

Course Structure & Syllabus
of
B.Tech Programme
in
Electrical & Electronics Engineering



(From the Session 2015-16)

VSSUT, BURLA

COURSE STRUCTURE

FIRST YEAR

(COMMON TO ALL BRANCHES)

FIRST SEMESTER				SECOND SEMESTER			
Theory		Contact Hrs.	CR	Theory		Contact Hrs.	CR
Course Code	Subject	L-T-P		Course Code	Subject	L-T-P	
	Mathematics - I	3 - 1 - 0	4		Mathematics - II	3 - 1 - 0	4
	Physics/Chemistry	3 - 1 - 0	4		Chemistry/ Physics	3 - 1 - 0	4
	Engineering Mechanics/ Computer Programming	3 - 1 - 0	4		Computer Programming/ Engineering Mechanics	3 - 1 - 0	4
	Basic Electrical Engineering/ Basic Electronics	3 - 1 - 0	4		Basic Electronics/ Basic Electrical Engineering	3 - 1 - 0	4
	English for Communication/ Environmental Science	3 - 1 - 0	4		Environmental Science/ English	3 - 1 - 0	4
Sessionals		Sessionals		Sessionals		Sessionals	
	Applied Physics Laboratory/Chemistry Lab	0 - 0 - 3	2		Chemistry Lab/Applied Physics Laboratory	0 - 0 - 3	2
	Workshop-I/ Engineering Drawing	0 - 0 - 3	2		Engineering Drawing/ Workshop-I	0 - 0 - 3	2
	Basic Electrical Engg. Lab/ Basic Electronics Lab	0 - 0 - 3	2		Basic Electronics Lab/ Basic Electrical Engg. Lab	0 - 0 - 3	2
	Business Communication Skill/ Programming Lab	0 - 0 - 3	2		Programming Lab/ Business Communication Skill	0 - 0 - 3	2
Total		15-5-12	28	Total		15-5-12	28

SECOND YEAR

THIRD SEMESTER				FOURTH SEMESTER			
Theory		Contact Hrs.	CR	Theory		Contact Hrs.	CR
Course Code	Subject	L-T-P		Course Code	Subject	L-T-P	
	Mathematics-III	3 - 1 - 0	4		Mathematics-IV	3 - 1 - 0	4
EE15-016	Electrical Machines-I	3 - 1 - 0	4	EE15-018	Electrical Machines II	3 - 1 - 0	4
EE15-032	Network theory	3 - 1 - 0	4	EE15-023	Electronics Circuits	3 - 1 - 0	4
	Engineering Thermodynamics	3 - 1 - 0	4		Object Oriented Programming	3 - 1 - 0	4
	Organisation Behaviour	3 - 1 - 0	4		Engineering Economics	3 - 1 - 0	4
Sessionals				Sessionals			
EE15-017	Electrical Machines-1 Lab	0 - 0 - 3	2	EE15-019	Electrical Machines II Laboratory (twice)	0 - 0 - 6	4
	Mechanical Engineering Lab	0 - 0 - 3	2		Object Oriented Programming Lab	0 - 0 - 3	2
EE15-012	Electrical Circuit Computation Lab	0 - 0 - 3	2	EE15-024	Electronics Circuit Lab	0 - 0 - 3	2
EE15-033	Network Theory Lab	0 - 0 - 3	2				
Total		15-5-12	28	Total		15-5-12	28

THIRD YEAR

FIFTH SEMESTER				SIXTH SEMESTER			
Theory		Contact Hrs.	CR	Theory		Contact Hrs.	CR
Course Code	Subject	L-T-P		Course Code	Subject	L-T-P	
EE15-029	Microprocessor & Microcontroller Theory & Applications	3 - 1 - 0	4	EE15-037	Power System-II	3 - 1 - 0	4
EE15-042	Signals & Systems-I	3 - 1 - 0	4	EE15-020	Electrical Measurements & Instrumentation	3 - 1 - 0	4
EE15-008	Digital Circuits & Design	3 - 1 - 0	4	EE15-022	Electromagnetic Theory	3 - 1 - 0	4
EE15-036	Power System-I	3 - 1 - 0	4	EE15-005	Control System Engineering-I	3 - 1 - 0	4
EE15-034	Power Electronics	3 - 1 - 0	4	Core Elective (Any One)			
				EE15-043	Signals & Systems-II	3 - 1 - 0	4
				EE15-048	VLSI Theory & Design	3 - 1 - 0	4
				EE15-021	Electric Drives & Traction	3 - 1 - 0	4
				EE15-028	Image Processing	3 - 1 - 0	4
Sessionals				Sessionals			
EE15-044	Signal Systems Lab-I	0 - 0 - 3	2	EE15-045	Signal System Lab-II	0 - 0 - 3	2
EE15-009	Digital Circuit Lab	0 - 0 - 3	2	EE15-007	Control & Instrumentation Lab	0 - 0 - 3	2
EE15-030	Microprocessors & Microcontrollers Laboratory	0 - 0 - 3	2	EE15-015	Electric Equipment Design & Simulation Lab(twice)	0 - 0 - 6	4
EE15-035	Power Electronics Lab	0 - 0 - 3	2			0 - 0 - 3	2
Total		15-5-12	28	Total		15-5-12	28

FOURTH YEAR

SEVENTH SEMESTER				EIGHTH SEMESTER			
Theory		Contact Hrs.	CR	Theory		Contact Hrs.	CR
Course Code	Subject	L-T-P		Course Code	Subject	L-T-P	
EE15-038	Power Systems-III	3 - 1 - 0	4	EE15-004	Communication Systems-II	3 - 1 - 0	4
EE15-003	Communication Systems-I	3 - 1 - 0	4	EE15-011	Digital Signal Processing	3 - 1 - 0	4
EE15-006	Control System Engineering-II	3 - 1 - 0	4		Open Elective	3 - 1 - 0	4
Core Elective (Any One)							
EE15-025	Embedded System	3 - 1 - 0	4				
EE15-027	HVDC Transmission	3 - 1 - 0	4				
EE15-040	Power Quality	3 - 1 - 0	4				
EE15-014	Electrical Engineering Material	3 - 1 - 0	4				
	Open Elective	3 - 1 - 0	4				
Sessionals				Sessionals			
	Minor Project	0 - 0 - 3	2		Seminar	0 - 0 - 3	2
EE15-039	Power System Lab	0 - 0 - 3	2		Comprehensive Viva	0 - 0 - 3	2
					Major Project	0 - 0 - 6	8
Total		15-5-6	24	Total		9-3-12	24

CORE ELECTIVE SUBJECTS FOR EEE DEPARTMENT

Course Code		Subject
Core elective1	EE15-043	Signal & Systems-II
	EE15-048	VLSI Theory & Design
	EE15-021	Electric Drives & Traction
	EE15-028	Image Processing
Core elective2	EE15-025	Embedded System
	EE15-027	HVDC Transmission
	EE15-040	Power Quality
	EE15-014	Electrical Engineering Material

OPEN ELECTIVE SUBJECTS ARE OFFERED BY EEE DEPARTMENT

Course Code		Subject
Open elective1	EE15-026	Energy Management
	EE15-010	Digital Image Processing
	EE15-031	Modelling & Simulation
Open elective2	EE15-047	Utilization of Electrical Energy
	EE15-041	Process Control & Instrumentation
	EE15-046	Signal and System

SYLLABUS
FIRST & SECOND SEMESTER
(COMMON TO ALL BRANCHES)

PHYSICS – I (3 – 1 – 0)

Module I

Interference

Superposition of waves - coherent and incoherent superposition, Intensity distribution.

Two source interference theory, Interference in thin films. Newton's Rings, Determination of wavelength of light and refractive index of liquid.

Diffraction

Diffraction: Introduction, Types of diffraction, Fraunhofer diffraction at a single slit, Plane Diffraction grating, Diffraction spectra, Determination of wavelength of light, angular dispersion, resolving power.

Polarization

Polarization: Introduction, Types of Polarization, Production of polarized light (elementary idea) Brewster's law, Malu's law, Double refraction (only statement, explanation), Construction and working of Nicol prism, Half wave plate and Quarter wave plate, Application of polarization (Polarimeter: Construction, Principle, Working).

Module II

Electromagnetism

Vector Calculus : Gradient, Divergence, Curl of vector field, Gauss divergence theorem. Stoke's theorem, Green's theorem, Maxwell's electromagnetic equation in differential form and in integral form, Electromagnetic wave equation: in vacuum and in conducting medium. Poynting vector, Poynting theorem, preliminary ideas about waveguides.

Module III

Quantum mechanics

Need for Quantum Physics, wave particle duality, Davisson Germer experiment, Schrodinger wave equation (time dependent and time independent), properties of wave function, Operators, eigen value, eigen function, expectation value, probability current, Simple applications: particle in a box, finite well, step potential and tunneling

Module IV

Lasers

Introduction, Characteristics of lasers, Einstein's coefficients & Relation between them, Lasing action, Population inversion, Different types of Lasers (Ruby Laser, He-Ne Laser), Three and Four level pumping schemes, Applications of LASER (elementary ideas)

Fiber optics

Introduction, Principle of wave propagation in Optical Fiber, Structure of Optical Fiber, Types of Optical Fibers, Acceptance angle and acceptance cone, Numerical aperture, Applications of optical fibers in communications

Nanomaterials

Introduction, Classification, Physical characteristics and applications (fundamental)

Text books:

1. Optics – A.K. Ghatak
2. Concepts of Modern Physics – A. Beiser

Reference Books:

1. Electricity & Magnetism – D. Griffiths
2. Quantum Mechanics – Gasiorowicz
3. Lasers, theory and applications - K. Thyagarajan and A.K. Ghatak, New York : Plenum Press.
4. Quantum Mechanics – M. Das and P.K Jena
5. An Introduction to Fiber Optics - A. Ghatak, K. Thyagarajan: Cambridge University Press.
6. Nano Materials by B. Viswanathan, Narosa Book Distributer

List of Experiments

1. To Determine the Young's Modulus (Y) of the material of a Wire by Searle's Method.
2. Determination of Surface Tension of water by Capillary rise method.
3. Determination of Acceleration due to gravity by using a Bar Pendulum.
4. To determine thermal conductivity of a bad conductor by using Lee's Apparatus.
5. Determination of Wavelength of monochromatic light with the help of a Newton's Ring Apparatus.
6. Determination of Grating element of a Diffraction grating using spectrometer.
7. To verify the laws of transverse vibration of string by using sonometer.
8. To determine the Rigidity modulus of the material of a wire by using Barton's apparatus.
9. To draw the characteristics of a Bipolar Junction Transistor.
10. To draw the V-I characteristics of a P. N Junction diode.

CHEMISTRY – I (3 – 1 – 0)

Module–I 10 Hours

Failure of Classical Mechanics, Schrodinger's Wave Equation (Need not be Derived), Energy for 1-D Potential Box, Interaction of Wave with Matter
Fundamental of Microwave, IR, UV-Vis Spectroscopy:
Basic Concept of Spectroscopy, Selection Rule, Numericals, Frank-Condon Principle,

Module – II 10 Hours

Thermodynamics of Chemical Processes: 05 Hours
Concept of Entropy, Chemical Potential, Equilibrium Conditions for Closed Systems, Phase and Reaction Equilibria, Maxwell Relations

Module – III 10 Hours

Definition of Terms: Phase, Components, Degree of Freedom, Phase Rule Equation. Phase Diagrams: One Component Systems – Water and Sulphur, Two Component System – Lead-Silver, Cooling Curves, Iron-Carbon Phase Diagram

Module–IV 10 Hours

Electrode Potentials and its Relevance to Oxidation and Reduction, Measurement of EMF, Determination of pH, Hydrogen, Glass, Quinhydrone Electrodes, Dry Cells, Fuel Cells and Corrosion: Concept, Galvanic Corrosion
Kinetics of Chemical Reactions: 05 Hours
Reversible, Consecutive and Parallel Reactions, Steady State Approximation, Chain
Engineering application of materials: 05 Hours
Organometallics and Nanomaterials

- 1) P. W. Atkins, Elements of Physical Chemistry, 4th Edition, Oxford University Press
- 2) C. N. Banwell and E. M. MacCash, Fundamentals of Molecular Spectroscopy, 5th Edition,
- 3) P. K. Kar, S. Dash and B. Mishra, B.Tech. Chemistry Vol. I, Kalyani Publications

Chemistry Laboratory

(Any ten Experiments)

1. Determination of amount of sodium hydroxide and sodium carbonate in a Mixture.
2. Determination of Total hardness of water by EDTA method.
3. Estimation of calcium present in the limestone.
4. Preparation of aspirin.
5. Standardization of KMnO_4 using sodium oxalate.
6. Determination of ferrous iron in Mohr's salt by potassium permanganate.
7. Determination of Rate constant of acid catalyzed hydrolysis of ester.
8. Determination of dissolved oxygen in a sample of water.
9. Determination of Viscosity of lubricating oil by red wood Viscometer.
10. Determination of Flash point of given oil by Pensky Marten's Flash point Apparatus.
11. Determination of available chlorine in bleaching powder.

Reference Book: B.Tech practical Chemistry-Kalyani publisher

MATHEMATICS - I

Subject – Mathematics I (Calculus, Linear Algebra and Numerical Method) (3-1-0)

Module 1: (10 Lectures)

Open sets, Closed sets, Limit points of a set, Limits, Continuous functions, Functions continuous on closed intervals, The derivative, Increasing and decreasing functions, Darboux's theorem, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Extremum values; Riemann integral: Definition and existence of the integral, Integral as a limit of sums, some integrable functions, Fundamental theorem of calculus, Mean value theorems for integral calculus.

Module 2: (10 Lectures)

Matrices, Vectors: Addition and Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Gauss Elimination, Linear Independence, Rank of a Matrix, Vector Space, Solutions of Linear Systems: Existence, Uniqueness, Determinants, Cramer's Rule, Gauss-Jordan Elimination, Vector Spaces, Inner Product Spaces,

Module 3: (10 Lectures)

Eigenvalues, Eigenvectors, Some Applications of Eigenvalue Problems, Symmetric, Skew-Symmetric, and Orthogonal Matrices, Eigenbases, Diagonalization, Quadratic Forms, Complex Matrices and Forms, Inclusion of Matrix Eigenvalues, Power Method for Eigenvalues

Module 4: (10 Lectures)

Numerical methods in general, Introduction, Solution of Equations by Iteration, Interpolation, Numerical Integration and Differentiation

Text Books:

- 1) S.C. Malik and S. Arora, Mathematical Analysis, New Age International
- 2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd

Chapters: S.C. Malik - 2(2.1- 2.3), 5(5.1-5.3), 6(6.1, 6.3-6.7), 7(7.1), 9(9.1, 9.6, 9.7, 9.9,9.10)
E. Kreyszig - 7(7.1-7.5, 7.7, 7.8,7.9), 8, 20 (20.7, 20.8), 19(19.1, 19.2, 19.3, 19.5)

Reference Books:

- 1) George B. Thomas , Jr. and Ross L. Finney, Calculus and Analytic Geometry, Addison Wesley Publishing Company
- 2) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
- 3) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

MATHEMATICS - II

Differential Equations (3-1-0)

Module 1: (10 Lectures)

Basic Concepts, Modeling, Separable ODEs, Modeling, Exact ODEs, Integrating Factors, Linear ODEs, Bernoulli Equation, Population Dynamics, Existence and Uniqueness of Solutions. Homogeneous Linear ODEs of Second Order, Homogeneous Linear ODEs with Constant Coefficients, Euler-Cauchy Equations, Existence and Uniqueness of Solutions, Wronskian, Nonhomogeneous ODEs, Solution by Variation of Parameters.

Module 2: (10 Lectures)

General linear differential equations of order n , Differential Operators, Homogeneous Linear ODEs, Homogeneous Linear ODEs with Constant Coefficients, Nonhomogeneous Linear ODEs, Conversion of an n th-Order ODE to a System, Basic Theory of Systems of ODEs.

Power Series Method, Theory of the Power Series Method, Frobenius Method, Sturm-Liouville Problems, Orthogonal Functions.

Module 3: (10 Lectures)

Laplace Transforms, Laplace Transform, Inverse Transform, Linearity. s -Shifting, Transforms of Derivatives and Integrals, ODEs, Unit Step Function, t -Shifting, Short Impulses, Dirac's Delta Function, Partial Fractions, Convolution, Integral Equations, Differentiation and Integration of Transforms.

Module 4: (10 Lectures)

Partial differential equations, Basic Concepts, Modeling: Vibrating String, Wave Equation Solution by Separating Variables, Use of Fourier Series, D' Alembert's Solution of the Wave Equation. Characteristics, Heat Equation: Solution by Fourier Series, Solution of PDEs by Laplace Transforms.

Text Book:

- 1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd, 9th edition.

Chapters: 1(1.1-1.5, 1.7), 2(except 2.4, 2.8, 2.9), 3, 4(4.1, 4.2), 5(5.1, 5.2, 5.4), 6(6.1-6.5), 12(12.1-12.5, 12.11)

Reference Books:

- 1) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
- 2) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press
- 3) J. Sinha Roy and S. Padhy, Ordinary and Partial Differential Equation, Kalyani Publisher.
- 4) Richard Bronsan and Gabriel Costa, Scahum's Outline of Differential Equations, McGraw Hill
- 5) Paul Duchateau and D.W. Zachmann, Scahum's Outline of Partial Differential Equations, McGraw Hill
- 6) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill

English for Communication

(Credit: 4-0-0)

Objective- For developing the ability to communicate effectively in professional environment by enhancing their skills in communication.

Module 1: Fundamentals of Communication (10 Hours)

- ❖ Communication: Process, pattern and stages of communication, channels and types of communication and Barriers to Communication.
- ❖ Functions of language: Descriptive, Expressive and Social Functions.
- ❖ Formal and Informal English
- ❖ Plain English
- ❖ Bias free language

Module 2: Communicative Grammar (10 Hours)

- ❖ Time, Tense and Aspects
- ❖ Verbs of State and Events
- ❖ Use of Modal Verbs
- ❖ Phrasal Verbs
- ❖ Passive and Active Voice
- ❖ Conditionals

Module 3: Sounds of English (10 Hours)

- ❖ The Speech Mechanism and Organs of Speech
- ❖ Consonant Sounds of English
- ❖ Vowel Sounds of English
- ❖ Stress Pattern: Syllable, Stress and Intonation.
- ❖ Problem sounds for Indian Speakers

Module 4: Business and Official Writing (10 Hours)

- ❖ Paragraph writing and Sentence Linker
- ❖ Business and Official Letters
- ❖ Report and Proposal writing,
- ❖ Notice, Circular and Memo writing
- ❖ Résumé (CV) Writing.

Text Books:

1. Effective Technical Communication by M Ashraf Rizvi (Tata McGraw Hill)
2. Better English Pronunciations By J. D.O Conner (Cambridge University Press)
3. A Communicative Grammar of English by G.N. Leech and Jan Svartik (OUP)

Reference Books: “Business communication” by Ramachandran, Lakshmi and Krishna (Macmillan)

ENGLISH COMMUNICATION SKILLS (Credit :0-0-2)

Objective: For enhancing corporate readiness among students by inculcating several skills of communication through activities.

Laboratory Activities:

1. **Giving Introduction (Self and others)**
2. **Group Discussion**
3. **Interviews**
4. **Role Play**
5. **Listening skill Development**
6. **Reading skill Development**
7. **Writing skill Development**
8. **Speaking skill Development**
9. **Meeting**
10. **Presenatation**

Books Recommended:

1. **Soft Skills – By Dr K Alex (S Chand)**

ENGINEERING MECHANICS

Module - I

1. **Concurrent forces on a plane:** Composition, resolution and equilibrium of concurrent coplanar forces, method of moment, friction (chapter 1). (7)
2. **Parallel forces on a plane:** General case of parallel forces, center of parallel forces and center of gravity, centroid of composite plane figure and curves(chapter 2.1 to 2.4) (4)

Module - II

3. **General case of forces on a plane:** Composition and equilibrium of forces in a plane, plane trusses, method of joints and method of sections, plane frame, principle of virtual work, equilibrium of ideal systems.(8)
4. **Moments of inertia:** Plane figure with respect to an axis in its plane and perpendicular to the plane, parallel axis theorem(chapter 3.1 to3.4, 5.1, appendix A.1 to A.3) (3)

Module - III

5. **Rectilinear Translation:** Kinematics, principle of dynamics, D Alembert's Principle, momentum and impulse, work and energy, impact (chapter 6). (11)

Module – IV

6. **Curvilinear translation:** Kinematics, equation of motion, projectile, D Alembert's principle of curvilinear motion. (4)
7. **Kinematics** of rotation of rigid body (Chapter 9.1) (3)

Text book:

1. Engineering mechanics: S Timoshenko & Young; 4th Edition (international edition) MC Graw Hill.

Reference books:

1. Fundamental of Engineering mechanics (2nd Edition):
S Rajasekharan & G Shankara Subramaniam; Vikas Pub. House Pvt ltd.
2. Engineering mechanics: K.L. Kumar; Tata MC Graw Hill.

SESSIONAL

Workshop -I

(Consists of 3 sections) :

1. Carpentry Section: Wooden rack/bench/chair/stool (any one)
2. Fitting Section: Paper Wt. Square or Rectangular joint (male and female joint) (any one)
3. Black Smith **Section** : Weeding hook/Hexagonal headed bolt blank (any one)

COMPUTER PROGRAMMING

L-T-P: 3-1-0

Cr.-4

Module I:

Introduction to computing- Block architecture of a computer, bit, bytes, memory, representation of numbers in memory. Introduction to problem solving- Basic concepts of an algorithm, program design methods, flowcharts. C Language Fundamentals- Character set, Identifiers, Keywords, Data Types, Constant and Variables, Statements. Input & Output - Input & Output Assignments, Formatted Outputs. Operators and Expressions- Operators, Precedence of operators.

Module II:

Decision Control Structure, Loop Control Structure and Case Control Structure. Functions- Monolithic vs Modular programs, User defined vs standard functions, formal vs Actual arguments, Functions category, function prototypes, parameter passing, Recursion. Arrays- 1D Array, 2D Array & Multi-Dimensional Array. Strings- Declaration & Initialization, String Handling Functions.

Module III:

Pointers- Pointer variable and its importance, Pointer Arithmetic, Passing parameters, pointer to pointer, pointer to function. Dynamic Memory Allocation. Structure- Nested Structure, Array of Structures, Pointer to Structure, Structure & Functions, typedef, Enumerated Data Type, Bit Fields. Union- Array of Union Variables, Union inside Structure. Storage Class.

Module IV:

Preprocessor Directives- Types, Pragma Directives, Conditional Directives. Files- Reading data from Files, Reading data from Files, Writing data to Files, Error Handling during File Operations. Advanced Issues in Input & Output – using *argc* & *argv*. Operation on Bits.

Text Books:

1. C: The Complete Reference: Herbert Schildt
2. Computer Fundamentals & Programming in C: Reema Thareja, Oxford University Press.

Reference Books:

1. Let us C- Y. Kanetkar, BPB Publications.
2. Programming with ANSI and Turbo C- Kamthane, A.N. Pearson Education
3. C How to Program- Deitel and Deitel, Pearson Education.
4. The C programming Language- Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall.

PROGRAMMING LAB (CS15-984)

L-T-P: (0-0-3)

Cr: 2

Introduction to OS : Linux/Unix, Dos, Windows, Vi editor, File Handling, Directory Structure, File Permissions, Creating and editing simple c programs, Compilation and Execution
C programming on variables and expression assignment, simple arithmetic loops, If-else, Case statements, Break, Continue, Go to
Single and Multidimensional arrays
Functions, Recursion, File handling in C
Pointers, address operator, Declaring pointers and operators on pointers, Address of an array, Structures, Pointer to structure, Dynamic memory allocation
Fundamental Programs on Data Structures (Stack, Queue, Linked lists, Trees, Graphs)

(EL15-002) BASIC ELECTRICAL ENGINEERING (3-1-0)

MODULE-I (10 HOURS)

DC Networks: Kirchhoff's laws, node and mesh analysis, Delta-star and star-delta transformations. Superposition, Thevenin's and Norton's theorem. Transients, in R-L, R-C and R-L-C circuits with DC. Excitation.

Single Phase AC Circuits: Single phase EMF generation, average and effective values of sinusoids, j- operations, complex representation of impedances, phasor diagrams, power factor, power in complex notation, solution of series and parallel circuits. Introduction to resonance in series RLC circuit.

Three Phase AC Circuit: Three phase EMF generation, delta and star connection, Line and Phase quantities. Solutions of 3-phase circuits with balanced load. Power in 3-phase balanced circuits.

MODULE-II (10 HOURS)

Magnetic Circuits: B-H Curve, Hysteresis, Permeability and reluctance, solution of simple magnetic circuits, Hysteresis and Eddy current losses.

DC Generator: Different types, Principle of Operation of DC generator, EMF equation, methods of excitation. DC Motor: Back e.m.f., speed and torque of a DC Motor, Conditions for maximum Power. Speed control of DC shunt motor.

Transformers: Construction and Principle of operation of single-phase transformer, EMF equation, Single-phase autotransformer.

MODULE-III (10 HOURS)

Three phase Induction Motor: Construction and principle of operation, types; Slip-torque characteristics.

Synchronous Machines: Construction & principle of operation of Synchronous generator and motor. EMF equation, Voltage regulation, Applications and starting of Synchronous motor.

Introduction to single-phase induction Motor.

MODULE-IV (10 HOURS)

Measuring Instruments: DC PMMC instruments, Extension of range by shunts and multipliers. Moving iron ammeters and voltmeters, Dynamometer type Watt meters, Induction type Energy Meter.

Power supply systems: Principle of generation - thermal, hydel and nuclear. Transmission and distribution of electric energy. Introduction to Electric Heating & Welding.

TEXT BOOKS

- [1]. Edward Hughes (revised by Ian McKenzie Smith), "Electrical & Electronics Technology", Pearson Education Limited. Indian Reprint 2002, 10th Edition.
- [2]. D.Kulshreshtha, " Basic Electrical Engineering" TMH, 1st Edition.

REFERENCE BOOKS

- [3]. H.Cotton, "Advanced Electrical Technology", CBS Publishers, New Delhi, 7th Edition.
- [4]. C.L. Wadhwa, "Electrical Engineering", New Age International Publishers, 2nd Edition.
- [5]. S. Parker Smith, "Problems in Electrical Engineering", Asia Publications, 10th Edition.

(EL15-003) BASIC ELECTRICAL ENGINEERING LAB (0-0-3)

- 1. Preliminary: Preparation of symbol chart for various systems & components as per ISS, To study the constructional & operational features for Voltmeter, Ammeter, Wattmeter, Frequency meter, multi-meter and Rheostat, Study of safety rules as per ISS
- 2. Measurement of the armature & field resistance of D.C. Machine by volt-amp method. & Starting and speed control of a D.C. shunt motor
- 3. Study of BH Curve
- 4. Determination of open circuit characteristics (O.C.C) of D.C shunt generator when separately excited at different speeds.
- 5. Measurement of earth resistance and insulation resistance
- 6. Starting of Induction motor and measurement of three phase power & power factor by 2-wattmeter method.
- 7. Calibration of a single phase Energy Meter by directed loading & Phantom loading

BASIC ELECTRONICS (3-1-0)

UNIT-1

(10 Hours)

Introduction to Electronics: Signals, Frequency Spectrum of Signals, Analog and Digital Signals, Linear Wave Shaping Circuits: RC LPF, Integrator, RC HPF, Differentiator. Properties of Semiconductors: Intrinsic, Extrinsic Semiconductors, Current Flow in Semiconductors, Diodes: p-n junction theory, Current-Voltage characteristics, Analysis of Diode circuits, Rectifiers, Clippers, Clampers, Special diodes- LED, Photo diode, Zener Diode.

UNIT-II

(14 Hours)

Bipolar junction Transistor (BJTs): Device Structure and Operation, Current-Voltage Characteristics, BJT as an Amplifier and as a Switch, Introduction to Power Amplifiers, A,B and C types. JFET: Physical Structure, Operation and Characteristics MOSFET: Physical Structure, Operation and Characteristics, Feedback Amplifiers & Oscillators: General Feedback Structure, Properties of Negative Feedback, Four Basic Feedback Topologies (block diagram only), Basic Principles of Sinusoidal Oscillators(Crystal, Hartley & Collpit). Operational Amplifiers (OP-AMPs): The Ideal OP-AMP, Inverting Configuration, Non-Inverting Configuration. OP-AMP Applications (Adder, Subtractor, Integrator, Differentiator).

UNIT-III

(10 Hours)

Digital Fundamentals: Binary Numbers, Signed-binary numbers, Decimal-to-Binary & Binary-to-Decimal Conversion, Binary Addition, Subtraction, Multiplication and Division, Hexadecimal Number Systems, Logic Gates, Boolean Algebra, De Morgan's Theorems, Laws of Boolean Algebra, RS Flip flop, JK Flip flop.

UNIT-IV

(10 Hours)

Introduction to Electronic Instruments: CRO: CRT, Waveform Display, Applications of CRO, Electronic Multimeter, Audio Signal Generator: Block diagram, Front Panel Controls. Principles of Communication: Fundamentals of AM & FM, Block diagram of Transmitters & Receivers.

TEXT BOOKS:

1. Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford University Press. Selected portions from chapters 1 to 3, 5, 8, 13.
2. Electronics Fundamentals and Applications, D Chattopadhyay and P.C. Rakshit, NewAge International Publications. Selected portions from chapters 4 to 12,14, 16 to 18,20,21.

REFERENCE BOOKS:

1. Integrated Electronics, Millman and Halkias, TMH Publications.
2. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education.

BASIC ELECTRONICS LAB
LIST OF EXPERIMENTS

1. Familiarity with electronic components and devices(Testing of semiconductor diode, Transistor, IC Pins connection) Digital multimeter should be used.
2. Study and use of CRO to view waveforms and measure its Amplitude and Frequency.
3. V-I Characteristics of a Semiconductor Diode. Determining DC and AC resistance.
4. Clipper and Clamper Circuit.
5. Half Wave and Full Wave Rectifier without Capacitor filter. Record of Waveforms, Measurement of Average and RMS value.
6. V-I (Output) Characteristics of N-P-N Transistor in CE Configuration.
7. OP-AMP: Inverting and Non-Inverting Configuration. Record of Waveforms.
8. Verification of Truth table of Logic gates (AND, OR,NOT, NAND, NOR, EX-OR)

CE 15001: ENVIRONMENTAL SCIENCE & ENGINEERING (3-1-0) CR-04

Module – I

(6 Hours)

Components of Earth System: Lithosphere, Cryosphere, Atmosphere, Hydrosphere, Biosphere and Outer space.

Ecological concepts and natural Resources: Ecological perspective and value of environment, Environmental auditing, Biotic components, Levels of organizations in environment Ecosystem Process: Energy, Food chain, Environmental gradients, Tolerance levels of environmental factor.

Natural Resources covering Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative).

Hydrological cycle, water balance, energy budget, precipitation, infiltration, evaporation and evapotranspiration.

Module – II

(15 Hours)

Environmental Pollution: Definition, Causes, effects and control measures of: Water pollution, Air pollution, Noise pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards

Environmental Issues: Climate change, Global warming, Acid rain, Ozone layer depletion, Sustainable development, Bio gas, Natural gas, Biodiversity, Urban problems related to energy, water scarcity, Water conservation, rain water harvesting, artificial recharge, watershed management, carbon trading, carbon foot print

National Ambient Air quality Standards, Noise standards, Vehicle emission standards

Module – III

(12 Hours)

Drinking water standard (IS 10500), Water Quality Criteria and wastewater effluent standards

Water treatment: Water sources and their quality, Lay out of a water treatment plant and working of each unit/ principles of each process i.e. Screening, Aeration, Sedimentation, coagulation, flocculation, Filtration, Disinfection. Miscellaneous treatment: Removal of color, tastes and odour control, removal of iron and manganese, fluoridation and defloridation. Advanced water treatment: Ion exchange, electro-dialysis, RO, desalination

Working principles of ready-made water filter/purification system commercially available

Lay out of a wastewater treatment plant and working of each unit.

Module – IV

(7 Hours)

Solid waste management: Source, classification and composition of MSW, Storage and transport of MSW, MSW management, Waste minimization of MSW, Reuse and recycling, Biological & thermal treatment (principles only), land fill

Biomedical Waste management – sources, treatment (principles only) and disposal

Hazardous Waste Management- Introduction, Sources, Classification, treatment (principles only)

Introduction to e-waste management.

Environmental impact Assessment: Project screening for EIA, Scoping studies

Environmental policies and acts (Air, Noise, Water, Forest, E-waste, Hazardous waste acts).

Text Book:

- 1 Environmental Engineering, G. Kiely, TMH, 2007

Reference Books:

- 1 Environmental Engineering, H.S. Peavy, D.R. Rowe and G. Tchobanoglous, McGraw Hill, 1985.
- 2 Introduction to Environmental Engineering, M. L. Davis and D. A. Cornwell, McGraw Hill International, 2005.

CE 15002: ENGINEERING DRAWING (0-0-3) CR-02

(Minimum 8 sheets and 2 Auto Cad classes)

Introduction to Engineering Drawing: Drawing instruments, lines, lettering and dimensioning.

Scales: Plain, Diagonal and Vernier Scales.

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Orthographic Projections: Concepts, Orthographic projections of points, Lines, Planes and Solids.

Sections of solids; Development of surfaces

Isometric Projections: Principles, Isometric Scale, Isometric Views, Isometric Views of lines, Planes, Simple and compound Solids,

Introduction to Auto-Cad:

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Text Book:

- 1 Engineering drawing by N.D. Bhatt and V.M Panchal, Charotar Publishing House, Anand.

Reference Books:

1. Engineering Drawing by Venugopal, New Age publisher.

THIRD SEMESTER

MATHEMATICS - III

(Multivariable Calculus and Special Functions) (3-1-0)

Module 1: (10 Lectures)

Vector and Scalar Functions and Fields, Derivatives, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field; Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Divergence Theorem of Gauss, Further Applications of the Divergence Theorem, Stokes's Theorem.

Module 2: (10 Lectures)

Fourier series and integral, Dirichlet criterion, Parseval's identity, the convolution theorem.

Module 3: (10 Lectures)

Orthogonal curvilinear coordinates, Jacobians, gradient, divergence, curl and Laplacian in curvilinear coordinates, Special curvilinear coordinates.

Module 4: (10 Lectures)

Gamma function, The Beta function – Dirichlet integral; Other special functions– Error function, exponential integral, sine and cosine integrals, Bessel's Equation, Bessel Functions $J_\nu(x)$, Bessel Functions of the Second Kind $Y_\nu(x)$, Legendre's Equation, Legendre Polynomials $P_n(x)$.

Text Books:

- 1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd
Chapters: 5(5.3, 5.5, 5.6), 9(9.4, 9.7, 9.8, 9.9), 10, 11(11.1-11.3, 11.6, 11.7), A3.4, A3.1

Reference Books:

- 1) S.C. Mallik and S. Arora, Mathematical Analysis, New Age International
- 2) [Milton Abramowitz](#) and [Irene A. Stegun](#), *Handbook of Mathematical Functions*, National Bureau of Standards, Applied Mathematics Series - 55
- 3) [Yury A. Brychkov](#), **Handbook of Special Functions: Derivatives, Integrals, Series and Other Formulas**, CRC Press
- 4) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
- 5) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

(EE15-016) ELECTRICAL MACHINES-I (3-1-0)

MODULE-I (10 HOURS)

Electromechanical Energy conversion, forces and torque in magnetic field systems – energy balance, energy and force in a singly excited magnetic field system, determination of magnetic force, energy, multi excited magnetic field systems.

DC Generators – Principle of operation, Action of commutator, constructional features, armature windings, lap and wave windings, simplex and multiplex windings, use of laminated armature, E. M.F. Equation,

Methods of Excitation: separately excited and self excited generators, build up of E.M.F., critical field resistance and critical speed, causes for failure to self excite and remedial measures, Armature reaction: Cross magnetizing and demagnetizing AT/pole, compensating winding, commutation, reactance voltage, methods of improving commutation

Load characteristics of shunt, series and compound generators, parallel operation of DC generators, use of equalizer bar and cross connection of field windings, load sharing.

MODULE-II (10 HOURS)

Transformers: Single phase transformer, Constructional details, Core, windings, Insulation, principle of operation, emf equation, magnetizing current and core losses, no load and on load operation, Phasor diagram, equivalent circuit, losses and efficiency, condition for maximum efficiency, voltage regulation, approximate expression for voltage regulation, open circuit and short circuit tests, Sumpner's test, Inrush of switching currents, harmonics in single phase transformers, magnetizing current wave form, Parallel operation of transformers.

MODULE-III (10 HOURS)

DC Motors: Principle of operation, Back E.M.F., Torque equation, characteristics and application of shunt, series and compound motors, Armature reaction and commutation, Starting of DC motor, Principle of operation of 3 point and 4 point starters, drum controller, Constant & Variable losses, calculation of efficiency, condition for maximum efficiency.

Speed control of DC Motors: Armature voltage and field flux control methods, Ward Leonard method.

Methods of Testing: direct, indirect and regenerative testing, brake test, Swinburne's test, Load test, Hopkinson's test, Field's test, Retardation test, separation of stray losses in a DC motor test.

MODULE-IV (10 HOURS)

Three phase Transformer: Constructional features of three phase transformers – three phase connection of transformers (Dd0, Dd6, Yy0, Yy6, Dy1, Dy11, Yd1, Yd11, zigzag), Scott connection, open delta connection, three phase to six phase connection, oscillating neutral, tertiary winding, three winding transformer, equal and unequal turns ratio, parallel operation, load sharing

Distribution transformers, all day efficiency, Autotransformers, saving of copper, applications, tap-changing transformers, cooling of transformers.

TEXT BOOKS

- [1]. A. E. Fitzgerald, C. Kingsley, and S. Umans, "Electric Machinery", TMH Publishers, 6th Edition.
- [2]. Electric Machines by I.J. Nagrath & D.P. Kothari, TMH Publishers, 4th Edition.

REFERENCE BOOKS

- [1]. A. E. Clayton, N. Hancock, "Performance and Design of Direct Current Machines", CBS Publishers, 1st Edition.
- [2]. M. G. Say, "Performance and Design of Alternating Current machines", CBS Publishers, 3rd Edition

(EE15-032) NETWORK THEORY (3-1-0)

MODULE-I (10 HOURS)

Coupled Circuits: Self-inductance and Mutual inductance, Coefficient of coupling, dot convention, Ideal Transformer, Analysis of multi-winding coupled circuits, Analysis of single tuned and double tuned coupled circuits.

Transient study in RL, RC, and RLC networks by Laplace transform method with DC and AC excitation. Response to step, impulse and ramp inputs.

Two Port networks: Two port parameters, short circuit admittance parameter, open circuit impedance parameters, Transmission parameters, Image parameters and Hybrid parameters. Ideal two port devices, ideal transformer. Tee and Pie circuit representation, Cascade and Parallel Connections.

MODULE-II (10 HOURS)

Network Functions & Responses: Concept of complex frequency, driving point and transfer functions for one port and two port network, poles & zeros of network functions, Restriction on Pole and Zero locations of network function. Impulse response and complete response.

Time domain behavior from pole-zero plot.

Three Phase Circuits: Analysis of unbalanced loads, Neutral shift, Symmetrical components, Analysis of unbalanced system, power in terms of symmetrical components

MODULE-III (10 HOURS)

Network Synthesis: Realizability concept, Hurwitz property, positive realness, properties of positive real functions, Synthesis of R-L, R-C and L-C driving point functions, Foster and Cauer forms

MODULE-IV (10 HOURS)

Graph theory: Introduction, Linear graph of a network, Tie-set and cut-set schedule, incidence matrix, Analysis of resistive network using cut-set and tie-set, Dual of a network.

Filters: Classification of filters, Characteristics of ideal filters

TEXT BOOKS

- [1]. Mac.E Van Valkenburg, "Network Analysis", PHI Learning publishers.
- [2]. Franklin Fa-Kun. Kuo, "Network Analysis & Synthesis", John Wiley & Sons.

REFERENCE BOOKS

- [1]. M. L. Soni, J. C. Gupta, "A Course in Electrical Circuits and Analysis", Dhanpat Rai Publications.
- [2]. Mac.E Van Valkenburg, "Network Synthesis", PHI Learning publishers.
- [3]. [Joseph A. Edminister](#), Mahmood Maqvi, "Theory and Problems of Electric Circuits", Schaum's Outline Series, TMH publishers.

HUM01 ENGINEERING ECONOMICS (4-0-0)

MODULE- 1

Theory of Demand- Modern Utility Theory, The Neumann- Morgenstern approach, The Friedman-Savage Hypothesis, Uncertainty and Consumer Behaviour, Expected value of Perfect Information, Revealed Preference Theory, Intertemporal Choice- Slutsky equation, Annual Economic Worth, Present Value, Discount rate IRR and NPV

MODULE- 2

Profit Maximisation: Theory of Production- Laws of Production, Returns to scale and variable proportions, Equilibrium of firm, and Choice of optimal combination of factors, Cost Minimisation- Calculus analysis of cost minimisation, Algebraic approach to cost minimisation, average and marginal costs- the short run Cobb- Douglas cost function, constant returns to scale and cost functions, Long run and short run curves- factor prices and cost functions , The envelop theorem for constrained optimisation , Cost control techniques, Critique of the principle of profit maximisation and Modern theories of firms- Baumol's sales maximisation hypothesis, Morris Model of Managerial Enterprise, Hall and Hitch Report and the full cost pricing principle, Bain's limit pricing theory

MODULE- 3

Analysis of Public Projects: Benefit cost analysis, Public goods, Common Property, Free Rider Problem, market failure and externalities, private and social cost, Social Welfare Functions- Welfare maximisation and pare to optimality, market responses to externalities- Mergers, social conventions, property right and bargaining case theorem

MODULE- 4

Linear models: simple regression model -the problem and estimation, classical normal linear regression model, Two- Variable regression- Internal estimation and hypothesis testing, Multiple Regression analysis- The problem of estimation, Dummy Variable Regression Models, Multiple parameter sensitivity analysis, linear Programming- graphic and simplex method; Game theory- the pay off matrix of game, Nash Equilibrium, the mixed strategies and the prisoner's dilemma

READING LIST

1. Varian, H.R. (1992). Introduction to Micro Economic Analysis, Norton and company, New York
2. Woolridge, J.M. (2009). Introductory Econometrics- A Modern Approach, South Western CENGAGE learning
3. Pearce, D.W. and Turner.(1990). Economics of Environment and Natural Resources, Harvester Wheatsheaf. New York
4. Koutsoyiannis, A.(1979). Modern Micro Economics, Macmillan, London
5. Damodaran, S. (2012). Managerial Economics, second Edition, OUP
6. Gujrati and Sangeeta. (2007). Basic Econometrics, TMH, New Delhi
7. Kolstad, C.D. (2000). Environmental Economics, OUP

(EE15-017) ELECTRICAL MACHINES LAB-I (0-0-3)

1. Open circuit and short circuit on single phase transformer
2. Parallel operation of two single phase transformer and load sharing
3. Back –to-back test of Single phase transformer
4. Load characteristics of DC shunt/compound generator
5. Load characteristics of DC series Motor
6. Swinburne test and brake test of DC shunt machine

(EE15-012) ELECTRIC COMPUTATION LAB (0-0-3)

1. Power measurement of AC system using MATLAB:
2. Time response of a first/ second order system using Laplace Transform.
3. Numerical analysis :Non-linear equations and optimization ,Differential equations
4. Series & parallel resonance circuit simulation.
5. Simulation of Half wave diode bridge rectifier circuit.
6. Simulation of Full wave diode bridge rectifier circuit.
7. DC analysis for R-L, R-C and R-L-C circuits using MATLAB .
8. AC analysis for R-L, R-C and R-L-C circuits using MATLAB .

(EE15-033) NETWORK THEORY LAB (0-0-3)

1. Verification of Superposition and Thevenin's Theorem.
2. Verification of Maximum Power Transfer Theorem.
3. Find out the band width, Q-factor and resonance frequency of a R-L-C series circuit.
4. Transient response of a D.C. R-L, R-C and R-L-C circuit.
5. Determination of A,B,C,D,Z,Y and h parameters of a two port network.
6. Spectral Analysis of a non-sinusoidal waveform.

FOURTH SEMESTER

MATHEMATICS - IV

(Complex Analysis, and Probability and Statistics) (3-1-0)

Module 1: (10 Lectures)

Complex Numbers, Complex Plane, Polar Form of Complex Numbers, Powers and Roots Derivative, Analytic Function, Cauchy-Riemann Equations, Laplace's Equation, Exponential Function, Trigonometric and Hyperbolic Functions, Logarithm, General Power; Line Integral in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Functions

Module 2: (10 Lectures)

Sequences, Series, Convergence Tests, Power Series, Functions Given by Power Series, Taylor and Maclaurin Series, Laurent Series, Singularities and Zeros, Infinity, Residue Integration Method, Residue Integration of Real Integrals; Geometry of Analytic Functions: Conformal Mapping, Linear Fractional Transformations, Special Linear Fractional Transformations, Conformal Mapping by Other Functions.

Module 3: (10 Lectures)

Random Variables, Probability Distributions, Mean and Variance of a Distribution, Binomial, Poisson, and Hypergeometric Distributions, Normal Distribution

Module 4: (10 Lectures)

Introduction. Random Sampling, Point Estimation of Parameters, Confidence Intervals, Testing Hypotheses, Decisions, Regression, Fitting Straight Lines, Correlation.

Text Book:

1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd
Chapters: 13, 14, 15(except 15.5), 16, 17(except 17.5), 24(24.5-24.8), 25(25.1-25.4, 25.9)

Reference Books:

- 1) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill
- 2) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
- 3) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

(EE15-018) ELECTRICAL MACHINES-II (3-1-0)

MODULE-I (10 HOURS)

Fundamental Principles of A.C. Machines: E.M.F. equation of an elementary alternator, Single & three Phase, relation between speed & frequency, factors affecting the induced e.m.f., full pitch & fractional pitch windings, winding factors, armature reaction, the rotating field leakage reactance. Concept of time phasor & space phasor.

Synchronous Generator: Various types & construction, cylindrical rotor theory, phasor diagram, open circuit & short circuit characteristics, armature reaction reactance, synchronous reactance, SCR, load characteristics, potier reactance, voltage regulation, EMF method, MMF method, modified MMF method, ZPF method, power angle characteristics.

MODULE-II (10 HOURS)

Theory of salient pole machine: Blondel's two reaction theory, phasor diagram, direct axis and quadrature axis synchronous reactances, power angle characteristics, Slip Test.

Parallel operation: Synchronizing method, effect of wrong synchronizing, load sharing between alternators in parallel. Sudden Short Circuit of a Synchronous Generator, Transient and Sub-transient reactances.

Synchronous Motor: General Physical consideration, torque and power relations in non-salient pole and salient pole motors, V-curves & inverted V-curves, Effect of change of excitation, synchronous conductor, starting of Synchronous Motor, performance characteristics, of synchronous motor. Hunting, Synchronous Induction motor.

MODULE-III (10 HOURS)

Three Phase Induction Motors: Types, Construction and principle of operation, 3 phase Induction Motor, general phasor diagram, equivalent circuit, power and torque relations, condition for maximum torque, circle diagram, Performance characteristics, effect of rotor resistance on speed torque characteristics, stable & unstable region of operation, Operation with unbalanced supply voltage. Starting: Starting of 3 phase induction motors, high starting torque motors, speed control, rheostatic method, pole changing method cascade control of speed, Double cage induction motor, Cogging and Crawling of Induction motor, induction generator

MODULE-IV (10 HOURS)

Single phase induction motor, theory of operation (Double revolving field theory, equivalent circuit, Determination of parameters) Methods of starting, split phase starting, Repulsion starting, shaded pole starting, performance characteristics.

Single phase series motor, theory of operation performance and application, Schrage motor, Universal motor

TEXT BOOKS

- [1]. A. E. Fitzgerald, C. Kingsley, and S. Umans, "Electric Machinery", TMH Publisher.
- [2]. I. J. Nagrath, D. P. Kothari, "Electric Machines", TMH Publishers.

REFERENCE BOOKS

- [1]. M. G. Say, "Performance and Design of Alternating Current machines", CBS Publishers.
- [2]. A. S. Langsdorf, "Theory of Alternating Current Machinery", TMH Edition.
- [3]. E. O. Taylor, "The Performance & Design of A.C. Commutator motors", Wheeler Publishing, New Delhi.

(EE15-023) ELECTRONICS CIRCUITS (3-1-0)

MODULE-I (10 HOURS)

Diode Circuits: Load-Line Concept, Clipping Circuits, Comparators, Sampling Gate, Rectifiers, Capacitor Filters, Additional Diode Circuits.

Transistor Characteristics: Junction Transistor, Transistor as an Amplifier, Transistor Construction, CB Configuration, CE Configuration, CE Cutoff & Saturation Region, CE Current Gain, CC Configuration, Analytical Expressions for Transistor Characteristics, Phototransistor.

Transistor at Low Frequencies: Graphical Analysis of the CE Configuration, Two-port Devices and the Hybrid Model, Transistor Hybrid Model, h - parameters, Analysis of the transistor amplifier using h -parameter. Emitter Follower, Miller's theorem and its dual, Cascading transistor amplifiers, Simplified CE and CC configurations.

MODULE-II (10 HOURS)

Junction FET and its V-I characteristics, FET small signal model, MOSFET, Biasing the FET, FET as a Voltage-Variable-Resistor, CD amplifier. The Hybrid- π CE Transistor Mode, Hybrid- π conductances and capacitances, Validity of hybrid- π mode, variation of hybrid- π parameters, CE Short-circuit current gain, current gain with resistive load, single stage CE Transistor amplifier, Emitter-follower at high frequencies, Classification of amplifiers, distortion, frequency response of an amplifier, Bode plot, step response of an amplifier, Bandpass of cascaded stages, RC-Coupled amplifier and its low frequency response,, High frequency response of two cascaded CE stages

MODULE-III (10 HOURS)

Classification of amplifier, Feedback concept, transfer gain, Negative feedback, Input-output resistance, method of analysis of a feedback amplifier, voltage series feedback pair, current series-shunt feedback, voltage shunt feedback, Effect of feedback on bandwidth, Double & triple pole transfer function with feedback, Approximate analysis of multiple pole feedback, Voltage series, shunt, current series and shunt frequency response, stability gain and phase margins, various types of compensations, different types of oscillators, Frequency stability

MODULE-IV (10 HOURS)

The basic operational amplifier (OPAMP), differential amplifier and its transfer characteristics, emitter-coupled differential amplifier, IC OPAMP, Off-set error voltages and currents, temperature drift of input offset voltage and current, measurement of OPAMP parameters and its frequency response, different types of compensation of OPAMP and its step response

Basic OPAMP Application, differential DC amplifier, AC-Coupled amplifier, analog integration and differentiation, active filters, resonant band-pass filters, delay equalizers, comparators, Sample & Hold circuits, AC/DC Converters, Logarithmic amplifiers, Schmitt Trigger, ECL, PLL and 555-Timers.

Class -A large signal amplifier, higher order harmonic generation, Transformer-coupled audio amplifier, push-pull amplifier, Class-B & AB Amplifiers, regulated power supplies, series voltage regulator.

TEXT BOOKS

- [1]. Milliman. J, Halkias. C and Parikh. C.D., "Integrated Electronics", Tata Mc. Graw Hills 2nd Ed. 2010.
- [2]. Mohammad Rashid, "Electronic Devices and Circuits", Cengage Learning Publishers.

REFERENCE BOOKS

- [1]. R.F. Coughlin and Fredrick F. Driscoll, "Operational Amplifiers & Linear Integrated Circuits", PHI Publishers.
- [2]. Sergio Fransco, "Design with Operational Amplifiers & Analog Integrated Circuits", TMH Publishers

BHU-1301 Organisational Behaviour (3-1-0)

Module-1(8 hours)

OB: Learning objectives, Definition & Meaning, Why to study OB, An OB model, New challenges for OB Manager

LEARNING: Nature of learning, How learning occurs, Learning & OB

Case Study Analysis

Module-2 (10 hours)

PERSONALITY: Meaning & Definition, Determinants of Personality, Personality Traits, Personality & OB

PERCEPTION: Meaning & Definition, Perceptual process, Importance of Perception in OB

MOTIVATION: Nature & Importance, Herzberg's Two Factor theory, Maslow's Need Hierarchy theory, Alderfer's ERG theory

Case Study Analysis

Module-3 (10 hours)

COMMUNICATION: Importance, Types, Barriers to communication, Communication as a tool for improving Interpersonal Effectiveness

GROUPS IN ORGANISATION: Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team Building

LEADERSHIP: Leadership & management, Theories of leadership- Trait theory, Behavioural Theory, Contingency Theory, Leadership & Followership, How to be an Effective Leader

CONFLICT: Nature of Conflict & Conflict Resolution

TRANSACTIONAL ANALYSIS: An Introduction to Transactional Analysis

Case Study Analysis

Module-4 (12 hours)

ORGANISATIONAL CULTURE: Meaning & Definition, Culture & Organisational Effectiveness

HUMAN RESOURCE MANAGEMENT: Introduction to HRM, Selection, Orientation, Training & Development, Performance Appraisal, Incentives

ORGANISATIONAL CHANGE: Importance of Change, Planned Change & OB Techniques

INTERNATIONAL OB: An Introduction to Individual & Interpersonal Behaviour in Global Perspectives

Case Study Analysis

Text Books/References:

[1] Stephen P. Robbins, Organisational Behaviour, Printice hall of India, New Delhi, 2000.

[2] K. Aswathappa, Organisational Behaviour, Himalaya Publishing House, Bombay, 1997.

[3] S. S. Khanka, "Organisational Behaviour", S. Chand Publication, Revised edition 2009.

Course Objectives:

1. To predict, understand and control the human behaviour in an organisation
2. To develop interpersonal relation in organisation
3. To maintain cordial industrial relation
4. To manage human resources efficiently in an organisation

Course Outcomes:

1. Students will be able to maintain the interpersonal and industrial relation when they will join into one organization.
2. Able to develop effective leadership quality.
3. Able to apply appropriate motivational techniques in accordance to the nature of the individual employee.
4. Able to manage human resources efficiently in an organisation.

(EE15-019) ELECTRICAL MACHINE LAB-II (0-0-6)

1. To determine the voltage regulation of alternator by EMF method
2. To determine the V curve and inverted V curve of a 3-Ph synchronous motor
3. Speed control of a 3 phase induction motor by rheostatic, cascading and pole changing methods
4. Synchronization of alternator with infinite bus.
5. No load and Blocked rotor test of three phase Induction motor.
6. Three phase connections of transformer
7. Determination of power angle characteristics of an Alternator
8. Load test of 3-Ph Induction Motor
9. Determination of Parameters of single phase induction motor
10. Separation of hysteresis and eddy current losses of single phase transformer.
11. Voltage regulation of 3 phase alternator by ZPF method.
12. Determination of Parameters of 3 phase three winding transformer and trace the waveform of Magnetizing Current & Induced e.m.f.

(EE15-024) ELECTRONICS CIRCUIT LAB (0-0-3)

1. Study of biasing circuit of transistor
2. Study of FET characteristics
3. Study of different clipper and clamper circuits
4. Determination of the frequency response of Low pass filter
5. Determination of the frequency response of High pass filter
6. Study of OPAMP as integrator and differentiator
7. Study of Class A Amplifier
8. Study of Class B Amplifier
9. RC phase shift oscillator and to observe its output waveform

FIFTH SEMESTER

(EE15-029) MICROPROCESSOR & MICRO CONTROLLER Theory & Application (3-1-0)

MODULE-I (10 HOURS)

Microprocessor Architecture: Introduction to Microprocessor and Microcomputer Architecture, Pins & Signals, Register Organization, Timing & Control Module, 8085 Instruction Timing & Execution.

Instruction Set and Assembly Language Programming of 8085:- Instruction set of 8085, Memory & I/O Addressing, Assembly language programming using 8085 Instruction Set, Use of Stack & Subroutines, Data transfer techniques, 8085 interrupts

MODULE-II (10 HOURS)

Interfacing & support chips: Interfacing EPROM & RAM Memories, 2716, 2764, 6116 & 6264

Microprocessor Based System Development Aids, Programmable Peripheral Interface: 8255, Programmable DMA Controller: 8257, Programmable Interrupt Controller: 8259

Application: Delay calculation, square wave generation, Interfacing of ADC & DAC, Data Acquisition System,

MODULE-III (10 HOURS)

Advanced Microprocessor: Basic features of Advance Microprocessors, Intel 8086 (16 bit processors):- 8086 Architecture, Register organization, signal descriptions, Physical Memory Organization, Addressing Modes, Instruction Formats, Instructions Sets & Simple Assembly language programmes, 8086 Interrupts.

Simple application: Delay calculation, square wave generation

MODULE-IV (10 HOURS)

Microcontroller:- Introduction for Microcontrollers, Microcontrollers & Microprocessors, Embedded verses External Memory devices, CISC & RISC Processors, Harvard & Von Neumann Architectures, 8051 Microcontrollers. MCS-51 Architecture, Registers, Stack Pointer & Program Counter. 8051 Pin Description, Connections, Parallel I/O ports, Memory Organization, 8051 Addressing Modes & Instructions, 8051 Assembly Language Programming Tools.

Simple application: Delay calculation, square wave generation, Interfacing of LCD unit.

TEXT BOOKS

[1]. D.V Hall and S.S.S.P Rao “ Microprocessor & its Interfacing”- 3rd Edition, TMH Publication

[2]. M.A Mazidi & J.G Majidi, “Microcontroller and Embedded Systems”, 2nd Edition, Prentice Hall Publication

REFERNCE BOOKS

[1]. Ghosh & Sridhar, “ 0000 to 8085 Introduction to Microprocessor for Scientists & Engineers”, PHI Publishers.

[2]. A.K.Roy & K.M.Bhurchandi, “Advanced Microprocessor and Peripherals (Architecture, Programming & Interfacing) ”, TMH Publications.

(EE15-042) SIGNALS & SYSTEMS-I (3-1-0)

MODULE-I (10 HOURS)

Introduction of Signals, Classification of Signals, General Signal Characteristics, Signal energy & Power, Continuous-Time Signals , Discrete-Time Signals

Basic System Properties, Systems with and without memory, Invertibility, causality, Stability, Time invariance, Linearity, Linear Time Invariant (LTI) Systems, Discrete Time LTI Systems, Convolution Representation of Linear Time-Invariant Discrete-Time Systems Convolution of Discrete-Time Signals Convolution Representation of Linear Time-Invariant Continuous-Time Systems Convolution of Continuous-Time Signals, Properties of LTI Systems, Casual systems

MODULE-II (10 HOURS)

Fourier Representations for Signals: Representation of Discrete Time Periodic signals, Continuous Time Periodic Signals, Discrete Time Non Periodic Signals, Continuous Time Non-Periodic Signals, Properties of Fourier Representations,

Frequency Response of LTI Systems, Fourier Transform representation for Periodic and discrete time Signals, Sampling, reconstruction, Discrete Time Processing of Continuous Time Signals, Fourier Series representation for finite duration Non-periodic signals.

MODULE-III (10 HOURS)

Modulation Types and Benefits, Full Amplitude Modulation, Pulse Amplitude Modulation, Multiplexing, Phase and Group delays

Representation of Signals using Continuous time Complex Exponentials: Laplace Transform, Unilateral Laplace Transform, its inversion, Bilateral Laplace Transform, Transform Analysis of Systems

MODULE-IV (10 HOURS)

Representation of Signals using Discrete time Complex Exponentials: The Z-Transform, Properties of Region of convergence, Inverse Z-Transform, Transform Analysis of LTI Systems, Unilateral Z-Transform

TEXT BOOKS

- [1]. Simon Haykin and Barry Van Veen, "Signals and Systems", John Wiley & Sons Publisher.
- [2]. Alan V. Oppenheim, Alan S. Willsky, with S. Hamid, S. Hamid Nawab, "Signals and Systems", PHI Publisher.

REFERENCE BOOKS

- [1]. Hwei Hsu, "Signals and Systems", Schaum's Outline TMH Publisher.
- [2]. Edward w. Kamen and Bonnie s. Heck, "Fundamentals of Signals & systems using Web and MATLAB", PHI Publisher.

(EE15-008) DIGITAL CIRCUITS AND DESIGN (3-1-0)

MODULE-I (10 HOURS)

Number system & codes: Binary Number base conversion, Octal & hexadecimal

numbers, complements, signed binary numbers, binary codes-BCD codes, gray codes, ASCII Character Code, Codes for serial data transmission & storage.

Boolean Algebra & Logic gates: Axiomatic definition of boolean Algebra .Property of Boolean Algebra, boolean functions, Canonical & standard form; min terms & max terms, standard forms; Digital Logic Gates, Multiple inputs.

MODULE-II (10 HOURS)

Gate level Minimization: The Map Method, K Map up to five variables, Product of Sum simplification, Sum of Product simplification, Don't care conditions. NAND and NOR Implementation, AND-OR inverter, OR-AND inverter implementation, Ex-OR Function, parity generation & checking, Hardware Description Language (HDL).

Combinational Logic: Combinational Circuits, Analysis & Design procedure; Binary Adder- subtractor, Decimal Adder, Binary Multiplier, Magnitude comparator, Multiplexers and demultiplexers, Decoders, Encoders, Multipliers, Combinational Circuits design

MODULE-III (10 HOURS)

Synchronous Sequential logic: Sequential Circuit, latches, Flip-flop, Analysis of Clocked Sequential circuits, HDL for Sequential Circuits, State Reduction & Assignment, Design procedure.

Register & Counters: Shift Register, Ripple Counters, Synchronous Counter, Asynchronous Counter, Ring Counters, Module-n Counters, HDL for Register & Counters .

MODULE-IV (10 HOURS)

Memory & Programmable logic: Random Access Memory (RAM), Memory , Decoding, Error detection & correction, Read only Memory, Programmable logic array, Sequential Programmable Devices.

Register Transfer levels: Register transfer level notion, Register transfer level in HDL, Algorithm, State machine, Design Example,. HDL Description of Design, Examples, Binary Multiplier, HDL Description, Digital Integrated logic Circuits: RTL, DTL, TTL, ECL, MOS & C-MOS Logic circuits,. Switch-level modeling with HDL

TEXT BOOKS

- [1]. M. Morris Mano, "Digital Design", PHI Publishers.
- [2]. John F. Wakerley, "Digital Design-Principle & practice", PHI Publishers.

REFERENCE BOOKS

- [1]. Charles H. Roth, "Fundamentals of Logic Design", Cengage Learning Publishers.
- [2]. Fredriac J. Hill and Gerald R. Peterson "Introduction to Switching Theory and Logic Design", John Wiley & Sons Publishers.

(EE15-036) POWER SYSTEM-I (3-1-0)

MODULE-I (10 HOURS)

Introduction to different sources of energy and general discussion on their application to generation, general introduction to power transmission by DC and AC overhead lines & underground cables, Per unit system, Single line diagram

Choice of size and number of generating units: Review of the terms maximum demand, load factor, diversity factor, plant capacity and use factor, load & load duration curve and their effect on the generating capacity. Reserve units (hot, cold and spinning- reserve), different types of power tariffs, brief idea about national grid and its operational problems.

MODULE-II (10 HOURS)

Hydro plant: classification of plants, base load and peak load station, Turbines, head gate, penstock, surge tank, scroll case, draft tube and tail race, power plant auxiliaries.

Thermal Power: Block diagrams, Boilers, steam turbines, super heater, economizer, air preheater, dust collection, draft fans and chimney; condensers, feed water heaters, cooling water system; Governors, plant layout and station auxiliaries.

MODULE-III (10 HOURS)

Nuclear Power: Fission & fusion, reactor construction, controlled chain reaction, operational control of reactors, Reactors (Boiling water, pressurized water, sodium graphite, breeder), layout of nuclear power plant.

Electrical System: excitation system, AVR: magnetic amplifier and thyristor converter type/DVR. Main transformer, unit transformer and station reserve transformer, commissioning tests of alternators and transformers.

MODULE-IV (10 HOURS)

Substation & Earthing: Types of substations, arrangement of bus-bars and control equipments, solid earthing, resistance earthing and Peterson coil,

Distribution System; types of distributors and feeders (radial & ring), voltage drop and load calculation, Primary and secondary distribution network, Capacitor placement in distribution network, Distribution system planning, Service area calculation.

TEXT BOOKS

- [1]. C.L. Wadhwa, "Electrical Power Systems", New Age International Publication
- [2]. Skrotizki & Vopat, "Power Station Engineering & Economy", TMH Publishers.

REFERENCE BOOKS

- [1]. S.N.Singh, "Electrical Power Generation Transmission and Distribution", PHI Publishers.
- [2]. B.R.Gupta, "Generation of Electrical Energy", S.Chand Publishers.

(EE15-034) POWER ELECTRONICS (3-1-0)

MODULE-I (10 HOURS)

Thyristors, Static V-I Characteristics of SCR, TRIAC, GTO & IGBT, Turn-On & Turn-OFF Mechanism of SCR, Gate Turnoff Thyristor (GTO) .Power BJTs . Power MOSFETs - Insulated Gate Bipolar Transistors (IGBTs) - Basic Structure and VI Characteristics. Static, dynamic and thermal characteristics. Protection, cooling and mounting techniques. Series and Parallel operation of devices. Triggering and basics of driver circuits. Different types of commutation schemes: Natural and Forced commutation.

MODULE-II (10 HOURS)

1-Phase Half & Full Wave Controlled Rectifier with various kinds of loads (R, R-L-E (motor)). Midpoint and Bridge type converters. Half Controlled and Fully Controlled Bridge circuits, different waveforms, Input Line Current Harmonics, Power factor, current distortion and displacement factors- Inverter Mode of Operation. Continuous and discontinuous modes, Effect of source inductance assuming constant load current. Effect of freewheeling diode. Three phase bridge converters for different types of load with constant load current, different waveforms. 180 and 120 degree operations.

MODULE-III (10 HOURS)

DC-DC Converters: Classification of types of choppers, One, Two and Four quadrant operations, Step up and down choppers, Analysis of Type-A chopper, Single-and two quadrant operation with DC motor load.

AC-AC Converters: Single-phase mid-point and bridge types of step-up and step-down Cyclo-converters. Single phase AC Voltage regulators and its basic analysis.

MODULE-IV (10 HOURS)

Single-phase Half and Full bridge Inverter, Pulse Width Modulated (PWM) technique for voltage control, SPWM Technique 1-phase inverters, Auxiliary Commutated (Mc-Murray) and Complementary Commutated (Mc-Murray Bedford) Inverters, Three-phase Voltage Source Bridge type of Inverters. (120 and 180 Degree conduction modes), Current Source Inverter.

Applications: UPS, SMPS, Induction Heating, Electronic Ballast, AC/DC drives speed control.

TEXT BOOKS

- [1]. M. H. Rashid, "Power Electronics", PHI Publisher.
- [2]. G.K.Dubey, SR.Doradla, A. Joshi and RMK. Sihna, "Thyristorised Power Controllers", Wiley Eastern Ltd. Publisher.

REFERENCE BOOKS

- [1]. Cyril W Lander, "Power Electronics", MGH Publishers.
- [2]. Philip T. Krein, "Elements of Power Electronics", Oxford University Press.

(EE15-044) SIGNAL & SYSTEMS LAB.-I (0-0-3)

(Use MATLAB CONTROL SYSTEM and SIGNAL PROCESSING TOOL BOXES)

1. Generation of square, triangular, exponential, sinusoidal signals and step, Impulse and RAMP functions.
2. Evaluation of convolution of finite –duration discrete time signals.
3. Frequency response of LTI Systems from Impulse response.
4. Frequency response of LTI systems Describes by differential or difference Equations.
5. Implementation of Decimation and Interpolation concepts
6. Generation of AM wave and analyzing its frequency content.
7. Determination of frequency response from Poles and Zeros.
8. Pole- Zero Plot in the Z-plane and determination of magnitude response.

(EE15-009) DIGITAL CIRCUIT LAB. (0-0-3)

1. Verification of Truth table of logic gates and verification of Demorgan's Theorems.
2. Study of timer chip N.E 555 and its use as monostable and astable multivibrator
3. Study of OPAMP (741) and its use as Analog comparator, Schmitt trigger and Integrator.
4. Study of counter chip 7493, and realize a divide by 6, Divide by 8 and divide by 5 counter using 7493.
5. Realization of half adder, full adder, half subtractor, full subtractor.
6. Realization of S-R flip flop using 7400.
7. Study of truth table of 7476 (Master slave J.K.) and realise mod-6 shift counter using 3(7476)
8. Design of 4-bit random counter
9. Design of adder and subtractor using multiplexer

(EE15-030) MICROPROCESSOR & MICROCONTROLLER LAB. (0-0-3)

A) 8085 (2 hours)

1. Addition, Subtraction, Multiplication, Division of two 8 bit numbers resulting 8/16 bit numbers.
2. Smallest /Largest number among 'n' number in a given data array + Binary to Gray Code Hexadecimal to decimal conversion.

B) INTERFACING (5 hours)

COMPULSORY

1. Generate square waves of different frequencies on all lines of 8255 by the help of delay program.
2. Study of stepper Motor and its operations (Clockwise, anticlockwise, angular movement, rotate in various speeds)

OPTIONAL (Any Two)

1. Study of Traffic Light controller
2. Generation of Square, triangular and saw tooth wave using Digital to Analog Converter
3. Study of 8253 and its operation (Mode 0, Mode 2, Mode 3)
4. Study of Mode 0, Mode 1, BSR Mode operation of 8255.
5. Study of 8279 (keyboard & Display interface)
6. Study of 8259 Programmable Interrupt controller.

C) 8051 MICROCONTROLLER (3 hours)

COMPULSORY

Initialize data to registers and memory using immediate, register, direct and indirect addressing mode

OPTIONAL (any one)

1. Addition, subtraction of 16 bit numbers.
2. Multiplication, Division of 16 bit numbers
3. Transfer a block of data to another memory location using indexing.
4. Operation of 8255 using 8051 microcontroller

D) 8086 (2 hours)

COMPULSORY

Addition, subtraction, Multiplication, Division of 16 bit nos + 2's complement of a 16 bit no.

OPTIONAL (Any One)

1. Finding a particular data element in a given data array.
2. Marking of specific bit of a number using look-up table.
3. Largest /Smallest number of a given data array.
4. To separate the Odd and Even numbers from a given data array.
5. Sorting an array of numbers in ascending/descending order

Total – 13 hours

NOTE Total 10 (Ten) experiments have to be completed.

Two from Gp-A, four from Gp-B, Two from Gp –C Two from Gp–D

(EE15-035) POWER ELECTRONICS LAB. (0-0-3)

1. Familiarization with power electronics components. (SCR, IGBT, MOSFET, GTO, BJT) & Draw the V-I Characteristics of BJT, MOSFET, SCR.
2. Study of Single phase Full and Half wave converters with R and R-L-E(Motor) loads with and without freewheeling action
3. Study of Three Phase Full and Half wave converters with R and R-L-E(Motor) loads
4. To study different triggering circuits for thyristors (Cosine Law & UJT Triggering)
5. To study single phase AC regulator using Triac (R & R-L Loads)
6. To study the single phase cycloconverter with R and R-L Loads
7. To study IGBT based PWM Inverter.
8. To study the speed control of DC motor using single-phase full wave converter.
9. DC Motor speed control by single quadrant chopper circuit.
10. To study a transistorized PWM Inverter.

SIXTH SEMESTER

(EE15-037) POWER SYSTEM-II (3-1-0)

MODULE-I (10 HOURS)

Lines Constants: Resistance, inductance and capacitance of single and three phase lines with symmetrical and unsymmetrical spacing transposition, charging current, skin effect and proximity effect, Performance of transmission Lines: Analysis of short, medium and long lines, equivalent circuit, representation of the lines and calculation of transmission parameters, Power flow through transmission line, Power circle diagram, Series and shunt compensation.

MODULE-II (10 HOURS)

Corona: Power loss due to corona, practical importance of corona, use of bundled conductors in E.H.V. transmission lines and its advantages, Overhead line Insulators, voltage distribution in suspension type insulators, string efficiency, grading. Sag and stress calculation of overhead conductors, vibration dampers
Under Ground Cable: Type and construction, grading of cables, capacitance in 3 core cables and dielectric loss in cables.

MODULE-III (10 HOURS)

Definition of the load flow problem, Network model formulation, A load flow sample study, Computational aspect of the load flow problem. Gauss siedel and Newton Raphson method for power flow fast decoupled load flow, On load tap changing transformer and block regulating transformer, effects of regulating transformers.

MODULE-IV (10 HOURS)

Economic Operation of Power System: Distribution of load between units within a plant, Transmission losses as function of plant generation, Calculation of loss coefficients, Distribution of loads between plants with special reference to steam and hydel plants, Automatic load dispatching. Introduction to Flexible AC Transmission System (FACTS), SVC, TCSC, SSSC, STATCOM and UPFC

TEXT BOOKS

- [1]. John J Grainger, W. D. Stevenson, "Power System Analysis", TMH Publisher
- [2]. I. J. Nagrath & D. P. Kothari, "Power System Analysis", TMH Publisher

REFERENCE BOOKS

- [1]. S.N.Singh, "Electrical Power Generation Transmission and Distribution", PHI Publishers.
- [2]. Abhijit Chakraborty, Sunitha Halder, "Power System Analysis, Operation And Control, PHI Publishers.

(EE15-020) ELECTRICAL MEASUREMENTS & INSTRUMENTATION (3-1-0)

MODULE-I (10 HOURS)

Measuring Instruments: Classification, Absolute and secondary instruments, indicating instruments, control, balancing and damping, constructional details, characteristics, errors in measurement, Ammeters, voltmeters: (DC/AC) PMMC, MI, Electrodynamicometer type

Wattmeters: Electrodynamicometer type, induction type, single phase and three phase wattmeter, compensation, Energymeters: AC. Induction type single phase and three phase energy meter, compensation, creep, error, testing, Frequency Meters: Vibrating reed type, electrical resonance type

MODULE-II (10 HOURS)

Instrument Transformers: Potential and current transformers, ratio and phase angle errors, phasor diagram, methods of minimizing errors; testing and applications.

Galvanometers: General principle and performance equations of D'Arsonval Galvanometers, Vibration Galvanometer and Ballistic Galvanometer.

Potentiometers: DC Potentiometer, Crompton potentiometer, construction, standardization, application. AC Potentiometer, Drysdale polar potentiometer; standardization, application.

MODULE-III (10 HOURS)

DC/AC Bridges :General equations for bridge balance, measurement of self inductance by Maxwell's bridge (with variable inductance & variable capacitance), Hay's bridge, Owen's bridge, measurement of capacitance by Schering bridge, errors, Wagner's earthing device, Kelvin's double bridge.

Transducer: Strain Gauges, Thermistors, Thermocouples, Linear Variable Differential Transformer (LVDT), Capacitive Transducers, Piezo-Electric transducers, Optical Transducer, Torque meters, inductive torque transducers, electric tachometers, photo-electric tachometers, Hall Effect Transducer

MODULE-IV (10 HOURS)

CRO: Block diagram, Sweep generation, vertical amplifiers, use of CRG in measurement of frequency, phase, Amplitude and rise time of a pulse.

Digital Multi-meter: Block diagram, principle of operation, Accuracy of measurement, Electronic Voltmeter: Transistor Voltmeter, Block diagram, principle of operation, various types of electronic voltmeter, Digital Frequency meter: Block diagram, principle of operation

TEXT BOOKS

- [1]. A K. Sawhney, "A Course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai Publications.
- [2]. Helfrick & Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI Publishers.

REFERENCE BOOKS

- [1]. Larry Jones & A Foster Chin, "Electronic Measurement & Instrumentation Systems", John Wiley & Son Publishers.
- [2]. Golding & Waddis, "Electrical Measurement and Measuring Instruments", Reem Publishers.

(EE15-022) ELECTROMAGNETIC THEORY (3-1-0)

MODULE-I (10 HOURS)

Representation of vectors in Cartesian, Cylindrical and Spherical coordinate system, Vector products, Coordinate transformation.

The Law of force between elementary electric Charges, Electric Field Intensity and Potential due to various charge configuration, Electric Flux density, Gauss law and its application, Application of Gauss Law to differential Volume element, Divergence Theorem. Potential Gradient, Dipole, and Energy Density in Electrostatic Field.

MODULE-II (10 HOURS)

Current and Conductors, Continuity of Current, Conductor Properties and Boundary Conditions. The Method of Images, Nature of dielectric Materials, Boundary Conditions for Perfect Dielectric Materials Capacitance, Poisson's & Laplace equation, Uniqueness Theorem, Analytical Solution in one dimension.- Use of MATLAB
Steady Magnetic Field: Biot Savart Law, Ampere's Circuital Law, Stoke's Theorem, Scalar and Vector Magnetic Potential,

MODULE-III (10 HOURS)

Force on a moving Charge, Force on a differential Current Element, Force & Torque Magnetization & Permeability, Magnetic Boundary Conditions, Inductance & Mutual Inductance.

Time Varying Fields: Faraday's Law, Displacement Current, Maxwell's Equation.

MODULE-IV (10 HOURS)

Wave propagation in Free Space, Dielectric, and Good Conductor. Poynting's Theorem and wave power, Wave polarization, Reflection and Transmission of Uniform Plane Waves at Normal & Oblique incidence, Standing Wave Ratio, Basic Wave Guide Operation and Basic Antenna Principles.

TEXT BOOKS

- [1]. W. H. Hayt (Jr), J. A. Buck, "Engineering Electromagnetics", TMH Publisher.
- [2]. K. E. Lonngren, S.V. Savor, "Fundamentals of Electromagnetic with MATLAB", PHI Publisher.

REFERENCE BOOKS

- [1]. E.C.Jordan, K.G. Balmain, "Electromagnetic Waves & Radiating System", PHI.
- [2]. M. N. Sadiku, "Elements of Electromagnetics", Oxford University Press.

(EE15-005) CONTROL SYSTEM ENGINEERING-I (3-1-0)

MODULE-I (10 HOURS)

Introduction: Scope of control system Engineering, Various Classification of Control System, Closed

Loop Control Versus Open Loop Control, Mathematical model of physical systems, transfer function, block diagram algebra, signal flow graph (SFG), Mason's gain formula.

Feed back Characteristics: Types of feedbacks, effect of degenerative feedback on control system, regenerative feedback, Application of Control. Theory in Non-Engineering Fields.

MODULE-II (10 HOURS)

Time domain analysis: Standard test signals: Time response of 1st. order systems to unit step and unit ramp inputs. Time response of second order systems to unit step input. Time response specifications. Steady state errors and error constants of different types of control systems Generalized error series method, Application of MATLAB and its Tool Box for time response analysis.

Controllers: Introduction, Proportional, derivative and integral control actions, PD, PI and PID controllers and their applications to feedback control systems, Zeigler- Nichols method of tuning PID controllers for known dynamic model of the plant. Introduction to Control System Design

MODULE-III (10 HOURS)

Concepts of stability: Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion, application of Routh stability criterion to linear feed back systems, Relative stability Analysis.

Root locus techniques: Root locus concepts, rules for construction of root loci, determination of roots from root locus, root contours, systems with transportation lag, Root locus plots with MATLAB.

MODULE-IV (10 HOURS)

Frequency domain analysis: Introduction, Polar plots, Bode plots, determination of stability from Bode plots, Nyquist stability criterion, application of Nyquist stability criterion to linear feedback systems, Log magnitude versus phase plots, Use of MATLAB for plotting Bode & Nyquist diagram. Closed loop frequency response: Constant M circles, constant N circles, use of Nichols chart. Components: A.C. Servo motor, DC servo motor, AC tacho meter, sychros, amplidyne, stepper motor, Models of Liquid Level control System, Hydraulics System, Pneumatic System,

TEXT BOOKS

- [1]. K. Ogata, "Modem Control Engineering", PHI Publishers.
- [2]. I.J. Nagrath, M. Gopal, "Control Systems Engineering", New Age International Publishers.

REFERENCE BOOKS

- [1]. G.F.Franklin, J.D.Powell, A. Emami, Naeini, "Feedback Control of Dynamic Systems", Schaum's Outlines, TMH Publishers.
- [2]. B.C.Kuo, F. Golnaraghi, "Automatic Control Systems", John Willey & Sons.

(EE15-043) SIGNAL AND SYSTEMS-II (3-1-0)

MODULE-I (10 HOURS)

Discrete Time Signals and System: Discrete Time Signals (Elementary examples, classification: periodic and a periodic Signals energy and Power signals, Even and odd Signals).

Discrete Time System: Block diagram representation of discrete time systems, classification of discrete time systems static and dynamic, time variant and time - invariant, linear and non-linear, casual and anti casual, stable and unstable.

Analysis and response (convolution sum) of discrete - time linear L TI system, Recursive and Non-recursive discrete time system. Constant coefficient differences equations and their solutions, impulse response of L TI system, structures of L TI systems recursive and Nonrecursive realization of FIR system. correlation of dispute time Signal.

MODULE-II (10 HOURS)

The Z transform: The Z-transform and one-sided Z-transform, properties of Z-transform, inverse of the Z-transform, Solution of difference equations. The Discrete Fourier Transform: The OFT and 10FT, relationship, OFT with Z-transform, the OFT as a linear transformation relationship of OFT with Z-transform, properties of OFT: periodicity, linearity, summery and time reversal of sequence. Circular convolution, circular correlation, circular correction by convolution, method linear convolution by overlap save methods and by overlap add method, Circular convolution and correlation by OFT method, Overlap add and save filtering by OFT method.

MODULE-III (10 HOURS)

Fast Fourier Transform: Operation counts by direct copulation of OFT, Radix- 2 FFT algorithm - Decimation-in-time (DIT) and Decimation-in-frequency (DIF) algorithm, Efficient computation OFT of Two real sequences, Efficient Computation of OFT of a 2 N-pt real sequences. Design and Digital Filters: Casually and its implication, Design of linear phase FIR filters using different windows. Design of IIR filters-Impulse Invariance Method and Bilinear transformation method.

MODULE-IV (10 HOURS)

Estimation of spectra from finite duration signals, Non-parametric method of power spectrum estimations. The Bartieff method and the Blackman and Tukey method. Implementation of Discrete Time System structure of FOR systems-Direct form, cascaded form. Structure IIR Systems - Direct form 1&11 realizations

TEXT BOOK

- [1]. J.G. Proakis and D.G.Manolakis, "Digital Signal Processing - Principles, Algorithms and Applications", PHI Publisher.

REFERENCE BOOKS

- [1]. S.Salivahanan, "Digital Signal Processing", TMH Publisher.
[2]. J.R.Johnson, "Introduction of Digital Signal Processing", PHI Publisher.

(EE15-048) VLSI THEORY & DESIGN (3-1-0)

MODULE-I (10 HOURS)

Introduction, Historical perspective, VLSI Design methodologies, VLSI Design Flow, Design, Hierarchy, Design Styles, CAD Technology, Fabrication of MOSFETS. Fabrication processes, NMOS Fabrication, CMOS n-well process, Layout Design rules Stick Diagrams ,Full Custom Mark Layout Design, MOS Transistor, Review of structure and operation of MOSFET (n-MOS enhancement type), CMOS, MOSFET v-I characteristics, MOSFET scaling and small geometry effects. MOSFET capacitances, Modeling of MOS Transistors-Basic concept the SPICE level-1 models, the level-2 and model equations.

MODULE-II (10 HOURS)

MOS Inverters: Basic NMOS inverters, characteristics, Inverters with resistive load and with n-type MOSFET load CMOS inverter and characteristics. MOS Inverters: Switching characteristics and interconnect effects: Delay time definitions and calculation, inverter design with delay constraints, estimation of parasitics switching power dissipation of CMOS inverters.

MODULE-III (10 HOURS)

Combinational MOS logic circuits, CMOS logic circuits, state style, complete logic circuits, pass transistor logic, sequential logic circuit –introduction, SR latch, clocked latch and flip-flop circuits, CMOS D latch and edge triggered flip- flop. Dynamics logic circuits: Dynamic logic, basic principles, high performance dynamics CMOS circuits, Dynamic Ram, SRAM, flash memory.

MODULE-IV (10 HOURS)

Systems Design method, design strategies, concept of FPGA, standard cell based design, design capture tools hardware definition languages such as VHDL, and packages, Xilinx (introduction),introduction to IRSIM and GOSPL (open source packages), design verification and testing, simulation of various levels including timing verification, faults models, Design strategies for testing chip level and system level test techniques.

TEXT BOOKS

- [1]. Sung Mo-Kang & Yussuf Leblebici, “CMOS Digital integrated Circuits – Analysis & Design”, TMH Publisher.
- [2]. Perry, “VHDL Programming”, TMH Publisher.

REFERENCE BOOKS

- [1]. Rabey et al., “Digital Integrated Circuits: A Design Perspective”, PHI Publisher.
- [2]. Geiger et.al., “VLSI design Techniques for analog and digital circuits”, TMH Publisher.
- [3]. R.Johnson, “Introduction of Digital Signal Processing”, PHI Publisher.

(EE15-021) ELECTRIC DRIVES AND TRACTION (3-1-0)

MODULE-I (10 HOURS)

Requirements, AC and DC drives, modern trends in drives technology, Characteristic of DC. Induction and Synchronous motor drives,(starting, running, speed control, braking),size and rating of motors(short time, intermittent, continuous),Mechanical considerations(enclosure, bearing transmission of drive, through chain, pulley and gears noise)

MODULE-II (10 HOURS)

Control for drive systems, Control of D.C. Induction, and Synchronous motor drives. Control Techniques for electric drives, Block diagram representation, transfer functions transient response, frequency response and stability, compensating techniques.

MODULE-III (10 HOURS)

Electric Traction: System of electric traction

Mechanics of Train Movement: Speed- time, distance- time and simplified speed-time curves, Attractive effort for acceleration and propulsion, effective weight, train resistance, adhesive weight, specific energy output and consumption.

Traction Motors: Review of characteristics of different types of DC and AC motors used in traction and their suitability

MODULE-IV (10 HOURS)

Rating and heating of electric drives, power loss, Heating and cooling of motors, Classes and duty and selection of motors, Drives for specific application like steel, paper, Textile Mills control of electric drives microprocessor hardware and software for drive system.

TEXT BOOKS

- [4]. V.Subrahmanyam, "Electric Drives", TMH Publisher.
- [5]. M.H.Rashid, "Power Electronics", PHI Publisher.

REFERENCE BOOKS

- [1]. G.K.Dubey, "Electric Drive", Norasa Publisher.
- [2]. B.K.Bose, "Modern Power Electronics and AC Drives", PHI Publisher.

(EE15-028) IMAGE PROCESSING (3-1-0)

MODULE-I (10 HOURS)

Digital Image Representation, Digital image Processing System, Visual perception, Sampling and Quantization, relationship between Pixels, Fourier Transformers, Walsh, Hadamard and Discrete Cosine Transforms.

MODULE-II (10 HOURS)

Spatial and Frequency domain methods, Enhancement by point Processing, Spatial Filtering, Enhancement in the Frequency Domain, Generation of Spatial Masks from Frequency Domain Specifications, Colour Image Processing.

MODULE-III (10 HOURS)

Image Restoration Degradation Model, Diagonalization of Circulant and Block Circulant of Matrices, Algebraic Approach to Restoration. Inverse Filtering, Least Mean Square Filter, Constrained Least squares restoration, Iterative Restoration, Restoration in the Spatial Domain.

MODULE-IV (10 HOURS)

Image Compression

Fundamentals, Image Compression Mode, Elements of Information Theory, Error-Free Compression, Image Compression Standards.

Image Segmentation

Detection of Discontinuity, Edge linking and Boundary Detection, Thresholding, Region Oriented Segmentation, The use of Motion in Segmentation.

TEXT BOOKS

- [1]. R.C.Gonzalez & R.E.Wood, "Digital Image Processing", Addison Wesley Publisher.
- [2]. B.Channda & D.Dutta, "Digital Image Processing and Analysis", PHI Publisher.

REFERENCE BOOKS

- [1]. Anil Ku Jain, "Fundamentals of Digital Image Processing", PHI Publisher.
- [2]. Arther R.Weeks Jr.Phi, "Fundamental of Electronic Image Processing", Wiley-IEEE Press.

(EE15-045) SIGNAL & SYSTEMS LAB.-II (0-0-3)

1. Computation of DFT and IDFT
2. Computation of NDFT and inverse INDFT using the lagrange interpolation method
3. Prove the general properties of DFT: a) Linearity (b) Circular time shifting (c) Circular frequency shifting, (d) duality (e) N-Point Circular Convolution(f) Modulation and (g) Parseval's relation.
4. Structure Simulation and Verification
5. Design of FIR filters (high and low pass) and plot their gain responses.
6. Design of second order IIR band pass and IIR notch filter and plot their magnitude responses.
7. Realization of $G(z)$ in Cascade and parallel forms
8. Design of Butterworth, low pass filter and Chebyshev low pass filter using the bilinear transformation method.

(EE15-007) CONTROL & INSTRUMENTATION LAB

1. Study of a two-phase AC servomotor and its transfer function parameters.
2. Find the frequency response of a Lag and Lead compensator.
3. To observe the time response of a second order process with P, PI, PID control and apply PID control to a DC servomotor.
4. To study the characteristic of a relay and analyze the relay control system (Phase Plane).
5. Study of a linear system simulator
6. Study of feedback characteristic using Amplidyne
7. To study digital control of a simulated system using an 8 bit microprocessor
8. Measurements of unknown resistance, inductance, and capacitance using Bridges.
9. To plot the displacement-voltage characteristics of the given LVDT.
10. Study of a Data Acquisition System.
11. Study of Synchro-transmitter & synchro-transformer.
12. Speed measurement of DC Motor by none-contact type transducer.
13. Calibration of DC Milli-Ammeter by a DC Potentiometer.

(EE15-015) ELECTRICAL EQUIPMENT DESIGN & SIMULATION LAB (0-0-6)

1. Design of DC machines
 - a) Design Simulink model on speed control of separately excited DC motor using armature resistance control method.
 - b) Design Simulink model on speed control of separately excited DC motor using field flux control method.
2. Design of DC machines
 - a) Design Simulink model on speed control of DC shunt motor using armature resistance control method.
 - b) Design Simulink model on speed control of DC shunt motor using field flux control method.
3. Design of DC machines
Design Simulink model on speed control of DC series motor.
4. Design Simulink model of three phase induction motor (Squirrel cage) with variable mechanical torque/speed.
5. Design Simulink model of three phase induction motor (Slip ring) with variable mechanical torque/speed.
6. Design Simulink model of an alternator.
7. Design Simulink model of synchronous motor for different speed.
8. Design Simulink model of synchronous motor for different mechanical load.
9. Design Simulink model of a single phase transformer (both in normal operation and fault condition).
10. Design Simulink model of a three phase transformer (both in normal operation and fault condition).
11. Design Simulink model of half wave (HW) rectifier (uncontrolled).
12. Design Simulink model of full wave (FW) rectifier (uncontrolled).

SEVENTH SEMESTER

(EE15-038) POWER SYSTEM-III (3-1-0)

MODULE-I (10 HOURS)

Philosophy of protection, Nature, Causes and consequences of faults, Zone of protection, Requirements of a protective scheme, Basic terminology components of protection scheme.

Circuit Breakers: Formation of arc during circuit breaking. Theories of arc Interruption. Recovery and restriking voltage, interruption of capacitive and inductive currents. Current chopping. circuit breaker rating, Different types of circuit breakers. Air break and Air blast circuit breaker. Plain break and controlled break all circuit breakers. Minimum oil circuit breakers. Vacuum circuit breaker, SF6 circuit breaker. D.C. Circuit breaker.

MODULE-II (10 HOURS)

Relay classification, Principle of different types of electromagnetic relay. General equation of phase and magnitude comparators, Duality of comparators, Electromagnetic relays, over current relays Directional relays, Distance relay- impedance, Reactance and Mho type, Differential relays, Concept of static and numerical relay.

Feeder Protection, Generator Protection, Transformer Protection, Bus Zone Protection

MODULE-III (10 HOURS)

Z bus Algorithm, Symmetrical and unsymmetrical fault analysis for power system, Z bus method in fault analysis. Arrangement of Bus bar, Circuit breaker and isolator. Current limiting reactors in power system and their arrangement calculation of fault MVA for symmetrical short circuits. Circuit breaker capacity.

MODULE-IV (10 HOURS)

Power System Stability, Steady State Stability, Transient stability, Swing equation, Equal area criterion for stability, critical clearing angle, point by point Methods of improvement of transient stability. Voltage stability, concept, causes and countermeasures.

Load frequency control, PF versus QV control.

TEXT BOOKS

- [1]. Van C Warrington, "Protective Relays-Vol.-I & II", John Wiley & Sons Publisher.
- [2]. Ravindranath, M.Chander, "Power System Protection and Switch Gear", Wiley Eastern Ltd. Publisher.

REFERENCE BOOKS

- [1]. John J Grainger, W. D. Stevenson, "Power System Analysis", TMH Publication
- [2]. P. Kundur, "Power System Stability and Control", TMH Publication

(EE15-003) COMMUNICATION SYSTEMS-I (3-1-0)

MODULE-I (10 HOURS)

Elements of Communication System-Analogue System, Digital System, Distinguishing features. Electromagnetic Spectrum. Bandwidth. Comparison between Analogue & Digital Communication Systems. Baseband Signals, Analogue Signal, Digital Signal. Converting an analogue signal to Digital Signal: Sampling, Nyquist Criteria. Information and Sampled value. Quantization and Binary Coding of sampled values. Transformation of Base band signal from Time domain to Frequency domain and Vice-versa. F.T. of few simple baseband signals.

MODULE-II (10 HOURS)

Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM). Inter Symbol Interference and Crosstalk. Digital Baseband Signal Formats-Unipolar, Bipolar, NRZ and RZ Pulse Code Modulation, Quantization error. Companding Pre-emphasis and De-emphasis. TDM of 8-bit PCM Signal. Digital Baseband Reception. Conceptual Definition of Matched Filter. Binary Matched Filter Detector. Modulation Techniques: Need for Modulation, Analogue Modulation Techniques: Amplitude Modulation (AM), Depth of Modulation, Modulated Waveform, Powers in Carrier, and Sidebands, Generation of DSBSC and SSB, Balanced Modulator, AM Demodulators.

MODULE-III (10 HOURS)

Frequency Modulation (FM)- Frequency Deviation, Frequency Modulated Waveform, Spectrum. Narrow Band FM and Wideband FM. Generation of FM; Narrow Band FM Modulator, Wideband FM Modulator, FM Discriminator.

Digital Modulation Techniques.Phase Shift Keying (PSK), Frequency Shift Keying (FSK) – their Basic Principle, Waveform, Generation and Detection. Ideal low pass, Band pass and Band rejection filters – their impulse Response. (no mathematical derivation).

MODULE-IV (10 HOURS)

Noises in Communication Systems: Sources of Noise, White noise, Narrow Band Noise. Spectral Density Function of Noise (no derivation explaining its utility in noise performance evaluation of a Communication System). SNR of AM, FM, PSK-PCM-Simple derivation and or Interpretation of Standard SNR expressions in each case. Noise bandwidth, Available Power, Noise temperature Two port noise Bandwidth, Input Noise Temperature, Noise Figure, Equivalent noise temperature of a cascade. An example of a receiving system.

TEXT BOOKS

- [1]. Martin S. Roden, “Analog and Digital Communication Systems”, SPD Publisher.
- [2]. Communication Systems by R. P. Singh and S. D. Sapre. TMH Publisher.

REFERENCE BOOKS

- [1]. H.Tanb and D. L. Shilling, “Principle of Communication System”, TMH Publisher.
- [2]. B.P.Lathi, “Modern Analog and Digital Communication”, Oxford Publisher.

(EE15-006) CONTROL SYSTEM ENGINEERING-II (3-1-0)

MODULE-I (10 HOURS)

State Variable Analysis and Design: Introduction, Concepts of State, State Variables and State Model, State Models for Linear Continuous-Time Systems, State Variables and Linear Discrete-Time Systems, Diagonalization, Solution of State Equations, Concepts of Controllability and Observability, Pole Placement by State Feedback, Observer based state feedback control.

MODULE-II (10 HOURS)

Introduction of Design: The Design Problem, Preliminary Considerations of Classical Design, Realization of Basic Compensators, Cascade Compensation in Time Domain(Reshaping the Root Locus), Cascade Compensation in Frequency Domain(Reshaping the Bode Plot),

Introduction to Feedback Compensation and Robust Control System Design.

Digital Control Systems: Advantages and disadvantages of Digital Control, Representation of Sampled process, The z-transform, The z-transfer Function. Transfer function Models and dynamic response of Sampled-data closed loop Control Systems, The Z and S domain Relationship, Stability Analysis.

MODULE-III (10 HOURS)

Nonlinear Systems: Introduction, Common Physical Non-linearities, The Phase-plane Method: Basic Concepts, Singular Points, Stability of Nonlinear System, Construction of Phase-trajectories, The Describing Function Method: Basic Concepts, Derivation of Describing Functions, Stability analysis by Describing Function Method, Jump Resonance, Signal Stabilization.

Liapunov's Stability Analysis: Introduction, Liapunov's Stability Criterion, The Direct Method of Liapunov and the Linear System, Methods of Constructing Liapunov Functions for Nonlinear Systems, Popov's Criterion.

MODULE-IV (10 HOURS)

Optimal Control Systems: Introduction, Parameter Optimization: Servomechanisms, Optimal Control Problems: State Variable Approach, The State Regulator Problem, The Infinite-time Regulator Problem, The Output regulator and the Tracking Problems, Parameter Optimization: Regulators, Introduction to Adaptive Control.

TEXT BOOKS

- [1]. K. Ogata, "Modern Control Engineering", PHI Publisher.
- [2]. I.J. Nagrath, M. Gopal, "Control Systems Engineering", New Age International Publishers.

REFERENCE BOOKS

- [1]. J.J. Distefano, III, A.R. Stubberud, I.J. Williams, "Feedback and Control Systems", TMH Publisher.
- [2]. K. Ogata, "Discrete Time Control System", Pearson Education Asia Publisher.

(EE15-025) EMBEDDED SYSTEMS (3-1-0)

MODULE-I (10 HOURS)

Introduction to Embedded Systems: What is an Embedded System, Embedded systems Vs. General computing systems, history of Embedded Systems, Classification of Embedded Systems, major application areas of Embedded Systems Purpose of Embedded Systems.

The typical Embedded Systems: Core of the Embedded System, memory, Sensors and Actuators, Communication Interface, Embedded Firmware, other system components, PCB and passive components.

MODULE-II (10 HOURS)

Hardware Software co-design and programme modeling: Fundamental Issues in Hardware –Software co-design, computational models in embedded design, Introduction to unified modeling language (UML), hardware-software trade off s.

Embedded Hardware design and developments: Analog Electronic components, Digital Electronic Components, VLSI and Integrated Circuit design.

Embedded Firmware design and developments: Embedded Firmware design approaches, Embedded Firmware development languages, Programming in Embedded C.

MODULE-III (10 HOURS)

Real time operating System (RTOS) based Embedded System Design: Operating System basics, types of operating Systems Task process and threads, multiprocessing and multitasking, Task scheduling, Threads, processes and scheduling: Putting task commutation, task synchronization, Device drives, How to choose an RTOS

MODULE-IV (10 HOURS)

The Embedded System Development Environment:

The integrated Development Environment (IDE), Types of files generated on Cross compilation, Disassembler/Decompiler, Simulators, Emulators and Debugging, Target Hardware Debugging.

Design Case Studies: Digital Clock, Battery operated Smartcard Reader, Automated meter reading system (AMR) and Digital Camera.

TEXT BOOKS

- [1]. Shibu K.V, “Introduction to Embedded Systems”, TMH Publication.
- [2]. Rajkamal, “Embedded Systems –Architecture, Programming and Design”, TMH Publication.

REFERENCE BOOKS

- [1]. Frank Vahid, Tony D. Givargis, “Embedded System Design – A Unified Hardware/Software Introduction”, John Wiley Publisher.
- [2]. David E. Simon, “An Embedded Software Primer”, PHI Publication.

(EE15-027) HVDC TRANSMISSION (3-1-0)

MODULE-I (10 HOURS)

Introduction, Comparison of AC and DC transmission, Application of HVDC Transmission, Description of HVDC transmission systems, Planning of HVDC transmission, Power carrying capability of AC and DC lines, Modern trends in HVDC transmission, Research and development.

HVDC Converters: Basic conversion principle, Selection of converter configuration, Rectifier operation, Converter bridge characteristics, Inverter operation, twelve pulse converter, Converter harmonics.

MODULE-II (10 HOURS)

Converter and HVDC control: Principle of DC link Control, Converter control characteristics, System control Hierarchy, Firing angle control, Current and extinction angle control, Reversal of dc power flow, Modification to the basic characteristics, Tap changer control, different control levels, power flow control, Telecommunication requirements.

MODULE-III (10 HOURS)

Multiterminal HVDC: Application, Types of MTDC systems, Control and protection of MTDC systems, Study of MTDC systems.

Converter Faults and Protection: Introduction, Converter faults, Protection against over currents, Over voltages in Converter station, Surge arresters, Protection against over voltages.

MODULE-IV (10 HOURS)

Harmonics and Filter: Introduction, Generation of Harmonics, Design of AC filters, Design criteria, design factors, network impedance, circuit modeling, Tuned filter, self-tuned filters, High pass filters, Type C damped filters, DC filters, Alternative methods of harmonic elimination, Magnetic flux compensation, Harmonic injection, Ripple injection, Carrier frequency and RI Noise.

TEXT BOOK

[1]. Padiyar K. R., "HVDC power transmission System", Willey Eastern Ltd. Publisher.

REFERENCE BOOKS

[1]. Arrillaga J., "High Voltage direct current transmission", Peter Peregrinus Publisher, London.

[2]. Kimbark E. W., "Direct Current transmission", vol. 1, John Wiley Publisher.

(EE15-040) POWER QUALITY (3-1-0)

MODULE-I (10 HOURS)

Overview of Power Quality and Power Quality Standard ,Interest in Power Quality, Power Quality, Voltage Quality ,Overview of Power Quality Phenomena ,Power Quality and EMC Standards ,Long Interruptions and Reliability Evaluation, Introduction, Observation of System Performance , Standards and Regulations, Overview of Reliability Evaluation ,Basic Reliability Evaluation Technique, Costs of Interruptions

MODULE-II (10 HOURS)

Short Interruptions, Introduction, Terminology ,Origin of Short Interruptions, Monitoring of Short Interruptions ,Influence of Equipment , Single Phase Tripping , Stochastic Prediction of Short Interruptions

MODULE-III (10 HOURS)

Voltage Sags – Characterization, Introduction, Voltage Sag Magnitude Voltage Sag Duration, Three Phase Unbalance, Phase –Angle Jumps ,Magnitude and Phase-Angle Jumps for three phase Unbalanced Sags, Other Characteristics of Load Influence on Voltage Sags, Sags due to Starting of Induction Motors

MODULE-IV (10 HOURS)

Mitigation of Interruptions and Voltage Sags, Overview of Mitigation Methods, Power System Design Redundancy Through Switching, Power System Design, Redundancy through Parallel Operation, The System – Equipment Interface

TEXT BOOK

[1]. Roger C.Dugan, “Electrical Power Systems Quality”, TMH Publisher.

REFERENCE BOOKS

[1]. M.H.S Bollen, “Understanding Power Quality Problems”, Wiley-Blackwell Publisher, IEEE Press.

[2]. C. Sankaran, “Power Quality”, CRC Press Publisher.

(EE15-014) ELECTRICAL ENGINEERING MATERIALS (3-1-0)

MODULE-I (10 HOURS)

Conductivity of Metal: Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, energy levels of a molecule, emission of electrons from metals, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects.

MODULE-II (10 HOURS)

Dielectric Properties: Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, significance of the loss tangent, dipolar relaxation, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, ferroelectricity, piezoelectricity.

MODULE-III (10 HOURS)

Magnetic properties of Materials: Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.

MODULE-IV (10 HOURS)

Semiconductors: energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials.

TEXT BOOKS

- [1]. C.S.Indulkar and S. Thiruvengadam, S., "An Introduction to Electrical Engineering Materials", S.Chand and Company Ltd. Publisher.
- [2]. Kenneth G. Budinski, "Engineering Materials", PHI Publisher.

REFERENCE BOOKS

- [1]. S.P.Seth, "A Course In Electrical Engineering Materials", Dhanpat Rai Publisher.
- [2]. Technical Teachers Training Institute, Madras, "Electrical Engineering Materials", TMH Publisher.

(EE15-026) ENERGY MANAGEMENT (3-1-0)

MODULE-I (10 HOURS)

General principles of energy management and energy management planning; application of Pareto's model for energy management; obtaining management support; establishing energy data base; conducting energy audit; identifying, evaluating and implementing feasible energy conservation opportunities; energy audit report; monitoring, evaluating and following up energy saving measures.

MODULE-II (10 HOURS)

Energy efficiency analysis; thermodynamics and energy; coefficient of performance; energy effectiveness; management of heating, ventilating and air-conditioning (HVAC) – principles, opportunities, case studies; management of process energy- principles, opportunities, case studies; management of electrical load and lighting - management opportunities with electric drives, lighting, heating and electrolytic systems; electrical load analysis; peak demand control; computer-aided energy management; cogeneration; forms of cogeneration; feasibility study for cogeneration.

MODULE-III (10 HOURS)

Energy efficiency of turbines, compressors and pumps (brief treatment only); specific energy consumption; parameters affecting specific energy consumption; flexi targeting technique.

Lighting- Energy efficient light sources-Energy conservation in Lighting Schemes- Electronic ballast-Power quality issues-Luminaries, case study.

MODULE-IV (10 HOURS)

Financial evaluation of energy projects; cash flow model; time value of money; evaluation of proposals - payback method, average rate of return method, internal rate of return method, present value method, profitability index, life cycle costing approach, investment decision and uncertainty; consideration of income taxes, depreciation and inflation in investment analysis.

TEXT BOOKS

- [1]. Pradeep Chaturvedi "Energy Management: Challenges for the Next Millennium", Vedams eBooks (P) Ltd. Publisher.
- [2]. Paul O'Callaghan, "Energy management", TMH Publisher.

REFERENCE BOOKS

- [1]. Craig B Smith, "Energy management principles", Pergamon Press.
- [2]. Albert Thumann "Handbook of Energy Audits", Fairmont Publishers.

(EE15-010) DIGITAL IMAGE PROCESSING (3-1-0)

MODULE-I (10 HOURS)

Introduction & Digital Image Fundamentals: The Origin of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sampling & Quantization, Some Basic Relationships Between Pixels, Linear & Non-Linear Operations. Image Enhancement in Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basic of Spatial Filtering: Smoothing Spatial Filters, Sharpening Spatial Filters.

MODULE-II (10 HOURS)

Image Enhancement in Frequency Domain: Introduction to the Fourier Transform, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homographic Filtering, Implementation. Image Restoration: A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradation, Estimating the Degraded Function, Inverse Filtering, Wiener Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Geometric Transformation- Spatial Transformation.

MODULE-III (10 HOURS)

Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing, Basic of Full Color Image Processing, Color Transformations, Smoothing & Sharpening, Color Segmentation, Noise in Color Images. Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing. The Hit-or-Miss Transformation, Some Basic Morphological Algorithms, Extension to Gray-Scale Images. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds, Motion Based Segmentation.

MODULE-IV (10 HOURS)

Image Compression: Need for Data Compression, Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression, Image Compression Standards. Representation & Description: Representation, Boundary Descriptors, Regional Descriptors, Use of Principle Components for Description, Relational Descriptors. Object Recognition: Patterns & Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.

TEXT BOOKS

- [1]. R.C.Gonzalez & R.E.Wood, "Digital Image Processing", Addison Wesley Publisher.
- [2]. B.Channda & D.Dutta, "Digital Image Processing and Analysis", PHI Publisher.

REFERENCE BOOKS

- [1]. Anil Ku Jain, "Fundamentals of Digital Image Processing", PHI Publisher.
- [2]. S. Jayaraman, S. Esakkirajan, T. Veerakumar, "Digital Image Processing", TMH Publisher,

(EE15-031) MODELLING & SIMULATION (3-1-0)

MODULE-I (10 HOURS)

System: concept, environment, stochastic activities, continuous and discrete time systems, system modelling and types of system models, Cobweb model, Distributed lag model.

Subsystems, corporate models and their segments, type of system studies, analysis, design and postulation.

MODULE-II (10 HOURS)

Continuous system simulation: system models, differential equations, analog methods, CSMP, feedback and interactive simulation, real time simulation.

System dynamics: Exponential growth and decay models, logistic curves, system dynamic diagram, multi-segment models, time delays, feedback in socio-economic system, world models.

MODULE-III (10 HOURS)

Random number generators and output data analysis for a single system, statistical techniques for comparing attentive systems, Variable reduction techniques

Probability concepts in simulation, Queuing system, arrival of patterns, exponential, erlang and hyper exponential distributions, service time, queuing disciplines, measures of queues, mathematical solutions.

MODULE-IV (10 HOURS)

Discrete system simulation: discrete events, representation of time, generation of arrival patterns, simulation programming tasks, gathering statistics, counters and summary of statistics, measuring utilization and occupancy, recording distributions and transit times.

Bond graphs for simple electrical and mechanical engineering systems modeling and simulation of hydraulic, thermal and manufacturing systems.

TEXT BOOK

[1]. A.M.Law and W.D.Kelton, "Simulation Modeling and Analysis", TMH Publishers.

REFERENCE BOOKS

[1]. G. Gordon, "System Simulation", PHI Publishers.

[2]. A. Mukherjee and R Karmakar, "Modeling and Simulation of Engineering Systems through Bond Graphs", Narosa Publishing House, CRC Press

(EE15-039) Power system Lab. (0-0-3)

11. Determination of operating characteristics of biased differential relay.
12. Determination of operating characteristics of an induction type overcurrent relay.
13. Study of Ferro resonance phenomenon of no-load, light load & critical load conditions.
14. Determination of A, B, C, D parameters of an artificial transmission line a transmission line.
15. Determination of transient and sub-transient reactance of a 3-phase alternator.
16. Calibration of different surface gaps for measurement of high voltage (Sphere-sphere, Pin-pin, Disc-disc) and Dry flash over test on different types of insulators by 100 kV AC and 280 kV DC
17. Study of impulse generator and generating standard impulse wave shape.
18. Measurement of loss tangent and dissipation factor using high voltage Schering bridge. Testing of insulating oil.
19. Parallel operation of two alternators and effect of its load sharing.

EIGHTH SEMESTER

(EE15-004) COMMUNICATION SYSTEMS-II (3-1-0)

MODULE-I (10 HOURS)

Antennas and Propagation of Radio Waves: Dipole Antenna and Parabolic Reflector Antenna-their Principle of Operation, Radiation Pattern and Gain Propagation of Radio wave over ground and through ionosphere. Line of Sight Propagation of Microwave Signal.

MODULE-II (10 HOURS)

Mobile Communication: Cellular Communication System: Block Schematic description, Cellular frequency bands, Digital Technology, Cellular Concept, Capacities, Roaming facilities. Received Signal, Fading concept of diversity reception. Multiple access facilities.

MODULE-III (10 HOURS)

Optical fiber system: Elements of Optical Fiber Communication System, Basic Optical Laws and Definitions ,Optical Fiber Modes and Configurations, Single Mode Fiber , Graded Index Fiber Structure, Attenuation and Distortion in Optical Fibers, LED and LASER Diodes, PIN Photo Detector, Avalanche Photo Diode, Optical Fiber Systems Link Budget.

MODULE-IV (10 HOURS)

Satellite Systems: Kepler' s law, Satellite Orbits, Spacing and Frequency Allocation, Look Angle, Orbital Perturbation, satellite Launching, Earth Station, Satellite Sub-Systems, Satellite System Link Models, Link Equations, Multiple Access, Direct Broadcast Satellite Services, Application of LEO, MEO and GEO Satellites.

TEXT BOOKS

- [1]. Constantine A. Balanis, "Antenna Theory", Wiley Publishers
- [2]. Theodore S. Rappaport, "Wireless Communications", PHI Publishers.

REFERENCE BOOKS

- [1]. Gred Keiser, "Optical fiber communication", TMH Publishers.
- [2]. Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communication", Wiley Publishers.

(EE15-011) DIGITAL SIGNAL PROCESSING (3-1-0)

MODULE-I (10 HOURS)

Discrete time signal and system: discrete- time signals (some elementary examples, classification of discrete-time signals), discrete- time system (block diagram representation, classification and interconnection of discrete time system), analysis of discrete time linear time-invariant system (response of LTI systems to arbitrary inputs, properties of convolution and interconnection of LTI systems, casual linear time-invariant systems, stability of linear time-invariant system), discrete-time systems described by difference equations, structure of LTI system, recursive and non-recursive realization of FIR systems, correlation of discrete time system.

MODULE-II (10 HOURS)

The Z-transform: the Z-transform, properties of Z-transform, inverse of Z-transform, the one-sided Z-transform. The discrete fourier transform: frequency domain sampling, the DFT, relationship of DFT to other transforms, properties of the DFT, circular convolution, circular correlation, circular correlation by convolution, method linear convolution by overlap save method and by overlap add method.

MODULE-III (10 HOURS)

Fast Fourier transform: operation counts by direct computation of DFT, divide and conquer approach to computation of the DFT, radix-2 FFT algorithm, decimation-in-time (DIT) and decimation-in frequency (DIF) algorithm, efficient computation of the DFT of real sequences and a $2N$ -point real sequence.

Design of digital filter: causality and its implementation, design of linear phase FIR filters using different windows, design of IIR impulse response method and bilinear transformation method.

MODULE-IV (10 HOURS)

Power spectrum estimation: estimation of spectra from finite duration signals, non-parametric method of power spectrum estimations, the bartieff method, blackman method and tukey method.

Implementation of discrete time system: structure of FIR and IIR filters.

TEXT BOOKS

- [1]. J.G. Proakis and D.G.Manolakis, "Digital Signal Processing - Principles, Algorithms and Applications", PHI Publisher.
- [2]. Sanjit Mitra "Digital Signal Processing – A Computer based approach" TMH Publisher.

REFERENCE BOOKS

- [1]. S.Salivahanan, "Digital Signal Processing", TMH Publisher.
- [2]. J.R.Johnson, "Introduction of Digital Signal Processing", PHI Publisher.

(EE15-047) UTILIZATION OF ELECTRICAL ENERGY (3-1-0)

MODULE-I (10 HOURS)

Electric Drives: Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

MODULE-II (10 HOURS)

Electric heating and welding: Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating, design of heating element, Arc furnaces, Coreless Induction furnace Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding,

MODULE-III (10 HOURS)

Illumination Fundamentals: Introduction, terms used in illumination, laws of illumination, sources of light, lighting sources and their use in domestic, street and industrial lighting, Energy considerations, photometry, Discharge lamps, MV and SV lamps – comparison between tungsten filament lamps and fluorescent tubes

MODULE-IV (10 HOURS)

Electric Traction: Traction Principles - Types of systems, services and supply systems, Special features of traction motor, tractive effort, methods of electric braking-plugging, rheostatic braking and regenerative braking, Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

TEXT BOOKS

- [1]. E. Openshaw Taylor, "Utilisation of Electric Energy", Orient Longman Publisher.
- [2]. Partab, "Art & Science of Utilization of electrical Energy", Dhanpat Rai & Sons Publisher.

REFERENCE BOOK

- [1]. C.L. Wadhwa, "Generation, Distribution and Utilization of electrical Energy", New Age International (P) Limited, Publishers.

(EE15-041) PROCESS CONTROL & INSTRUMENTATION (3-1-0)

MODULE-I (10 HOURS)

Process Dynamics: Introduction to process control. Dynamic modeling of engineering systems. Review of Laplace transforms.

First order, second order systems. Systems with time delays. Interacting & non-interacting processes. Process identification. MIMO processes.

MODULE-II (10 HOURS)

Feedback control: Feedback control. Block diagram. Feedback controllers: PID control etc. Typical time-domain responses of feedback control systems. Design of feedback control systems.

Stability analysis of closed-loop control systems. Routh stability criterion. Root locus technique.

Frequency response analysis.. PID controller tuning methods such as Ziegler-Nichols.

MODULE-III (10 HOURS)

Advanced process control: Feedback control of systems with dead time or inverse response, Feed forward control, cascade control, ratio control, selective control etc.

Introduction to digital control. Multi loop and multivariable control.

MODULE-IV (10 HOURS)

Instrumentation: Introduction to performance characteristics of different transducers and systems, Dynamic analysis of measurement systems, errors in instrumentation systems ,Measuring devices for flow, temperature, pressure and level, transmitters, transmission lines, final control elements and their calculations and selection.

TEXT BOOKS

[1]. Seborg,D.E. Edgar,T.F., Mellichamp,D.A., “Process Dynamics and Control”, John Wiley & Sons Publishers.

[2]. Coughanowr, D.R. “Process Systems Analysis and Control”, TMH Publishers.

REFERENCES BOOKS

[1]. Liptak, B.G. “Instrument Engineer's Handbook, Volume I & II: Process Measurement and Analysis”, CRC Press.

[2]. Smith, C.A. and Corripio, A.B., “Principles and practice of automatic process control”, Wiley Publishers.

(EE15-046) SIGNALS AND SYSTEMS (3-1-0)

MODULE-I (10 HOURS)

Introduction of Signals, Classification of Signals, General Signal Characteristics, Signal energy & Power, Continuous-Time Signals, Discrete-Time Signals

Basic System Properties, Systems with and without memory, Invertibility, causality, Stability, Time invariance, Linearity, Linear Time Invariant (LTI) Systems, Discrete Time LTI Systems, Convolution

Representation of Linear Time-Invariant Discrete-Time Systems Convolution of Discrete-Time Signals Convolution, Representation of Linear Time-Invariant Continuous-Time Systems Convolution of Continuous-Time Signals, Properties of LTI Systems, Casual systems.

MODULE-II (10 HOURS)

Fourier Representations for Signals: Representation of Discrete Time Periodic signals, Continuous Time Periodic Signals, Discrete Time Non Periodic Signals, Continuous Time Non-Periodic Signals, Properties of Fourier Representations,

Sampling: Sampling theorem, Nyquist rate, Reconstruction of continuous time signal from its samples.

MODULE-III (10 HOURS)

Modulation Types and Benefits, Full Amplitude Modulation, Pulse Amplitude Modulation, Multiplexing, Phase and Group delays.

Representation of Signals using Continuous time Complex Exponentials: Laplace Transform, Unilateral Laplace Transform, its inversion, Bilateral Laplace Transform, Transform Analysis of Systems.

MODULE-IV (10 HOURS)

Representation of Signals using Discrete time Complex Exponentials: The Z-Transform, Properties of Region of convergence, Inverse Z-Transform, Transform Analysis of LTI Systems, Unilateral Z Transform.

TEXT BOOKS

- [1]. Simon Haykin and Barry Van Veen, "Signals and Systems", John Wiley & Sons Publisher.
- [2]. Alan V. Oppenheim, Alan S. Willsky, with S. Hamid, S. Hamid Nawab, "Signals and Systems", PHI Publications.

REFERENCE BOOKS

- [1]. Hwei Hsu, "Signals and Systems", Schaum's Outline TMH Publisher.
- [2]. Edward w. Kamen and Bonnie s. Heck, "Fundamentals of Signals & systems using Web and MATLAB", PHI Publishers.