

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
ANANTAPUR**

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING

III YEAR – I SEMESTER

Course Structure

CODE	SUBJECT	T	P	C
	Computer System Organization	4+1*	-	4
	Electrical Measurements	4+1*	-	4
	Power Systems-II	4+1*	-	4
	Power Electronics	4+1*	-	4
	Electrical Machines-III	4+1*	-	4
	Linear Systems Analysis	4+1*	-	4
	Electrical Machines Lab – II	-	3	2
	Control Systems and Simulation Lab	-	3	2
	Total	30	6	28

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IV year – I Semester

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CODE	SUBJECT	T	P	C
	Neural Networks and Fuzzy Logic	4+1*	-	4
	Power Semiconductor Drives	4+1*	-	4
	Power System Analysis	4+1*	-	4
	Power System Operation and Control	4+1*	-	4
	ELECTIVE – I	4+1*	-	4
	HVDC Transmission			
	EHV AC Transmission			
	High Voltage Engineering			
	ELECTIVE – II	4+1*	-	4
	Reliability Engineering and Application to Power Systems			
	Non-Conventional Sources of Energy			
	Electrical Distribution Systems			
	Microprocessors and Microcontrollers Lab	-	3	2
	Electrical Measurements Lab	-	3	2
	Total	30	6	28

NOTE: All University Examinations (Theory and Practical) are of 3 hours duration.

* : Tutorials

T : Theory periods per week P: Practical /Drawing Periods per week

C : Total Credits for the subject

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
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III Year B.Tech EEE I-Sem

T	P	C
4+1*	0	4

COMPUTER SYSTEM ORGANIZATION

Objective:

- Is to acquaint budding engineers with the basic principles of organization, operation and performance of modern-day computer systems.
- It covers all aspects of computer technology, from the underlying integrated circuit technology used to construct computer components, to the use of parallel organization concepts in combining those components.

UNIT-I:

BASIC STRUCTURE OF COMPUTERS: Computer Types, Functional unit, Basic OPERATIONAL concepts, Bus structures, Software, Performance, multiprocessors and multi computers. Data Representation. Fixed Point Representation. Floating – Point Representation. Error Detection codes.

UNIT-II:

REGISTER TRANSFER LANGUAGE AND MICROOPERATIONS: Register Transfer language. Register Transfer Bus and memory transfers, Arithmetic Microoperations, logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes. Computer Registers Computer instructions – Instruction cycle.

UNIT – III:

Memory – Reference Instructions. Input – Output and Interrupt. STACK organization. Instruction formats. Addressing modes. DATA Transfer and manipulation. Program control. Reduced Instruction set computer

UNIT-IV:

MICRO PROGRAMMED CONTROL: Control memory, Address sequencing, microprogram example, design of control unit Hard wired control. Microprogrammed control

UNIT-V:

THE MEMORY SYSTEM: Basic concepts semiconductor RAM memories. Read-only memories Cache memories performance considerations, Virtual memories secondary storage.

UNIT-VI:

INPUT-OUTPUT ORGANIZATION: Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt Direct memory Access.

UNIT-VII:

PIPELINE AND VECTOR PROCESSING: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors.

UNIT-VIII:

MULTI PROCESSORS: Characteristics or Multiprocessors, Interconnection Structures, Interprocessor Arbitration. InterProcessor Communication and Synchronization Cache Coherence. Shared Memory Multiprocessors.

TEXT BOOKS:

1. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, PHI/Pearson.
2. Computer Organization and Architecture by V.Rajaraman and T.Radhakrishnan, PHI Publications.

REFERENCES:

1. Computer Organization and Architecture – William Stallings Sixth Edition, PHI/Pearson.
2. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI/Pearson.
3. Fundamentals or Computer Organization and Design, - Sivaraama Dandamudi Springer Int. Edition.
4. Computer Organization – Car Hamacher, Zvonks Vranesic, SafeaZaky, Vth Edition, McGraw Hill.

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ELECTRICAL MEASUREMENTS

Objective :

Electrical measurements course introduces the basic principles of all measuring instruments. It also deals with the measurement of RLC parameters voltage, current Power factor, power, energy and magnetic measurements.

UNIT-I Measuring Instruments

Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type – Extension of range of E.S. Voltmeters.

UNIT –II Instrument transformers

CT and PT – Ratio and phase angle errors – design considerations Type of P.F. Meters – dynamometer and moving iron type – 1-ph and 3-ph meters – Frequency meters – resonance type and Weston type – synchrosopes.

UNIT –III Measurement of Power

Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems.

UNIT –IV Measurement of Energy

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading using R.S.S. meter. Three phase energy meter – trivector meter, maximum demand meters.

UNIT – V Potentiometers

Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage.

A.C. Potentiometers: polar and coordinate types standardization – applications.

UNIT – VI Resistance Measurements

Method of measuring low, medium and high resistance – sensitivity of Wheatstone's bridge – Carey Foster's bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method.

UNIT –VII A.C. Bridges

Measurement of inductance, Quality Factor - Maxwell's bridge, Hay's bridge, Anderson's bridge, Owen's bridge. Measurement of capacitance and loss angle - Desauty bridge. Wien's bridge – Schering Bridge.

UNIT – V III

Magnetic Measurements:

Ballistic galvanometer – equation of motion – flux meter – constructional details, comparison with ballistic galvanometer. Determination of B-H Loop methods of reversals six point method – A.C. testing – Iron loss of bar samples– core loss measurements by bridges and potentiometers.

TEXT BOOK:

1. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, fifth Edition, Wheeler Publishing.
2. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications.

REFERENCE BOOKS:

1. Electrical Measurements – by Buckingham and Price, Prentice – Hall
2. Electrical Measurements by Harris.
3. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publishers.

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POWER SYSTEMS-II

Objective :

This course is an extension of Power systems-I course. It deals with basic theory of transmission lines modeling and their performance analysis. Also this course gives emphasis on mechanical design of transmission lines, cables and insulators.

UNIT-I Transmission Line Parameters

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems.

Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT-II Performance of Short and Medium Length Transmission Lines

Classification of Transmission Lines - Short, medium and long line and their model representations - Nominal-T, Nominal-Pie and A, B, C, D Constants for symmetrical & Asymmetrical Networks, Numerical Problems.

Mathematical Solutions to estimate regulation and efficiency of all types of lines - Numerical Problems.

UNIT-III Performance of Long Transmission Lines

Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations, Incident, Reflected and Refracted Waves -Surge Impedance and SIL of Long Lines, Wave Length and Velocity of Propagation of Waves - Representation of Long Lines - Equivalent-T and Equivalent Pie network models (numerical problems).

UNIT – IV Power System Transients

Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

UNIT-V Various Factors Governing the Performance of Transmission line

Skin and Proximity effects - Description and effect on Resistance of Solid Conductors - Ferranti effect - Charging Current - Effect on Regulation of the Transmission Line, Shunt Compensation.

Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference.

UNIT-VI Overhead Line Insulators

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems - voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.

UNIT-VII Sag and Tension Calculations

Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

UNIT-VIII Underground Cables

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems.

Capacitance of Single and 3-Core belted cables, Numerical Problems.

Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

TEXT BOOKS:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
2. Electrical power systems - by C.L.Wadhwa, New Age International (P) Limited, Publishers,1998.

REFERENCE BOOKS:

1. Power system Analysis-by John J Grainger William D Stevenson, TMC Companies, 4th edition
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. Power System Analysis by Hadi Saadat – TMH Edition..
4. Modern Power System Analysis by I.J.Nagaraj and D.P.Kothari, Tata McGraw Hill, 2nd Edition.

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POWER ELECTRONICS

Objective :

With the advent of semiconductor devices, revolution is taking place in the power transmission distribution and utilization. This course introduces the basic concepts of power semiconductor devices, converters and choppers and their analysis.

UNIT – I POWER SEMI CONDUCTOR DEVICES

Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power MOSFET – Power IGBT and their characteristics and other thyristors – Basic theory of operation of SCR – Static characteristics – Turn on and turn off methods- Dynamic characteristics of SCR - Turn on and Turn off times -Salient points

UNIT – II DEVICES AND COMMUTATION CIRCUITS

Two transistor analogy – SCR - UJT firing circuit — Series and parallel connections of SCR's – Snubber circuit details – Specifications and Ratings of SCR's, BJT, IGBT - Numerical problems – Line Commutation and Forced Commutation circuits.

UNIT – III SINGLE PHASE HALF CONTROLLED CONVERTERS

Phase control technique – Single phase Line commutated converters – Mid point and Bridge connections – Half controlled converters with Resistive, RL loads and RLE load– Derivation of average load voltage and current -Active and Reactive power inputs to the converters without and with Free wheeling Diode –Numerical problems

UNIT – IV SINGLE PHASE FULLY CONTROLLED CONVERTERS

Fully controlled converters, Mid point and Bridge connections with Resistive, RL loads and RLE load– Derivation of average load voltage and current – Line commutated inverters -Active and Reactive power inputs to the converters without and with Free wheeling Diode, Effect of source inductance – Derivation of load voltage and current – Numerical problems.

UNIT – V THREE PHASE LINE COMMUTATED CONVERTERS

Three phase converters – Three pulse and six pulse converters – Mid point and bridge connections average load voltage With R and RL loads – Effect of Source inductance–Dual converters (both single phase and three phase) - Waveforms –Numerical Problems.

UNIT – VI AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS

AC voltage controllers – Single phase two SCR's in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – Derivation of RMS load voltage, current and power factor wave forms – Firing circuits -Numerical problems -Cyclo converters – Single phase mid point cyclo converters with Resistive and inductive load (Principle of operation only) – Bridge configuration of single phase cyclo converter (Principle of operation only) – Waveforms

UNIT – VII CHOPPERS

Choppers – Time ratio control and Current limit control strategies – Step down choppers Derivation of load voltage and currents with R, RL and RLE loads- Step up Chopper – load voltage expression Morgan's chopper – Jones chopper and Oscillation chopper (Principle of operation only) Waveforms — AC Chopper – Problems.

UNIT – VIII INVERTERS

Inverters – Single phase inverter – Basic series inverter – Basic parallel Capacitor inverter bridge inverter – Waveforms – Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray – Bedford inverters - Voltage control techniques for inverters Pulse width modulation techniques – Numerical problems.

TEXT BOOKS :

1. Power Electronics – by M. D. Singh & K. B. Kanchandhani, Tata Mc Graw – Hill Publishing company, 1998.
2. Power Electronics : Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998

REFERENCE BOOKS :

1. Power Electronics – by Vedam Subramanyam, New Age International (P) Limited, Publishers
2. Power Electronics - by V.R.Murthy , 1st edition -2005, OXFORD University Press
3. Power Electronics-by P.C.Sen,Tata Mc Graw-Hill Publishing.
4. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradra, A. Joshi and R. M. K. Sinha, New Age International (P) Limited Publishers, 1996.

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ELECTRICAL MACHINES - III

Objective :

This subject is an extension of previous machines courses. It deals with the detailed analysis of Synchronous generators and motors which are the prime source of electrical power generation and its utilities. Also concerns about the different types of single phase motors which are having significant applications in house hold appliances and control systems.

UNIT – I Construction and Principle of operation

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation.

UNIT-II Synchronous Generator Characteristics

Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

UNIT – III Regulation of Synchronous Generator

Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of X_d and X_q (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT – IV Parallel Operation of Synchronous Generator

Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactances.

UNIT – V Synchronous Motors – Principle of Operation

Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed .

UNIT-VI Power Circles

Excitation and power circles – hunting and its suppression – Methods of starting – synchronous induction motor.

UNIT – VII Single Phase Motors

Single phase Motors: Single phase induction motor – Constructional features-Double revolving field theory – Elementary idea of cross-field theory – split-phase motors – shaded pole motor.

UNIT – VIII Special Motors

Principle & performance of A.C. Series motor-Universal motor – Principle of permanent magnet and reluctance motors.

TEXT BOOKS

1. Electric Machines – by I.J.Nagrath & D.P.Kothari, Tata Mc Graw-Hill Publishers, 7th Edition 2005.
2. Electrical Machines – by P.S. Bimbra, Khanna Publishers.

REFERENCE BOOKS:

1. The Performance and Design of A.C.Machines – by M.G.Say, ELBS and Ptiman & Sons.
2. Electric Machinery – by A.E. Fitzgerald, C.Kingsley and S.Umans, Mc Graw-Hill Companies, 5th edition, 1990.
3. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw-Hill, 2nd edition.
4. Electromechanics-III (Synchronous and single phase machines), S.Kamakashiah, Right Publishers

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LINEAR SYSTEMS ANALYSIS

UNIT-I STATE VARIABLE ANALYSIS

Choice of state variables in Electrical networks-Formulation of state equations for Electrical networks-Equivalent source method.Network topological method - Solution of state equations-Analysis of simple networks with state variable approach.

UNIT-II FOURIER SERIES AND FOURIER TRANSFORM REPRESENTATION

Introduction, Trigonometric form of Fourier series, Exponential form of Fourier series, Wave symmetry, Fourier integrals and transforms, Fourier transform of a periodic function, Properties of Fourier Transform, Parseval's theorem, Fourier transform of some common signals, Fourier transform relationship with Laplace Transform.

UNIT-III APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORM REPRESENTATION

Introduction, Effective value and average values of non sinusoidal periodic waves, currents, Power Factor, Effects of harmonics, Application in Circuit Analysis, Circuit Analysis using Fourier Series.

UNIT – IV LAPLACE TRANSFORM APPLICATIONS

Application of Laplace transform Methods of Analysis – Response of RL, RC, RLC Networks to Step, Ramp, and impulse functions, Shifting Theorem – Convolution Integral – Applications

UNIT-V TESTING OF POLYNOMIALS

Elements of realisability-Hurwitz polynomials-positive real functions-Properties-Testing-Sturm's Test, examples.

UNIT-VI NETWORK SYNTHESIS

Network synthesis:
Synthesis of one port LC networks-Foster and Cauer methods-Synthesis of RL and RC one port networks-Foster and Cauer methods

UNIT-VII SAMPLING

Sampling theorem – Graphical and Analytical proof for Band Limited Signal impulse sampling, natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, introduction to Band Pass sampling, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and Energy / Power spectral density function.

UNIT-VIII Z-TRANSFORMS

Fundamental difference between continuous and discrete time signals, discrete time complex, exponential and sinusoidal signals, periodicity of discrete time complex exponential, concept of Z-Transform of a discrete sequence. Distinction between Laplace, Fourier and Z-Transforms. Region of convergence in Z-Transforms, constraints on ROC for various classes of signals, Inverse Z-Transform properties of Z-Transforms.

TEXT BOOKS:

1. Signals, Systems and Communications by B.P. Lathi, BS Publications 2003.
2. Network Analysis and Synthesis – Umesh Sinha- Satya Prakashan Publications

REFERENCE BOOKS:

1. Linear System Analysis – A N Tripathi, New Age International
2. Network and Systems – D Roy Chowdhary, New Age International
3. Engineering Network Analysis and Filter Design- Gopal G Bhisk & Umesh
4. Linear system analysis by A.Cheng, Oxford publishers.

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ELECTRICAL MACHINES LAB – II

The following experiments are required to be conducted as compulsory experiments:

1. O.C. & S.C. Tests on Single phase Transformer
2. Sumpner's test on a pair of single phase transformers
3. Scott connection of transformers
4. No-load & Blocked rotor tests on three phase Induction motor
5. Regulation of a three –phase alternator by synchronous impedance & m.m.f. methods
6. V and Inverted V curves of a three—phase synchronous motor.
7. Equivalent Circuit of a single phase induction motor
8. Determination of X_d and X_q of a salient pole synchronous machine

In addition to the above eight experiments, atleast any two of the following experiments are required to be conducted from the following list:

1. Parallel operation of Single phase Transformers
2. Separation of core losses of a single phase transformer
3. Brake test on three phase Induction Motor
4. Regulation of three-phase alternator by Z.P.F. and A.S.A methods
5. Efficiency of a three-phase alternator
6. Heat run test on a bank of 3 Nos. of single phase Delta connected transformers
7. Measurement of sequence impedance of a three-phase alternator.
8. Performance characteristics of a Schrage motor

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CONTROL SYSTEMS AND SIMULATION LAB

Any Eight of the following experiments are to be conducted:

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC motor
6. Effect of P, PD, PI, PID Controller on a second order systems
7. Lag and lead compensation – Magnitude and phase plot
8. Transfer function of DC generator
9. Temperature controller using PID
10. Characteristics of magnetic amplifiers
11. Characteristics of AC servo motor

Any two simulation experiments are to be conducted:-

1. PSPICE simulation of Op-Amp based Integrator and Differentiator circuits.
2. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.
3. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB
4. State space model for classical transfer function using MATLAB – Verification.

REFERENCE BOOKS:

1. Simulation of Electrical and electronics Circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

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NEURAL NETWORKS AND FUZZY LOGIC

Objective :

This course introduces the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks. Also deals with Associate Memories and introduces Fuzzy sets and Fuzzy Logic system components. The Neural Network and Fuzzy Network system application to Electrical Engineering is also presented. This subject is very important and useful for doing Project Work.

Unit – I: Introduction to Neural Networks

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Unit- II: Essentials of Artificial Neural Networks

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

Unit–III: Single Layer Feed Forward Neural Networks

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Unit- IV: Multilayer Feed forward Neural Networks

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

Unit V: Associative Memories

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem

Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network

Summary and Discussion of Instance/Memory Based Learning Algorithms, Applications.

Unit – VI: Classical & Fuzzy Sets

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT VII: Fuzzy Logic System Components

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

UNIT VIII: Applications

Neural network applications: Process identification, control, fault diagnosis and load forecasting.

Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

TEXT BOOK:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. Introduction to Neural Networks using MATLAB 6.0 - S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH, 2006

REFERENCE BOOKS:

1. Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 2002.
2. Neural Networks – Simon Hakins , Pearson Education
3. Neural Engineering by C.Eliasmith and CH.Anderson, PHI
4. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.

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POWER SEMICONDUCTOR DRIVES

Objective :

This course is an extension of Power Electronics applications to AC and DC drives. Control of DC motor drives with single phase and three phase converters and choppers are given in detail. The control of AC motor drives with variable frequency converters and variable voltage are presented.

UNIT – I: Control of DC motors by Single phase Converters

Introduction to Thyristor controlled Drives, Single Phase semi and Fully controlled converters connected to d.c separately excited and d.c series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed d.c motors.

UNIT-II: Control of DC motors by Three phase Converters

Three phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

UNIT – III: Four Quadrant operation of DC Drives

Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic and Regenerative Braking operations. Four quadrant operation of D.C motors by dual converters – Closed loop operation of DC motor (Block Diagram Only)

UNIT-IV: Control of DC motors by Choppers

Single quadrant, Two –quadrant and four quadrant chopper fed dc separately excited and series excited motors – Continuous current operation – Output voltage and current wave forms – Speed torque expressions – speed torque characteristics – Problems on Chopper fed d.c Motors – Closed Loop operation (Block Diagram Only)

UNIT – V: Control of Induction Motor through Stator voltage

Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics.

UNIT – VI : Control of Induction Motor through Stator Frequency

Variable frequency characteristics-Variable frequency control of induction motor by Voltage source and current source inverter and cyclo converters- PWM control – Comparison of VSI and CSI operations – Speed torque characteristics – numerical problems on induction motor drives – Closed loop operation of induction motor drives (Block Diagram Only)

UNIT –VII: Control of Induction motor of Rotor side

Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – advantages applications – problems

UNIT – VIII: Control of Synchronous Motors

Separate control & self control of synchronous motors – Operation of self controlled synchronous motors by VSI and CSI cycloconverters. Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Applications – Advantages and Numerical Problems – Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable frequency control, Cyclo converter, PWM, VFI, CSI

TEXT BOOKS:

1. Fundamentals of Electric Drives – by G K Dubey Narosa Publications
2. Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI.

REFERENCE BOOKS:

1. Power Electronics – MD Singh and K B Khanchandani, Tata – McGraw-Hill Publishing company, 1998
2. Modern Power Electronics and AC Drives by B.K.Bose, PHI.
3. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications.
4. A First course on Electrical Drives – S K Pillai New Age International(P) Ltd. 2nd Edition.

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POWER SYSTEM ANALYSIS

Objective :

This course introduces formation of Z bus of a transmission line, power flow studies by various methods. It also deals with short circuit analysis and analysis of power system for steady state and transient stability.

UNIT -I Power System Network Matrices-1

Graph Theory: Definitions, Bus Incidence Matrix, Y_{bus} formation by Direct and Singular Transformation Methods, Numerical Problems.

UNIT -II Power System Network Matrices-2

Formation of Z_{BUS} : Partial network, Algorithm for the Modification of Z_{BUS} Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems).- Modification of Z_{BUS} for the changes in network (Problems)

UNIT -III Power flow Studies-1

Necessity of Power Flow Studies – Data for Power Flow Studies – Derivation of Static load flow equations – Load flow solutions using Gauss Seidel Method: Acceleration Factor, Load flow solution with and without P-V buses, Algorithm and Flowchart. Numerical Load flow Solution for Simple Power Systems (Max. 3-Buses): Determination of Bus Voltages, Injected Active and Reactive Powers (Sample One Iteration only) and finding Line Flows/Losses for the given Bus Voltages.

UNIT – IV Power flow Studies-2

Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution with or without PV Busses- Derivation of Jacobian Elements, Algorithm and Flowchart.

Decoupled and Fast Decoupled Methods.- Comparison of Different Methods – DC load Flow

UNIT – V Short Circuit Analysis-1

Per-Unit System of Representation. Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems.

Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems.

UNIT –VI Short Circuit Analysis-2

Symmetrical Component Theory: Symmetrical Component Transformation, Positive, Negative and Zero sequence components: Voltages, Currents and Impedances.

Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems.

Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedance, Numerical Problems.

UNIT –VII Power System Steady State Stability Analysis

Elementary concepts of Steady State, Dynamic and Transient Stabilities.

Description of: Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State Stability and Methods to improve steady state stability.

UNIT –VIII Power System Transient State Stability Analysis

Derivation of Swing Equation. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation.- Solution of Swing Equation: Point-by-Point Method. Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

TEXT BOOKS:

1. Computer Techniques in Power System Analysis by M.A.Pai, TMH Publications.
2. Modern Power system Analysis – by I.J.Nagrath & D.P.Kothari: Tata McGraw-Hill Publishing company, 2nd edition.

REFERENCE BOOKS:

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.
3. Power System Analysis by Hadi Saadat – TMH Edition.
4. Power System Analysis by B.R.Gupta, Wheeler Publications.

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POWER SYSTEM OPERATION AND CONTROL

Objective :

This subject deals with Economic operation of Power Systems, Hydrothermal schedulings and modeling of turbines, generators and automatic controllers. It emphasizes on single area and two area load frequency control and reactive power control.

UNIT – I Economic Operation of Power Systems-1

Optimal operation of Generators in Thermal Power Stations, - heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected.

UNIT – II Economic Operation of Power Systems-2

Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula.

UNIT – III Hydrothermal Scheduling

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, Scheduling problems-Short term Hydrothermal scheduling problem.

UNIT –IV Modelling of Turbine, Generator and Automatic Controllers

Modelling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models.

Modelling of Generator (Steady State and Transient Models): Description of Simplified Network Model of a Synchronous Machine (Classical Model), Description of Swing Equation (No Derivation) and State-Space II-Order Mathematical Model of Synchronous Machine.

Modelling of Governor: Mathematical Modelling of Speed Governing System – Derivation of small signal transfer function.

Modelling of Excitation System: Fundamental Characteristics of an Excitation system, Ttransfer function, Block Diagram Representation of IEEE Type-1 Model

UNIT – V Single Area Load Frequency Control

Necessity of keeping frequency constant.

Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case.

UNIT – VI Two-Area Load Frequency Control

Load frequency control of 2-area system – uncontrolled case and controlled case, tie-line bias control

UNIT-VII Load Frequency Controllers

Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control.

UNIT – VIII Reactive Power Control

Overview of Reactive Power control – Reactive Power compensation in transmission systems – advantages and disadvantages of different types of compensating equipment for transmission systems; load compensation – Specifications of load compensator, Uncompensated and compensated transmission lines: shunt and Series Compensation.

TEXT BOOKS:

1. Electrical Power Systems by C.L.Wadhwa, Newage International-3rd Edition
2. *Modern Power System Analysis* – by I.J.Nagrath & D.P.Kothari Tata M Graw – Hill Publishing Company Ltd, 2nd edition.

REFERENCE BOOKS:

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., THOMPSON, 3rd Edition.
2. Electric Energy systems Theory – by O.I.Elgerd, Tata Mc Graw-hill Publishing Company Ltd., Second edition.
3. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
4. Power System Analysis by Hadi Saadat – TMH Edition.

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**H.V.D.C. TRANSMISSION
(ELECTIVE-I)**

Objective :

This subject deals with the importance of HVDC transmission, analysis of HVDC converters, Faults and protections, Harmonics and Filters. It also deals with Reactive power control and Power factor improvements of the system.

UNIT – I BASIC CONCEPTS

Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC & DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

UNIT – II ANALYSIS OF HVDC CONVERTERS

Choice of Converter configuration – analysis of Graetz – characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star – star mode – their performance.

UNIT – III CONVERTER & HVDC SYSTEM CONTROL

Principal of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

UNIT-IV REACTIVE POWER CONTROL IN HVDC

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies-sources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

UNIT –V POWER FLOW ANALYSIS IN AC/DC SYSTEMS

Modelling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC loadflow – P.U. System for d.c. quantities-solution of AC-DC Power flow-Simultaneous method-Sequential method.

UNIT-VI CONVERTER FAULT & PROTECTION

Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference.

UNIT – VII HARMONICS

Generation of Harmonics –Characteristics harmonics,calculation of AC Harmonics,Non- Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics

UNIT-VIII FILTERS

Types of AC filters,Design of Single tuned filters –Design of High pass filters.

TEXT BOOKS:

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar, New Age International (P) Limited, and Publishers.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao.

REFERENCE BOOKS:

1. HVDC Transmission – J.Arrillaga.
2. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.
3. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications.

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**EHV AC TRANSMISSION
(Elective-I)**

Unit – I: Preliminaries:

Necessity of EHV AC transmission – advantages and problems–power handling capacity and line losses- mechanical considerations – resistance of conductors – properties of bundled conductors – bundle spacing and bundle radius- Examples.

Unit – II: Line and ground reactive parameters:

Line inductance and capacitances – sequence inductances and capacitances – modes of propagation – ground return - Examples

Unit – III: Voltage gradients of conductors:

Electrostatics – field of sphere gap – field of line charges and properties – charge – potential relations for multi-conductors – surface voltage gradient on conductors – distribution of voltage gradient on sub-conductors of bundle – Examples.

Unit – IV: Corona effects – I:

Power loss and audible noise (AN) – corona loss formulae – charge voltage diagram – generation, characteristics - limits and measurements of AN – relation between 1-phase and 3-phase AN levels – Examples.

Unit – V: Corona effects – II:

Radio interference (RI) - corona pulses generation, properties, limits – frequency spectrum – modes of propagation – excitation function – measurement of RI, RIV and excitation functions – Examples.

Unit – VI: Electro static field:

Electrostatic field: calculation of electrostatic field of EHV/AC lines – effect on humans, animals and plants – electrostatic induction in unenergised circuit of double-circuit line – electromagnetic interference-Examples.

Unit- VII: Traveling wave theory

Traveling wave expression and solution- source of excitation- terminal conditions- open circuited and short-circuited end- reflection and refraction coefficients-Lumped parameters of distributed lines-generalized constants-No load voltage conditions and charging current.

Unit –VIII: Voltage control:

Power circle diagram and its use – voltage control using synchronous condensers – cascade connection of shunt and series compensation – sub synchronous resonance in series capacitor – compensated lines – static VAR compensating system.

TEXT BOOKS:

1. EHVAC Transmission Engineering by R. D. Begamudre, New Age International (p) Ltd.
2. HVAC and DC Transmission by S. Rao

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**HIGH VOLTAGE ENGINEERING
(ELECTIVE-I)**

Objective ;

This subject deals with the detailed analysis of Breakdown occur in gaseous, liquids and solid dielectrics. Information about generation and measurement of High voltage and current. In addition the High voltage testing methods are also discussed.

UNIT I INTRODUCTION TO HIGH VOLTAGE TECHNOLOGY AND APPLICATIONS

Electric Field Stresses, Gas / Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

UNIT II BREAK DOWN IN GASEOUS AND LIQUID DIELECTRICS

Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids.

UNIT III BREAK DOWN IN SOLID DIELECTRICS

Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

UNIT IV GENERATION OF HIGH VOLTAGES AND CURRENTS

Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators.

UNIT V MEASUREMENT OF HIGH VOLTAGES AND CURRENTS

Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

UNIT VI OVER VOLTAGE PHENOMENON AND INSULATION CO-ORDINATION

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

UNIT VII NON-DSTRUCTIVE TESTING OF MATERIAL AND ELECTRICAL APPARATUS

Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements.

UNIT VIII HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS

Testing of Insulators and bushings, Testing of Isolators and circuit breakers, Testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements.

TEXT BOOKS:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition
2. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition.

REFERENCE BOOKS:

1. High Voltage Engineering by C.L.Wadhwa, New Age International (P) Limited, 1997.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.

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**RELIABILITY ENGINEERING AND APPLICATIONS TO POWER SYSTEMS
(ELECTIVE-II)**

UNIT – I Basics of Probability theory & Distribution

Basic probability theory – rules for combining probabilities of events – Bernoulli's trials – probabilities density and distribution functions – binomial distribution – expected value and standard deviation of binomial distribution.

UNIT – II Network Modelling and Reliability Analysis

Analysis of Series, Parallel, Series-Parallel networks – complex networks – decomposition method.

UNIT – III Reliability functions

Reliability functions $f(t)$, $F(t)$, $R(t)$, $h(t)$ and their relationships – exponential distribution – Expected value and standard deviation of exponential distribution – Bath tub curve – reliability analysis of series parallel networks using exponential distribution – reliability measures MTTF, MTTR, MTBF.

UNIT – IV Markov Modelling

Markov chains – concept of stochastic transitional probability Matrix, Evaluation of limiting state Probabilities. – Markov processes one component repairable system – time dependent probability evaluation using Laplace transform approach – evaluation of limiting state probabilities using STPM – two component repairable models.

UNIT – V Frequency & Duration Techniques

Frequency and duration concept – Evaluation of frequency of encountering state, mean cycletime, for one , two component repairable models – evaluation of cumulative probability and cumulative frequency of encountering of merged states.

UNIT – VI Generation System Reliability Analysis

Reliability model of a generation system– recursive relation for unit addition and removal – load modeling - Merging of generation load model – evaluation of transition rates for merged state model – cumulative Probability, cumulative frequency of failure evaluation – LOLP, LOLE.

UNIT – VII Composite Systems Reliability Analysis

Decompositions method – Reliability Indices – Weather Effects on Transmission Lines.

UNIT – VIII Distribution System and Reliability Analysis

Basic Concepts – Evaluation of Basic and performance reliability indices of radial networks.

TEXT BOOKS:

1. Reliability Evaluation of Engg. System – R. Billinton, R.N.Allan, Plenum Press, New York, reprinted in India by B.S.Publications, 2007.
2. Reliability Evaluation of Power systems – R. Billinton, R.N.Allan, Pitman Advance Publishing Program, New York, reprinted in India by B.S.Publications, 2007.

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**NON-CONVENTIONAL SOURCES OF ENERGY
(ELECTIVE-II)**

Objective :

It introduces solar energy its radiation, collection, storage and application. It also introduces the Wind energy, Biomass energy, Geothermal energy and ocean energy as alternative energy sources.

UNIT – I

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT-III

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-IV

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

UNIT-V

BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

UNIT-VI

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

UNIT-VII

OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-VIII

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, seebeck, peltier and joul Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1. Non-Conventional Energy Sources /G.D. Rai
2. Renewable Energy Technologies /Ramesh & Kumar /Narosa

REFERENCE BOOKS:

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
3. Non-Conventional Energy Systems / K Mittal /Wheeler
4. Solar Energy /Sukhame

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**ELECTRICAL DISTRIBUTION SYSTEMS
(ELECTIVE-II)**

UNIT – 1 GENERAL CONCEPTS

Introduction to distribution systems, Load modelling and characteristics. Coincidence factor, contribution factor loss factor - Relationship between the load factor and loss factor. Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

UNIT – II DISTRIBUTION FEEDERS

Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of the secondary distribution system.

UNIT – III SUBSTATIONS

Location of Substations: Rating of distribution substation, service area within primary feeders. Benefits derived through optimal location of substations.

UNIT – IV SYSTEM ANALYSIS

Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines.

UNIT – V PROTECTION

Objectives of distribution system protection, types of common faults and procedure for fault calculations. Protective Devices: Principle of operation of Fuses, Circuit Reclosures, line sectionalizes, and circuit breakers

UNIT – VI COORDINATION

Coordination of Protective Devices: General coordination procedure.

UNIT – VII COMPENSATION FOR POWER FACTOR IMPROVEMENT

Capacitive compensation for power-factor control.

Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched),
Power factor correction, capacitor allocation - Economic justification - Procedure to determine the best capacitor location.

UNIT – VIII VOLTAGE CONTROL

Voltage Control: Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.

TEXT BOOK:

1. "Electric Power Distribution system, Engineering" – by Turan Gonen, Mc Graw-hill Book Company.
2. Electric Power Distribution – by A.S. Pabla, Tata Mc Graw-hill Publishing company, 4th edition, 1997.

REFERENCE BOOK:

1. Electrical Power Distribution and Automation by S.Sivanagaraju, V.Sankar, Dhanpat Rai & Co, 2006
2. Electrical Power Distribution Systems by V.Kamaraju, Right Publishers.

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MICROPROCESSORS AND MICROCONTROLLERS LAB

I . Microprocessor 8086:

Introduction to MASM/TASM.

Arithmetic operation – Multi byte addition and subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.

Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.

By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.

Modular Program: Procedure, Near and Far implementation, Recursion.

Dos/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.

II. Interfacing

8259 – Interrupt Controller.

8279 – Keyboard Disply.

8255 – PPI.

8251 – USART.

III. Mcrocontroller 8051:

1. Reading and Writing on a parallel port.
2. Timer in different modes.
3. Serial communication implementation.
4. Understanding three memory areas of 00 – FF (Programs using above areas).
5. Using external interrupts
6. Programs using special instructions like swap, bit/byte, set/reset etc.
7. Programs based on short, page, absolute addressing.

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ELECTRICAL MEASUREMENTS LAB

The following experiments are required to be conducted as compulsory experiments:

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Measurement of % ratio error and phase angle of given C.T. by comparison.
6. Schering bridge & Anderson bridge.
7. Measurement of 3 phase reactive power with single-phase wattmeter.
8. Measurement of parameters of a choke coil using 3 voltmeter and 3 ammeter methods.

In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted:

9. Optical bench – Determination of polar curve measurement of MHCP of filament lamps
10. Calibration LPF wattmeter – by Phantom testing
11. Measurement of 3 phase power with single watt meter and 2 No's of C.T.
12. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given C.T. by Null method.
13. P.T. testing by comparison – V.G. as Null detector – Measurement of % ratio error and phase angle of the given P.T.
14. Dielectric oil testing using H.T. testing Kit
15. LVDT and capacitance pickup – characteristics and Calibration
16. Resistance strain gauge – strain measurements and Calibration
17. Polar curve using Lux meter, Measurement of intensity of illumination of fluorescent lamp.
18. Transformer turns ratio measurement using a.c. bridge.
19. Relay testinf using secondary current injection set for over current & reverse current.
20. A.C. Potentiometer – Polar form/Cartesian form – Calibration of AC Voltmeter, Parameters of Choke.
21. Measurement of Iron loss in a bar specimen using a CRO and using a wattmeter.