Course Structure & Syllabus

of

B.Tech Programme

in

Electrical 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
EL15-002	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**	
	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
EL15-003	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
EL15-019	Electrical Machines-I	3 - 1 - 0	4	EL15-021	Electrical Machines II	3 - 1 - 0	4
EL15-035	Network theory	3 - 1 - 0	4	EL15-014	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**			
EL15-020	Electrical Machines-I Lab	0 - 0 - 3	2	EL15-022	Electrical Machines Laboratory II (twice)	0 - 0 - 6	4
	Mechanical Engineering Lab	0 - 0 - 3	2		Object Oriented Programming Lab	0 - 0 - 3	2
EL15-016	Electrical Circuit Computation Lab	0 - 0 - 3	2	EL15-015	Electronics Circuit Lab	0 - 0 - 3	2
EL15-036	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	
EL15-031	Microprocessor & Microcontroller & Applications	3 - 1 - 0	4	EL15-025	Electric Power Transmission & Distribution	3 - 1 - 0	4
EL15-023	Electrical Measurements & Instrumentation	3 - 1 - 0	4	EL15-039	Power Electronics	3 - 1 - 0	4
EL15-012	Digital Circuits & Design	3 - 1 - 0	4	EL15-026	Electromagnetic Theory	3 - 1 - 0	4
EL15-042	Power Station Engineering	3 - 1 - 0	4	EL15-009	Control System Engineering-II	3 - 1 - 0	4
EL15-008	Control System Engineering-I	3 - 1 - 0	4	**Core Elective (Any One)**			
				EL15-045	Signals & Systems-I	3 - 1 - 0	4
				EL15-027	Embedded System	3 - 1 - 0	4
				EL15-005	Communication Systems	3 - 1 - 0	4
Sessionals				**Sessionals**			
EL15-033	Microprocessor & Microcontroller Lab	0 - 0 - 3	2	EL15-047	Signal System Lab.	0 - 0 - 3	2
EL15-010	Control Systems Lab	0 - 0 - 3	2	EL15-041	Power Electronics Lab	0 - 0 - 3	2
EL15-013	Digital Circuit Lab	0 - 0 - 3	2	EL15-011	Design of Electrical Apparatus (twice)	0 - 0 - 6	4
EL15-030	Instrumentation Lab	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	
EL15-048	Switch Gear & Protective Devices	3 - 1 - 0	4	EL15-029	High Voltage Engineering	3 - 1 - 0	4
EL15-044	Power System Operation & Control	3 - 1 - 0	4	EL15-038	Non Conventional Energy sources	3 - 1 - 0	4
EL15-024	Electric Drives & Traction	3 - 1 - 0	4				
Core Elective (Any One)					**Open Elective**	3 - 1 - 0	4
EL15-040	Power Electronics Design & Application	3 - 1 - 0	4				
EL15-046	Signals & System-II	3 - 1 - 0	4				
EL15-017	Electrical Engineering Material	3 - 1 - 0	4				
EL15-034	Nano-Technology	3 - 1 - 0	4				
	Open Elective	3 - 1 - 0	4				
Sessionals				**Sessionals**			
	Minor Project	0 - 0 - 3	2		Seminar	0 - 0 - 3	2
EL15-043	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

Course Code		**Subject**
Core elective1	EL15-045	Signal & Systems-I
	EL15-027	Embedded System
	EL15-005	Communication System
Core elective2	EL15-041	Power Electronics Design & Application
	EL15-046	Siganls & System-II
	EL15-017	Electrical Engineering Material
	EL15-034	Nano-Technology

OPEN ELECTIVE SUBJECTS

Course Code		Subject
Open elective1	EL15-001	Alternative Energy Sources
	EL15-004	Biomedical Instrumentation
	EL15-007	Control System Engineering
	EL15-006	Control & Automation
Open elective2	EL15-018	Electrical Machines & Drives
	EL15-028	Heuristic Optimization Techniques
	EL15-032	Microprocessor & Microcontroller
	EL15-037	Physics of Dielectrics

SYLLABUS

FIRST & SECOND SEMESTER
(COMMON TO ALL BRANCHES)

PHYSICS – I (3 – 1 – 0)

Module I (10 Hours)

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 of grating.

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 (10 Hours)

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 integral form , Electromagnetic wave equation: in vacuum and conducting medium. Pyonting vector ,Pyonting theorem, preliminary ideas about waveguides.

Module III (10 Hours)

Quantum mechanics

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

Module IV (10 Hours)

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 (fundamentals)

Text books:

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

Reference Books:

1. Electricity & Magnetism – D. Griffiths
2. Quantum Mechanics – Gascirowicz
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
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–III 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

Module–IV 10 Hours

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

(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, Statement and applications of 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, IncIusion 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) 9th Edition

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 nth-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 (Cross cultural communication)
- Bias free language

Module 2: Communicative Grammar (10 Hours)

- Time, Tense and Aspects
- Verbs of State and Events
- Use of Modal 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. **Presentation**

Books Recommended:

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

ENGINEERING MECHANICS

Module – I (10 Hours)

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 (10 Hours)

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 (10 Hours)

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

Module – IV (10 Hours)

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 Rajesekharan & G Shankara Subramanium; 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: (10 Hours)

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. Operatorsand Expressions-Operators, Precedence of operators.

Module II: (10 Hours)

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

Module III: (10 Hours)

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: (10 Hours)

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

Text Books:

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

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. Fritzgerald, C. Kingsley, and S. Umans, "Electric Machinary", 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

(EL15-035) 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 form 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, Algebric 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

(EL15-020) 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

(EL15-016) ELECTRICAL CIRCUIT 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 .

(EL15-036) 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

(EL15-019)

(EL15-021) 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. Fritzgerald, 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.

(EL15-014) 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-pi CE Transistor Mode, Hybrid-pi conductances and capacitances, Validity of hybrid-pi mode, variation of hybrid-pi 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, Band pass 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 rift 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 Learing Publishers.

REFERENCE BOOKS

[1]. R.F. Coughlin and Fredrick F. Driscoll, “Opereational Amplifiers & Linear Integrated Circuits”, PHI Publishers.

[2]. Sergio Fransco, “Design with Operational Amplifers & 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

TRANSACTIONALANALYSIS: 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.

(EL15-022) 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.

(EL15-015) 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
10. Colpitt's Oscillator
11. Hartley Oscillator
12. Monostable Multivibrator
13. Astable Multivibrator

FIFTH SEMESTER

(EL15-031) MICROPROCESSOR & MICRO CONTROLLER Theory & Applications (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, Havard & 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] Ramesh, Gaonkar, "Microprocessor Architecture Programming and Application with the 8085, 5th Edition CBS Publication.

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

(EL15-023) 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, Electrodynamometer type

Wattmeters: Electrodynamometer type, induction type, single phase and three phase wattmeter, compensation, Energy meters: 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 Schearing bridge, errors, Wagner's earthing device, Kelvin's double bridge.

Transducer: Strain Gauges, Thermistors, Thermocouples, Linear Variable Differential Transformer (LVDT), Capacitive Transducers, Peizo-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 Publshers.

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.

(EL15-012) 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- subs tractor, 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.

(EL15-042) POWER STATION ENGINEERING (3-1-0)

MODULE-I (10 HOURS)

Introduction to different sources of energy and general discussion on their application to generation.

Hydrology: Catchments area of a reservoir and estimation of amount of water collected due to annual rainfall, flow curve and flow duration curve of a river and estimation of amount stored in a reservoir formed by a dam across the river, elementary idea about Earthen and Concrete dam,

Turbines: Operational principle of Kaplan, Francis and Pelton wheel, specific speed, work done and efficiency.

Hydro plant: - head gate, penstock, surge tank, scroll case, draft tube and tail race, classification of plants, turbines different heads, plant capacity as a base load and peak load station, power plant auxiliaries.

MODULE-II (10 HOURS)

Thermal Power: Overall plant components in Block diagrams indicating the air circuit, coal and ash circuit, water and steam circuit, cooling water circuit; various types of steam turbines, ash and coal handling system, water tube boiler, fire tube boiler, super heater, economizer, air preheater, dust collection, draft fans and chimney; condensers, feed water heaters, evaporate and makeup water, bleeding of steam; cooling water system; Governors, plant layout and station auxiliaries.

MODULE-III (10 HOURS)

Nuclear Power: Introduction to fission & fusion, reactor construction, controlled chain reaction, operational control of reactors, Brief study of various types of reactors (Boiling water, pressurized water, sodium graphite, breeder) layout of nuclear power plant. Electrical System: Different types of alternators, methods of cooling. Excitation system: - Shaft mounted D.C. Generator, elements of static and brush less excitation, field flashing.

MODULE-IV (10 HOURS)

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

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), Effect of power-factor on the generating capacity and economy, Different types of power tariffs, Brief idea about national grid and its operational problems.

TEXT BOOKS

[1]. C.L. Wadhwa, " Electrical Powe Systems" New Age International Publishers.

[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.

(EL15-008) 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.

Feedback 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 feedback 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, synchros, 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.

(EL15-033) MICROPROCESSOR & MICROCONTROLLER LAB. (0-0-3)

A) 8085 (2HOURS)

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 (5HOURS)

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) 8051MICROCONTROLLER (3HOURS)

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 (2HOURS)

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

(EL15-010) CONTROL SYSTEMS LAB. (0-0-3)

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

(EL15-013) 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 realize mod-6 shift counter using 3(7476)
8. Design of 4-bit random counter
9. Design of adder and subtractor using multiplexer

(EL15-030) INSTRUMENTATION LAB. (0-0-3)

1. Measurements of unknown resistance, inductance, and capacitance using Bridges.
2. To plot the displacement-voltage characteristics of the given LVDT.
3. Study of a Data Acquisition System.
4. Study of Synchro-transmitter & synchro-transformer.
5. Speed measurement of DC Motor by none-contact type transducer.
6. Calibration of DC Milli-Ammeter by a DC Potentiometer.
7. Measurement of IR, earth Resistance and determination of cable fault.

SIXTH SEMESTER

(EL15-025) ELECTRIC POWER TRANSMISSION AND DISTRIBUTION (3-1-0)

MODULE-I (10 HOURS)

General Introduction to power transmission by D.C. and A.C. overhead lines

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, use of static or synchronous condensers for improvement of regulation.

MODULE-II (10 HOURS)

Corona: Power loss due to corona, practical importance of corona, and inductive interference with neighboring communication lines, use of bundled conductors in E.H.V. transmission lines and its advantages

Overhead line Insulators: Voltage distribution in suspension type insulators, method of equalizing, voltage distribution, economic use of insulators.

Mechanical Design of Overhead Transmission Line, Sag and stress calculation, tension and sag at erection, effect of ice and wind, vibration dampers

Under Ground Cable: Type and construction, grading of cables, capacitance in 3 core cables and dielectric loss

MODULE-III (10 HOURS)

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

MODULE-IV (10 HOURS)

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

Per unit system one line diagram Power flow through transmission line, Power circle diagram, Series and shunt compensation.

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 Chakrpabati, Sunitha Halder, “Power System Analysis, Operation And Control, PHI Publishers.

(EL15-039) 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.

(EL15-026) 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.

(EL15-009) CONTROL SYSTEM ENGINEERING-II (3-1-0)

MODULE-I (10 HOURS)

State Variable Analysis and Design: Introduction, Concepts of State, Sate 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, "Modem 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.

(EL15-045) 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, casuality, 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 Nonperiodic 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.

(EL15-027) 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 communation, 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, Dissembler/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.

(EL15-005) COMMUNICATION SYSTEMS (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 and band signal from Time domain to Frequency domain and Vice-versa. F.T. of few simple baseband signals.

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.

MODULE-II (10 HOURS)

Modulation Techniques: Need for Modulation, Analogue Modulation Techniques: Amplitude Modulation (AM), Depth of Modulation, Modulated Waveform, Powers in Carrier, and Sidebands, Generation of DSBC and SSB, Balanced Modulator, AM Demodulators. 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-III (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.

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 ionoaphwew. Line of Sight Propagation of Microwave Signal.

MODULE-IV (10 HOURS)

Modern Communication Systems:

Brief description of fiber optic communication System: Block Diagram, Range of operating Wavelength, Optical Fiber, Optical Sources – LEO & LASER, Optical detectors; Concept of GH2 – km Bandwidth. Advantages of fiber optic system.

Brief description of Satellite Communication Systems: Block diagram. Frequency bands of operation, uplink and down link frequencies, Transponder, earth stations, Types of Antenna mounted on satellites. Services available through satellite.

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.

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.

(EL15-047) SIGNAL & SYSTEMS LAB. (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.

(EL15-041) 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.

(EL15-011) Design of Electrical Apparatus LAB (0-0-6)

1. Provide experimental practice in AC circuit power analysis and design for maximum power transfer design.
2. Transient analysis of first & second order circuits
3. Modeling, simulation and analysis of coupled circuits analysis
4. Study of the effect of Q on frequency response and bandwidth of series and parallel resonant circuits.
5. Study of low pass and high pass filters.
6. Circuit designs of ADC and DAC
7. Determination of self and mutual inductance of a coupled circuit

SEVENTH SEMESTER

(EL15-048) SWITCHGEAR AND PROTECTIVE DEVICES (3-1-0)

MODULE-I (10 HOURS)

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

MODULE-II (10 HOURS)

Feeder: Protection: Over current and earth fault protection, Distance protection, Pilot wire protection, Carrier current protection.

Generator Protection: Biased differential protection, restricted earth fault protection, Field suppression, Negative sequence protection, Earth fault detection in rotor circuit

Power transformer Protection: Biased differential protections, restricted earth fault protection, Buchholz relay Protection of combined transformer and alternator.

Bus Zone Protection: frame leakage and circulating current scheme-use of translay relay.

MODULE-III (10 HOURS)

Circuit Breakers: Formation of arc during circuit breaking. Characteristics of electric arc. Theories of arc Interruption. Recovery and restriking voltage, interruption of capacitive and inductive currents. Current chopping. Principle of A.C. and D.C. circuit breaking requirements of good circuit breaker 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. H.R.C. Fuse: Construction and characteristics

MODULE-IV (10 HOURS)

Static Relays : Development and classification of static relays, Different types of phase and amplitude capacitors, Basic static relays used in protective scheme, Elementary idea about digital & numerical protection. Testing and maintenance of protective gear, Protection against surge-surge absorber, Surge-diverter.

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.

TEXT BOOKS

[3]. Van C Warrington, “Protective Relays-Vol.-I & II”, John Wiley & Sons Publisher.

[4]. Ravindranath, M.Chander, “Power System Protection and SwitchGear”, Wiley Eastern Ltd. Publisher.

REFERENCE BOOKS

[1]. T S Madhav Rao, “Power System Protection”, TMH Publication

[2]. Sunil S. Rao, “Switch Gear and Protection”, Khanna Publication

(EL15-044) POWER SYSTEM OPERATION & CONTROL (3-1-0)

MODULE-I (10 HOURS)

Concept of real and reactive powers, Complex power, Transmission capacity, The static load flow equations(SLFE),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-II (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, Voltage stability indices.

MODULE-III (10 HOURS)

Economic Operation of Power System: Distribution offload 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.

Z bus Algorithm, Symmetrical and unsymmetrical fault analysis for power system, Z bus method in fault analysis.

MODULE-IV (10 HOURS)

Load frequency control, PF versus QV control, Modelling of speed governing system, Division of power system into control areas, Single area control and two area control.

TEXT BOOKS

[1]. John J Grainger, W. D. Stevenson, “Power System Analysis”, TMH Publisher.

[2]. C. L. Wadhwa, “Electric Power System”, New Age Publishers.

REFERENCE BOOKS

[1]. Abhijit Chakrpabati, Sunitha Halder, “Power System Analysis, Operation And Control, PHI Publishers.

[2]. P. Kundur, “Power System Stability and Control”, TMH Publisher.

(EL15-024) ELECTRIC DRIVES AND TRACTION (3-1-0)

MODULE-I (10 HOURS)

Requirements, AC and DC drives, modern trends in drives technology, Characteristics 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

[1]. V.Subrahmanyam, “Electric Drives”, TMH Publisher.

[2]. 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.

(EL15-040) POWER ELECTRONICS DESIGN AND APPLICATION (3-1-0)

MODULE-I (10 HOURS)

Solid State Power Devices: Construction and switching characteristics of Gate Turnoff Thyristor (GTO), .Power BJTs, Power MOSFETs, Insulated Gate Bipolar Transistors (IGBTs), Design of above devices drive circuits, switching and aid circuits. Methods of cooling and Protection

MODULE-II (10 HOURS)

Resonant DC-DC Converters: Operation, characteristics and design equations, Control techniques and application. Three Phase Square Wave /Stepped Wave Inverters. Three Phase SPWM Inverters. Effect of Blanking Time on Inverter Output Voltage. Selective Harmonic Elimination Method. Current controlled PWM, Bang-bang and space vector modulation techniques.

MODULE-III (10 HOURS)

Current Regulated Inverter -Current Regulated PWM Voltage Source Inverters. Hysteresis Control - Areas of application of Current Regulated VSI. Switched Mode Rectifier - Operation of Single/Three Phase Bridges in Rectifier Mode. Control Principles. Special Inverter Topologies - Current Source Inverter. Analysis of Single Phase Capacitor Commutated CSI. Resonant DC-link VSI, Its operation characteristics design and control.

MODULE-IV (10 HOURS)

Power Factor Control - Shunt Reactive Power Compensators. Switched Capacitors. Static Reactor Compensators based on thyristors. Static Reactive VAr Generators using PWM Current Regulated VSIs. Active power line conditioners, Active Power Filtering. Harmonic Generation by PE Equipment. Harmonic Pollution Standards. PWM Current Regulated VSI based implementation of a Single Phase Active Power Filter. Vector controlled and slip-power controlled Induction motor drives. Application of PC, DSP and microprocessor in machine drives

TEXT BOOKS

[1]. Ned Mohan Tora M. Undeland, William P.Robbins, “Power Electronics”, John Wiley & Sons Publisher.

[2]. M H Rashid, “Power Electronics”, PHI Publisher.

REFERENCE BOOKS

[1]. B.K.Bose, “Modern Power Electronics and AC Drives”, PHI Publisher.

[2]. Cyril W Lander, “Power Electronics”, MGH Publishers.

(EL15-046) SIGNALS 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 Nonnrecursive 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.

(EL15-017) 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.

(EE15-034) NANO-TECHNOLOGY (3-1-0)

MODULE-I (10 HOURS)

Introduction, Definition of Nanotechnology: Broad perspective of Nanotechnology, Narrow perspective of Nanotechnology, Cultural perspective of Nanotechnology. Knowing the Size, Understanding Nanotechnology, Nanotechnology and Today'sWorld, Importance of Nanoscale Science and Technology, Agitated Humans and Nanotechnology.

MODULE-II (10 HOURS)

Introduction, History of Nanotechnology-by Chris Phoenix, Contribution of Different Scientist in Nanotechnology: Richard Feynman, K. Eric Drexler, Gerd Binnig and Heinrich Rohrer, Don Eigler and Erhard Schweizer, Professor Richard Smalley, Professor Mauro Ferrari, Joseph Proust, History at a Glance, Different Timelines of Nanotechnology.

MODULE-III (10 HOURS)

Introduction, The Beginning of technological Revolution, Silicon Based Technology, Benefits and Challenges of Molecular Manufacturing: The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities. Visions and Objective of Nanotechnology, Nanotechnology in Different Fields: Automobile, Electronics, Nan biotechnology, Materials, Medicine, Dental care, Nanocomputers, Power storage, Nanotechnology products.

MODULE-IV (10 HOURS)

Introduction, Nanotechnology in Industries, Nanotechnology in Computing: Quantum computing, Molecular Computation, Nanotechnology in Electronics: Computational Nanotechnology, Computational Optoelectronics, Mechanical Nanocomputers, Supercomputing systems.

Nanotechnology in Health and Life Sciences: Nanotechnology in medicine, Drug delivery, Drug encapsulation, Tissue repair and implantation, Bioresorable materials, Other application of nano technology in health and medicine.

Nanotechnology in Smart Materials: Sensors, Smart instruments- atom computers

Nanotechnology in High Voltage Insulation: Nanocomposites.

Nanotechnology in Defence, Nanotehnology in Optics: Optical industry, Metrology.

TEXT BOOKS

[1]. Foster, “Nanotechnology”, Pearson Education Publisher.

[2]. Ratner, “Nanotechnology: A gentle Introduction to the next Big Idea”, Pearson Education Publisher.

REFERENCE BOOKS

[1]. Lakhtakia, “Handbook of Nanotechnology, The- Nanometer Structures: Theory, Modeling and Simulation”, PHI Publisher.

[2]. Chattopadhyay, “Introduction to nanoscience and Technology”, PHI Publisher.

(EL15-001) ALTERNATIVE ENERGY SOURCES (3-1-0)

MODULE-I (10 HOURS)

The energy portfolio, aspects of energy production and consumption; the energy life cycle; Local, regional and global environmental effects of energy; Measures of Sustainability. Energy carriers: Electricity and Hydrogen Fuel; Energy Management

Solar thermal energy conversion technologies: Nature of solar radiation; Isolation; Measurements and estimation; Physical principles of conversion of solar radiation into heat; energy balance equation and collector efficiency, concentrating collectors and flat plate collectors, solar thermal electric power generation.

MODULE-II (10 HOURS)

Solar photo voltaic systems: System components and configurations, cells, modules, and arrays, batteries, charge controllers, inverters, system sizing, mechanical integration, electrical integration, utility interconnection.

Wind energy: Wind characteristics, data analysis and resource estimation; Wind turbine power curves; Measurement of wind velocity and direction; Wind turbine configurations- drag and lift types; Electric generators for wind turbine application; Power converter, auxiliary equipment; Wind Energy Conversion System Topologies; Wind turbine control; Wind turbine sitting considerations

MODULE-III (10 HOURS)

Tidal power: Tidal phenomena, historical background, basic aspects of tidal power development and tide mills; Tidal power project components; Design considerations- Selection of tidal power sites, feasible tidal range, preliminary design and productivity considerations; Tidal barrier construction techniques- dikes, types of float in modules, concrete caissons.

Energy from Ocean Waves and Ocean thermal energy conversion technologies: Basic principle, Resource Estimation, System components.

MODULE-IV (10 HOURS)

Bio mass energy: Possibilities of energy provision from biomass; Thermo-chemical conversion, Physical-chemical conversion, Bio-chemical conversion; Classification of biogas plants– floating drum type and fixed dome type; Biomass gasifiers; Gasification process, application of gasifiers for electricity generation; Pyrolysis and alcohol fuels.

Geothermal energy sources, geothermal exploitation, prime-movers for geothermal energy conversion system, material selection for geothermal power plants, flashed steam and total flow concept, geothermal power plant layout

TEXT BOOKS

[1]. J.W. Tester et. al., “Sustainable Energy”, PHI Learning Pvt. Ltd. Publisher.

[2]. Martin Kaltschmitt et al., “Renewable Energy”, Springer Publisher.

REFERENCE BOOKS

[1]. R. Ramesh, “Renewable energy technologies”, Narosa Publication.

[2]. S. Rao, Parulkar, “Energy Technology”, Khanna Publication.

[3]. G.D.Rai, “ Non-Conventional Sources of Energy”, Khanna Publishers.

(EL15-004) BIO-MEDICAL INSTRUMENTATION (3-1-0)

MODULE-I (10 HOURS)

Basic physiological system of the body::Problems encountered in measuring living systems,

bioelectric potentials, biomaterials, Basic Transducer Principles::Active and passive transducers, Transducers for biomedical applications, Generation, propagation and distribution of bioelectric potentials (ECG, EEG and EMG)

Bio potential electrodes::Basic types (micro, skin surface and needle electrodes), biochemical transducers(PH, blood, gas and specific ions electrodes)

MODULE-II (10 HOURS)

The cardiovascular system and measurements::Heart and cardiovascular system and circulation block diagram, blood pressure and measurement ,characteristics of blood flow and heart sounds, Electrocardiography, ECG lead configurations, ECG recording and their types

The Nervous System::The anatomy of nervous system, Neuronal communication EPSP & IPSP Organization of the brain, Measurements from the nervous system

MODULE-III (10 HOURS)

Systemic Body & Skin Temperature Measurement::Temperature measurements, Brief idea about ultrasonic measurements

Patient care monitoring::Elements of intensive care: Organization of the Hospital for patient care monitoring, Pace-makers types, systems, modes and generators, Defibrillators types, Bio telemetry and applications of telemetry in patient care.

MODULE-IV (10 HOURS)

Automation of chemical tests, Instrumentation for diagnostic X Rays, Interfacing computer with medical instrumentation and other equipments, biomedical computer applications, Shock hazards from electrical equipments, methods of accident prevention.

TEXT BOOKS

[1]. R.S.Khanpur, “Handbook of Biomedical Instrumentation”, TMH Publisher.

[2]. Cromwell, F.J.Weibell & F.A.Pfieffer, “Biomedical Instrumentation & Measurements”, PHI Publisher.

(EL15-007) CONTROL SYSTEM ENGINEERING (3-1-0)

MODULE-I (10 HOURS)

Introduction: Basic concept of control systems, Open loop and closed loop systems, difference between Open loop and closed loop systems, classifications.

Mathematical model of physical systems, transfer function, block diagram algebra, signal flow graph (SFG), Mason's gain formula. Feedback theory: Types of feedback, effect of degenerative feedback on control system, Regenerative feedback.

MODULE-II (10 HOURS)

Time domain analysis: Standard test signals (step, ramp, parabolic and impulse signals), Time response of 1^{st} order system to unit step and unit ramp inputs, time response of 2^{nd} order system to unit step input, time response specification, steady state errors and error constants of different types of control systems, generalized error series method.

Concept of stability: Necessary condition of stability, Hurwitz stability criterion, Routh stability criterion, application of Routh stability criterion to linear feedback systems, relative stability.

Root locus techniques: construction, determination of stability from root locus, determination of roots from root locus, root contour.

MODULE-III (10 HOURS)

Frequency domain analysis: Introduction, Bode plot, determination of stability from Bode plot, polar plot, Nyquist stability criterion, application of Nyquist stability criterion to linear feedback systems.

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

MODULE-IV (10 HOURS)

State variable analysis: concept and analysis of state and state variable of homogeneous systems, state model for linear continuous time invariant SISO systems.

Digital control systems: Advantages and disadvantages of digital control systems, representation of sampled process, Sannon's sampling theorem, signal reconstruction.

Z-transfer function: Types and properties of Z-transform, transfer function of ZOH, relation between s and Z-transfer function, Inverse Z-transfer function, pulse Z-transfer function of sampled data closed loop control system, solution of difference equation.

TEXT BOOKS

[1]. K. Ogata, "Modem 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.

(EL15-006) CONTROL AND AUTOMATION (3-1-0)

MODULE-I (10 HOURS)

Introduction: Introduction to Automation and Control, Automations; basic laws and principles, level of automation Introductions to sensors and measurement systems; pressure measurement, temperature measurement, velocity measurement, force and torque measurements, response of measuring systems

MODULE-II (10 HOURS)

NC & CNC: NC co-ordinate systems and machine motions, types of NC systems, components of NC systems, machine tool application, NC part programming, APT language, computer automated part programming, DNC, CNC and adaptive control.

MODULE-III (10 HOURS)

Industrial Control systems: Continuous and discrete control, Control requirements, Programmable Logic Controllers (PLCs), Sensors and Actuators. Introduction to Process Control, PID Control, Implementation of PID Controllers, Logic circuits: Pneumatic logic circuits, Electric and electronic controls used in automation. Different types of controllers, Single loop and Multi-loop controllers and their tuning, direct controllers and their tuning.

MODULE-IV (10 HOURS)

Automation in material handling and storage system: Automated guided vehicle systems (AGV), Monorails and other rail guided vehicles, Conveyor systems, automated storage systems, engineering analysis of storage system.

TEXT BOOKS

[1]. George Stephanopolus, “Chemical Process Control”, PHI Publisher.

[2]. Harriot P., “Process Control”, TMH Publisher.

REFERENCE BOOKS

[1]. Norman A Anderson, “Instrumentation for Process Measurement and Control”, CRC Press Publisher.

[2]. Dale E. Seborg, Thomas F Edgar, Duncan A Mellichamp, “Process dynamics and control”, Wiley John and Sons Publisher.

[3]. Marlin T.E., “Process Control”, TMH Publisher.

(EL15-043) Power system Lab. (0-0-3)

1. Determination of operating characteristics of biased differential relay.
2. Determination of operating characteristics of an induction type over current relay.
3. Study of Ferro resonance phenomenon of no-load, light load & critical load conditions.
4. Determination of A, B, C, D parameters of an artificial transmission line a transmission line.
5. Determination of transient and sub-transient reactance of a 3-phase alternator.
6. 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
7. Study of impulse generator and generating standard impulse wave shape.
8. Measurement of loss tangent and dissipation factor using high voltage Schering bridge. Testing of insulating oil.
9. Parallel operation of two alternators and effect of its load sharing.

EIGHTH SEMESTER

(EL15-029) HIGH VOLTAGE ENGINEERING (3-1-0)

MODULE-I (10 HOURS)

Conduction and breakdown in gases: Gases as insulating media, Ionization processes. Townsend current growth equation. Current growth in the presence of secondary processes. Townsend's criterion for breakdown. Experimental determination of ionization coefficients.

Breakdown in electronegative gases, time lags for breakdown, streamer theory of breakdown in gases, Paschen's law, Breakdown in non-uniform field and corona discharges,

Post breakdown phenomena and applications, practical considerations in using gases for insulation purposes.

MODULE-II (10 HOURS)

Conduction and breakdown in liquid dielectrics: Pure liquids and commercial liquids, conduction and breakdown in pure liquids.

Breakdown in solid dielectrics: Introduction, Intrinsic breakdown. Electromechanical breakdown, Thermal breakdown.. Breakdown of solid dielectrics in practice.

MODULE-III (10 HOURS)

Generation of high voltage and currents: Generation of high D.C, voltages, Generation of high alternating voltages, Generation of Impulse voltages. Tripping and control of impulse generators. Generation of Impulse currents.

Measurements of high voltages and currents: Measurement of high D.C. voltages. Measurement of high D.C. and impulse voltages. Introduction.. Measurement of high D.C. A.C. and impulse currents, cathode ray oscillographs for impulse voltages and currents measurements.

MODULE-IV (10 HOURS)

Non destructive testing of materials and electrical apparatus: Introduction. Measurement of D.C. resistivity. Measurement of dielectric constant and loss factor. Partial discharge measurements.

High voltage testing of electrical apparatus: Testing of insulators and bushings. Testing of isolators and circuit breakers, cables. Testing of transformers, surge diverter

Radio Interference measurements.

TEXT BOOKS

[1]. M. S. Naidu, V. Kamaraju, "High Voltage Engineering", TMH Publisher.

[2]. Kuffel. E., Zaengel W., "High Voltage Engineering: Fundamentals", Elsevier Publications.

REFERENCE BOOKS

[1]. C.L.Wadhwa, "High Voltage Engineering", New Age Internationals Publisher.

[2]. Ravindra Arora, Wolfgang Mosch, "High Voltage Insulation Engineering", New Age Internationals Publisher.

(EL15-038) NON-CONVENTIONAL ENERGY SOURCES (3-1-0)

Module-I (10 Hours)

Energy Scenario: Classification of Energy Sources, Energy resources (Conventional and nonconventional), Energy needs of India, and energy consumption patterns. Worldwide Potentials of these sources. Energy efficiency and energy security. Energy and its environmental impacts, Distributed generation.

Solar Energy: Solar thermal Systems: Types of collectors, Collection systems, efficiency calculations, applications.

Photo voltaic (PV) technology: Present status, solar cells, cell technologies, characteristics of PV systems, equivalent circuit, array design , building integrated PV system, its components , sizing and economics. Peak power operation. Standalone and grid interactive systems.

MODULE-II (10 HOURS)

Wind Energy: Wind speed and power relation, power extracted from wind, wind distribution and wind speed predictions. Wind power systems: system components, Types of Turbine, Turbine rating. Choice of generators, turbine rating, electrical load matching, Variable speed operation, maximum power operation, control systems, system design features, stand alone and grid connected operation. Small Hydro Systems

MODULE-III (10 HOURS)

Energy storage and hybrid system configurations: Energy storage, Battery – types, equivalent circuit, performance characteristics, battery design, charging and charge regulators. Battery management. Flywheel-energy relations, components, benefits over battery. Fuel Cell energy storage systems. Ultra Capacitors. Bio-Mass and Bio-Fuels.

MODULE-IV (10 HOURS)

Grid Integration: Stand alone systems, Concept of Micro-Grid and its components, Hybrid systems – hybrid with diesel, with fuel cell, solar-wind, wind –hydro systems, mode controller, load sharing, system sizing. Hybrid system economics, Interface requirements, Stable operation, Transient-safety, Operating limits of voltage, frequency, stability margin, energy storage, and load scheduling. Effect on power quality, harmonic distortion, voltage transients and sags, voltage flickers, dynamic reactive power support. Systems stiffness.

TEXT BOOKS

[1]. R. Ramesh, “Renewable energy technologies”, Narosa Publication.

[2]. G.D.Rai, “ Non-Conventional Sources of Energy”, Khanna Publishers.

REFERENCE BOOKS

[1]. Mittal, “Non-conventional Energy Systems”, Wheelers Publication.

[2]. S. Rao, Parulkar, “Energy Technology”, Khanna Publication.

(EL15-018) ELECTRICAL MACHINES & DRIVES (3-1-0)

MODULE-I (10 HOURS)

Requirements, AC and DC drives, modern trends in drives technology, Characteristics 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)

Characteristics of permanent magnet, synchronous machines with permanent magnet, vector control of PMSM-Motor model and control scheme. Modeling of PM brushless dc motor, drive scheme -Three-phase full wave Brushless dc motor -Sinusoidal type of Brushless dc motor - current controlled Brushless dc motor Servo drive and their suitability

MODULE-IV (10 HOURS)

Variable Reluctance motor drives- Torque production in the variable reluctance motor-Drive characteristics and control principles - Current control variable reluctance motor servo drive.

TEXT BOOKS

[1]. V.Subrahmanyam, “Electric Drives”, TMH Publications.

[2]. M.H.Rashid, “Power Electronics”, PHI Publications.

REFERENCE BOOKS

[1]. G.K.Dubey, “Electric Drive”, Norasa Publishers.

[2]. R. Krishnan, “Electric Motor Drives Modeling, Analysis & control”, PHI Publishers.

(EL15-028) HEURISTIC OPTIMIZATION TECHNIQUES (3-1-0)

MODULE-I (10 HOURS)

Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets : Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning , Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.

MODULE-II (10 HOURS)

Neural networks: Single layer networks, Perceptrons: Adaline, Mutilayer Perceptrons Supervised Learning, Back-propagation, LM Method, Radial Basis Function Networks, Unsupervised Learning Neural Networks, Competitive Learning Networks, Kohonen Self-Organizing Networks, Learning Vector Quantization, Hebbian Learning. Recurrent neural networks,. Adaptive neuro-fuzzy information; systems (ANFIS), Hybrid Learning Algorithm, Applications to control and pattern recognition.

MODULE-III (10 HOURS)

Derivative-free Optimization Genetic algorithms: Basic concepts, encoding, fitness function, reproduction. Differences of GA and traditional optimization methods. Basic genetic programming concepts Applications.,

MODULE-IV (10 HOURS)

Evolutionary Computing, Simulated Annealing, Random Search, Downhill Simplex Search, Swarm optimization

TEXT BOOKS

[1]. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI Publisher.

[2]. R.Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence-PC Tools”, AP Professional Publishers.

REFERENCE BOOKS

[1]. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill Publisher.

[2]. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley Publisher.

(EL15-032) MICROPROCESSOR & MICROCONTROLLER (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, Havard & 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 & S.S.S.P Rao, " Microprocessors and its Interfacing", 3rd Edition TMH Publications.

(2) M.A Mazid I.J.G Mazidi, "Microcontrollers 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) Ramesh Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", 5th Edition, CBS Publication

(3) A.K.Roy & K.M.Bhurchandi, "Advanced Microprocessor and Peripherals (Architecture, Programming & Interfacing) ", TMH Publications.

(EL15-037) PHYSICS OF DIELECTRICS

MODULE-I (10 HOURS)

Definitions, Multi-pole Development, Electrical Dipole, Electrical Field Equation in substances, General properties of dielectrics polarizations, fundamental equations of dielectric, Calculation of electrical field in various dielectrics.

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 loss tangent, dipolar relaxation, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulator, insulating materials.

MODULE-III (10 HOURS)

Measurement of dielectric constant and loss tangents by bridge methods, dielectric spectroscopy, Dielectric breakdown, Application of dielectrics, Ferro, Piro and Piezo-electricity; Phenomology: theory and application.

MODULE-IV (10 HOURS)

Experimental investigation methods of dielectrics. Determination of field dependence and temperature dependence.

Advanced engineering materials: Biomaterials, energy materials (solar cells, fuel cells-H_2O_2 and lithium cells, ultra capacitors)

TEXT BOOKS

[1]. Jonsker, “Dielectric relaxation in solids”, Chelsea dielectric Press, London.

[2]. C.S. Indulkar and S.Thiruvengadam, “An introduction to Electrical Engineering Materials”, S.Chand Publishers.

REFERENCE BOOKS

[1]. Kenneth G. Budinski, “Engineering Materials”, PHI Publishers.

[2]. Kwan Chikao, “Dielectric phenomena in solids”, Elsevier Publishers.