Veer Surendra Sai University of Technology, Burla
Department of Electrical Engineering
Bachelor of Technology in Electrical & Electronics Engineering (Four Years Course) 2015-18

1st. Semester							2nd. Semester						
No.	Sub Code	Subject	Hours			Cr	No.	Sub Code	Subject	Hours			Cr
			L	T	P					L	T	P	
1		Math-I					1		Math-II				
2		Physics-I/Chemistry-I					2		Physics-I/Chemistry-I				
3		Engineering Mechanics / Programming & Data					3		Engineering Mechanics / Programming & Data				
4		Basic Electrical Engineering/Basic Electronics					4		Basic Electrical Engineering/Basic Electronics				
5		English for Communication / Environmental Science &					5		English for Communication / Environmental Science &				
6		Physics Lab/Chemistry Lab					6		Physics Lab/Chemistry Lab				
7		Engineering Graphics/Workshop Practice					7		Engineering Graphics/Workshop Practice				
8		Language Lab./Prog. Lab					8		Language Lab./Prog. Lab				
9		Basic Electrical Engineering Lab./Basic Electronics Lab.					9		Basic Electrical Engineering Lab./Basic Electronics Lab.				
		Total							Total				

3rd. Semester							4th. Semester						
No.	Sub Code	Subject	Hours			Cr	No.	Sub Code	Subject	Hours			Cr
			L	T	P					L	T	P	
1		Math-III					1		Math-IV				
2		Engineering Economics & Costing/Organization					2		Engineering Economics & Costing/Organization				
3	BEE	Electrical Machine-I					3	BEE	Electrical Machine-II				
4	BEE	Network Theory					4	BEE	Electronics Circuit				
5	BEE	Enginering Thermodynamics					5	BME	Object Oriented Programming				
6	BEE	Electrical Machine Lab-I.					6	BEE	Electrical Machine Lab.-II				
7	BME	Mechanical Engineering Lab					7	BEE	Obejct Oriented Programming				
8	BEE	Electrical Circuit Computation					8	BEE	Electronics Circuit Lab				
9	BEE	Network Theory Lab.					9						
		Total							Total				

5th. Semester							6th. Semester						
No.	Sub Code	Subject	Hours			Cr	No.	Sub Code	Subject	Hours			Cr
			L	T	P					L	T	P	
1	BEE	Mcroprocessor & Microcontroller Theory &					1	BEE	Power System-II				
2	BEE	Signal & System -I					2	BEE	Electrical Measurements & Instrumentation				
3	BEE	Digital Circuits & Design					3	BEE	Electromagnetic Theory				
4	BEE	Power System-I					4	BEE	Control System Engineering-I				
5	BEE	Power Electonics					5	BEE	Signals & Systems-II				
6	BEE	Signal System Lab.-I					6	BEE	Control & Instrumnetation				
7	BEE	Digital Circuits Lab.					7	BEE	Signal System Lab.-II				
8	BEE	Microprocessor & Microcontroller Lab.					8	BEE	Electric Equipment Design & Simulation Lab				
9	BEE	Power Electronics Lab.											
		Total							Total				

7th. Semester							8th. Semester						
No.	Sub Code	Subject	Hours			Cr	No.	Sub Code	Subject	Hours			Cr
			L	T	P					L	T	P	
1	BEE	Power System-III					1	BEC	Communication System				
2	BEC	Communication System					2	BMS	Production & Operation				
3	BEE	Control System Engineering-II											
4	**Departmental Elective-I (Any One)**						3	**Departmental Elective-III (Any One)**					
	BEE	VLSI Theory & Design						BEE	Non Conventional Energy				
	BEE	Electric Drives & Traction						BEE	Bio-Medical Instrumentation				
	BEE	Embedded System						BEE	Energy Audit & Management				
	BEE	Image Processing						BEE	Reliability Engineering				
5	**Departmental Elective-II (Any One)**						4	**Core Elective-IV (Any One)**					
	BEE	Electrical Engineering						BCS					
	BEE	Power Quality						BCS					
	BEE	HVDC Transmission						BCS					
	BEE	Nano-Technology						BEE					
6	BEE	Power System Lab.					5	BEE	Comprehensive Viva				
7	BEE	Seminar					6	BEE	Major Project				
8	BEE	Installation Design											
9	BEE	Minor Project											
		Total							Total				

(1ST & 2ND SEMESTER)

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 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 BOOK

[1]. Edward Hughes (revised by Ian McKenzie Smith). *"Electrical & Electronics Technology"* Pearson Education Limited. Indian Reprint 2002.

REFERENCE BOOKS

[1]. H.Cotton, *"Advanced Electrical Technology"*, CBS Publishers, New Delhi, 7th Edition.

[2]. C.L. Wadhwa, *"Electrical Engineering",* New Age International Publishers.

[3]. D.Kulshreshtha, *" Basic Electrical Engineering"* TMH

[4]. S. Parker Smith: *"Problems in Electrical Engineering"* Asia Publications.

(1^{ST} & 2^{ND} SEMESTER)

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. Callibration of a single phase Energy Meter by directed loading & Phantom loading

(3RD SEMESTER)

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 , coenergy, 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, magnetising 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.

BOOKS

[1]. A. E. Clayton, N. Hancock, "Performance and Design of D.C Machines", BPB Publishers

[2]. M. G. Say, "Performance and design of AC machines", CBS Publishers.

[3]. A. E. Fritzgerald, C. Kingsley, and S. Umans, "Electric Machinary", MGH Publisher.

[4]. Electric Machines by I.J. Nagrath & D.P. Kothari, TMH Publishers.

(3RD SEMESTER)

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

BOOKS

[1]. Mac.E Van Valkenburg, *"Network Analysis",*

[2]. Franklin Fa-Kun. Kuo, *"Network Analysis & Synthesis",* John Wiley & Sons.

[3]. M. L. Soni, J. C. Gupta, *"A Course in Electrical Circuits and Analysis",*

[4]. Mac.E Van Valkenburg, *"Network Synthesiss",*

[5]. Joseph A. Edminister, Mahmood Maqvi, *"Theory and Problems of Electric Circuits",* Schaum's Outline Series, TMH

(3RD SEMESTER)

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

(3RD SEMESTER)

NETWORK DEVICE 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.

(3RD SEMESTER)

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 .

(4TH SEMESTER)

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: Synchronising method, effect of wrong synchronising, 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, Shcrage motor, Universal motor

BOOKS

[1]. M. G. Say, "Performance and design of AC machines", CBS Publishers.

[2]. A. E. Fritzgerald, C. Kingsley, and S. Umans, *"Electric Machinary",* MGH Publisher.

[3]. I. J. Nagrath, D. P. Kothari, *"Electric Machines",* TMH Publishers.

[4]. A. S. Langsdorf, "Theory of Alternating Current Machinery", TMH Edition.

[5]. E. O. Taylor, "The Performance & Design of A.C. Commutator motors", Wheeler Publishing, New Delhi.

(4^{TH} SEMESTER)

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 Magetising Current & Induced e.m.f.

(5TH SEMESTER)

MICROPROCESSOR & MICRO CONTROLLER THEORY & APPLICATION (3-1-0)

MODULE-I (10 HOURS)

Microprocessor Architecture: Introduction to Microprocessor and Microcomputer Architecture, Pins & Signals, Register Organization, Timing & Control Module, 8085 Instruction Timing & Execution. Instruction Set and Assembly Language Programming of 8085:- Instruction set of 8085, Memory & I/O Addressing, Assembly language programming using 8085 Instruction Set, Use of Stack & Subroutines, Data transfer techniques, 8085 interrupts

MODULE-II (10 HOURS)

Interfacing & support chips: Interfacing EPROM & RAM Memories, 2716, 2764, 6116 & 6264 Microprocessor Based System Development Aids, Programmable Peripheral Interface: 8255, Programmable DMA Controller: 8257, Programmable Interrupt Controller: 8259

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

MODULE-III (10 HOURS)

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

Simple application: Delay calculation, square wave generation

MODULE-IV (10 HOURS)

Microcontroller:- Introduction for Microcontrollers, Microcontrollers & Microprocessors, Embedded verses External Memory devices, CISC & RISC Processors, 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.

BOOKS

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

[2]. Fundamentals of Microprocessor & Microcontroller by B.RAM, Dhanpat Rai Publications.

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

[4]. Microcontrollers, theory and applications, TMH, Ajay V. Deshmukh.

(5TH SEMESTER)

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

BOOKS

[1]. Simon Haykin and Barry Van Veen, *"Signals and Systems",* John Wiley & Sons.

[2]. Alan V. Oppenheim, Alan S. Willsky, with S. Hamid, S. Hamid Nawab, *"Signals and Systems",* PHI.

[3]. Hwei Hsu, *"Signals and Systems",* Schaum's Outline TMH

[4]. Edward w. Kamen and Bonnie s. Heck, *"Fundamentals of Signals & systems using Web and MATLAB"*, PHI

(5TH SEMESTER)

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 inveter 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

BOOKS

[1]. Digital Design,3rd edition by M. Morris Mano, Pearson Education

[2]. Digital Design-Principle& practice, 3rd edition by John F. Wakerley, Pearson Education

(5TH SEMESTER)

POWER SYSTEM-I (3-1-0)

MODULE-I (10 HOURS)

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

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

MODULE-II (10 HOURS)

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

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

MODULE-III (10 HOURS)

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

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

MODULE-IV (10 HOURS)

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

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

BOOKS

[1]. Electrical power by J.B.Gupta

[2]. Power station engg.& economy by SKrotizki & Vopat(Tata M.H)

(5TH SEMESTER)

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.

BOOKS

[1]. M. H. Rashid .Power Electronics, Prentice Hall India,1993

[2]. G.K.Dubey et.al , Thyristorised Power Controllers, Wiley Eastern Ltd, 2001.

[3]. Cyril W Lander, Power Electronics, 1993

(5TH SEMESTER)
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.

(5TH SEMESTER)
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. Realisation of half adder, full adder, half subtractor, full subtractor.
6. Realisation of S-R flip flop using 7400.
7. Study of truth table of 7476 (Master slave J.K.) and realise mod-6 shift counter using 3(7476)
8. Design of 4-bit random counter
9. Design of adder and subtractor using multiplexer

(5TH SEMESTER)
SIGNAL & SYSTEMS LAB.-I (0-0-3)

(Use MATLAB CONTROL SYSTEM and SIGNAL PROCESSING TOOL BOXES)

1. Generation of square, triangular, exponential, sinusoidal signals and step, Impulse and RAMP functions.
2. Evaluation of convolution of finite –duration discrete time signals.
3. Frequency response of LTI Systems from Impulse response.

4. Frequency response of LTI systems Describes by differential or difference Equations.
5. Implementation of Decimation and Interpolation concepts
6. Generation of AM wave and analyzing its frequency content.
7. Determination of frequency response from Poles and Zeros.
8. Pole- Zero Plot in the Z-plane and determination of magnitude response.

(5^{TH} SEMESTER)

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

A) 8085 (2 hours)

1. Addition, Subtraction, Multiplication, Division of two 8 bit numbers resulting 8/16 bit numbers.

2. Smallest /Largest number among 'n' number in a given data array + Binary to Gray Code Hexadecimal to decimal conversion.

B) INTERFACING (5 hours)

COMPULSORY

1.Generate square waves of different frequencies on all lines of 8255 by the help of delay program.

2.Study of stepper Motor and its operations (Clockwise, anticlockwise, angular movement, rotate in various speeds)

OPTIONAL (Any Two)

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

C)8051MICROCONTROLLER (3 hours)

COMPULSORY

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

OPTIONAL (any one)

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

D)8086 (2 hours)

COMPULSORY

Addition, subtraction, Multiplication, Division of 16 bit nos + 2's complement of a 16 bit no. OPTIONAL (Any One)

1. Finding a particular data element in a given data array.
2. Marking of specific bit of a number using look-up table.
3. Largest /Smallest number of a given data array.
4. To separate the Odd and Even numbers from a given data array.
5. Sorting an array of numbers in ascending/descending order Total – 13 hours

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

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

(6TH SEMESTER)

POWER SYSTEM-II (3-1-0)

MODULE-I (10 HOURS)

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

MODULE-II (10 HOURS)

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

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

MODULE-III (10 HOURS)

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

MODULE-IV (10 HOURS)

Economic Operation of Power System: Distribution 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.

Introduction to Flexible AC Transmission System (FACTS), SVC, TCSC, SSSC, STATCOM and UPFC

BOOKS

[1]. John J Grainger, W. D. Stevenson, *"Power System Analysis"*, TMH Publication

[2]. I. J. Nagrath & D. P. Kothari, *"Power System Analysis",* TMH Publication

(6TH SEMESTER)

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, Energymeters: AC. Induction type siqgle 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

BOOKS

[1]. A Course in Elec. & Electronics Measurements & Instrumentation: A K. Sawhney

[2]. Modern Electronic Instrumentation and Measurement Techniques: Helfrick & Cooper

[3]. Electronic Measurement & Instrumentation Systems: Larry Jones & A Foster Chin

[4]. Electrical Measurement and Measuring Instruments - Golding & Waddis

(6TH SEMESTER)

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 Magnetisation & 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.

BOOKS

[1]. W. H. Hayt (Jr), J. A. Buck, *"Engineering Electromagnetics",* TMH

[2]. K. E. Lonngren, S.V. Savor, *"Fundamentals of Electromagnetics with Matlab"*, PHI

[3]. E.C.Jordan, K.G. Balmain, *"Electromagnetic Waves & Radiating System",* PHI.

[4]. M. N. Sadiku, *"Elements of Electromagnetics",* Oxford University Press.

(6TH SEMESTER)

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

MODULE-I (10 HOURS)

Introduction: Scope of control system Engineering, Various Classification of Control System, Closed Loop Control Versus Open Loop Control, Mathematical model of physical systems, transfer function, block diagram algebra, signal flow graph (SFG), Mason's gain formula.

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

MODULE-II (10 HOURS)

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

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

MODULE-III (10 HOURS)

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

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

MODULE-IV (10 HOURS)

Frequency domain analysis: Introduction, Polar plots, Bode plots, determination of stability from Bode plots, Nyquist stability criterion, application of Nyquist stability criterion to linear feedback systems, Log magnitute 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,

BOOKS

[1]. K. Ogata, "Modem Control Engineering", PHI

[2]. I.J. Nagrath, M. Gopal, *"Control Systems Engineering",* New Age International Publishers.

[3]. J.J.Distefano, III, A.R.Stubberud, I.J.Williams, *"Feedback and Control Systems",* TMH,

[4]. G.F.Franklin, J.D.Powell, A. Emami, Naeini, *"Feedback Control of Dynamic Systems",* Schaum's Outlines, TMH

[5]. B.C.Kuo, F. Golnaraghi, *"Automatic Control Systems",* John Willey & Sons.

(6TH SEMESTER)

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

MODULE-I (10 HOURS)

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

Discrete Time System: Block diagram representation of discrete time systems, classification of discrete time systemssstatic and dynamic, time variant and time - invariant, linear and non-linear, casual and antiicasual, 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

BOOKS

[1]. S. K. Mitra, “Digital Signal Processing- A computer based approach”, TMH

[2]. Digital Signal Processing - Principles, Algorithms and Applications by J.G. Proakis and D.G.Manolakis, 3rd Edition, Pearson.

[3]. Digital Signal Processing by S.Salivahanan, TMH Reference Book:

[4]. Introduction of Digital Signal Processing - J.R.Johnson, PHI.

(6TH SEMESTER)

CONTROL & 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.

(6TH SEMESTER)

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

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

(6TH SEMESTER)

ELECTRICAL EQUIPMENT DESIGN & SIMULATION LAB. (0-0-6)

Computer aided design using MATLAB

1. Design & Simulation of three phase transformer
2. Design & Simulation of DC machine
3. Design & Simulation of Synchronous Machine and Induction Machine

(7TH SEMESTER)

POWER SYSTEM-III (3-1-0)

MODULE-I (10 HOURS)

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

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

MODULE-II (10 HOURS)

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

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

MODULE-III (10 HOURS)

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

Arrangement of Bus bar, Circuit breaker and isolator. Current limiting reactors in power system and their arrangement calculation of fault MVA for symmetrical short circuits. Circuit breaker capacity.

MODULE-IV (10 HOURS)

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

Load frequency control, PF versus QV control,

BOOKS

[1]. Van C Warrington, *"Protective Relays*" Vol.-I & II

[2]. Ravindranath, M.Chander, *"Power System Protection and SwitchGear",* Wiley Eastern Ltd. New Delhi

[3]. John J Grainger, W. D. Stevenson, *"Power System Analysis",* TMH Publication

[4]. P. Kundur, *"Power System Stability and Control",* TMH Publication

(7TH SEMESTER)

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.

BOOKS

[1]. K. Ogata, *"Modem Control Engineering",* PHI.

[2]. I.J. Nagrath, M. Gopal, *"Control Systems Engineering",* New Age International Publishers.

[3]. J.J.Distefano, III, A.R.Stubberud, I.J.Williams, *"Feedback and Control Systems",* TMH.

[4]. K.Ogata, *"Discrete Time Control System",* Pearson Education Asia.

(7TH SEMESTER)

ELECTIVE-I

VLSI THEORY & DESIGN (3-1-0)

MODULE-I (10 HOURS)

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

MODULE-II (10 HOURS)

MOS Inverters: Basic NMOS inverters, characteristics, Inverters with resistive load and with n-type MOSFET load CMOS inverter and characteristics.

MOS Inverters: Switching characteristics and interconnect effects: Delay time definitions and calculation, inverter design with delay constraints, estimation of parasitics switching power dissipation of CMOS inverters.

MODULE-III (10 HOURS)

Combinational MOS logic circuits, CMOS logic circuits, state style, complete logic circuits, pass transistor logic, sequential logic circuit –introduction, SR latch, clocked latch and flip-flop circuits,CMOS D latch and edge triggered flip- flop

Dynamics logic circuits: Dynamic logic, basic principles, high performance dynamics CMOS circuits, Dynamic Ram, SRAM, flash memory.

MODULE-IV (10 HOURS)

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

BOOKS

[1]. CMOS Digital integrated Circuits – Analysis & Design – Sung Mo-Kang & Yussuf Leblebici, TMH

[2]. VHDL Programming by example – Perry TMH

[3]. Digital Integrated Circuits: A Design Perspective –Rabey et al.Pearson Education.

[4]. VLSI design Techniques for analog and digital circuits – Geiger et.Al.McGraw Hill

(7TH SEMESTER)

ELECTIVE-I

ELECTRIC DRIVES AND TRACTION (3-1-0)

MODULE-I (10 HOURS)

Requirements, AC and DC drives, modern trends in drives technology, Characteristis 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.

BOOKS

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

[2]. M.H.Rashid, “Power Electronics”, P.H.I.Edition

[3]. G.K.Dubey, “Electric Drive”, Norasa Pub. House ND

(7TH SEMESTER)

ELECTIVE-I

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.

BOOKS

[1]. Introduction to Embedded Systems: by SHIBU K.V.,TMH Publication

[2]. Embedded Systems –Architecture, Programming and Design- RAJKAMAL, TMH Publication.

(7TH SEMESTER)

ELECTIVE-I

IMAGE PROCESSING (3-1-0)

MODULE-I (10 HOURS)

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

MODULE-II (10 HOURS)

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

MODULE-III (10 HOURS)

Image Restoration

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

MODULE-IV (10 HOURS)

Image Compression

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

Image Segmentation

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

BOOKS

[1]. Digital Image Processing,R.C.Gonzalez & R.E.Wood,Addison Weslay

[2]. Digital Image Processing and Analysis,B.Channda & D.Dutta,Prentice Hall

[3]. Fundamentals of Digital Image Processing, Anil Ku Jain,PHI

[4]. Fundamental of Electronic Image Processing, Arther R.Weeks Jr.PHi

(7TH SEMESTER)

ELECTIVE-II

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 of relation, hall effect, thermal conductivity semiconductors, electrical conductivity of doped materials.

BOOKS

[1]. C.S.Indulkar and S. Thiruvengadam, S., *"An Introduction to Electrical Engineering Materials*:. Chand and Company Ltd.

[2]. Kenneth G. Budinski,, "*Engineering Materials*: Prentice Hall of India, New Delhi

(7TH SEMESTER)

ELECTIVE-II

POWER QUALITY (3-1-0)

MODULE-I (10 HOURS)

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

MODULE-II (10 HOURS)

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

MODULE-III (10 HOURS)

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

Sags due to Starting of Induction Motors

MODULE-IV (10 HOURS)

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

BOOKS

[1]. Understanding Power Quality Problem-by M.H.S Bollen

[2]. Standard Publisher Distributor –Delhi-110006 IEEE Press

(7TH SEMESTER)

ELECTIVE-II

HVDC TRANSMISSION (3-1-0)

MODULE-I (10 HOURS)

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

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

MODULE-II (10 HOURS)

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

MODULE-III (10 HOURS)

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

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

MODULE-IV (10 HOURS)

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

BOOKS

[1]. Padiyar K. R. "*HVDC power transmission System*", Willey Eastern Ltd,New Delhi, 1990 .

[2]. Arrillaga J. "*High Voltage direct current transmission*", Peter Peregrinus, London. 1983

[3]. Kimbark E. W. "*Direct Current transmission", vol. 1*, John Wiley, New York. 1971.

(7TH SEMESTER)

ELECTIVE-II

NANOTECHNOLOGY (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,DifferentTimelines of Nanotechnology.

MODULE-III (10 HOURS)

Introduction, The Beginning of technological Revolution, Silicon BasedTechnology, 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.

BOOKS

[1]. "Nanotechnology" , Foster, Pearson Education.

[2]. "Nanotechnology: A gentle Introduction to yhe next Big Idea" , Ratner, Pearson Education.

[3]. Handbook of Nanotechnology, The- Nanometer Structures: Theory, Modeling and Simulation", Lakhtakia, PHI Learning Pvt Ltd.

[4]. "Introduction to nanoscience and Technology", Chattopadhyay, PHI Learning Pvt Ltd.

(7TH SEMESTER)

POWER SYSTEM LAB. (0-0-3)

1. Determination of operating characteristics of biased differential relay.
2. Determination of operating characteristics of an induction type overcurrent 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.

(7TH SEMESTER)

INSTALLATION DESIGN (0-0-3)

1. Load Survey, Calculation of load center, sub-station rating, transformer ratings.
2. Study of a distribution network, layout diagram of network.
3. Wiring Systems, service connections, Power circuits, Internal and external wiring design & estimation
4. Industrial installations.

(8TH SEMESTER)

ELECTIVE-III

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.

BOOKS

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

[2]. Energy Technology – S. Rao, Parulkar

[3]. Non-conventional Energy Systems – Mittal, Wheelers Publication.

[4]. Non-Conventional Sources of Energy- G.D.Rai, Khanna Publishers

(8TH SEMESTER)

ELECTIVE-III

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.

BOOKS

[1]. R. S. Khanpur, *"Handbook of Biomedical Instrumentation"* TMH

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

(8TH SEMESTER)

ELECTIVE-III

ENERGY AUDIT & MANAGEMENT (3-1-0)

MODULE-I (10 HOURS)

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

MODULE-II (10 HOURS)

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

MODULE-III (10 HOURS)

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

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

MODULE-IV (10 HOURS)

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

BOOKS

[1]. *"Energy Management: Challenges for the Next Millennium"*, Pradeep Chaturvedi, Vedams eBooks (P) Ltd.

[2]. *"Energy management"* ,Paul O'Callaghan,McGraw Hill Book Co.

[3]. *"Energy management principles"*, Craig B Smith,. Pergamon Press.

[4]. *"Albert Thumann"***,** .Handbook of Energy Audits., Fairmont Pr; 5th edition (1998).

(8TH SEMESTER)

ELECTIVE-III

RELIABILITY ENGINEERING (3-1-0)

MODULE-I (10 HOURS)

Types Of System, Qualitative and Quantitative assessment, Use of quantitative assessment , Reliability Definition And Concept, Reliability Indices And Criteria, Reliability And Availability, Absolute And Relative Reliability, Reliability Evaluation Technique, Reliability Improvement, Reliability Activities in System Design & its Economics, Basic Probability Theory, Binomial Distribution and its engineering applications, Network modeling concepts, Series & Parallel Systems, Series-Parallel System, Partially Redundant & Standby redundant System.

MODULE-II (10 HOURS)

Modeling and Evaluation Concept, Conditional Probability Approach, Cut Set Method, Application And Comparison Of Previous Technique, Tie Set Method, Connection Matrix Technique, Event Trees, Fault Tree, Multi-Failure Mode, Distribution Concept & terminologies, General Reliability Function & their evaluation techniques, Shape Of Reliability Function

The Poison Distribution & the Normal Concept, Exponential, Weibull, Gamma, Rayleigh, Lognormal and rectangular distributions, Data Analysis, System Reliability Evaluation of different kinds of Using Probability Distributions, Mean Time To Failure, Wear out And Component Reliability, Maintenance And Component Reliability

MODULE-III (10 HOURS)

Discrete Markov Chain, General Modeling Concept, Stochastic Transitional Probability Matrix, Time Dependant Probability Evaluation, Limiting State Probability Evaluation, Absorbing States, Application Of Discrete Markov Technique, Continuous Markov Process, General Modeling Concept, State Space Diagrams, Stochastic Transitional Probability Matrix, Evaluating Limiting State Probabilities, Evaluating Time Dependant State Probabilities, Reliability Evaluation In Repairable System, Mean Time To Failure, Application Of Technique To Complex System, Frequency And Duration Technique, Application To Multistate Problems, Frequency Balance Approach, Two Stage Repair And Installation Process

MODULE-IV (10 HOURS)

Approximate System Reliability Evaluation, Series & Parallel System, Network Reduction Technique, Minimal Cut Set /Failure Mode Approach, Inclusion Of Scheduled maintenance, Common Mode Failure, System With Non-Exponential Distribution, Method Of Stage, Stages In Series & Parallel, Stages In Series With Two Parallel Stage, Time Dependant And Limiting State Probabilities, Monte Carlo Simulation, Concept Of Simulation, Random Varieties, Simulation Output, Application Of MCS Technique, Number Of Simulation.

BOOKS

[1]. R.Billington & R.N. Allan," Reliability Evaluation of Engineering and Systems", Plenum Press.

[2]. K.C. Kapoor & L.R. Lamberson,"Reliability in Engineering and Design", John Wiely and Sons.

(8TH SEMESTER)

ELECTIVE-IV

COMPUTER NETWORK (3-0-0)

MODULE-I (10 HOURS)

Overview of Data Communication & Networking:

Physical Layer: Analog & Digital, Analog signals, Digital signals, Analog Vs Digital, Data Rate Limits, Transmission Impairment, More about Signals.

Digital Transmission: Line coding, Block coding, Sampling, Transmission mode.

Analog Transmission: Modulation of Digital Data, Telephone modems, Modulation of Analog signals.

Multiplexing: FDM 150, WDM 155, TDM 157

Transmission Media: Guided media, Unguided media(wireless)

Circuit Switching & Telephone Network: Circuit Switching, Telephone Network.

MODULE-II (10 HOURS)

Data Link Layer:

Error Detection & Correction: Types of Errors, Detection, Error Correction.

Data Link Control and Protocols: Flow and error Control, Stop and wait ARQ Go-Back N ARQ Selective Repeat ARQ, HDLC

Point-to-Point Access: PPP

Pont-to-Point Protocol, PPP Stack, Multi Access: Random Access, Controlled Access, Channelization, Local area Network: Ethernet

Traditional Ethernet, Fast Ethernet, Gigabit Ethernet

Wireless LANs: IEEE 802.11,Bluetooth virtual circuits: Frame Relay and ATM

MODULE-III (10 HOURS)

Network Layer : Host to Host Delivery :Internetworking, addressing and

Routing Network Layer Protocols : ARP,IPVA ICMP ,IPV6 and ICMPR6

Transport Layer : Process to Process Delivery : UDP: TCP congestion control and Quality of service

MODULE-IV (10 HOURS)

Application Layer:

Client Server Model, Socket Interface Domain Name System (DNS):

Electronic Mail (SMTP) and file transfer (FTP) HTTP and www

Security :Cryptography, Network Security, Security in the internet, Message security, User Authentication

BOOKS

[1]. Data Communications and Networking, Third Edition, Behrouz A, Forouzan Tata Mc Graw-Hill Publishing Company Limited

[2]. Computer Networks: Third Edition, A System Approach, LarryL/Petersonand Bruce

[3]. Computer Networks, A.S.Tannenbaum PHI.

(8TH SEMESTER)

ELECTIVE-IV

SOFT COMPUTING (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

BOOKS

[1]. J.S.R.Jang, C.T.Sun and E.Mizutani, "*Neuro-Fuzzy and Soft Computing"*, PHI, 2004, Pearson Education 2004.

[2]. Timothy J.Ross, *"Fuzzy Logic with Engineering Applications"*, McGraw-Hill, 1997.

[3]. Davis E.Goldberg, *"Genetic Algorithms: Search, Optimization and Machine Learning"*, Addison Wesley, N.Y., 1989.

[4]. R.Eberhart, P.Simpson and R.Dobbins, *"Computational Intelligence - PC Tools"*, AP Professional, Boston, 1996.

(8TH SEMESTER)

ELECTIVE-IV

COMPUTER SYSTEM ARCHITECTURE (3-0-0)

MODULE-I (10 HOURS)

Introduction*:* Brief history of computers, organization and architecture, basic organization of computers, system bus & interconnection, PCI, computer functions, I-cycle, interrupt and class of interrupts, Von-Neumann Machine: structure of IAS, computer components, fetch and execute cycles, example of program execution instruction cycle state diagram, instruction pipelining.

MODULE-II (10 HOURS)

CPU Organization: Fundamental concepts, fetching and storing a word in memory, register transfer, performing an arithmetic and logic operation, execution of a complete instruction, general register organization: control word, examples of micro-operations, stack organization, RPN, evaluation of arithmetic expression using RPN, instruction format; three address, two address, one address and zero address instructions, addressing modes; types of addressing modes, numerical examples, data transfer and manipulation; data transfer, data manipulation, arithmetic, logical & bit manipulation instruction, program control; conditional branch instruction, subroutine, program interrupt, types of interrupt, RISC & CISC characteristics, control unit operation; hardware and micro-programmed control.

MODULE-III (10 HOURS)

Input/Output *Organization*: Peripheral devices, input-output interface, I/O bus and interface module, asynchronous data transfer, strobe control, handshaking, asynchronous serial transfer, asynchronous communication interface, modes of transfer; programmed I/O, interrupt driven I/O, direct memory access (DMA), DMA controller, I/O channel & processor, priority interrupt: daisy chaining priority, parallel priority interrupt.

MODULE-IV (10 HOURS)

Memory Organization: Memory hierarchy, characteristic of memory system, semiconductor main memory types, organization, memory cell operation, cache memory; cache principles, elements of cache design, cache size, mapping function, replacement algorithm, LRU, FIFO, LFU, write policy, number of caches; single versus two level caches, Pentium cache organization, associative memory; hardware organization, match logic, read operation, write operation auxiliary memory; magnetic disks magnetic tapes, virtual memory; paging, address mapping using pages, segmentation, demand paging, memory management hardware.

BOOKS

[1]. William Stallings, *"Computer Organization and Architecture",* Fourth Edition, PHI

[2]. M.Morris Mano, *"Computer System Architecture",* Third Edition, PHI