10EE71 COMPUTER TECHNIQUES IN POWER SYSTEM ANALYSIS

Subject Code	:	**10EE71**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

NETWORK TOPOLOGY: Introduction, Elementary graph theory – oriented graph, tree, co-tree, basic cut-sets, basic loops; Incidence matrices – Element-node, Bus incidence, Tree-branch path, Basic cut-set, Augmented cut-set, Basic loop and Augmented loop, Primitive network – impedance form and admittance form. **6 Hours**

UNIT - 2

NETWORK MATRICES: Introduction, Formation of Y_{BUS} by method of inspection (including transformer off-nominal tap setting) and method of singular transformation ($Y_{BUS} = A^T yA$), Formation of Bus Impedance matrix by step by step building algorithm (without mutual coupling elements). **6 Hours**

UNIT - 3 & 4

LOAD FLOW STUDIES: Introduction, Power flow equations, Classification of buses, Operating constraints, Data for load flow, Gauss-Seidal Method – Algorithm and flow chart for PQ and PV buses (numerical problem for one iteration only), Acceleration of convergence; Newton Raphson's Method – Algorithm and flow chart for NR method in polar coordinates (numerical problem for one iteration only). Algorithm for Fast Decoupled load flow method, Comparison of Load Flow Methods. **14 Hours**

PART - B

UNIT - 5 & 6

ECONOMIC OPERATION OF POWER SYSTEM: Introduction, Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation scheduling including generator limits and neglecting losses; Iterative techniques; Economic Dispatch including transmission losses – approximate penalty factor, iterative technique for solution of economic dispatch with losses; Derivation of transmission loss formula; Optimal scheduling for Hydrothermal plants – problem formulation, solution procedure and algorithm. **12 Hours**

UNIT - 7 & 8

TRANSIENT STABILITY STUDIES: Numerical solution of Swing Equation – Point-by-point method, Modified Euler's method, Runge-Kutta method, Milne's predictor corrector method. Representation of power system for transient stability studies – load representation, network performance equations. Solution techniques with flow charts. **14 Hours**

TEXT BOOKS:

1. **Computer Methods in Power System Analysis,** Stag, G. W., and EI-Abiad, A. H.- McGraw Hill International Student Edition. 1968
2. **Computer Techniques in Power System Analysis**, Pai, M. A- TMH, 2nd edition, 2006.

REFERENCE BOOKS:

1. **Modern Power System Analysis,** Nagrath, I. J., and Kothari, D. P, TMH,3rd Edition, 2003.
2. **Advanced Power System Analysis and Dynamics**, Singh, L. P, New Age International (P) Ltd, New Delhi, 2001.
3. **Computer Aided Power System Operations and Analysis**"- Dhar, R. N, TMH, 1984.
4. **Power System Analysis,** Haadi Sadat, TMH, 2nd Edition, 12th reprint, 2007

10EE72 ELECTRICAL POWER UTILIZATION

Subject Code	:	**10EE72**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

HEATING AND WELDING: Advantages and methods of electric of heating, resistance ovens, induction heating, dielectric heating, the arc furnace, heating of building. Electric welding, resistance and arc welding, control devices and welding equipment. **10 Hours**

UNIT - 2

ELECTROLYTIC PROCESS: Fundamental principles, extraction, refining of metals and electroplating. Factors affecting electro deposition process, power supply for electrolytic process. **6 Hours**

UNIT - 3 & 4

ILLUMINATION: Laws of illumination, lighting calculation, factory lighting, flood lighting, street lighting, different types of lamps-incandescent, fluorescent, vapor, CFL and LED lamps and their working, comparision, Glare and its remedy. **10 Hours**

PART - B

UNIT - 5, 6 & 7

ELECTRIC TRACTION: Introduction, requirements of an ideal traction,systems of traction, speed time curve, tractive effort,co-efficient of adhesion, selection of traction motors, method of speed control, energy saving by series parallel control, ac traction equipment. AC series motor, characteristics, regenerative braking, linear induction motor and their use. AC traction, diesel electric equipment, trains lighting system, specific energy, factors affecting specific energy consumption. **20 Hours**

UNIT - 8

INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES: Configuration and performance of electrical vehicles, traction motor characteristics, tractive effort, transmission requirement, vehicle performance and energy consumption. **6 Hours**

TEXT BOOKS:

1. **Utilization Of Electric Energy,**E Openshaw Taylor, 12th Impression,2009,Universities Press.
2. **Modern Electric, Hybrid Electric and Fuel Cell Vehicles**, Mehrdad, Ehsani, Yimin Gao, Sabastien. E. Gay, Ali Emadi- CRC Press.

REFERENCE BOOKS:

1. **A Course in Electrical Power**, Soni Gupta and Bhatnager-Dhanapat Rai & sons.
3. **Electrical Power,** Dr. S.L.Uppal, Khanna Publications

10EE73 HIGH VOLTAGE ENGINEERING

Subject Code	:	**10EE73**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Introduction to HV technology, need for generating high voltages in laboratory. Industrial applications of high voltage, Electrostatic precipitation, separation, painting and printing.

6Hours

UNIT - 2 & 3

BREAKDOWN PHENOMENA: Classification of HV insulating media. Properties of important HV insulating media under each category. Gaseous dielectrics,Ionization: primary and secondary ionization processes. Criteria for gaseous insulation breakdown based on Townsend's theory. Limitations of Townsend's theory. Streamer's theory breakdown in non uniform fields. Corona discharges. Breakdown in electro negative gases. Paschen's law and its significance. Time lags of Breakdown. Breakdown in solid dielectrics: Intrinsic Breakdown, avalanche breakdown, thermal breakdown, and electro mechanic breakdown. Breakdown of liquid dielectrics: Suspended particle theory, electronic Breakdown, cavity breakdown (bubble's theory), electro convection breakdown. **12 Hours**

UNIT - 4

GENERATION OF HV AC AND DC VOLTAGE: HV AC-HV transformer; Need for cascade connection and working of transformers units connected in cascade. Series resonant circuit- principle of operation and advantages. Tesla coil. HV DC- voltage doubler circuit, cock croft- Walton type high voltage DC set. Calculation of high voltage regulation, ripple and optimum number of stages for minimum voltage drop. **8 Hours**

Part - B

UNIT - 5

GENERATION OF IMPULSE VOLTAGE AND CURRENT: Introduction to standard lightning and switching impulse voltages. Analysis of single stage impulse generator-expression for Output impulse voltage. Multistage impulse generator working of Marx impulse. Rating of impulse generator. Components of multistage impulse generator. Triggering of impulse generator by three electrode gap arrangement. Trigatron gap and oscillograph time sweep circuits. Generation of switching impulse voltage. Generation of high impulse current. **6 Hours**

UNIT - 6

MEASUREMENT OF HIGH VOLTAGES: Electrostatic voltmeter-principle, construction and limitation. Chubb and Fortescue method for HV AC measurement. Generating voltmeter- Principle, construction. Series resistance micro ammeter for HV DC measurements. Standard sphere gap measurements of HV AC, HV DC, and impulse voltages; Factors affecting the measurements. Potential dividers-resistance dividers capacitance dividers mixed RC potential dividers. Measurement of high impulse currents-Rogogowsky coil and Magnetic Links. **10 Hours**

UNIT - 7

NON-DESTRUCTIVE INSULATION TESTING TECHNIQUES: Dielectric loss and loss angle measurements using Schering Bridge, Transformer ratio Arms Bridge. Need for discharge detection and PD measurements aspects. Factor affecting the discharge detection. Discharge detection methods-straight and balanced methods. **6 Hours**

UNIT - 8

HIGH VOLTAGE TESTS ON ELECTRICAL APPARATUS: Definitions of terminologies, tests on isolators, circuit breakers, cables insulators and transformers. **4 Hours**

TEXT BOOKS:

1. **High Voltage Engineering**, M.S.Naidu and Kamaraju- 4th Edition, THM, 2008.
2. **High Voltage Engineering Fundamentals**, E.Kuffel and W.S. Zaengl, 2nd Edition, Elsevier Press, 2005.
3. **High Voltage Engineering** ,C.L.Wadhwa, New Age International Private limited, 1995.

REFERENCE BOOKS:

1.**High Voltage Engineering Theory and Practice,** Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, Roshdy Radwan, 2nd Edn(Revised & Expanded) Marcel-Dekker Publishers(Special Indian Edn.).

10EE74 INDUSTRIAL DRIVES & APPLICATIONS

Subject Code	:	**10EE74**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

AN INTRODUCTION TO ELECTRICAL DRIVES & ITS DYNAMICS: Electrical drives. Advantages of electrical drives. Parts of electrical drives, choice of electrical drives, status of dc and ac drives, Dynamics of electrical drives, Fundamental torque equation, speed torque conventions and multiquadrant operation. Equivalent values of drive parameters, components of low torques, nature and classification of load torques, calculation of time and energy loss in transient operations, steady state stability, load equalization. **9 Hours**

UNIT - 2

SELECTION OF MOTOR POWER RATING: Thermal model of motor for heating and cooling, Classes of motor duty, determination of motor rating. **5 Hours**

UNIT - 3 & 4

D C MOTOR DRIVES:

(a) Starting braking, transient analysis, single phase fully controlled rectifier, control of separately excited dc motor, Single-phase half controlled rectifier control of separately excited dc motor.

(b) Three phase fully controlled rectifier - control of separately excited dc motor, three phase half controlled rectifier - control of separately excited dc motor, multi-quadrant operation of separately excited dc motor fed from fully controlled rectifier. Control of dc series motor, chopper controlled dc drives-separately excited dc motor and series motor. **12 Hours**

PART - B

UNIT - 5

INDUCTION MOTOR DRIVES:

Operation with unbalanced source voltage and single phasing, operation with unbalanced rotor impedances, analysis of induction motor fed from non-sinusoidal voltage supply, starting braking, transient analysis.

06 Hours

UNIT - 6

Stator voltage control:

Variable voltage and variable frequency control, voltage source inverter control, closed loop control, current source inverter control, , rotor resistance control, slip power recovery, speed control of single phase induction motors. **06 Hours**

UNIT - 7

SYNCHRONOUS MOTOR DRIVES: Operation from fixed frequency supply, synchronous motor variable speed drives, variable frequency control of multiple synchronous motors. Self-controlled synchronous motor drive employing load commutated thyrister inverter. **10 Hours**

UNIT - 8

INDUSTRIAL DRIVES: Rolling mill drives, cement mill drives, paper mill drives and textile mill drives.

4 Hours

TEXT BOOK:

1. **Fundamentals of Electrical Drives**, G.K Dubey , Narosa publishing house, 2nd Edition,2002.

REFERENCE BOOKS:

1. **Electrical Drives**, N.K De and P.K. Sen- PHI, 2009.
2. **A First Course On Electric Drives**, S.K Pillai-Wiley Eastern Ltd 1990.
3. **Power Electronics, Devices, Circuits and Industrial Applications**, V.R. Moorthi, "Oxford University Press, 2005.
4. **Electric Motor Drives,Modeling,Analysis and Control**, R.Krishnan,PHI,2008.

ELECTIVES-II(GROUP **B)**

10EE751 HVDC TRANSMISSION

Subject Code	:	**10EE751**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

GENERAL ASPECTS OF DC TRANSMISSION AND COMPARISON OF IT WITH AC TRANSMISSION: Historical sketch, constitution of EHV AC and DC links, Limitations and Advantages of AC and DC Transmission**.** **12 Hours**

UNIT - 3 & 4

CONVERTER CIRCUITS: Valve Characteristics, Properties of converter circuits, assumptions, single phase, three phase converters, choice of best circuits for HV DC circuits. **12 Hours**

PART - B

UNIT - 5

ANALYSIS OF THE BRIDGE CONVERTER: Analysis with grid control but no over lap, Analysis with grid control and with over lap less than 60 deg, Analysis with overlap greater than 60 deg, complete characteristics of rectifier, Inversion. **10 Hours**

UNIT - 6 & 7

CONTROL OF HVDC CONVERTERS AND SYSTEMS: grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control. **10 Hours**

UNIT - 8

PROTECTION: Introduction, DC reactor, voltage oscillations and valve dampers, current oscillations and anode dampers, DC line oscillations and line dampers, clear line faults and reenergizing the line. **8 Hours**

TEXT BOOKS:

1. **Direct current Transmission,** EW Kimbark,
2. **Power system stability and control,** Prabha Kundur, TMH, 9th reprint, 2007.
3. **High Voltage Power Transmission:The HVDC Options,** Jos Arrillaga, Y.H.Liu and Mevelle R Watson, Wiley Interscience.
4. **High Voltage D.C.Power Transmission System,** K.R.Padiyar,New Age International Publishers Ltd.

10EE752 PROGRAMMABLE LOGIC CONTROLLERS

Subject Code	:	10EE752	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUTION: Introduction to Programmable logic controller (PLC), role in automation (SCADA), advantages and disadvantages, hardware, internal architecture, sourcing and sinking, characteristics of I/O devices, list of input and output devices, examples of applications. I/O processing, input/output units, signal conditioning, remote connections, networks, processing inputs I/O addresses. **7 Hours**

UNIT - 2

ROGRAMMING: Ladder programming- ladder diagrams, logic functions, latching, multiple outputs, entering programs, functional blocks, programme examples like location of stop and emergency switches **8 Hours**

UNIT - 3 & 4

PROGRAMMING LANGUAGES: Instruction list, sequential functions charts & structured text, jump and call subroutines**.** **10 Hours**

PART - B

UNIT - 5

INTERNAL RELAYS: ladder programmes, battery- backed relays, one - shot operation, set and reset, master control relay. **5 Hours**

UNIT - 6 & 7

Timers and counters: Types of timers, programming timers, ON and OFF- delay timers, pulse timers, forms of counter, programming, up and down counters, timers with counters, sequencer. **12 Hours**

UNIT - 8

Shift register and data handling: shift registers, ladder programs, registers and bits, data handling, arithmetic functions, temperature control and bottle packing applications. **10 Hours**

Note: Programming is to be with reference to only Mitsubhish PLC

TEXT BOOKS:

1. **Programmable Logic controllers-**W Bolton, 5th edition, Elsevier- newness, 2009.
2. **Programmable logic controllers - principles and applications"-**John W Webb, Ronald A Reis, Pearson education, 5th edition, 2nd impression, 2007.

REFERENCE BOOKS:

1. **Programmable Controller Theory and Applications**,L. A Bryan, E. A Bryan, An industrial text company publication, 2nd edition, 1997.
2. **Programmable Controllers, An Engineers Guide-**E. A Paar, newness, 3rd edition, 2003.

10EE753 ARTIFICIAL NEURAL NETWORK

Subject Code	:	**10EE753**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

Introduction, history, structure and function of single neuron, neural net architectures, neural learning, use of neural networks. **7 Hours**

UNIT - 2

Supervised learning, single layer networks, perceptrons, linear separability, perceptron training algorithm, guarantees of success, modifications. **6 Hours**

UNIT - 3

Multiclass networks-I, multilevel discrimination, back propagation, setting parameter values, theoretical results. **6 Hours**

UNIT - 4

Accelerating learning process, application, Madaline adaptive multilayer networks. **7 Hours**

PART - B

UNIT - 5

Prediction networks, radial basis functions, polynomial networks, regularization, unsupervised learning, winner-take-all networks. **7 Hours**

UNIT - 6

Learning vector quantizing, counter propagation networks, adaptive resonance theorem, toplogically organized networks, distance based learning, recognition. **6 Hours**

UNIT - 7

Associative models, Hop Field networks, brain state networks, Boltzmann machines, hetero associations. **7 Hours**

UNIT - 8

Optimization using Hopfiled networks, simulated annealing, random search, evolutionary computation. **6 Hours**

TEXT BOOKS:

1. **Elements Of Artificial Neural Networks** -Kishan Mehrotra, C. K. Mohan, Sanjay Ranka, Penram, 1997
2. **Artificial Neural Networks**- R, Schalkoff, McGraw Hill, 1997.

REFERENCE BOOKS:

1.Neural Network Design- Hagan, Demuth and Beale Cengage,2nd Edition

2.Introduction To Artificial Neural Systems- J. Zurada, Jaico, 2003

3.Neural Networks -Haykins, PHI, 1999.

4. Artificial Neural Networks, B. Yegnanarayana ,PHI,2009 Edition.

10EE754 OPERATING SYSTEM

Subject Code	:	10EE754	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART- A

UNIT – 1

INTRODUCTION TO OPERATING SYSTEM, SYSTEM STRUCTURES: What operating system do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. **6 Hours**

UNIT - 2

Process Management: Process concept; Process scheduling; Operations on processes; Inter-process communication. Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling. **7 Hours**

UNIT - 3

PROCESS SYNCHRONIZATION: Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors. **7 Hours**

UNIT - 4

DEADLOCKS: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **6 Hours**

PART – B

UNIT - 5

MEMORY MANAGEMENT: Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.**7 Hours**

UNIT - 6

FILE SYSTEM, IMPLEMENTATION OF FILE SYSTEM: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. **7 Hours**

UNIT - 7

SECONDARY STORAGE STRUCTURES, PROTECTION: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems. **6 Hours**

UNIT - 8

CASE STUDY: THE LINUX OPERATING SYSTEM: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter-process communication. **6 Hours**

TEXT BOOK:

1. **Operating System Principles –** Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley, 8th Edition, 2009.

REFERENCE BOOKS:

1. **Operating Systems: A Concept Based Approach** – D.M Dhamdhere, TMH, 2nd Edition,2006.
2. **Operating Systems,** P.C.P. Bhatt, PHI, 2nd Edition, 2008.
3. **Operating Systems,**Harvey M Deital,Pearson Education, 3rd Edition.

10EE755 DIGITAL SYSTEM DESIGN WITH VHDL

Subject Code	:	**10EE755**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter. **10 Hours**

UNIT - 2

DESIGNING WITH PROGRAMMABLE LOGIC DEVICES: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PALs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner. **5 Hours**

UNIT - 3

DESIGN OF NETWORKS FOR ARITHMETIC OPERATIONS: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider. **5 Hours**

UNIT - 4

DIGITAL DESIGN WITH SM CHARTS: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines. **6 Hours**

PART - B

UNIT - 5

DESIGNING WITH PROGRAMMABLE GATE ARRAYS AND COMPLEX PROGRAMMABLE LOGIC DEVICES: Xilinx 3000 series FPGAs, Designing with FPGAs, Xilinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.

6 Hours

UNIT - 6

FLOATING-POINT ARITHMETIC: Representation of floating-point numbers, Floating-point multiplication, Other floating-point operations. **6 Hours**

UNIT - 7

ADDITIONAL TOPICS IN VHDL: Attributes, Transport and Inertial delays, Operator overloading, Multivalued logic and signal resolution, IEEE-1164 standard logic, Generics, Generate statements, Synthesis of VHDL code, Synthesis examples, Files and TEXTIO. **7 Hours**

UNIT - 8

VHDL MODELS FOR MEMORIES AND BUSES: Static RAM, A simplified 486 bus model, interfacing memory to a microprocessor bus. **7 Hours**

TEXT BOOKS:

1. **Digital Systems Design Using VHDL,**Charles H. Roth. Jr, Cengage, 2010.
2. **Digital Electronics And Design With VHDL,** A. Pedroni, Volnet, Elsevier, 1st edition, 2008

REFERENCE BOOKS:

1. **Fundamentals of Digital Logic with VHDL Design,**Stephen Brwon & Zvonko Vranesic, TMH,2nd Edition 2006
2. **Digital Fundamentals using VHDL,**Floyd, Pearson Education, 2003,
3. **VHDL Primer**, J. Bhaskar , PHI, 2009.

10EE756 TESTING AND COMMISSIONING OF ELECTRICAL EQUIPMENT

Subject Code	:	**10EE756**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

TRANSFORMERS:

a. Specifications: Power and distribution transformers as per BIS standards.

b. Installation: Location, site, selection, foundation details (like bolts size, their number, etc), code of practice for terminal plates, polarity & phase sequence, oil tanks, drying of windings and general inspection.

5 Hours

c. Commissioning tests: Following tests as per national & International Standards, volt ratio test, earth resistance, oil strength, Bucholz & other relays, tap changing gear, fans & pumps, insulation test, impulse test, polarizing index, load & temperature rise test.

7 Hours

d. Specific Tests: Determination of performance curves like efficiency, regulation etc, and determination of mechanical stress under normal &abnormal conditions.

3 Hours

UNIT - 3 & 4

SYNCHRONOUS MACHINES:

a. Specifications: As per BIS standards.

b. Installation: Physical inspection, foundation details, alignments, excitation systems, cooling and control gear, drying out.

c. Commissioning Tests: Insulation, Resistance measurement of armature & field windings, waveform & telephone interference tests, line charging capacitance.

4 Hours

d. Performance tests: Various tests to estimate the performance of generator operations, slip test, maximum lagging current, maximum reluctance power tests, sudden short circuit tests, transient & sub

transient parameters, measurements of sequence impedances, capacitive reactance, and separation of losses, temperature rise test, and retardation tests.

6 Hours

e. Factory tests: Gap length, magnetic eccentricity, balancing vibrations, bearing performance.

2 Hours

PART - B

UNIT - 5, 6 & 7
INDUCTION MOTORS:
a. **Specifications** for different types of motors, Duty, I.P. protection.

2 Hours

b. Installation: Location of the motors (including the foundation details) & its control apparatus, shaft & alignment for various coupling, fitting of pulleys & coupling, drying of windings.

4 Hours

c. Commissioning Test: Mechanical tests for alignment, air gap symmetry, tests for bearings, vibrations & balancing.

5 Hours

Electrical Tests: Insulation test, earth resistance, high voltage test, starting up, failure to speed up to take the load, type of test, routine test, factory test and site test (in accordance with ISI code

4 Hours

d. Specific Tests: Performance & temperature raise tests, stray load losses, shaft alignment, and re-rating & special duty capability.

4 Hours

UNIT - 8
SWITCH GEAR & PROTECTIVE DEVICES: Standards, types, specification, installation, commissioning tests, maintenance schedule, type & routine tests.

6 Hours

TEXT BOOKS:

1. **Testing & Commissioning Of Electrical Equipment** -S. Rao,Khanna Publishers,2004
2. **Testing & Commissioning Of Electrical Equipment** -B .V. S. Rao, Media Promoters and Publication Pvt., Ltd.

REFERENCE BOOKS:

1. **Relevant Bureau of Indian Standards**
2. **A Handbook on Operation and Maintenance of Transformers**- H. N. S. Gowda, Published by H. N. S. Gowda,2006
3. **Handbook of SwitchGears,**BHEL, TMH,2005.
4 **J and P Transformer Book**,Elsevier Publication.

ELECTIVES-II (GROUP **C)**

10EE761 POWER SYSTEMPLANNING

Subject Code	:	**10EE761**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION OF POWER PLANNING, National and regional planning, structure of power system, planning tools, electricity regulation, Load forecasting, forecasting techniques, modeling. **8 Hours**

UNIT - 2 & 3

GENERATION PLANNING, Integrated power generation, co-generation / captive power, power pooling and power trading, transmission & distribution planning, power system economics, power sector finance, financial planning, private participation, rural electrification investment, concept of rational tariffs.

10 Hours

UNIT - 4

COMPUTER AIDED PLANNING: Wheeling, environmental effects, green house effect, technological impacts, insulation co-ordination, reactive compensation. **8 Hours**

PART - B

UNIT - 5 & 6

POWER SUPPLY RELIABILITY, reliability planning, system operation planning, load management, load prediction, reactive power balance, online power flow studies, test estimation, computerized management. Power system simulator**.** **10 Hours**

UNIT - 7 & 8

Optimal Power system expansion planning, formulation of least cost optimization problem incorporating the capital, operating and maintenance cost of candidate plants of different types (thermal hydro nuclear non conventional etc), Optimization techniques for solution by programming. **16 Hours**

TEXT BOOK:

1. **Electrical Power System Planning,** A.S.Pabla, Macmillan India Ltd, 1998

10EE762 COMPUTER CONTROL OF ELECTRICAL DRIVES

Subject Code	:	10EE762	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

REVIEW OF MICRO CONTROLLERS IN INDUSTRIAL DRIVES SYSTEM: Typical Micro controller's 8 bit 16 bit (only block diagram) Digital Data Acquisition system, voltage sensors, current sensors, frequency sensors and speed sensors. **4 Hours**

UNIT - 2

EVOLUTION OF POWER ELECTRONICS IN DRIVES: Power semiconductors devices used for drives control, GTO, BJT, power MOSFET, IGBT, MCT and IGCT structures, Ratings, comparison and their applications. Block diagram of power integrated circuit for D C motor drives. **4Hours**

UNIT - 3

A C MACHINE DRIVES: general classification and National Electrical Manufacturer Association (NEMA) classification, Speed control of Induction motors with variable voltage constant frequency, constant voltage variable frequency, (v/f) constant operation, drive operating regions. Variable stator current operation. Effect of Harmonics. **9 Hours**

UNIT - 4

SYNCHRONOUS MACHINE DRIVES: Wound field machine, comparison of Induction and wound field synchronous machines, Torque angle characteristics of salient pole synchronous machines, synchronous reluctance permanent magnet synchronous machines (SPM), variable reluctance machines (VRM).
8 Hours

PART - B

UNIT - 5

PHASE CONTROLLED CONVERTERS: Converter controls, Linear firing angle control, cosine wave crossing control, phase locked Oscillator principle, Electrro magnetic Interference (EMI) and line power quality problems, cyclo converters, voltage fed converters, Rectifiers, Current fed converters. **7 Hours**

UNIT - 6

PRINCIPLES OF SLIP POWER RECOVERY SCHEMES: Static Kramer's drive system, block schematic diagram, phasor diagram and limitations, Static Scherbins scheme system using D.C link converters with cyclo converter modes of operation, modified Scherbins Drive for variable source, constant frequency (VSCF) generation. **6 Hours**

UNIT - 7

PRINCIPLE OF VECTOR CONTROL OF A C DRIVES: Phasor diagram, digital Implementation block diagram, Flux vector estimation, indirect vector control block diagram with open loop flux control, synchronous motor control with compensation. **6 Hours**

UNIT - 8

EXPERT SYSTEM APPLICATION TO DRIVES (ONLY BLOCK DIAGRAM): Expert system shell, Design methodology, ES based P-I tuning of vector controlled drives system, Fuzzy logic control for speed controller in vector control drives,structure of fuzzy control in feedback system. **8 Hours**

TEXT BOOKS:

1. **Power Electronics & Motor Drives,**Bimal Bose, Elsevier 2006

2. **Modern Power Electronics & Drives,**Bimal K. Bose, Pearson Education 2003.

REFERENCE BOOK:

1. **Advanced Microprocessor and Interfacing,** Badri Ram, TMH, 1st Edition.

10EE763 DATA STRUCTURES

Subject Code	:	**10EE763**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART A

UNIT – 1

Design and Analysis of Algorithms: From problems to programs, Data Structures and Abstract Data types. **04 Hours**

UNIT – 2

Basic Data Type and Trees: Data types List, Implementation of lists, stacks Queues, Mappings, Stacks and recursive procedures. Basic terminology, ADT Tree, / Implementation of trees, Binary trees. **10 Hours**

UNIT – 3

Basic Operation on Sets: Introduction to sets an ADT with union intersection and difference, A Bit-vector implantation sets, A linked list implementation sets, The dictionary, simple dictionary implementation, the Hash table data structures, Estimating the efficiency of functions, Implementation of the mapping ADT, Priority Queues, Implementation of priority queues. **06 Hours**

UNIT – 4

Directed Graphs: Basic Definitions, Representation for directed graphs, the single source short path problems, Traversals of Directed Graphs, Directed A cyclic graphs, strong components. **06 Hours**

PART B

UNIT – 5

Sorting: The internal sorting model, simple sorting schemes, Quick sort Heapsort, Binsorting. **06 Hours**.

UNIT – 6

Algorithm analysis Techniques: Efficiency of algorithms, analysis of receive programs solving Recurrence Equations, A general solution for a large class of Recurrences. **06 Hours**

UNIT – 7

Algorithm Design Techniques: Divide and conquer algorithms, Dynamic programming, Greedy Algorithms, Back tracking, local search algorithms. **08 Hours**.

UNIT – 8

Data structures and Algorithm for external storage: A model of external computation, External sorting, sorting information in files, external search Trees. **08 Hours**

Text Book:

1.Data Structures and Algorithms, Alfred Aho, John E. Hopcroft and Jeffery D Ullaman, Pearson Education.

Reference Books:

1. **Introduction to Data structures and Algorithms with C+** by Gleen. W.Rowe, PHI Publications.
2. **Data structures using C & C++,** Langsam, Angenstein, Tenenbaum ,Pearson, 2nd edition,.
3. **Data Structures and Algorithm Analysis in C,** Weiss Mark Allen, Pearson Education,2nd Edition.

10EE764 VLSI CIRCUITS AND DESIGN

Subject Code	:	10EE764	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

A REVIEW OF MICROELECTRONICS AND AN INTRODUCTION TO MOS TECHNOLOGY: Introduction to integrated circuit technology. Introduction, VLSI technologies, MOS transistors, fabrication, thermal aspects, production of E-beam masks. **6 Hours**

UNIT - 2

BASIC ELECTRICAL PROPERTIES OF MOS AND BICMOS CIRCUIT: Drain to source current I_{ds} versus V_{ds} relationships-BICMOS latch up susceptibility. MOS transistor characteristics, figure of merit, pass transistor NMOS and COMS inverters, circuit model, latch up in CMOS circuits. **8 Hours**

UNIT - 3

MOS AND BICMOS CIRCUIT DESIGN PROCESSES: MOS layers, stick diagrams, design, symbolic diagrams. **8 Hours**

UNIT - 4

BASIC CIRCUIT CONCEPTS: Sheet resistance, capacitance layer inverter delays, wiring capacitance, choice of layers. **6 Hours**

PART - B

UNIT - 5

SCALING OF MOS CIRCUITS: Scaling model and scaling factors- Limitations due to current density. **8 Hours**

UNIT - 6

SUBSYSTEM DESIGN AND LAYOUT: Architectural issues, systems considerations. Examples of structural design, clocked sequential circuits. **8 Hours**

UNIT - 7

SUBSYSTEM DESIGN PROCESSES: General considerations, illustration of design process, observations. **4 Hours**

UNIT - 8

ILLUSTRATION OF THE DESIGN PROCESS: Observation on the design process, Regularity Design of an ALU subsystem. Design of 4-bit adder, implementation of ALU functions. **4 Hours**

TEXT BOOKS:

1. **Basic VLSI Design,** Douglas Pucknell &Eshragian**,** PHI, 3rd Edition, 2009.
2. **Fundamentals of Modern VLSI Devices,**Yuan Taun Tak H Ning Cambridge Press, South Asia Edition 2003,
3. **ModernVLSI Design,** Wayne wolf, Pearson Education Inc. 3rd edition, 2003.
4. **Introduction to CMOS VLSI Design-A Circuits and Systems Perspective,** Neil Weste,Pearson Education.3rd Edition.

10EE765 MICRO AND SMART SYSTEM TECHNOLOGY

Subject Code	:	10EE765	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO MICRO AND SMART SYSTEMS:

a) What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.

b) What are microsystems? Feynman's vision. Micromachined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects. Applications areas. Commercial products.**5 Hours**

UNIT - 2

MICRO AND SMART DEVICES AND SYSTEMS: PRINCIPLES AND MATERIALS:

a) Definitions and salient features of sensors, actuators, and systems.

b) Sensors: silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conductometric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor.

c) Actuators: silicon micro-mirror arrays, piezo-electric based inkjet print-head, electrostatic comb-drive and micromotor, magnetic micro relay, shape-memory-alloy based actuator, electro-thermal actuator

d) Systems: micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin. **8 Hours**

UNIT - 3

MICROMANUFACTURING AND MATERIAL PROCESSING:

a) Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization.

b) Silicon micromachining: surface, bulk, moulding, bonding based process flows.

c) Thick-film processing:

d) Smart material processing:

e) Processing of other materials: ceramics, polymers and metals

f) Emerging trends **7 Hours**

UNIT - 4

MODELING:

a) Scaling issues.

b) Elastic deformation and stress analysis of beams and plates. Residual stresses and stress gradients. Thermal loading. Heat transfer issues. Basic fluids issues.

c) Electrostatics. Coupled electromechanics. Electromagnetic actuation. Capillary electro-phoresis. Piezoresistive modeling. Piezoelectric modeling. Magnetostrictive actuators. **6 Hours**

PART - B

UNIT - 5

COMPUTER-AIDED SIMULATION AND DESIGN:

Background to the finite element element method. Coupled-domain simulations using Matlab. Commercial software. **8 Hours**

UNIT - 6

ELECTRONICS, CIRCUITS AND CONTROL:

Carrier concentrations, semiconductor diodes, transistors, MOSFET amplifiers, operational amplifiers. Basic Op-Amp circuits. Charge-measuring circuits. Examples from microsystems. Transfer function, state-space modeling, stability, PID controllers, and model order reduction. Examples from smart systems and micromachined accelerometer or a thermal cycler. **8 Hours**

UNIT - 7

INTEGRATION AND PACKAGING OF MICROELECTRO MECHANICAL SYSTEMS:

Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low-temperature-cofired-ceramic (LTCC) multi-chip-module technology. Microsystem packaging examples. **6 Hours**

UNIT - 8

CASE STUDIES: BEL pressure sensor, thermal cycler for DNA amplification, and active vibration control of a beam.

4 Hours

PART - C

UNIT - 9

Mini-projects and class-demonstrations (not for Examination)

9 Hours

a) CAD lab (coupled field simulation of electrostatic-elastic actuation with fluid effect)
b) BEL pressure sensor
c) Thermal-cycler for PCR
d) Active control of a cantilever beam

TEXT BOOKS AND A CD-SUPPLEMENT:

1. **MEMS & Microsystems: Design and Manufacture,** Tai-Ran Hsu, TMH, 1st Edition.
2. "Micro and Smart Systems" by Dr. A.K.Aatre, Prof. Ananth Suresh, Prof.K.J.Vinoy, Prof. S. Gopalakrishna,, Prof. K.N.Bhat.,John Wiley Publications

REFERENCE BOOKS:

1. Animations of working principles, process flows and processing techniques, A CD-supplement with Matlab codes, photographs and movie clips of processing machinery and working devices.
2. **Laboratory hardware kits for** (i) BEL pressure sensor, (ii) thermal-cycler and (iii) active control of a cantilever beam.

3 Microsystems Design, S. D. Senturia, 2001, Kluwer Academic Publishers, Boston, USA. ISBN 0-7923-7246-8.

4 Analysis and Design Principles of MEMS Devices, Minhang Bao, Elsevier, Amsterdam, The Netherlands, ISBN 0-444-51616-6.

5. Design and Development Methodologies, Smart Material Systems and MEMS, V. Varadan, K. J. Vinoy, S. Gopalakrishnan, Wiley.

6. MEMS- Nitaigour Premchand Mahalik, TMH 2007

10EE766 ELECTROMAGNETIC COMPATIBILITY

Subject Code	:	**10EE766**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Designing of electromagnetic compatibility, EMC regulation, typical noise path, and use of network theory, method of noise coupling, miscellaneous noise sources, and method of eliminating interference. **8 Hours**

UNIT - 2 & 3

CABLING: Capacitive coupling, effect of shield on magnetic coupling, mutual inductance calculations, magnetic coupling between shield and inner conductor, shielding to prevent magnetic radiation, shielding a receptor against magnetic fields, shield transfer impedance, experimental data, example of selective shielding, co-axial cable versus shielded twisted pair braided shields, effect of pig tails, ribbon cable, electrically long cables. **10 Hours**

UNIT - 4

GROUNDING: Safety grounds, signal grounds, single point ground systems, hybrid grounds, multipoint ground systems, functional ground layout, practical low frequency grounding, hardware grounds, single ground reference for a circuit amplifier shields, grounding of cable shields, ground loops, low frequency analysis of common mode choke, high frequency analysis of common mode choke, differential amplifiers, shields grounding at high frequencies, guard shields guarded meters. **10 Hours**

PART - B

UNIT - 5

BALANCING AND FILTERING: Balancing, power supply decoupling, decoupling filters, amplifier decoupling driving capacitive loads, high frequency filtering, system bandwidth, and modulation and coding. **8 Hours**

UNIT - 6 & 7

SHIELDING: Near field and far fields, characteristic and wave impedance's shielding effectiveness, absorption loss, reflection loss, composite absorption and reflection loss, summary of shielding equation, shielding with magnetic material, experimental data, apertures, wave guide below cutoff, conductive gaskets, conductive windows, conductive coatings, cavity resonance, brooding of shields. **10 Hours**

UNIT - 8

ELECTROSTATIC DISCHARGE: State generation, human body model, static discharge, and ESD protection in equipment design, software and ESD protection, ESD versus EMC. **6 Hours**

TEXT BOOK:

1. **Noise reduction techniques in electronic systems**, Henry W. Ott, John Wiley, 2nd edition, 1988
3. **Engineering Electromagnetic Compatibility: Principles, Measurements & Technologies**, V. Prasad Kodali, S. Chand & Co. Ltd. Delhi, 2000.

REFERENCE BOOKS:

1. Electromagnetics Explained – A Hand Book For Wireless/Rf,Emc And High Speed Electronoics.

10EEL77 Relay and High Voltage Laboratory

Subject Code	:	10EEL77	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

(Total 12 experiments are to be conducted by choosing at least 03 experiments from part A, 02 each from part-B and C and 05 from part-D)

PART - A

1. Over current relay **:**
   (a) IDMT non-directional characteristics
   (b) Directional features
   (c) IDMT directional
2. IDMT characteristics of over voltage or under voltage relay.(solid state or electromechanical type
3. (a) To determine 50% probability flashover voltage for air insulation subjected to impulse voltage.
   (b) Generation of standard lightning impulse voltage and to determine efficiency and energy of impulse generator.
   Operating characteristics of over voltage or under voltage relay. (Solid state or electromechanical type).
4. Operation of negative sequence relay.
5. Bias characteristics of differential relay.
6. Current-time characteristics of fuse.

PART - B

1. Operating characteristics of microprocessor based (numeric) over –current relay.
2. Operating characteristics of microprocessor based (numeric) distance relay.
3 Operating characteristics of microprocessor based (numeric) over/under voltage relay.

PART - C

1. Generator protection –Merz-Price- protection scheme.
2. Feeder protection scheme-fault studies.
3. Motor protection scheme-fault studies.

PART - D

1. Spark over characteristics of air insulation subjected to high voltage AC with spark over voltage corrected to STP.
2 Spark over characteristics of air insulation subjected to high voltage AC, with spark over voltage corrected to STP for uniform and non-uniform field configuration.
3 Spark over characteristics of air insulation subjected to high voltage DC
4 Measurement of HVAC and HVDC using standard spheres.
5 Breakdown strength of transformer oil using oil-testing unit.
6. Field mapping using electrolytic tank for any one-model cable/capacitor/transmission line/ Sphere gap models.

10EEL78 Power System Simulation Laboratory

Subject Code	:	**10EEL78**	**IA Marks**	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

Power system simulation using MATLAB/ C or C ++ /Sci lab /octave

1. a) Y Bus formation for power systems with and without mutual coupling, by singular transformation and inspection method.
   b) Determination of bus currents, bus power and line flow for a specified system voltage (Bus) Profile
2. Formation of Z-bus(without mutual coupling) using Z-bus building Algorithm .
3. ABCD parameters: Formation for symmetric π/T configuration. Verification of AD-BC=1 Determination of efficiency and regulation
4. Determination of power angle diagrams, reluctance power, excitation, emf and regulation for salient and non-salient pole synchronous machines,.

5 To obtain swing curve and to determine critical clearing time and regulation for a single machine connected to infinity bus through a pair of identical transmission lines under 3-phase fault on one of the lines for variation of inertia constant/line parameters /fault location/clearing time/pre-fault electrical output.

6. Formation of Jacobian for a system not exceeding 4 buses (no PV buses) in polar coordinates
7. Write a program to perform load using Gauss- Seidel method (only p q bus)
8. To determine fault currents and voltages in a single transmission line system with star-delta transformers at a specified location for LG, LLG.
9. Load flow analysis using Gauss Siedel method, NR method, Fast decoupled method for both pq and pv buses.
10. Optimal Generation Scheduling for Thermal power plants.

Note: Questions 1-7: Simulation Experiments using MATLAB/C or C++/Scilab/Octave
Questions 8-10: Use suitable standard software package.

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