, overtaking sight distance. Camber, horizontal curves, super-elevation, transition curve, extra widening, gradient, grade compensation and design of vertical curves.

UNIT- II:

Traffic engineering: Objectives of traffic studies, traffic characteristics, volume, speed, density, headways and relationship among them. Traffic volume studies, speed and delay studies, intersection delay studies, highway capacity and level of service concept as per HCM 2000, origin and destination studies, intersection improvement studies at grade, need of grade separated intersections, channelization, rotary planning and design, concept of signal design, parking and accident studies.

UNIT-III:

Highway materials & Pavement design: Various properties of highway materials, pavement types, factors to be considered for pavement design, structural difference between flexible and rigid pavement design. Flexible pavement design - concept of layer theory, design wheel load, ESWL, EALF, vehicle damage factor, design by CBR developed by US corps of engineers, IRC cumulative standard axles method (IRC - 37: 2013). Rigid pavement design - concept, wheel load stresses analysis by Westergaard. Sub-grade, dry lean concrete, radius of relative stiffness. Modulus of sub grade reaction and other characteristics of concrete, critical wheel load and temperature stresses. Longitudinal and transverse joints, contraction joints, expansion joints, construction joints, dowel bars and tie bars functions.

UNIT-IV:

Railway Engineering: Introduction to Railways, permanent way component parts and its functions. Rails - various types, functions, creep in rails, creep measurement, coning of wheels and rail fixations. Sleepers - various types. merits and demerits, ballast, various types and sub grade preparation. Railway alignment and geometric design - alignment. super-elevation, negative super elevation, cant deficiency. Example problems. Points and crossing. Layout of left and right hand turnouts. Construction and maintenance of permanent way.

UNIT -V:

Airport engineering: Introduction to air transportation, history and international organizations role in development of airports, air craft types and its characteristics. General lay-out of an airport and its component parts. Site selection of an airport as per ICAO, orientation of runway by wind rose diagrams, basic runway length determination, corrections to basic runway length, geometric design, types of airports as per landing & take-off and dimensions.

Text Books:

1. Khanna. S. K. and Justo, C. E. G (1994), "Highway Engineering", Nemchand& Bros, New Delhi. India.
2. Khanna. S. K. Arora, M. G. and Jain. S. S. (1994) "Airport Planning and Design" Fifth edition. Nem Chand & Bros, Roorkee, India.
3. Chandra, S and Agarwal, M. M. (2007) "Railway Engineering" Oxford Higher Education, University Press New Delhi.

Suggested Reading:

1. McShane, W.R., Roess, R.P. and Prassas, E.S., Traffic Engineering. Prentice Hall. Englewood Cliffs, 1997.
2. Yang, H. and Huang., "Pavement Analysis and Design", Prentice Hall India Ltd-2004.
3. "Highway Capacity Manual", Transportation Research Board, National Research Council. Washington, D.C., 2000.
4. Saxena. S.C and Arora. S, "Text book of railway Engineering" DhanpatRai and Sons. 1988.
5. Relevant IRC codes.

16CE C11

CONSTRUCTION MANAGEMENT AND ADMINISTRATION

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

Course Objectives: To make the student

1. Understand the significance & aspects of construction management, and principles & types of organization.
2. Understand various planning & controlling tools like bar charts, and network techniques for solving construction problems.
3. Acquire knowledge about Network planning, Project updation &Time-cost analysis.
4. Familiar with construction contracts, project delivery methods, construction safety and laws applicable to construction Industry in India.
5. Understand optimization techniques for decision-making in construction Industry.

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

1. Successfully apply management skills in positions within the construction industry.
2. Apply technical skills and knowledge in construction, and technology in support of planning, analyzing, and solving construction problems.
3. Apply professional and ethical standards of behavior in dealing with all stakeholders to manage a quality construction project from start to completion, while maintaining budget, time - schedule, quality and safety requirements.
4. Put in efforts to manage the construction sites accident-free as far as possible and deal with contract management and untoward incidents at construction site efficiently.
5. Apply optimization techniques to decision-making scenarios in professional endeavours.

UNIT-I

Significance of construction management: objectives and functions of construction management, construction management team, principles of organization, types of organization.

UNIT-II

Construction Planning: Large scale production, economics of large scale production. Construction planning, bar charts, network techniques in construction management, CPM and PERT.

UNIT-III

Time Cost Analysis: Cost time analysis in network planning, updating, simple problems of civil engineering works.
Time estimate: expected likely, pessimistic and optimistic time, normal distribution curve and network problems.

UNIT-IV

Contracts: Introduction, types of construction contracts and their advantages and disadvantages, conditions of contracts, safety in safety in construction and safety measures, workmen compensation act, contract labour act. Demolition of Buildings. Tender: Tender form, Tender Documents, Tender Notice, Work Order.
Project Delivery Methods: BOT, SBOO, BOOT; Public Private Partership (PPP), Detailed Report (DPR).

UNIT-V

Optimization: Optimization through linear programming, need for linear programming, linear programming model, graphical method, simplex method and linear programming in construction.

Text Books :

1. Gahlot P.S. and Dhir. B.M., Construction Planning and Management, Wiley Eastern LTd., 1992.
2. Punmia B.C. and Khandelwal, PERT and CPM, Lakshmi Publications 1990.

Suggested Reading:

1. Seetharaman, "Construction Engineering and Management, 4th Edition, Umesh Publications, New Delhi, 1999.
2. Srinath L.S., PERT and CPM: Principles and Application, East West Press, 1975.
3. Mahesh Varma, Construction Planning and Equipment, Metropolitan Book Co. Pvt. LTd., 1985.
4. Taha H., Opeartions Research, Wiley Int., 2002.
5. Gupta .V.K, "Operations Research", S.Chand Publications, 2008.

16CE C12

WATER AND WASTE WATER ENGINEERING

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

Course Objectives: To enable the student

1. Know how to forecast future population to estimate water demand of any community and also to calculate the head losses in the distribution pipe network analysis.
2. Know the design aspects of sedimentation tanks, clariflocculators and sand filters.
3. Estimate storm water and sewage quantity and design the hydraulics of sewers .
4. Design waste water treatment units in a sewage treatment plant.
5. Study the different sludge disposal methods available and to know about the solid waste management in India and its drawbacks.

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

1. To design the water distribution system based on the population forecast.
2. To design various units of a WTP.
3. To apply the concepts of BOD, COD and TOC in sewerage systems and design of sewers.
4. To design the various treatment units in waste water treatment plant.
5. About solid waste management in India and low cost treatment technologies.

UNIT-I

Introduction: Necessity of protected water supply and sanitation. Water demand and per capita consumption, factors affecting population forecasts. **Water supply:** Sources of water and quality parameters, standards of potable water, infiltration pipes & galleries, intake structures pipes, joints, valves & pumps. Water distribution systems and solution of a simple network using Hardy Cross method.

UNIT-II

Treatment of water: Clarification, sedimentation - Principles. Design of sedimentation tanks, coagu1ation and flocculation, design of a clari-

flocculator. Filtration - Types of filters and filter media. Design principles of slow and rapid sand filters. Backwash mechanisms. Pressure filters.
Disinfections - Necessity and methods, Chlorination of water supplied, action of chlorine, break point chlorination. Ozone and U-V radiations, Removal of hardness, tastes &odour control.

UNIT - III

Domestic sewage: Quantity estimation, quality parameters - BOD, COD and TOC. Sewerage systems, ultimate disposal of sewage. Land and water bodies. Sewage conveyance - Sewer types and appurtenances. Velocity in sewers, Design of a simple sewerage system. Storm water sewers - Storm water estimation by rational method.

UNIT-IV

Waste water treatment: Preliminary treatment, screens, grit chambers. Primary treatment - Sedimentation - rectangular and circular sedimentation tanks. Secondary treatment - sewage filtration - trickling filter design. Activated sludge process - design parameters, secondary clarifier. Design aspects of a sewage treatment facility.

UNIT - V

Sludge: Sludge digestion and disposal methods - septic tanks- design parameters and working principles. Low cost waste treatment - oxidation ponds, Aerated Lagoons.
Solid waste: - Types, source and composition of solid waste. Methods of collection, separation transportation and disposal.

Text Books:

1. G.S. Birdi, Water Supply and Sanitary Engineering, DhanpatRai& Sons; 2002.
2. Garg, S.K., "Environmental Engineering Vol. I & II", Khanna Publishers, New Delhi, 1994.

Suggested Reading:

1. Peavy H.S, Rowe D.R and Tchobanoglous G, ""Environmental Engineering " Tata McGraw Hill Publications, New Delhi, 1985.
2. G.M. Fair, J.C. Geyer and D. Okun, "Water and waste Engineering", vol. II, John Wiley & sons, Inc., New York. 1968.
3. Metcalf & Eddy, M.C. "Wastewater Engineering - Treatment & Reuse", Tata McGraw Hill, Publications, New Delhi, 2003.

16CE C13

STRENGTH OF MATERIALS - II

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

Course Objectives: To enable the students

1. Study the basic concept of deflections of beams using various methods.
2. Draw SFD & BMD for indeterminate beams.
3. Understand the behavior of circular shafts subjected to torsion and also combined bending and torsion; compute the strain energy of members subjected to axial loads, shear, bending and torsion.
4. Know the theory and practical applications of springs and also to understand the failure behavior of columns & struts.
5. Know the concept of unsymmetrical bending and shear centre for different members.

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

1. Compute deflections in various types of beams under-various types of static loads, using various methods.
2. Determine the moments and shears in indeterminate beams under various types of loadings.
3. Determine the torsional strength of structural members and also to design them to resist a given torque; also to compute strain energy in member under various loading situations.
4. Design various types of springs and also columns & struts.
5. Evaluate the behavior of members under unsymmetrical bending and locate shear centres for different section.

UNIT-I

Slopes and Deflections: Slope and deflections by double integration method and Macalay's Method for cantilever, simple supported beams and overhanging beams carrying point loads, uniformly distributed loads, uniformly varying loads and couples. Moment area method and Conjugate beam method.

UNIT-II

Propped Cantilevers : Cantilever beams on elastic and rigid props for point loads and uniformly distributed loads. Shear force, bending moment diagrams, deflections.

Fixed beams: Analysis of fixed beam & sketching of BMD & SFD , slope and deflections in fixed beams with and without sinking of supports for point loads, uniformly distributed loads, uniformly varying loads.

Continuous beams: Theorem of three moments (Clapyron's theorem) & Analysis of continuous beams with and without sinking of supports by theorem of three moments. Shear force and bending moment diagrams.

UNIT-III

Torsion: Theory of pure torsion solid and hollow circular shafts, strength and stiffness of shafts . Transmission of power. Combined torsion and bending with and without end thrust. Determination of principal stresses and maximum shear stress. Equivalent B.M. and Equivalent T.M.

Strain energy: Strain energy, proof resilience and modulus of resilience. Strain energy in bars subjected to gradually applied loads , suddenly applied and impact loads. Strain energy due to shear, bending and torsion.

UNIT-IV

Springs: Types of Springs & significance, Close and open coiled helical springs under axial load and axial twist. Carriage springs.

Columns and Struts: Emperical formulae Column & Struts, Failure of short, medium & slender column, Different end conditions of columns, Euler's theory for long columns. Rankine-Gordon's formula. Eccentrically loaded columns, Secant and prof. Perry's formulae.

UNIT-V

Unsymmetrical bending of beams: Unsymmetrical bending - Location of neutral axis, maximum stresses for rectangular section. Symmetric channel section.

Shear Centre: Shear stress, shear flow, shear center locating shear center for angle section, channel section and T-section , with one axis of symmetry.

Text Books:

1. B.C.Punmia , Strength of Materials, Laxmi publishers, Delhi, 2011.
2. S.Ramamrutham, Strength of Materials, Dhanpat Rai & Sons, Delhi, 2012.

Suggested Reading:

1. S.B. Junnarkar, Mechanics of structures (Vol-I & Vol-II), Charotar Publishing house, Anand, 2002.
2. D.S. Prakash Rao, Strength of Materials-A Practical Approach, Universities Press, Hyd 1999.
3. E.P. Popov, Engineering Mechanics of solids, 1993.
4. G.H. Ryder, Strength of Materials, 3rd Edition in SI units, Macmillan India Ltd, Delhi, 2012.
5. A.Pytel and F.L.Singer, Strength of Materials , Harper & Row , 4th Edition, New York.1987.

16CE C14

FLUID MECHANICS - I

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

Course Objectives:

1. To understand fluid properties, fluid pressure & forces, basic concepts and continuity equation.
2. To understand the fluid motion, energy equation, analyze the forces on various objects.
3. To know various measuring instruments in finding the fluid pressure, velocity, and discharge.
4. To understand and analyze different flow characteristics of laminar and turbulent flows.
5. To study the motion of compressible flows and it's behaviour with different processes.

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

1. To evaluate the various properties of fluid, analyse fluid flow and forces.
2. To apply the various laws and principles governing fluid flow to practical problems.
3. To measure pressure, velocity and Discharge of fluid flow in pipes, channels, and tanks.
4. To apply laws related to laminar and turbulent flow in pipes.
5. To evaluate compressibility of gases and its behaviour, apply energy & continuity equation.

UNIT-I

Fluid Properties and Kinematics: Definition of fluid, Properties of fluids-Density, specific Weight, Specific volume, Specific Gravity, Bulk Modulus, Vapour pressure, Viscosity and Surface tension, Newton's law of Viscosity and its application. Capillarity.

Fluid Statics: Pascal's Hydrostatic Law, Absolute and gauge pressure. Forces on immersed bodies:

Total pressure, center of pressure, pressure on curved surface.

Buoyancy: Buoyancy, Metacentre, stability of submerged and floating bodies.

Fluid Kinematics: Classification of fluid flow- steady unsteady, uniform, non uniform, one, two and three dimensional flows. Concept of streamline, stream tube, path line and streak line. Law of mass conservation - continuity equation from control volume and system analysis. Rotational and Irrotational flows, Stream function, Velocity potential function. Significance and use of flownets.

UNIT-II

Fluid Dynamics: Convective and local acceleration, body forces and surface forces, Eulers equation of motion from control volume and system analysis.

Law of energy conservation : Bernoulli's equation from integration of the Euler's equation. Signification of the Bernoulli's equation, its limitations, modifications and application to real fluid flows.

Impulse momentum equation: Momentum Correction factor. Impact of Jets, force exerted on flat and curved vane. Application of the impulse momentum equation to evaluate forces on nozzles and bends. Pressure on curved surface- vortex flow- forced and free vortex.

UNIT-III

Measurement of Pressure: Piezometer sand Manometers- Micro manometer- Bourdon Gauge, Transducers.

Measurement of Velocity: Pitoto tube, pitot static tube, Current meter and Hot-wire anemometer.

Measurement of Discharge in pipes and tanks: Venture meter, Orifice meter, nozzle meter, elbow meter and rotameter. Flow through mouthpiece and orifice.

Measure of Discharge in Free surface flows: Notches and weirs.

UNIT-IV

Compressive Flow: compressibility of liquids and gases. Continuity equation, Bernoulli's energy equation (for isothermal and adiabatic processes) and impulse momentum equation. Velocity of a pressure wave for adiabatic and isothermal processes. Mach number and Mach cone and its applications. Stagnation Pressure, Density and Temperature in adiabatic process.

UNIT-V

Flow through pressure conduits: Reynold's Experiment and its signification. Upper. Lower Critical Reynold's Numbers, Critical velocity. Hydraulic gradient. Laminar flow through circular pipes. Hagen Poiseuille equation. Turbulent flow characteristics. Ehadloss through pipes. Darcy-Weisbach equation. Friction factor. Moody's diagram. Minor loss, Pipes in Series and Pipes in parallel.

Text Book:

1. P.N.Modi & S.M.Sethi, Hydraulic and Fluid Mechanics, Standard Book House, Delhi, 11th Edition, 1995.
2. A.K.Jain, Fluid Mechanics, Khanna Publishers, Delhi, 1993.

Suggested Books:

1. K.L. Kumar, Engineering Fluid Mechanics, Eurasia Publishing House, 1997.
2. R.K. Rajpur, Fluid Mechanics and Hydraulic Machines, S.Chand and Company, 2003.
3. Yunus A. Cengel & John M. Cimbla, Fluid Mechanics Fundamentals and Applications, Tata MsGraw Hill Education private Ltd, 2012.

16CE C15

STRENGTH OF MATERIALS LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To know and understand the experiments on various materials to assess their behavior / limitations.
2. To know the brittle and ductile material failure patterns etc., by conducting experiments.
3. To assess the hardness property of engineering materials.
4. To understand the shear force, bending moments and deflections for different types of beams.
5. To know rigidity modulus by conducting spring and torsion test.

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

1. To compute the strength of members of various materials under different structural actions such as compression, tension, flexure and torsion.
2. To compute the elastic property of the material of beams by measuring deflections in beams and using the relations between load and deflection for various type of beams.
3. To determine the hardness of different types of materials.
4. To study the load-deflection behaviour for various types of springs.
5. To study the Torque-Twist behaviour of a given shaft.

<u>LIST OF EXPERIMENTS</u>

1. Direct Tension test on metal rods.
2. Young's Modulus of metal specimen by direct Tension test.
3. Brinnel's and Rock well hardness test.
4. Compression test.
5. Impact test.
6. Test on helical Spring to determine the rigidity modulus.
7. Torsion Test to determine the rigidity modulus of a shaft.
8. Deflection test on a cantilever beam to determine the Young's modulus.
9. Deflection test on a simple beam to determine the Young's Modulus.

PROFESSOR & HEAD
Department of Civil Engineering
Chaitanya Bharathi Institute of Technology
GANDIPET, HYDERABAD-5000 075

10. Deflection test on a Fixed beam to determine the Young's Modulus.
11. Deflection test on a Continuous beam to determine the Young's Modulus.

Suggested Readings:

1. B.C.Punmia , Strength of Materials, Laxmi publishers, Delhi, 2011.
2. S.Ramamrutham, Strength of Materials, Dhanpat Rai & Sons, Delhi, 2012.
3. G.H. Ryder, Strength of Materials, 3rd Edition in SI units, Macmillan India Ltd,

16CE C16

SURVEYING -II LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives :

1. To understand the importance of vertical angles for finding the heights and distances.
2. To get exposure to modern instruments for solving the problems and also understanding the concepts of automation in surveying.
3. To be in a position to set the curves by using various methods and identifying the data required to be computed for the same.
4. To get an idea about developing drawings based on field data.
5. To get an idea about the data transferring to field from the developed maps.

Course Outcomes :

1. To Find the Reduced level of a given point in different practical situations.
2. To determine the area of a given topography using principles of Tachometry.
3. To use Total Station for locating ground details and plotting.
4. To set simple curves using Total Station.
5. To locate ground features using GPS.

LIST OF EXPERIMENTS

1. Finding the R.L. of a given point using two instrument stations in the same vertical plane as that of the point when the base of the point is inaccessible.
2. Finding the difference of level between two given points using two theodilite stations (Baseline) in different planes.
3. Determination of Tacheometer constants and finding the area by using stadia tacheometer.
4. Finding the gradient of a line connecting two points using stadia tacheometry .
5. Locating ground details using Total Station and plotting the same.
6. Staking of points for a foundation or a Road centre line or a pipe line using Total station.

7. Setting of simple curve with the help of Total Station by coordinate system .
8. Location of Ground features using GPS instrument and plotting the same after processing the data.
9. Developing contour maps for a land using modern instruments.

Suggested Readings:

1. C. Venkata Ramaiah, "A Text book of Surveying", University press, Hyderabad, 1997.
2. B.C. Punmia, "Surveying Vol. I and II", Laxmi publications, 1994.

16EG CO3

SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT LAB

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

Course Objectives: To help the students

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

Course Outcomes: The students will be able to

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

Exercise 1

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

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

Exercise 2

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

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

Exercise 3

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

Exercise 4

Corporate Culture: Grooming and etiquette, communication media etiquette, Academic ethics and integrity.

Exercise 5

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

Suggested Reading:

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

16CE C17

Mini Project -Survey Camp

Instruction	6 days (36 hrs) between IV Semester to V Semester
Duration of Semester End Examination	-
Semester End Examination	-
CIE	50 Marks
Credits	1

A one week (6 days - 36 hours) surveying camp should be organized in the intervening period between the completion of the IV Semester and the commencement of V semester.

The work has to be graded for 50 Sessional marks by a committee consisting of the Head of the department and 2-3 Senior Faculty members.

The surveying camp should expose the student to all the aspects of planning, organizing and conducting a filed survey and plotting of the same.

PROFESSOR & HEAD
Department of Civil Engineering
Chaitanya Bharathi Institute of Technology
GANDIPET, HYDERABAD-5000 075

16CE C18

REINFORCED CONCRETE DESIGN - I

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

Course Objectives: To enable the student

1. Understand general mechanical behavior of reinforced concrete, design philosophies, design requirements get introduced to IS: 456 code and working stress method of design applied to RC rectangular beams.
2. Understand the basic principles of Limit state design, assumptions made in theory of flexure and flexural design procedures for singly reinforced and doubly reinforced rectangular beam.
3. Grasp the fundamentals of analysis and design of rectangular beams for shear and torsion, checking for bond and applying serviceability check for beams.
4. Know the procedures for analysis and design of one-way simply supported and cantilever slabs and two-way simply supported and continuous slabs.
5. Learn the design and detailing of columns and footings of rectangular and circular sections.

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

1. Use and suggest Reinforced concrete for various practical applications, interpret the clauses of IS:456 and apply the working stress method of design for rectangular beams.
2. Design RC beams of rectangular and flanged sections/ for flexure using limit state method.
3. Design RC beams for shear and torsion and check for bond and serviceability.
4. Analyze and design solid rectangular RC slabs of one way (cantilever, simply supported and continuous) and two way (simply supported and continuous).
5. Design RC columns (short and long) and axially loaded footings of circular and rectangular sections.

Note: All relevant IS codes necessary for teaching their course may be introduced and referred in detail by the concerned faculty.

UNIT - I:

Introduction to Reinforced Cement concrete: Concrete - characteristics strength - Grade of Concrete - Workability, durability of concrete - Reinforced concrete

(RC) - Types of reinforcing steel - Yield stress - Advantages of reinforced concrete - basic requirement of RC structures.

Design Philosophies: Development of design philosophies - working stress method - Ultimate load method - Limit state method - Merit and demerits.

Introduction to IS:456:General design requirements and specifications.

Working Stress method: Assumptions made in design of flexural members - Cover to reinforcing steel - Theory of bending in RC beams - Balanced, under and over reinforced sections. Analysis and design for flexure of singly and doubly reinforced rectangular beams.

UNIT- II:

Limit state method of design:

Introduction to limit state method - classification of limit states - characteristic loads - partial safety factors – Factors for material and load - design stress - stress and strain diagram of concrete and steel - Assumptions made in design of flexural members - Stress block parameter - Analysis and flexural design of singly reinforced, doubly reinforced rectangular beams and flanged beams.

UNIT - III:

Limit state of collapse in shear and torsion: Types of shear reinforcement - analysis and design for shear and torsion in beams - Bond - development length and curtailment of reinforcement in beams and detailing of bars: IS code provisions.

Limit state of serviceability: Short term, long term, total deflection - check for deflection - cracking - IS code provisions.

UNIT - IV:

Analysis and design of slabs: Solid rectangular slabs - cantilever slab - simply supported and cantilever one way and two way slabs subjected to uniformly distributed loads - IS code method of design of these slabs - Detailing of reinforcement and check for serviceability in slabs.

Design of stair: Design and detailing of dog legged stair.

UNIT - V:

Analysis and design of columns: Short and long columns - End conditions- effective length of columns assumptions made in design - analysis - design and detailing of axially loaded square, rectangular and circular columns with lateral ties and helical bar - Design of axially loaded short columns subjected to uni-axial and bi-axial moments , using interaction diagrams – design principles for long columns.

Footings: Types of Foundations and IS Specifications, Design and detailing of isolated rectangular and circular footings for axial loads.

Text Books:

1. N. Subramanian, "Design of Reinforced Concrete Structures" Oxford University Press. First Published in 2013,Second impression 2014.

2. S Unni Krishnan Pillai and Devadas Menon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Co Ltd, (Third Edition), 2009.

Suggested Reading:

1. V.L.Shah and S.R.Karve, "Limit State Theory and Design of Reinforced Concrete", Structures Publications, 7th Edition,2014.
2. A.K. Jain, "Reinforced Concrete: Limit State Design", Nem Chand & Brothers-Roorkee; Seventh edition, paperback – 2012.
3. Sushil Kumar, "Treasure of RCC Designs", Standard Book House; Edition: 19th, Year-2014 edition (1 December 2009).
4. N. Krishna Raju, "Design of Reinforced Concrete Structures", CBS Publishers and Distributors, New Delhi,4th edition, 2016.

16CE C19

SOIL MECHANICS

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

Course Objectives: To enable the students

1. Understand the basic principles of soil mechanics and basic properties of soils and basic knowledge of identifying soil.
2. Understand the flow through soils and its behavior and gain a practical outlook of utilizing soil as construction materials.
3. To know the knowledge about the highly compressible soil settlements.
4. Capable of estimating the strength of soil to different loading conditions.
5. Deal with problem of earth pressures and slope stability and to utilize the knowledge with respect to practical orientation and R&D perspective.

Course Outcomes: At the end of the course, the student should

1. Be able to identify various types of soils, their properties and to apply the basic principles of soil mechanics to simple field problems.
2. Be able to prepare models for the behavior of soils, flow through soils and use / suggest soil as a construction material.
3. Be able to compute the settlements of the compressible soils.
4. Be able to estimate the strength of soil under different loading conditions.
5. Be able to deal with field problems of earth pressures and slope stabilities.

UNIT-I:

Physical and Index properties of soils: Introduction about origin and formation of soils, basic definitions from soil three phase diagram (weight ratios & volume ratio), Inter relationships of preliminary properties. Determination of laboratory tests for water content, field density, specific gravity by various methods, Index properties, sieve analysis, consistency of soils (Liquid limit, Plastic limit & shrinkage limit), Indian soil classification IS-1498-1970.

UNIT-II:

Permeability of soils: Darcy's. law of seepage water through soils- validity of determination of co-efficient of permeability (constant head, variable head permeability tests) – Field tests (Pumping in and pumping out tests) – Equivalent permeability of stratified soils.

Seepage in Soil: Seepage flow, seepage pressure – Flow nets – Locating phreatic line in a homogeneous earthen dam using Kogeny's parabola – computation of seepage quantity.

Stress in Soils: Total effective and neutral stress.
Quick Sand Phenomena**:** Critical Hydraulic gradient.

UNIT-III:

Compaction: Compaction Mechanism, factors affecting compaction. Laboratory determination of compaction characteristics- standard and modified Proctor tests – IS Light and Heavy compaction tests; Field surface compaction: compaction equipment, procedure, quality control.

Consolidation: Spring Analogy, Laboratory consolidation test, calculation of void ratio, compression characters (a_v, m_v & C_c) and settlement equation, differential equation for one dimensional consolidation, co-efficient of consolidation - square root & logarithm time fitting method and problems in consolidation settlements.

UNIT-IV:

Shear strength: Significance of Shear strength in soils – Mohr-Coulomb equation – shear parameters – Laboratory tests for determination of shear strength – Direct shear test, Tri-axial compression tests. (UU, CU and CD), Un-confined compression test, Vane shear test. Factors affecting shear strength of cohesion-less and cohesive soils. Determination of elastic Moduli.

UNIT-V:

Earth pressure: States of earth pressure – Active, Passive at rest condition; Rankin's theory; computation of active and passive earth pressure in cohesion-less & Cohesive Soils and c-ø soils; Coulomb's Wedge theory; Rehbhan's graphical solution.

Slope stability: Definition and classification of slopes – types of slope failures- Factors of safety with respect to cohesion, angle of shearing resistance, Height – Analysis of stability of slope using Swedish slip circle method and Taylor's stability number.

Text Books:

1. K. R. Arora, "*Soil Mechanics and Foundation Engineering*", Standard Publisher Dist.; 7th Edition, 2009.
2. B. C. Punmia, A. K Jain, and A. K. Jain "*Soil Mechanics and Foundations*", Laxmi Publications; Sixteenth edition, 2017.

Suggested Reading:

1. Relevant IS Codes
2. Gopal Ranjan, "*Basic and Applied Soil Mechanics*", New Age International Pvt Ltd; Third edition 2016.
3. C.Venkatramaiah, "*Geotechnical Engineering*", New Age Publications, revised Fifth edition, 2017.
4. B. M. Das and K. Sobhan, "*Principles of Geotechnical Engineering*", NPTEL study material.

16CE C20

THEORY OF STRUCTURES – I

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

Course Objectives: To enable the student to

1. Understand the concept of influence line diagrams for determinate beams for various types of loads and to find maximum SF and BM in the beams.
2. Grasp the procedure to construct influence line diagrams for different truss girders for various types of loads and to find maximum forces in the members of trusses.
3. Study the behavior of arches (two and three hinged) and their analysis for point loads and uniformly distributed loads.
4. Know the concept and analysis of cables and suspension bridges with three hinged stiffening girder.
5. Understand the methods to find the deflections of determinate trusses and frames by different methods and to analyze the redundant frames by different methods.

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

1. Draw the ILD's and able to find the maximum SF and BM for various positions of the moving loads.
2. Draw the ILD's for forces in the members of trusses and to find the maximum forces for various positions of the moving loads.
3. Analyze three and two hinged arches for various loads.
4. Find maximum forces in the cables and able to analyze suspension bridges with stiffened girders.
5. Find deflections of joints plane frames and trusses and analyze redundant trusses.

UNIT– I:

Moving loads: Influence line diagrams for support reactions, bending moment and shear force for a simply supported beam/girder. Determination of maximum values of support reactions, bending moment and shear force at any section for various moving load systems on simply supported beam / girder.

Curves of maximum bending moment and shear force for simply supported girders traversed by (i) single point load, (ii) two point loads (iii) uniformly distributed load longer than the span, and (iv) uniformly distributed load shorter than the span. Focal length, enveloping parabola and EUDL.

UNIT– II:

Moving loads on truss girders: Influence lines for forces in the members of statically determinate trusses like Warren truss, Pratt truss, and Curved flange trusses. Determination of maximum forces in truss members due to moving point loads and uniformly distributed loads. Counter bracing.

UNIT– III:

Three hinged arches: Three hinged parabolic and segmental arches, determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading. Influence lines for horizontal thrust, bending moment, normal thrust and radial shear.

Two hinged arches: Parabolic and segmental arches, determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading and temperature effects.

UNIT– IV:

Cables and Suspension bridges: Stresses in suspended cables due to point loads and uniformly distributed loads, equation of the cable, length of cable and general cable theorem. Suspension bridge with 3-hinged stiffening girders for static loading, determination of maximum tension in the cable, bending moment and shear force.

UNIT– V:

Deflections of Determinate structures: Deflection of pin-jointed plane frames and rigid jointed plane frames using Castigliano's theorem –I and Unit Load method.
Redundant pin-jointed plane frames: Analysis of pin-jointed plane frames using Castiglione's theorem –II and Unit load method, with one degree of redundancy (internal / external), Assembly and temperature effects.

Text Books:

1. B.C Punmia, and A. K. Jain, "*SMTS - II Theory of Structures*", Laxmi Publications, New Delhi, 2017.
2. S. Ramamrutham, "*Theory of Structures*", Khanna Publishers, New Delhi, 2018.

Suggested Reading:

1. H. J. Shah, S. B. Junnarkar, "*Mechanics of Structures Vol. II [Theory and analysis of structures]*", 24th Edition, Charotar Publishing House Pvt. Ltd., 2015.
2. T. S. Thandava Moorthy, "*Structural Analysis*", 2nd edition. Oxford University Press, 2012.
3. C. S. Reddy, "*Basic Structural Analysis*", 3rd Ed., Tata McGraw Hill, New Delhi, 2017.
4. D.S. Prakash Rao, "*Structural Analysis*" - *A Unified Approach*, University Press, 2012.

16CE C21

CONCRETE TECHNOLOGY

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

Course objectives: To enable the students

1. Learn the properties of various ingredients of concrete.
2. Understand the behaviour of concrete in fresh and hardened states.
3. Understand concrete mix design and compare the quantities using various design methods.
4. To acquire knowledge on the properties and effective usage of various admixtures.
5. Gain knowledge of various special concretes and their applications.

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

1. Determine the properties of the ingredients of concrete and adjudge their suitability.
2. Determine the properties of fresh and hardened concretes.
3. Carryout concrete mix design and apply statistical quality control techniques for quality assurance.
4. Use admixtures in suitable doses for improvement in various properties of concrete and for use in ready-mix concrete preparation.
5. Employ a special type of concrete depending on the purpose.

UNIT-I:

Constituents of concrete- review: Manufacture of Cement, Types of cements, tests on cements and aggregates.

Properties of Fresh concrete: Batching and Mixing, Workability, factors affecting workability, Measurement of workability using slump cone, compaction factor and V-B time tests, Segregation and bleeding, Compaction of concrete and Types of vibrators.

UNIT-II:

Hardened concrete: Strength of concrete and influencing factors, water- cement ratio, Gel, space ratio, Role of water in the mix, Short term and long term properties of concrete - shrinkage & creep, Types of Shrinkage, Factors affecting shrinkage & creep, Relationship between various mechanical strengths of concrete, Curing of concrete, Methods of curing, Maturity concept, Stress-Strain behaviour of concrete, Durability of concrete.

UNIT-III:

Mix design of concrete: Basic considerations, Factors to be considered in the choice of mix proportions, Quality control, various methods of mix design- I.S. code method, British and ACI methods.

UNIT-IV:

Admixtures: Classification of admixtures, Mineral and Chemical admixtures, Influence of various admixtures on properties of concrete, Applications, Ready mix concrete (RMC), Fly ash concrete – properties and applications.

UNIT-V:

Special Concretes: High strength concrete, High density concrete, Light weight concrete, Ferro cement, Recycled aggregate concrete, Self compacting concrete (SCC).

Fiber Reinforced Concrete: Need, Mechanism and properties of Fiber reinforced concrete (FRC), Types of Fibers and applications of FRC.

Text Books:

1. A.M Neville., "Properties of Concrete", English Language Book Society / Longman Publications, 1996.
2. M.S. Shetty, "Concrete Technology", S. Chand Publishers, 2005.
3. A. R. Santhakumar, "Concrete Technology", Oxford University, Press 2006.

Suggested Reading:

1. A.M. Neville and J.J. Brooks, "*Concrete Technology*", Dorling and Kindersley Publications, 2006.
2. P. K. Mehta, and J. M. M. Paulo, "*Concrete- Microstructure – properties and Material*", Mc. Graw Hill Publishers, 1997.
3. N. Krishnaraju, "*Design of Concrete Mixes*", CBS Publishers, 2010.

16CE C22

FLUID MECHANICS - II

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

Course Objectives: To enable the student

1. Understand and analyze the open channel flows, steady uniform flow and computation, friction and energy losses.
2. Understand and analyze the non-uniform flows and flow profile, energy dissipation.
3. Exposure to the basic principles of Aerodynamic forces, boundary layer formation and effects, pressure wave and compressibility effect in pipes.
4. Understand dimensional analysis, study of models, models applied to practical applications.
5. Familiarize with various types of hydraulic machinery (turbines and pumps), design and performance studies.

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

1. Able to apply the concepts of open channel flow and pipe flow to the field problems.
2. Able to apply the concepts of non-uniform open channel flow to the field problems.
3. Interprets the basics of computation of drag and lifts forces in the field of aerodynamics, boundary layer effect, effect of pressure wave in pipes.
4. Able to apply model studies to practical applications, should be able design and study models in labs.
5. Design the turbines and pumps, should be able to run the turbines and pumps for efficient conditions.

UNIT–I

Steady uniform flow through open channels: Definitions, difference between pipe flow and channel flow, velocity and pressure distributions in channel cross section, energy and momentum correction coefficients, uniform flow, Manning and Chezy formulae, most efficient channel cross-section, specific energy and specific force, concept of critical depth and its applications.

UNIT-II

Non-uniform flow through open channels: Critical flow, Significance of Froude Number, dynamic equation of gradually varied flow, classification of gradually varied flow profiles and computation of flow profiles. Hydraulic Jump- Momentum equation for a jump in horizontal rectangular channel, energy dissipation in hydraulic jump. Introduction to surges.

UNIT-III

Boundary layer-Definition, laminar and turbulent boundary layers, boundary layer thickness, displacement thickness, momentum thickness and energy thickness, hydro dynamically smooth and rough boundaries, boundary layer separation.

Drag and lift: Fundamental concepts of drag and lift forces. Drag on sphere, cylinder, flat plate and aerofoil. Principles of streamlining, Magnus effect.

UNIT-IV

Unsteady flow in pipes: Water hammer phenomenon, pressure rise due to gradual and sudden valve closure, critical period of the pipeline.

Dimensional analysis and models studies: Dimensional analysis as a tool in experimental hydraulics, Rayleigh Method, Buckingham method; geometric, kinematic and dynamic similarity, similarity laws; significance of Reynolds, Froude and Mach numbers, different types of models and their scale ratios, distorted and undistorted models, scale effect in models.

UNIT-V

Hydraulic turbines: Classification, specific speed, unit quantities velocity triangles, power developed and efficiencies. Principles of design of reaction and impulse turbines, characteristics curves, selection of turbines.

Centrifugal Pumps: Components, work done and efficiency, minimum starting speed, Euler head equation, specific speed and characteristic curves of centrifugal pumps, Pumps in series and parallel.

Text Books:

1. P. N. Modi & S. M. Seth, "*Hydraulic and Fluid Mechanics*", Standard Book House, Delhi, 20th Edition, 2013.
2. K. Subramanya, "*Flow in Open Channels*", Tata McGraw-Hill Education, 2009.

Suggested Reading:

1. K. Subramanya, "*1000 Solved Problems in Fluid Mechanics*", Tata Mc-Graw Hill Publications 2005.
2. Ven Te Chow, "*Open-Channel Hydraulics*", The Blackburn Press; 57th edition, 2009.
3. A. K. Jain, "*Fluid Mechanics: Including Hydraulic Machines*", Khanna Publisher, 12th edition, 2016.
4. R. L. Streeter, G. Z. Watters, and J. K. Vennerd, "*Elementary Fluid Mechanics*", John Wiley International Publications, 7th Edition, , 1996.

16CE E01

ROCK MECHANICS
(Elective-I)

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

Course Objectives:

1. The objective of the course is to provide basic knowledge of Rock Mechanics and its application.
2. To understand the properties of the rocks.
3. To know the strength of the rock.
4. To study the application of rocks in engineering.
5. To know and apply the preventive techniques in rocks.

Course Outcomes:

1. Able to know the basic knowledge about rocks.
2. Able to determine the rock properties.
3. Able to determine the strength and quality of the rocks.
4. Able to know the failure criteria of the rock.
5. Able to apply the preventive techniques for the rock.

UNIT- I:

Introduction, Importance and application of rock mechanics to engineering problems, Rock Mechanics and its relationship with soil mechanics and engineering geology. Definition of Rock masses. Rock masses as construction material, Main features constituting rock mass. Effect of alteration and weathering.

UNIT- II:

Engineering properties of rocks, Porosity, Density, Moisture content, Degree of saturation, Coefficient of permeability, Durability, Compressive strength, Tensile strength, Shear strength, Elasticity, Plasticity deformability. Sampling and samples preparations - IS codes, Uni-axial compressive strength, Tensile strength - Brazilian test, Shear strength test. Plate load test for deformability, shear test, Test for internal stresses - flat jack.

UNIT– III:

Classification - Litho logical classification of rocks, Rock mass classification, Rock Quality Designation, Rock Structure rating, RMR classification, Q classification. Inter relation between Q and RMR. Classification of fissures, Joints and faults.

UNIT– IV:

Geophysical Methods - Seismic Refraction & Electrical Resistivity methods, GPR, rock blasting.

UNIT– V:

Earthquake: Magnitude and intensity of earthquake. Seismic waves. Seismic zones in India. Geological Hazards - Rock Instability and slope movement: Concept of sliding blocks. Different controlling factors - Prevention by rock bolting and rock anchoring, retaining wall, slope treatment, grouting. Case studies.

Text Books:

1. B. P. Verma, "*Engineering Geology and Rock Mechanics*", Khanna Publishers, 1998.
2. T. Ramamurthy, "*Engineering in Rocks for Slopes, Foundations and Tunnels*", Prentice Hall India Learning Private Limited; Third edition, 2014.

Suggested Reading:

1. J.C. Jaeger and N.G.W. Cook, "*Fundamentals of Rock Mechanics*", Wiley India Pvt Ltd, 4th edition, 2012.
2. D. Deb and A. K. Verma, "*Fundamentals and Applications of Rock Mechanics*", PHI, 2016.
3. R. E. Goodman, "*Introduction to Rock Mechanics*", Wiley India Pvt Ltd; Second edition, 2010.

16CEE02

ADVANCED SURVEYING

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

Course Objectives:

1. To enable the student understand the basic principles of Aerial surveying and its role in civil engineering.
2. To expose the student to image interpretation and equipment used for the same.
3. To enable the student to get acquainted with digital image processing system.
4. To expose the student to understand about how microwave sensing can be used in surveying.
5. To understand about the errors in surveying and application various statistical procedures for adjusting the errors in different

Course out comes:

1. To be in a position to understand the Photogrammetric surveying techniques.
2. To know the techniques involved in image processing.
3. To get exposure to digital image processing.
4. To be able to understand microwave sensing and its application.
5. To be able to adjust the errors that are cropping while carrying surveying.

UNIT– I:

Aerial surveying : Aerial Photogrammetry -introduction, activities of Photogrammetry, Basic Geometric Characteristics of Aerial Photographs-element s of a vertical photograph-photo coordinate measurement-Photographic scale-problems, ground coverage of aerial photographs, area measurement, Relief displacement of vertical features-correction for relief displacement, image parallax, ground control aerial photography, mapping with aerial photographs, Flight planning.

UNIT– II:

Visual Image interpretation: Introduction, fundamentals, elements, strategies, interpretation keys, wavelengths of sensing, temporal aspects, process, preparation of images and viewing- basic visual interpretation equipment, concepts of land use land cover mapping- classification With remotes Sensor data.

UNIT– III:

Digital image Processing: Introduction, various types of image manipulations, image rectification and restoration-geometric correction— Radiometric correction-Noise removal, image enhancement, spatial feature manipulation -spatial filtering-low pass filters and high pass filters-convolution-edge enhancement, Multi image manipulation.

UNIT– IV:

Microwave sensing - introduction, Radar development- side looking radar system , operation, Range resolution ,synthetic aperture radar - geometric characteristics-transmission characteristics-other characteristics. Radar image interpretation, Lidar-introduction and applications.

UNIT– V:

Theory of errors and survey adjustments introduction, types of errors, laws of weights, Principles of Least squares, Most probable value, method of displacements, Method of correlates, probable errors , distribution error, Triangulation adjustment-station adjustment, figure adjustment- adjustment of a triangle, chain of triangles, quadrilaterals, polygon with central station -methods of equal shifts, adjustment of levels and adjustment of a closed traverse.

Text Books:

1. T. Lillesand, R. W. Kiefer, "*Remote Sensing and Image Interpretation*", Jhon Willey & Sons, 2015.
2. A. M. Chandra, "*Higher Surveying*", New Age international (P) Limited, 2015.

Suggested Reading :

1. A. M. Chandra, "Geo-informatics", New age international Publishers, 2016.
2. R. Subramanian, "*Surveying and Levelling*", Oxford University Press, 2nd edition, 2012.
3. C. Venkatramaiah, "*Textbook of Surveying*", Orient Blackswan Private Limited, 2nd edition, 2011.
4. K. R. Arora, "*Surveying Volume - II*", Standard Book House; 13th edition, 2015.

PROFESSOR & HEAD
Department of Civil Engineering
Chaitanya Bharathi Institute of Technology
GANDIPET, HYDERABAD-5000 075

16CE E03

ADVANCED STRENGTH OF MATERIALS
(Elective-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 flexural behaviour of curved bars and determining the stresses in various X-sections.
2. To understand the behaviour of beams curved in plan, subjected to different types of loads.
3. To learn the determination of stresses in rotating discs, rings & cylinders.
4. To realize the significance of experimental techniques in stress analysis & understand the brittle coating & strain gauge methods for stress analysis
5. To know the failure criteria of materials and various theories of elastic failure.

Course Outcomes: At the end of the course, the student is expected to be

1. Capable of designing curved bars of different X-sections.
2. Able to determine stresses in beams curved in plan.
3. Expert to determine stresses in discs, rings & cylinders.
4. Competent to employee methods of brittle coating and strain gauges for stress analysis.
5. Proficient in using an appropriate elastic theory of failure for the materials and determine principal stresses.

UNIT – I:

Bending of curved bars: Introduction, Bending of curved bars, stresses in curved bars with large curvature (Winkler-Bach Theory), calculation of stresses in curved bars of different sections-rectangular, circular and trapezoidal in crane hooks, rings and chain links.

UNIT-II:

Beams curved in plan: Introduction, circular beam loaded uniformly and symmetrically supported on columns, Semi-Circular beam simply supported on 3 equally spaced supports, fixed cantilever quarter circular beam with a point load at free end, A fixed ended segmented curved beam.

UNIT-III:

Rotating Rings, Discs & Cylinder: Introduction, thin rotating ring or cylinder, rotating solid thin disc, rotating disc with a central hole, rotating disc of uniform strength, rotating long cylinder, temperature stresses in a thin disc.

UNIT-IV:

Experimental stress analysis Techniques:- Introduction, Brittle Lacquers - Brittle coating techniques, Coating stresses, Theory of failure for Brittle coatings, crack patterns in brittle coating, crack detection, types of Brittle coating, Resin based brittle coating, equipment for Stress analysis by brittle coating method, specimen preparation, Testing & calibration of brittle coating.

Strain gauge: Introduction, strain sensitivity, metal foil gauge, temperature compensator, parameter influencing the behaviour of strain gauge.

UNIT-V:

Elastic theories of failure: Introduction - Failure by Yielding-Failure by Fracture - Yield and Fracture Criteria-Maximum Shearing Stress Theory-Maximum Distortion Energy Theory-Octahedral Shearing Stress Theory-Comparison of Yielding Theories-Maximum Principal Stress Theory- Mohr's Theory-Coulomb-Mohr Theory.

Text Books:

1. V. N. Vazirani and M. M Ratwani, "*Analysis of Structures Vol. 1: Analysis, Design And Details Of Structures*", Khan Publications, 2003.
2. U.C. Jindal, "*Advanced Topics of Strength of Materials (PART-II)*", Galgotia Publications Pvt.Ltd. 2001.

Suggested Reading:

1. Heinemann, "*Mechanics of Materials*" Butterworth, 3rd edition, 1997.
2. J. O. Seely and F. B. Smith, "*Advanced Mechanics of Ma*terials", 1967.
3. R. Subramanian, "*Strength of Materials*", Oxford University press, 2016.
4. U. C. Jindal, "*Strength of Materials*", Pearson Education; 2nd edition, 2017.

16CE C23

FLUID MECHANICS 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 enable the student understand the governing parameters for the discharge measurement for flows through various measuring devices.
2. To verify the flow and velocity measurements by conducting different tests.
3. To understand Bernoulli's principle by conducting experiments.

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

1. Ability to find the co-efficient of discharge for flows through various flow measuring devices.
2. To differentiate between laminar and turbulent flows and identify the governing parameters for both.
3. Applies the concept of Bernoulli's energy principle.

LIST OF EXPERIMENTS

1. Determination of C_d, C_v, and C_c for circular Orifice (constant Head method).
2. Determination of C_d for mouthpiece (constant Head method).
3. Determination of C_d for V notch.
4. Determination of minor losses in pipes.
5. Determination of C_d broad crested weir.
6. Determination of C_d for venturimeter.
7. Determination of C_d of a mouth piece for unsteady flow in a hemi – spherical tank.
8. Determination of types of flows using Reynolds apparatus.
9. Determination of Darcy's friction factor.
10. Verification of Bernoulli's principle.

Text Books:

1. M.N. Shesha Prakash, "*Experiments in Hydraulics and Hydraulic Machines – Theory and Procedures*", PHI Learning Private Limited, 2011.

16CE C24

ENVIRONMENTAL 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: To enable the students

Conduct physical and chemical analysis of water sample

1. Interpret laboratory results and report the values in comparison with environmental quality standards.
2. Find the optimum coagulant dosage for effective sedimentation.
3. Determine dissolved oxygen of water sample.
4. Determine the dosage for chlorination for disinfection of water supplies.

Course Outcomes: At the end of the course, the students should have learnt

1. To characterize the quality of water for suspended matter by physical tests.
2. To evaluate the quality of water for hardness, chlorides using chemical analysis.
3. To assess the alum dosage for effective sedimentation.
4. To measure Dissolved Oxygen concentration to assess the quality of water.
5. To measure the concentration of degradable organic matter.

List of Experiments:

1. Determination of alkalinity.
2. Determination of hardness.
3. Determination of chlorides.
4. Determination of pH.
5. Determination of electrical conductivity.
6. Determination of D.O.
7. Determination of B.O.D.
8. Determination of Iron.
9. Determination of Turbidity.
10. Determination of total solids, total inorganic solids.
11. Determination of residual chlorine.
12. Determination of optimum coagulant dosage by jar test.
13. Determination of C.O.D.

References:

1. Relevant IS codes and Specifications.

PROFESSOR & HEAD
Department of Civil Engineering
Chaitanya Bharathi Institute of Technology
GANDIPET, HYDERABAD-5000 075

16CE C25

CONCRETE LABORATORY

Instruction	3 Hours per week
Duration of semester End Examination	3 Hours
Semester Examination	50 Marks
CIE	25 Marks
Credits	2

Course objectives:
1. To understand properties of constituent materials of concrete
2. To comprehend the behaviour of fresh concrete
3. To understand mechanical behaviour hardened concrete
4. To acquire knowledge of conducting Non-Destructive testing on concrete structures

Course outcomes: At the end of this course, students will be able to:
1. Test different concrete mixing materials and issue test reports
2. Assess the workability of field concrete and guide the site supervisor in preparing a good concrete
3. Perform tests on mechanical characteristics of concrete and issue test reports.
4. Handle NDT equipment's and evaluate concrete by NDT methods

List of Experiments:
1. Determination of specific gravity and bulk density of cement.
2. Determination of normal consistency and initial setting time of cement.
3. Determination of compressive strength of cement.
4. Determination of fineness of cement by sieving and by air permeability methods.
5. Determination of specific gravity, bulk density, voids ratio and porosity of fine aggregate.
6. Determination of Bulking of sand by field and laboratory methods of coarse aggregate.
7. Determination of fineness moduli of fine & coarse aggregates.
8. Measurement of workability of design concrete mixes by slump & compaction factor tests.
9. Determination of Compressive, split tensile and flexural strengths of design concrete mixes.
10. Non-Destructive testing of concrete using Rebound hammer & UPV tests.

References:
1. Relevant IS codes and Specifications

16CE C26

THEORY OF STRUCTURES-II

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

Course Objectives: To enable the student to

1. Understand the concept of indeterminate beams and frames and to analyze by slope deflection method due to point loads and udl load system.
2. Grasp the procedure for indeterminate beams and frames by moment distributed method due to point loads and udl load system.
3. Understand the concepts of Kani's Method for indeterminate beams and frames due to point loads and udl load system.
4. Grasp the procedure for indeterminate beams and frames by flexibility matrix method due to point loads and udl load system.
5. Analyze the indeterminate beams and frames by stiffness matrix method due to point loads and udl load system.

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

1. Analyze the indeterminate beams and frames by slope deflection method due to point loads and UDL load system.
2. Analyze the indeterminate beams and frames by moment distribution method due to point loads and UDL load system.
3. Analyze the indeterminate beams and frames by Kani's method due to point loads and UDL load system.
4. Analyze the indeterminate beams and frames by flexibility matrix method due to point loads and UDL load system.
5. Analyze the indeterminate beams and frames by stiffness matrix method due to point loads and UDL load system.

UNIT – I:

Slope deflection method: Introduction, Analysis of Continuous beams with and without sinking of supports. Single bay - single storied portal frames with and without side sway. Loading on each span may be point load(s) and uniformly distributed load on whole span.

UNIT-II:

Moment distribution method: Introduction, Analysis of Continuous beams with and without sinking of supports. Single bay - single storied portal frames with and without side sway. Loading on each span may be point load(s) and uniformly distributed load on whole span.

PROFESSOR & HEAD
Department of Civil Engineering
Chaitanya Bharathi Institute of Technology
GANDIPET, HYDERABAD-500 075

UNIT– III:

Kani's method: Introduction, Analysis of Continuous beams with and without sinking of supports. Single bay - single storied portal frames with and without side sway. Loading on each span may be point load(s) and uniformly distributed load on whole span.

UNIT– IV:

Flexibility method of Analysis: Introduction, Analysis of continuous beams, and rigid jointed plane frames with static indeterminacy not exceeding three. Analysis pin jointed plane frames with static indeterminacy not exceeding two.

UNIT– V:

Stiffness method of Analysis: Introduction, Analysis of continuous beams, pin jointed plane frames and rigid jointed plane frames with kinematic indeterminacy not exceeding three.

Text Books:

1. T. S. Thandava Moorthy, "*Structural Analysis*", Oxford University Press, 2nd Edition, 2012.
2. C. S. Reddy, "*Basic Structural Analysis*", Tata McGraw Hill, 3rd Edition 2017.

Suggested Reading:

1. B.C. Punmia, and A. K. Jain, "*SMTS - II Theory of Structures*", Laxmi Publications, 2017.
2. S. Ramamrutham, "*Theory of Structures*", Khanna Publishers, 2018.
3. D. S. Prakash Rao, "*Structural Analysis*" - *A Unified Approach*, University Press, 2012.
4. W. Weaver, JR. and J. M. Gere., "*Matrix Analysis of Framed Structures*", CBS Publishers, 2nd edition, 2004.

16CE C27

REINFORCED CONCRETE DESIGN-II

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

Course Objectives: To enable the student

1. Understand the design and detailing of rectangular and trapezoidal combined footings.
2. Learn the concepts of design and detailing of cantilever and counter fort retaining walls.
3. grasp the design and detailing of circular and rectangular water tanks
4. Comprehend the concepts of design and detailing of Solid slab bridges
5. Know the procedures for design and detailing of T-bean bridges

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

1. Design and detail the rectangular and trapezoidal combined footing .
2. Design and detail the cantilever and counter fort retaining wall .
3. Design and detail circular and rectangular water tanks
4. Design and detail solid slab, bridges under given condition.
5. Design and detail the various components of T-Beam bridges.

(Note: All relevant IS and IRC codes necessary for teaching this course may be introduced and referred in detail by the Faculty concerned)

UNIT – I

Combined Footings: Limit state design & detailing of combined rectangular and trapezoidal footings.

UNIT – II

Retaining walls: Limit state design and detailing of cantilever and counter fort type of retaining walls.

UNIT – III

Water tanks: Elastic Design & Detailing of circular and rectangular ground level and over-head tanks, design of staging for wind loads.

UNIT – IV

Bridges: Basic components- Types of bridges -Loads on bridges- IRC standards; Elastic design and detailing of two lane, simply supported RC Solid Slab Bridge including Kerb.

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UNIT- V

T-beam bridges: Components of a T-beam bridge- Elastic design and detailing of two lane, Simply Supported, Three girder T-beam bridge- Use of effective width method- Pigeaud's curves and Courbon's method.

Text Books:

1. N. Krishna Raju, "*Advanced Reinforced Concrete Design (IS: 456-2000)* ",CBS Publications 2nd Edition,2010.
2. Vazirani and Ratwani," *Design Of Concrete Bridges*", Khanna Publishers, 1998.

Suggested Reading:

1. D.S. Prakash Rao, "*Design Principles and Detailing of Concrete Structures*", Tata McGraw-Hill Publishing Co. Ltd., 1998.
2. D. Johnson Victor, "*Essentials of Bridge Engineering*", paperback, Oxford & IBH, Publishing Co., New Delhi, 6th Edition, 2015.
3. S. Ponnuswamy, "*Bridge Engineering*", Tata McGraw Hill, Third Edition, 2017.
4. N. Krishna Raju, "*Design of Bridges*", Oxford &IBH-Pubs Company-New Delhi, Fourth Edition, 2008.

16CE C28

WATER RESOURCES ENGINEERING - 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. Understand surface & sub surface hydrology, peak flow estimation, computation of yield from an open well.
2. Learn flow irrigation, lift irrigation, Design of Canal sections, and efficient use of Irrigation water.
3. Acquaint with locating site of a reservoir, design of a reservoir capacity.
4. Grasp the Design procedure for a diversion head works.
5. Technical acquaintance of water regulation.

Course Outcomes:

1. Ability to design a Rain Gauge network, flood estimation, estimate yield from an open well.
2. Capability to design canals, Capacity to operate irrigation system efficiently.
3. Select an ideal site for a reservoir, estimate its optimum capacity and regulate a reservoir efficiently.
4. Design, Construct and operate a barrage.
5. Regulate Canal flows efficiently as an irrigation engineer.

UNIT- I :

Water Resources: India's water wealth-Regional, National -Inequity in distribution-Role of Water resources in National Development.

Hydrology: Scope of hydrology in civil engineering, Hydrologic cycle, Rainfall, measurement of rainfall and estimation of mean rainfall over a catchment, optimum number of rain gauges for a catchment- infiltration, evaporation, runoff, factors affecting runoff- peak flow estimation, unit hydrograph method, flood frequency and return period.

UNIT-II:

Irrigation: Duty, delta and base period of crops, crop water requirements, methods of irrigation, micro-irrigation, irrigation efficiencies, depth of irrigation, wilting point, consumptive use, irrigation interval-types of canals, alignment of canals, canal sections, balancing depth of cutting, Kennedy's and Lacey's theories, design of lined and unlined canals.

Lift Irrigation: Necessity, layout and component parts of Lift irrigation.

UNIT-III:

Reservoirs: Investigations and site selection criteria, Storage capacity design, sedimentation, Flood routing.

Ground water: Types of aquifers, Aquifer parameters, steady radial flow into a confined and unconfined aquifers, Darcy's law, yield of an open well, Safe yield, Water harvesting structures and augmentation of ground water, Sustainable Ground Water management.

UNIT-IV:

Diversion head works: Components, causes of failures, Design criteria, Difference between weir and barrage, Bligh's Creep theory, Khosla's theory and method of independent variables, design principles of barrage.

UNIT-V:

Regulation works: Canal falls, types, design principles of trapezoidal notch fall, types of regulators, Functions of cross regulator and head regulator, cross drainage works, types, Criteria for selection of CD work, and design principles of an aqueduct, types of outlets, flexibility, sensitivity and proportionality of outlets.

Text Books:

1. P. N. Modi, "*Irrigation Water Resources & Water Power Engineering",* Standard Publishers, 9th edition 2014.
2. S. K. Garg, "*Irrigation Engineering and Hydraulic Structures: Water Resources Engineering - Vol. II",* Khanna Publishers, 2017.

Suggested Reading:

1. M. M. Dandekar and K. N. Sharma, "*Water Power Engineering*", Vikas Publishers, New Delhi, 2013.
2. Ch. S. N. Murthy, "*Water Resources Engineering: Principles and Practice*", New Age International Publishers; 2nd edition, 2002.
3. B.C. Punmia and Ashok Kumar Jain, "*Irrigation and Water Power Engineering*, Laxmi Publishers, 2016.
4. K. C. Patra," Hydrology and Water Resources Engineering", Alpha Science, 2008.

16CE C29

FOUNDATION ENGINEERING

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

Course objectives: To enable the students

1. Understand the stress distribution in the soils for different loading conditions.
2. Understand the principle of bearing capacity and settlement analysis.
3. Understand the principles of deep foundations.
4. Deal with the field problems.
5. Learn about coffer dams, caissons, and timbering of excavations.

Course outcomes: At the End of the course the students should be able to

1. Compute the stress distribution in the ground under different loading conditions.
2. Estimate the bearing capacity of different soils for shallow foundation.
3. Design the deep foundation by piles or wells.
4. Deal with the field problems in laying cofferdams and different dewatering techniques and sampling methods.
5. Interpret and implement the Concepts of Coffer dams , Caissons and Timbering of Excavations

UNIT-I:

Stress distribution in Soils: Boussinesq's and Westegaurd's equations for point load. Application of point load formulae for uniformly distributed load on circular area, Line load, Strip Load, rectangular area. Use of Newmark's chart for different areas using Boussinesq's equation, Contact pressure distribution.

UNIT-II:

Bearing capacity of soils: Terzaghi's equation for bearing capacity in soils –It's modification for continuous, square, rectangular and circular footings, general and local shear failure conditions. Plate load test as per IS specification. Allowable bearing capacity. Standard penetration test and use of N values for estimating soil conditions and bearing capacity.

Settlement Analysis: Computation of pressures before loading and after loading. Estimation of settlement – ultimate and after any given period.

UNIT-III:

Pile Foundations: Types of piles–Timber, steel, concrete, cast-in situ, precast piles, bearing piles, friction piles, compaction piles, large diameter piles. Pile capacity – Static formulae, dynamic formulae, pile load test, determination of point resistance and skin friction as per IS code. Bearing capacity of pile groups, negative skin friction.

UNIT-IV:

Coffer dams: Earth embankments, cantilever sheet piles, braced coffer dams. Double wall cofferdams, cellular coffer dams – circular, diaphragm type, general description and construction methods.

Caissons: types of caissons–Open caissons, pneumatic caissons, box caissons(floating caissons). General description and construction methods. Dewatering techniques: sumps, ditches. Well points, deep walls. Geo-textile methods: Types and uses.

UNIT-V:

Site investigation: Principles of exploration, sampling methods, transportation and storage of samples, boring and drilling methods, log of bore holes, sampling tubes and samplers. Sampling records.

Timbering of excavation: Bracing for shallow and deep excavations. Computation of lateral earth pressure. Reaction of struts.

Text Books:

1. K. R. Arora, "*Soil Mechanics and Foundation Engineering*", 7th Edition, Standard Publishers, 2009.
2. Gopal Ranjan, "*Basic and Applied Soil Mechanics*", 3rd Edition, New Age International, 2016.

Suggested Reading:

1. B.C Punmia and Ashok Kumar Jain and Arun Kumar Jain, "*Soil Mechanics and Foundations*", Laxmi Publications, 16th Edition, 2017.
2. E. J. Bowles, "*Foundation Analysis and Design*", Tata Mc Graw Hill, 2017.

16CE E04

FINITE ELEMENT METHODS
(Elective-II)

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

Course Objectives: To enable the student

1. Learn the fundamentals of Finite element method (FEM) and derive elasticity matrices fro 2-D and 3-D elasticity problems.
2. Understand basic principles of minimum potential energy methods and variational formulation of FEM know the stiffness matrix formulations using bar element and analyze simple problems.
3. Understand the FEM formulation using truss, beam, and plane frame elements and analyze simple problems with kinematic indeterminacy not greater than 3.
4. Get familiarized with displacement models, Isoparametric elements and quadrilateral elements and know the formulation of global stiffness matrices.
5. Know the formulation of stiffness matrices for Axi-Symmetric elements, Tetrahedron elements.

Course outcomes: At the end of the course, the student should have learnt

1. The fundamentals of FEM, elements of theory of elasticity.
2. Principle of minimum potential energy and variation formulation of FEM and analyze simple problems using bar elements.
3. The analysis of trusses, beams and rigid jointed plane frames.
4. The formulation of Global stiffness matrix, load matrix and analysis structures using 1st order triangular elements, isoparametric elements, and quadrilateral elements.
5. Application of Axi-Symmetric and Tetra-Hedron elements.

UNIT-I:

Introduction to FEM: General description of the method, brief history of the method, applications of the method, advantages of the finite element method, steps in the finite element method. Types of elements; Types of forces: body forces, surface tractions and point loads, Boundary conditions.

Strain displacement, and stress- strain relations for 2-D and 3-D problems. Equations of equilibrium and compatibility conditions for 2-D and 3-D problems. Plane stress and plane strain situations and derivation of elasticity matrices (D).

UNIT-II:

Finite Element Formulation: Principle of minimum potential energy, Principle of virtual displacement, Global coordinate system, local coordinate system, Raleigh Ritz method, Weighted Residual method- Galerkin's method, Boundary value problems- with one element and two elements.

Bar Elements: Shape functions, stiffness matrix for a 2- noded bar element, axial bar subjected to point loads-constant cross section and varying cross section bar.

UNIT-III:

Truss Elements: Transformation matrix, Stiffness matrix of truss member in local and global axis, analysis of trusses with kinematic indeterminacy not exceeding three.

Beam Elements: Shape functions, beam element stiffness matrix, element load vector, and analysis of continuous beams with kinematic indeterminacy not exceeding three.

Plane Frame elements: Element stiffness matrix in local coordinates, Transformation or Rotation matrix, and stiffness matrix and load vector in global coordinates.

UNIT-IV:

Displacement models: Selection of displacement models, geometric invariance, conforming and non-conforming elements.

2-D Triangular Elements (CST):Determination of strain-displacement matrix, area coordinates, shape functions, determination of element stiffness and load matrices, assembling global stiffness and load matrices. Problems with kinematic indeterminacy not exceeding three.

Iso-parametric elements: Iso-parametric concept, Iso-parametric, Sub parametric and Super parametric elements. Gauss Quadrature of numerical integration.

Quadrilateral elements: Construction of shape functions for 4 noded and 8 noded elements, determination of stiffness matrix, and nodal load matrices for 4-noded quadrilateral element.

UNIT-V:

Axi-symmetric elements: Strain-displacement relationship, stress-strain relationship, determination of stiffness matrix for 3-noded ring element and load matrices for body force and surface traction.

Tetrahedron elements: Volume coordinates, Strain-displacement matrix, and stiffness matrix.

Text Books:

1. David V. Hutton, "*Fundamentals of Finite Element Analysis*", McGraw Hill Education (India) Private Limited, 2017.
2. P. N. Godbole, "*Introduction to Finite Element Method*", I. K. International Publishing House Pvt. Ltd. New Delhi, 2013.

Suggested Reading:

1. T. R. Chandrupatla, and A.D. Belegundu, "*Introduction to Finite Elements in Engineering"*, Pearson Education India; 4 edition, 2015.
2. D. L. Logan, "*A First Course in the Finite Element Method"*, Cengage Learning India Private Limited; 5 edition, 2012.
3. O. C. Zienkiewicz, and R. L. Taylor, "*The Finite Element Method: Its Basis and Fundamentals*", Butterworth-Heinemann; 7 edition, 2013.
4. P. Seshu. "Textbook of *Finite Element Analysis*", PHI, 1st edition, 2010.

16CE E05

GEOGRAPHICAL INFORMATION SYSTEM AND REMOTE SENSING (Elective - II)

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

Course objectives: To enable the student

1. Understand the basics and applications of GIS, and to take decisions using GIS under uncertain Conditions.
2. Understands the basic difference between vector GIS and raster GIS.
3. Understand the various types of data, realize the importance of spatial data and also in a position to apply methods of data compression techniques.
4. Perform data analysis and modeling using GIS.
5. Understand the basics of remote sensing and apply the principles to watershed modeling, environmental modeling and watershed management.

Course Outcomes: At the end of the course, the student

1. Is able to apply the principles of GIS to various field problems and take decisions under uncertain conditions.
2. Is able to understand advantages and disadvantages of using vector GIS and raster GIS.
3. Is able to apply the methods of data Compression using GIS.
4. Can perform the data modeling and analysis using GIS.
5. Is able to apply the basic principles of Remote Sensing for Watershed modeling, Environmental Modeling and for Watershed Management.

UNIT– I:

Introduction: Map, definitions, representations–Point line, polygon, common coordinate systems, map projects – transformations – Coordinate systems- – map analysis. History of development of GIS – Applications of GIS: Soil and water resources, agriculture, land use planning, geology and municipal applications, using GIS for decision making under uncertainty.

UNIT-II:

Data entry, storage and maintenance: Data types–spatial non spatial (attribute data)–data-structure, data format – point line vector – Raster – Polygon – Object structural model – filters and files data in computer – keyboard entry, manual digitizing, scanner, remotely sensed data. Concepts of Geo referencing, Existing digital data – cartographic database. Digital elevation data – data compression.

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Chaitanya Bharathi Institute of Technology
GANDIPET, HYDERABAD-5000 075

UNIT-III:

Data analysis and modeling: Spatial analysis, data retrieval, query (SQL)–Simple analysis, recode overlay, vector analysis, raster data analysis – modeling in GIS – Digital elevation model– cost and path analysis – knowledge based systems.

GIS Analysis Functions: Organizing data for analysis, classification of GIS analysis function, maintenance and analysis of spatial data – transformation, conflation, edge matching and editing, Maintenance and analysis for non-spatial attribute data editing and query functions.

UNIT-IV:

GIS analysis function for integrated analysis of spatial and attribute data: Retrieval and classification function: Overlay operations, neighborhood operations, connectivity function, output formatting – Map annotations text pattern and line styles, graphic symbols, cartographic modeling by GIS analysis procedure with an example.

Presentation of Geo-data Analysis: Types of output data–types of errors elimination and accuracies – sampling - components of data quality.

UNIT-V:

Introduction of Remote Sensing: Electromagnetic radiation, characteristics, interaction with earth surface, sensors types, satellite characteristics IRS series, data products interpretation of data.

Software scenario – Functions: Watershed modeling, Watershed Management, Environmental modeling – Visibility analysis. Vehicle tracking.

Text Books:

1. K. T. Chang, "*Introduction to Geographic Information Systems*", McGraw-Hill Education, 1st edition, 2015.
2. P.A. Burrough, "*Principles of Geographical Information Systems for Land Resources Assessment (Monographs on Soil and Resources Survey)*", Oxford University Press, 1986.
3. Lillesand and Kiefer, "*Remote Sensing and Image Interpretation*", Wiley; Sixth edition, 2011.

Suggested Reading:

1. I. Heywood, S. Cornelius and Steve Carver, "*An Introduction to Geographical Information Systems*", Pearson, 4th Edition, 2012.
2. B. Bhatta, "*Remote Sensing and GIS*", Oxford, Second edition, 2011.
3. S. Kumar, "*Basics of Remote Sensing and GIS*", Laxmi Publications, First edition, 2016.
4. S. Aronoff, "*Geographic Information Systems: A Management Perspective*", WDL Publications Ottawa, 1991.

16CE E06

ARTIFICIAL NEURAL NETWORKS, FUZZY LOGIC & EXPERT SYSTEMS (ELECTIVE - 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 importance of Artificial Intelligence and get introduced to Fuzzy Logic (FL), Artificial neural networks (ANN)& Expert systems (ES).
2. To get acquaintance with various components & types of Neural Networks.
3. To learn the fundamentals & applications of fuzzy sets to civil engineering problems.
4. To learn the concepts & various types of expert systems tools.
5. To get exposure of different software packages by solving a case study using FL, ANN & ES.

Course Outcomes: At the end of the course, the student is expected to

1. Have the overall idea &knowledge to employ FL, ANN & ES for specific applications.
2. Have fundamental knowledge of ANN.
3. Have rudimentary knowledge of Fuzzy sets & their applications.
4. Have the grasp of Expert System & its applications.
5. Apply FL, ANN & ES to the real cases of civil engineering and get the solutions to the problems, with the help of standard software packages.

UNIT– I:

Introduction: Brief introduction to the study of artificial intelligence:" An insight to the concept of natural intelligence followed by the development of artificial neural networks, fuzzy logic systems and expert systems tools. Demonstration of the importance of artificial neural networks, fuzzy logic, and expert systems with the help of at least two practical examples of Civil Engineering for each study. Importance of nuerofuzzy systems.

UNIT– II:

Neural Networks: Components of artificial neural networks neurons, inputs, outputs, error, error propagation, hidden layers threshold logic, weights: bias, noise, momentum, rate of learning, training and testingHebb's rule, Delta rule Supervised learning – Generalized delta rule unsupervised learning.

Types of Neural Networks Perceptions feed forward back propagation networks Hop field networks.

UNIT– III:

Fuzzy sets: Crispness vagueness, uncertainty, and fuzzy sets. Basic Definitions and operations of Fuzzy sets, approximate reasoning, and membership function. Fuzzy Relations: Fuzzy relation and fuzzy composition, fuzzy aggregation procedures, Dominance Matrix, Weight ages, applications of Fuzzy sets to civil engineering problems, and pattern recognition.

UNIT- IV:

Expert systems: Structure of expert systems, Knowledge of acquisition, Knowledge organization, methods of representing knowledge, types of inference engines, reasoning under uncertainty, various types of expert system tools, heuristics, search mechanism, expert system Development and hybrid expert systems.

UNIT- V:

Exposure to Software Packages: Neural networks (Mat lab tool kit)–fuzzy logic expert systems (L5 object)Applications of Artificial Neural Networks, Fuzzy logic and expert systems in Civil Engineering Case studies with at least one problem on each aspect of ANN, FL and Expert systems.

Text Books:

1. H. J. Zimmerman, "Fuzzy Sets, Decision Making, and Expert Systems", Kluwer Academic Publications, Boston, 1987.
2. H. Adeli, "Expert Systems in Construction and Structural Engineering", Chapman & Hall, Ltd. London, UK, 1988.

Suggested Reading:

1. K. Knight, E. Rich, S. B. Nair "*Artificial Intelligence*", McGraw Hill Education; 3rd edition, 2017.
2. J. A. Freeman and D. M. Skapura, "*Neural Networks: Algorithms, Applications and Programming Techniques (Computation and Neural Systems Series)*", Addison Wesley, 1991.

16CE C30

SOIL MECHANICS LABORATORY

Instruction	3Hours per week
Duration of semester End Examination	3 Hours
Semester Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To prepare the students with good skills in the laboratory procedures in soil mechanics.
2. To empower the students to deal with the field and laboratory, procedures in soil Explorations and sampling procedures.

Course Outcomes: At the end of the course the student should have learnt

1. The basic skills of conducting experiments on Soils for knowing their properties, identifying its type and interpret the results.
2. To apply the experimentation skills to the field problems such as site investigations and Soil Exploration techniques.

Determination of Basic and Index properties (Any Five Tests)

1. Determination of specific gravity of soil solids using "Density bottle" method.
2. Determination of specific gravity of soil solids using "Pycnometer" method.
3. Determination of water content using "Pycnometer" method.
4. Determination of liquid limit using Casgrandes standard LL device.
5. Determination of liquid limit using cone penetration apparatus.
6. Determination of plastic limit.
7. Sieve Analysis for plotting Particle size distribution curve.
8. Determination of Field Density using Sand Replacement Method.
9. Determination of Relative Density of Sand.

Determination of Engineering properties (Any Five Tests)

10. Determination of Compaction Characteristics.
11. Determination of Co-efficient of Permeability by "Constant Head Permeameter test".
12. Determination of Co-efficient of Permeability by "Variable Head Permeameter test".
13. Determination of shear strength parameters by "Direct Shear Test".
14. Determination of shear strength of cohesive soils by "Unconfined compression Test".
15. Determination of shear strength of conducting "Vane shear test".

<u>Test Procedures</u>:

16. Consolidometer test.
17. Tri-axial Shear test.

Suggested Reading:

1. Relevant IS Codes of Practice.
2. T.W. Lambe, "*Soil Testing for Engineers (Wiley Series in Geotechnical Engineering)*, 1966.
3. Relevant ASTM Codes of Practice.

16CE C31

HYDRAULICS AND HYDRAULIC MACHINERY LAB

Instruction	3Hours per week
Duration of semester End Examination	3 Hours
Semester Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: To enable the student

1. Understand uniform and non-uniform flows and the importance of Froude number in open channel flows.
2. Determine super elevation in a curved channel.
3. Determine the force exerted by fluid jet on vane, determine efficiency and performance of turbines and centrifugal pumps.
4. Study streamline patterns in a fluid flow system and air pressure distribution around an Airfoil.

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

1. To compute the open channel rugosity coefficient in uniform flows and Froude number, energy losses in non- uniform flows.
2. To differentiate between uniform, non-uniform flows and flow in curved channel.
3. To determine work done by fluid jet on vane, compute work done and draw performance characteristic curves for turbines and centrifugal pumps.
4. To find the discharge between stream lines and pressure variations around an airfoil.

List of experiments

1. Uniform flow in channels - Determination of Manning's Rugosity coefficient, Chezy's constant.
2. Curved Channel flow - Determination of super elevation
3. Hydraulic Jump - Determination of Froude number, loss of energy, type of jump.
4. Impact of Jets - Determination of force on flat vane and curved vane.
5. Centrifugal Pump-Determination of efficiency and performance characteristics of a constant speed pump.
6. Pelton Wheel turbine-Determination of efficiency and performance characteristics of a Pelton wheel turbine.
7. Franics Turbine-Determination of efficiency and performance characteristics of a Francis turbine.
8. Kaplan Turbine-Determination of efficiency and performance characteristics of a Kaplan turbine.
9. Hele Shaw's Apparatus - Study of stream line pattern.

Text Books:

1. M.N. Shesha Prakash, "*Experiments in Hydraulics and Hydraulic Machines – Theory and Procedures*", PHI Learning Private Limited, 2011.

16CE C32

TRANSPORTATION ENGINEERING LAB

Instruction	3Hours per week
Duration of semester End Examination	3 Hours
Semester Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: To enable the student

1. Assess the quality of the material used in pavement construction and compare with IRC specifications.
2. Identify the field data required for assessing the traffic parameters.

Course Outcomes:

1. To apply methods for assessing various types of material to be used in the pavement construction.
2. To plan for the collection of field data and to present the same data for the analysis and take decisions for smooth movement of the traffic.

A) Tests on bitumen

1. Penetration Test.
2. Ductility test.
3. Softening point test.
4. Specific gravity test.
5. Viscosity test.
6. Flash and fire point test.

B) Tests on road aggregates

7. Aggregate crushing value test.
8. Los Angeles abrasion test.
9. Aggregate impact value test.
10. Aggregate shape test(flakiness & elongation).
11. Water Absorption.
12. Soundness.

C) Traffic Studies (demonstration only)

13. Traffic volume study.
14. Spot Speed Study.
15. O & D Study concepts.
16. Speed and delay studies.

D) Miscellaneous Tests

17. Determination of C.B.R.
18. Preparation of representative sample by coning and quartering.
19. Bitumen extraction test.
20. Marshal stability concepts and Tests.

Suggested Reading:

1. IRC codes and specifications.

16CE C33

INDUSTRIAL VISIT

Sessional Examination
*Grade

Students are expected to visit at least two works of Civil Engineering importance in and around Hyderabad and submit a detail report on the same to the department. The Department should evaluate the reports and presentation through a Committee consisting of Head of the Department and two more members of the senior faculty.

*** Satisfactory / Unsatisfactory.**

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, Raabes 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 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, 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.

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, 5^{th} edition, 2016. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

18PY C03

INTRODUCTION TO MECHANICS AND ELECTROMAGNETIC THEORY
(for Civil, Mech & Prod)

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 and ultrasonics.
2. Gains knowledge of rigid body dynamics.
3. Learns the basics of electrostatics.
4. Understands the fundamentals of magnetostatics.
5. Familiar with electromagnetic waves.

Course Outcomes:
At the end of the course, the student will be able to
1. Describe the types of oscillations and analyze them.
2. Develop the concepts of dynamics and apply them to solve the related problems.
3. Analyze the role of different laws in electrostatics.
4. Discuss the significance of magnetostatics.
5. Develop the concepts related to electromagnetic behavior.

UNIT- I :Oscillations:
Simple harmonic motion, Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly- damped oscillators; Forced oscillations and resonance.
Ultrasonics: Production of ultrasonics by piezoelectric and magnetostriction methods – Detection of ultrasonics -– Determination of ultrasonic velocity in liquids – Applications.

UNIT-II: Rigid body Dynamics:
Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples. two-dimensional motion in terms of (a) Angular velocity vector, and its rate of change and (b) Moment of inertia tensor.

UNIT- III :Electrostatics in Vaccum:
Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction, Boundary conditions of electric field and electrostatic potential.

UNIT - IV : Magnetostatics:
Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities: ferromagnetic, paramagnetic and diamagnetic materials, B-H curve.

UNIT- V : Electromagnetic Waves:
The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves, Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples.

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.

Pl. check the word.

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.

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-IUnderstanding 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- 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-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.

18PY C06

MECHANICS AND ELECTROMAGNETIC LABORATORY
(for Civil, Mech & Prod)

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 various kinds of oscillators.
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 the various kinds of oscillations.
3. Determine the loss of energy of a ferromagnetic material and its uses in electrical engineering .
4. Understand the suitability of dielectric materials in engineering applications.
5. Use LCR circuits in different applications.

Experiments

1. *e/m* of Electron by Thomson's Method.
2. B-H curve – Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen.
3. Stewart & Gee's.
4. Mutual induction.
5. Dielectric constant – Determination of dielectric constant of given PZT sample.
6. Error analysis – Estimation of errors in the determination of time period of a torsional pendulum.
7. Helmholtz's resonator.
8. Compound pendulum.
9. Flywheel.
10. Coupled oscillator.
11. LCR circuit.
12. Melde's experiment.
13. Young's modulus.
14. Viscosity by oscillating disc (Lamp scale method).

15. Ultrasonic interferometer – Determination of velocity of ultrasonics in a given liquid.

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.

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
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.

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.

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 201.
4. ArunaKoneru, Professional Speaking Skills, Oxford University Press, 2016.

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 Stroke'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: 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.

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 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, 8thedition (2006).

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.
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); rinting 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 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.

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 first order RL and RC circuits.

UNIT-II: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, 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.

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.

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. (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 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.