

**GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY,
HISSAR**

**Master of Technology Electrical Engg
Power System
Scheme of Courses/Examination**

Semester- I

Sl. No	Course Code	Subject	Teaching Schedule				Evaluation Marks				Credit
			L	T	P	Tot	Theory	Sessional	P/V	Tot	
1	MTEE-101	Advanced Power System	4	-	-	4	70	30	-	100	4
2	MTEE-103	Advanced Power Apparatus & Machines	4	-	-	4	70	30	-	100	4
3	MTEE-105	Digital Control System	4	-	-	4	70	30	-	100	4
4	MTEE-107	Optimal Control System	4	-	-	4	70	30	-	100	4
5	MTEE-109	Advanced Control System Lab	-	-	3	3	-	30	70	100	1.5
6	MTEE-111	Advanced Power System Lab-I	-	-	3	3	-	30	70	100	1.5
7	MTEE-113	Seminar-I		2		2		40		40	1
						24	280	320	140	640	20

Semester-II

Sl. No	Course Code	Subject	Teaching Schedule				Evaluation Marks				Credit
			L	T	P	Tot	Theory	Sessional	P/V	Tot	
1	MTEE-102	Power System Protection & Relaying	4	-	-	4	70	30	-	100	4
2	MTEE-106	HVDC Transmission & Distribution	4	-	-	4	70	30	-	100	4
3	MTEE-108	System Engineering	4	-	-	4	70	30	-	100	4
4	MTEE-110	Power System Software Lab	-	-	3	3	-	30	70	100	3
5	MTEE-112	Advance Power System Lab-II	-	-	3	3	-	30	70	100	3
6	MTEE-114	Seminar-II		2		2	-	40	-	40	1
			9	5	6	20	210	190	140	540	16

Note: At the end of second semester, the candidates will have to undergo thorough literature survey during vacations in the field of interest which will be the basis for his/her Dissertation/Project in semester –III and IV. A Report /synopsis is to be submitted & presentation /viva will be conducted internally on literature surveyed in the beginning of Semester-III.

Semester-III

Sl. No	Course Code	Subject	Teaching Schedule				Evaluation Marks				Duration of Exam.(Hrs)	Credit
			L	T	P	Tot	Theory	Sessional	P/V	Tot		
1		*Elective-I	4	-	-	4	70	30	-	100	4	4
2		**Elective-II	4	-	-	4	70	30	-	100	4	4
3	MTEE-203	Project	-	-	3x4	12	-	30	70	100	-	10
			6	2	-	22	140	90	70	300	-	18

*Elective-I

SN	Course Code	Subject	SN	Course Code	Subject
1	MTEE -205	Intelligent Control	4	MTEE -209	Advance Microprocessors
2	MTEE -207	Power System Planning	5	MTEE -211	Reliability Engineering

**Elective-II

S N	Course Code	Subject	S N	Course Code	Subject
1	MTEE -213	Load and Energy Management	4	MTEE -217	Power System Restructuring & Deregulation
2	MTEE -215	Special Topics in Power System	5	MTEE -219	Computational Methods for Electromagnetics

Semester-IV

Sl. No	Course No.	Subject	Teaching Schedule	Examination Schedule (Marks)			Credit
				Sessional	P/V	Tot	
			Total				
1	MTEE-202	Dissertation (Thesis)	14	50	100	150	14
2	MTEE-204	Seminar on Dissertation & Progress Report	2	50	-	50	2
		Total	16	100	100	200	16

Note: Each student is required to publish at least two research papers (minimum standards: one paper in a referred journal and one in an International journal/National conference), to enable him/her to qualify for the award of M.Tech degree. Before submission of Dissertation, student has to submit proof of his/her publications and acceptance.

1st Semester

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MTEE-101
Advanced Power System

Credit 4

Unit 1

Network Modelling: System graph, loop, cut set and Incidence matrices, Primitive network and matrix, Formation of various network matrices by singular transformation and their interrelations. Building algorithm & modification for bus impedance matrix, Formation of bus admittance matrix and modification.

Unit 2

Fault Studies: Representation of three phase network elements, Treatment under balanced and unbalanced excitation, Transformation matrices and unbalanced elements.
Network short circuit studies using Z bus, Short circuit calculations for various types of faults.
Load flow studies using Gauss-Seidel and Newton-Raphson methods, Decoupled and fast decoupled method, Representation of regulating and off nominal ratio transformers, Tie-line control, Comparison of methods.

Unit 3

Power System Security: Factors affecting security, contingency analysis using network sensitivity method and AC power flow method.
State estimation in power systems: Method of least-squares, State estimation of AC network, Detection and identification of bad measurements, Network observability and pseudo measurements, Application of power system state estimation.

Unit 4

Stability Studies: Transient stability analysis, swing equation, stability of multi machine system using modified Euler method and Runge-Kutta method.

Text/Reference:

1. G.W. Stagg & A.H El-Abaid, "Computer methods in Power system analysis", McGraw Hill, New York.
2. L. P. Singh, "Advanced Power System Analysis and Dynamics", New Age, International Publishers, New Delhi.
3. M. A. Pai, "Computer Techniques in Power System Analysis", Tata McGraw Hill Publishing Co. Ltd.
4. John J.Grainger and W.D.Stevenson, "Power System Analysis", McGraw Hill, New York, 1994.
5. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1994.
6. Hadi Saadat, "Power System Analysis", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2002.

Advanced Power Apparatus and Machines**Unit 1**

Generalized Theory of Electrical Machines: Introduction, primitive model, transformation, voltage equations for induction machine.

Induction Machines: Introduction, effect of space harmonics, slip power control, capacitor self-excitation of induction machines and its applications.

Unit 2

Transformers: Transformer as a mutually coupled circuit, equivalent circuit from coupled circuit approach.

Multi circuit Transformers: Advantage, theory, equivalent circuit, regulation, three circuit transformers.

Three phase autotransformers: Connections and Analysis Parallel operation of dissimilar transformers, Harmonics, Inrush current phenomenon, Effect of load and three phase connections.

Unit 3

Electric drives: Basic concept characteristics and operating mode of drive motors. Starting, braking and speed control of motors (AC & DC), Four Quadrant drives, Types of loads.

Unit 4

Duty cycle, Heating/cooling and insulation in motors, Choice of motors and rating, Modern trend in industrial drives, Studies relating to steel mills, paper mills, textile mill, machine tools etc. A.C. motor drives in transportation system and traction.

Special Machines: Servomotors, Stepper motors, Synchronos, BLDC motors.

Text/Reference:

1. MIT Staff, 'Magnetic Circuits and Transformers', MIT Press Cambridge.
2. Fitzgerald & Kingsley, 'Electric Machinery' McGraw Hill Co. New Delhi.
3. PS Bimbhra 'Generalized Theory of Electrical Machines' Khanna Publishers, New Delhi.
4. Dubey, G.K. Fundamentals of Electrical Drives, Narosa Publishing House, New Delhi.
5. Bose B.K., Modern Power Electronics and AC Drives, Pearson Educational, Delhi, 2002.
6. S. K. Pillai, A first course on electrical drives, New Age International (P) Ltd., New Delhi.
7. Krishan R. Electric Motor Drives: Modeling Analysis and Control: PHI Pvt Ltd. New Delhi-2001.

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MTEE-105
Digital Control System

Credit 4

Unit-1

Signal Processing in Digital Control: Basic digital control scheme, principle of signal conversion, basic discrete-time signal, time-domain model for discrete-time systems, z-transform, transfer function models, jury stability criterion, sample and hold systems, sample spectra and aliasing

Unit-2

Models of Digital Control Devices and Systems: Introduction, z-domain description of sampled continuous-time plants, z-domain description of systems with dead-time, implementation of digital controllers, digital PID controllers, digital temperature control system, stepping motors and their control, PLC

Unit-3.

Analysis using State Variable Methods: State variable representation-concepts, modeling, transformation, state diagrams, Jordan canonical form, Eigen values and Eigenvectors, Solution of state equations, concepts of controllability and Observability,

Unit-4

Digital Observers: State regulator design-full order and reduced order state observer, design of state observers, compensator design by separation principle, state feedback with integral control ,deadbeat control by state feedback and deadbeat observers

Text/References:

1. Discrete time Control Systems by K. Ogata, "Prentice Hall International".
2. Control System Engineering by Nagrath and Gopal, "New Age International".
3. Digital Control Systems by B.C. Kuo "Oxford University Press

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**MTEE-107
OPTIMAL CONTROL SYSTEM**

Credit 4

Unit-I

Problem formulation – Mathematical model – Physical constraints – Performance measure, Optimal control problem. Form of optimal control. Performance measures for optimal control problem. Selection a performance measure.

Unit-2

Calculus of variations – Fundamental concepts. Minimization of Functionals. Functionals involving in independent Function, Constrained Minimization, Formulation of Variational Calculus Using Hamilton Method, Minimum Principle- Pontryagin's minimum principle and state inequality constraints.

Unit-3

Dynamic Programming – Optimal control law – Principle of Causality, invariant imbedding, optimality, Multistage Decision in Continuous time-Hamilton Jacobi Equation, Methods of steepest decent, Variation of extremals.

Unit-4

Discrete-Time Linear State Regulator, Continuous-Time Linear State Regulator, Time-Invariant Linear State Regulator for Continuous-Time Systems and Discrete-Time Systems, Numerical Solution of Riccati Equation- Direct Integration, Negative Exponential Method, An Iterative Method

Text/ References:

1. Donald E. Kirk, Optimal Control Theory: An Introduction, Prentice-Hall networks series, 1970.
2. Anderson .B. D. O, Moore .J. B, Optimal control linear Quadratic methods, Prentice Hall of India, New Delhi, 1991.
3. Sage A. P, White .C. C, Optimum Systems Control, Second Edition.

List of Experiments**Study of Softwares such as MATLAB, LabView etc.**

1. To implement PI, PD & PID controllers for temperature control of an oven on pilot plant &/or on a simulation kit.
2. To observe the effects of nonlinearities (such as saturation, backlash etc.) on the performance of PI, PD & PID controllers used for a first order system.
3. To observe the effects of nonlinearities (such as saturation, backlash etc.) on the performance of PI, PD & PID controllers used for a second order system.
4. To observe the effects of load disturbances on the performance of PI, PD, PID & Fuzzy controllers.
5. To control speed of a dc motor using choppers.
6. Implementation of speed control of a stepper motor.
7. To implement fuzzy controller on a 2nd/3rd order system.
8. To control the pressure of Hydraulic System.
9. To control the pressure of Pneumatic System.
10. To study vector control of induction motor.

NOTE: At least 10 experiments be performed in the semester. At least seven experiments should be performed from above list. Remaining 3 experiments may either be performed from the above list or designed & set by concerned institution as per scope of syllabus.

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MTEE-111
Advanced Power System Lab-1

Credit 1.5

List of experiments

1. To study on IDMT over current relay. Obtain & plot its current-time characteristics for various plugs setting time multiplier & measure pickup / reset ratio.
2. To plot operating Characteristics of percentage differential relay.
3. To plot operating Characteristics of under voltage relay.
4. To plot operating Characteristics of over voltage relay.
5. To plot operating Characteristics of Negative sequence relay.
6. To Measure ABCD parameters of a transmission line model using the defining relations.
7. To determine the dielectric strength of a given transformer oil with the help of standard testing equipments.
8. To determine circuit parameters of three winding transformer, by open circuit & short circuit test.
9. To study performance of transmission line under different loads.
10. To study three phase fault.

NOTE: At least 10 experiments be performed in the semester. At least seven experiments should be performed from above list. Remaining 3 experiments may either be performed from the above list or designed & set by concerned institution as per scope of syllabus.

Unit 1

Introduction: Need for protective systems, Zones of protection, classification of protective relays and protective schemes, Current transformers and potential transformers, Advantages of static relays. Comparators: general equation of comparators, Analysis for amplitude comparator, analysis for phase comparator, duality between amplitude and phase comparators, different types of amplitude and phase comparators.

Unit 2

Over current relays: Instantaneous over current relays, definite time overcurrent relays, directional overcurrent relay, comparison with conventional relays, differential relays, operating and restraining characteristics, types of differential relays, comparison with conventional relays, distance relays, impedance relays, reactance relays, mho relay quadrilateral relays, elliptical relays, comparison with conventional relays.

Unit 3

Distance protection: Principle of distance relaying, time grading of distance relays, schemes of distance protection, distance protection by impedance, reactance and mho relays, Effect of power swings on the performance of distance relays.

Pilot relaying schemes: Pilot wire protection, carrier current protection.

Unit 4

Protection of Generators and Motors: Types of faults, Stator and rotor protection against various types of faults.

Protection of Transformers: Types of faults, differential protection schemes, harmonic restraint relay, over flux protection, earthing transformer protection.

Bus Zone Protection: Types of Bus-bar faults, differential current protection frame leakage protection.

Microprocessor based protective relays: Over current relay, impedance relay, reactance relay, mho relay, microprocessor based distance relaying.

Text/Reference:

1. TSM Rao, "Power System Protection – Static Relays", Tata McGraw Hill.
2. S.P Patra, S.K Basu and S. Choudhary, "Power System Protection", Oxford IBH Pub.
3. B.Ravindernath and M. Chander, "Power System Protection and Switchgear", Wiley Eastern Ltd.

Unit 1

Introduction: Role of EHV AC Transmission, standard transmission voltages, average value of line parameters, power handling capacity.

Line parameters, Properties of bundled conductors, resistance, inductance and capacitance of bundled conductor lines, temperature rise of conductors and current carrying capacity. Voltage gradients on conductors: Charge potential relations for multi-conductor lines, surface voltage gradient on conductors, distribution of voltage gradient on sub conductors of bundle.

Unit 2

Corona Effects: Corona loss, attenuation of traveling waves, audible noise, limits for audible noise, AN measurement and meters, Day night equivalent noise level, limits for radio interference fields, RI excitation function, measurements of RI, RIV, Excitation function.

Switching Over voltages: Origin of over voltages and their types, over voltages due to interruption of low inductive current and interruption of capacitive currents, Reduction of switching surges on EHV systems.

Unit 3

Power frequency over voltages: Problems at power frequency, no-load voltage conditions and charging current, voltage control using synchronous condensers, sub synchronous resonance in series-capacitor compensated lines, state reactive compensating schemes.

Operational aspects of Power flow: Line loadability, effects of over load, reactive power limitations and over voltage problem.

Unit 4

H V D C Transmission: Introduction, Comparison of AC and DC transmission, Application of DC transmission, Planning of HVDC transmission, Parallel operation of AC and DC systems, Methods of control of power.

Text/Reference:

1. Begamudre, "EHV AC Transmission engineering", Wiley Easter Ltd. 2nd Ed.
2. Edison Electric Institute, "EHV transmission reference book", GE Co.
3. EPRI, Palo Alto, "Transmission line reference book 345 KV".
4. Rudenberg, "Transient performance of electric power systems" McGraw Hill.
5. EW Kimbark, 'Direct current Transmission', Vol. I, Wiley Interscience.
6. J. Arrillaga, 'High Voltage Direct Current Transmission', Peter Peregrines.
7. KR Padiyar, ' HVDC Power Transmission Systems', New Age International (P) Ltd., Publishers, 3rd Edition.

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MTEE-108
System Engineering

Credit 4

Unit 1

Optimization Theory: Introduction to optimization theory, Importance in solving system engineering problems, convex sets & Functions; affine and convex sets, supporting and separating hyper planes, dual cones and generalized inequalities.

Unit 2

Linear Programming problem; Formulation, Simplex Method, Dual Simplex method, sensitivity analysis, duality in programming. Introduction to nonlinear programming.

Unit 3

Unconstrained Optimization-formulation of quadratic optimization problems, gradient descent and steepest descent methods, Newton's method, self-concordance.
Constrained optimization – direct optimization, Cutting plane methods, methods of feasible direction, analytic center cutting plane methods. Multi-objective optimization.
Application to approximation and filling problems.

Unit 4

System Modeling: Introduction, types of modeling, modeling of time-varying, distributed, stochastic, nonlinear, discrete event and hybrid systems.
Conventional tools for linear system modeling, Introduction to non-conventional modeling tools, Neural models, and fuzzy models.
Model simulation languages and tools.

Text/References:

1. SS Rao, "Optimization theory and applications" Wiley Eastern Ltd.
2. KV Mittal, "Optimization methods", Wiley Eastern Ltd.
3. NA Kheir, "System modeling and computer simulation" Marcel Decker, New York.
4. Korn G.A., "Interactive Dynamic System Simulation", McGraw Hill, N.Y.

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MTEE-110
POWER SYSTEM SOFTWARE LAB

Credit 1.5

List of experiments

Study of Softwares such as MATLAB, LabView etc.

Computer Programmes on the following:

1. Formation of Y-bus.
2. Formation of Z-Bus
3. Guass seidel method of Solving power flow equations
4. N-R Method
5. Fast decoupled Method
6. Excitation Control
7. Load frequency control
8. Application of Optimal Control theory
9. Calculation ATC
10. Economic Dispatch

NOTE: At least 10 experiments be performed in the semester. At least seven experiments should be performed from above list. Remaining 3 experiments may either be performed from the above list or designed & set by concerned institution as per scope of syllabus.

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MTEE-112

Credit 1.5

Advanced Power System Lab-II

List of experiments

1. To study fault location in a cable by Murray Loop Test.
2. To study C.T. testing by comparison method.
3. To study P.T. testing by comparison method.
4. To determine equivalent circuit parameters of three phase three winding transformer, by open circuit & short circuit test.
5. To plot V & \wedge -Curves of a synchronous machine. Determination of X_o of a synchronous machine.
6. To plot the curves for Measurement of $X_d' + X_q'$ (Direct axis and Quardiantant axis).
7. To study the characteristics of transmission line represented by :
 - i) T-Network :
 - ii) Pie-Network
8. To study the characteristics of differential relay.
9. Testing and calibration of energy meter.
10. To study the 3 phase, 3 wire distribution system.

NOTE: At least 10 experiments be performed in the semester. At least seven experiments should be performed from above list. Remaining 3 experiments may either be performed from the above list or designed & set by concerned institution as per scope of syllabus.

3rd Semester

Electives

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MTEE-215

Credit 4

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SPECIAL TOPICS IN POWER SYSTEMS

Unit 1

Power System Restructuring and Deregulations: Introduction to Power System Deregulation Market Models Pool & Bilateral International Experiences. Role of ISO, Market Power, Bidding and Auction Mechanisms.

Transmission Open Access, Transmission Pricing, Impact of Congestion and Congestion Management, ATC and Factor affecting ATC, Determination of ATC.

Unit 2

Power System Computation and Computer Application: OPF and its Formulation, Solution Techniques NLP Methods, LPOPF Interior Point Method, AI Techniques and Genetic Algorithm.

Unit 3

SCADA & Distribution Automation: Energy management systems, Power system communication, PICC Digital Communication, Microwave communication, Utility communication architecture, Java and Web based technologies. Software Agents.

Unit 4

Flexible AC Transmission Systems (FACTS): Reactive Power Control in Electric Transmission Systems, Loading Capability and Stability Considerations. Introduction to facts, related concepts and system requirements, Application considerations of FACT devices.

Text/Reference:

1. Lei Lee Lai, Power System restructuring and deregulation. John Wiley and Sons, UK. 2001.
2. K. Bhattacharya, MHT Bollen and J.C Doolder, Operation of Restructured Power Systems, Kluwer Academic Publishers, USA, 2001.
3. A.J Wood and B.F Wollenberg. Power System Operation and Control, John Wiley and Sons.
4. S.A Soman, S.A Khafasok, Shubha Pandit, Computational Methods for large Sparse Power System Analysis: An Object Oriented Approach. Kluwer Academic Publishers.

INTELLIGENT CONTROL**Unit-1**

ANN Models & Architecture:

Biological foundations, ANN models, Types of activation function, introduction to network architecture, multilayer feed forward network (MLFFN), Kohonen self organizing map, radial basis, Function network (RBFN), recurring neural network.

Unit-2

Learning Processes:

Supervised and unsupervised learning, error-correction learning, Hebbian learning, Boltzman learning, single layer and multilayer perception model, least mean square algorithm, back propagation algorithm, Application in forecasting and pattern recognition and other power engineering problems.

Unit-3

Fuzzy Sets and Theory:

Fuzzy sets, fuzzy set operations, properties, membership functions, fuzzy to crisp conversion, measures of fuzziness, fuzzification and defuzzification methods, application in engineering problems.

Unit-4

Fuzzy Control System:

Introduction, simple fuzzy logic controllers with examples, special forms of fuzzy logic models, classical fuzzy control problems.

Text/References:

1. M. T. Hagon, Howard B. Demuth and Mark Beale, "Neural Network Design, PWSPublishing Company" 1995.
2. Jacek M Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, Bombay, 1994.
3. Wasserman, "Neural Computing: Theory and Practice, Van Nastrand Reinhold, 1989"
4. Freeman, J. A. and D. M. "Neural Networks _-Algorithms, application and programming techniques, Addison Weley, 1991"
5. Ronald R. Yager and Dimiyar P. Filev, Essentials of Fuzzy Modeling and Control, John Wiley & Sons, Inc
6. Rajasekran S. and Pai G. A.V" Neural Networks, Fuzzy logic and genetic Algorithm Synthesis and Applications, PHI New Delhi.

POWER SYSTEM RESTRUCTURING AND DEREGULATION**Unit 1**

Introduction: Basic concept and definitions, privatization, restructuring, transmission open access, wheeling, deregulation, components of deregulated system, advantages of competitive system.

Power System Restructuring: An overview of the restructured power system, Difference between integrated power system and restructured power system, Explanation with suitable practical examples.

Unit 2

Deregulation of Power Sector: Separation of ownership and operation, Deregulated models, pool model, pool and bilateral trades model, multilateral trade model.

Competitive electricity market: Independent System Operator activities in pool market, Wholesale electricity market characteristics, central auction, single auction power pool, double auction power pool, market clearing and pricing, Market Power and its Mitigation Techniques, Bilateral trading, Ancillary services.

Unit 3

Transmission Pricing: Marginal pricing of Electricity, nodal pricing, zonal pricing, embedded cost, Postage stamp method, Contract Path method, Boundary flow method, MW-mile method, MVA-mile method, Comparison of different methods.

Unit 4

Congestion Management: Congestion management in normal operation, explanation with suitable example, total transfer capability (TTC), Available transfer capability (ATC), Different Experiences in deregulation: England and Wales, Norway, China, California, New Zealand and Indian power system.

Text/Reference:

1. Loi Lei Lai, "Power System Restructuring and Deregulation", John Wiley & Sons Ltd.
2. K. Bhattacharya, MHT Bollen and J.C Doolder, Operation of Restructured Power Systems, Kluwer Academic Publishers, USA, 2001.
3. Lorrin Philipson and H. Lee Willis, "Understanding Electric Utilities and Deregulation", Marcel Dekker Inc, New York.
4. [Yong-Hua Song](#), [Xi-Fan Wang](#), Operation of market-oriented power systems, Springer, Germany.

**POWER SYSTEM PLANNING
MTEE-207**

Unit 1

Introduction: Power System planning, objective, stages in planning & design, Key indices of power system reliability and their calculations, Linkage between reliability and capacity planning.

Unit 2

Generating System capability Planning: Probabilistic models of generating units, growth rate, Rate of generation capacity, Outage performance and system evaluation of loss of load and loss of energy indices, Power supply availability assessment

Unit 3

Interconnected Systems: Multi area reliability analysis, Power pool operation and power exchange energy contracts, quantification of economic and reliability benefits of pool operation
Demand/ Energy forecasting: Electricity consumption pattern, Peak demand and energy forecasting by trend and economic projection methods,

Unit 4

Power System expansion planning: Formulation of least cost optimization problem involving capital, operation and maintenance costs of candidate units of different types.
Investment Planning Models: Traditional generation expansion planning models, integrated resource planning models, production cost simulation models.

Text/Reference:

1. Wallach Y., Power System Planning, McGraw Hill International.
2. Sullivan P., Power System Planning, McGraw Hill International.
3. Dasari, S. " Electric Power System Planning, " IBT Publishers, New Delhi.
4. Billinton R., Power System Reliability Calculation, MIT Press, USA
5. Endreyeni, Reliability Modeling in Electric Power System, John Wiley, New York
6. McDonald J.R., Modern Power system Planning, McGraw Hill International.

LOAD AND ENERGY MANAGEMENT
MTEE-213

Unit 1

Load Forecasting: Classification and characterization of loads, Approaches to load forecasting, Forecasting methodology, Energy forecasting, Peak demand forecasting, Non-weather sensitive forecast and Weather sensitive forecast, Total forecast, Annual and monthly peak demand forecasts. Applications of state estimation to load forecasting.

Unit 2

Load Management: Introduction to Load management. Electric energy production and delivery system structure (EEPDS). Design alternatives for EEPD systems. Communication/control techniques for load management. Tariff structure and load management, principles of macro & microeconomics and energy pricing strategies, Assessing the impacts of load management.

Unit 3

Energy Demand Forecasting: Static and dynamic analysis of energy demand, elements of energy demand forecasting, methodologies and models for energy demand forecasting, techno-economic approach in energy demand forecasting.

Unit 4

Trends and Case Studies: Energy management strategy, symbiotic relation between information, energy models and decision making, case studies like industrial energy forecasting, transportation energy forecasting, residential, commercial and agricultural energy forecasting

Text/Reference:

1. Martino J., Technological Forecasting for Decision Making, Elsevier Press, New York.
2. Gellings C.W. and Penn Well P.E., Demand Forecasting in the Electric Utility Industry, Fairmount Press
3. Makridakis S., Forecasting Methods and Applications, Wiley.
4. Barney L. Capehart, Wayne C. Turner, William J. Kennedy, Guide to energy management, The Fairmont Press, Inc.
5. Pradeep Chaturvedi, Energy management: challenges for the next millennium, Concept Publishing Company, New Delhi.

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MTEE-211

Credit 4

RELIABILITY ENGINEERING

Unit 1

Review of basic concepts in Reliability Engg., Reliability function, different reliability models, etc., Reliability evaluation techniques for complex system; Non path set and cutset approaches, path set and cut set approaches, different reliability measures, Reliability allocation/apportionment, reliability improvement, redundancy optimization techniques.

Unit 2

Fault tree analysis: fault tree construction, simplification and evaluation, importance measures, modularization, applications, advantages and disadvantages of fault tree techniques.

Unit 3

Maintainability Analysis: measures of system performance, types of maintenance, reliability centered maintenance , reliability and availability evaluation of engineering systems using Markov models.

Unit 4

Applications of fuzzy theory and neural networks to Reliability Engineering. Reliability testing, design for reliability and maintainability. Typical reliability case studies.

References:

1. R. Ramakumar, "Engineering Reliability", Prentice Hall, NJ.
2. KB Mishra, "Reliability Analysis & Prediction".
3. KB Mishra, "New trends in System Reliability Evaluation".
4. M.L. Shooman, "Probabilistic reliability – an engineering approach" RE Krieger Pub., 1990.
5. K.K. Aggarwal, "Reliability Engineering".

ADVANCED MICROPROCESSORS**UNIT-I**

Architecture of 8086 microprocessor, Memory Addressing, Bus Timings for MN/MX mode, interrupt structure. Memory Interfacing and Address decoding techniques for 8086 microprocessor

UNIT-II

Addressing modes, Instruction set and application programs, Assembler Directives, Programming Techniques using TASM, Interfacing D/A and A/D converters using programmable I/O devices, Interfacing Stepper motor. ARCHITECTURE OF INTEL X86 FAMILY :CPU block diagrams, Pin diagrams and internal descriptions of - 80286,386,486 and Pentium Processor, Instruction formats.

UNIT-III

Introduction to microcontrollers, Architecture of 8051 microcontroller, basic Instruction set, programming, serial data communication, interfacing with D/A and A/D converters.

UNIT-IV

Application of Microprocessors, A Microcomputer-based Industrial Process-control System, Hardware for Control Systems and Temperature Controller, Overview of Smart-Scale Operation.

References:

1. Advanced Microprocessors, PHI, D.V.Hall
2. The Intel Processors, Pearson Education, B. Brey
3. Gibson, "Microprocessors", Prentice Hall of India.
4. K.J. Ayala, "Micro Controller", Penram International

COMPUTATIONAL METHODS FOR ELECTROMAGNETICS

Unit 1

Fundamental Concepts:

Review of Maxwell's equations and boundary conditions, integral equations versus differential equations, radiation and edge conditions, modal representation of fields in bounded and unbounded media.

Unit 2

Green's Functions:

Green's function technique for the solution of partial differential equations, classification of Green's functions, various methods for the determination of Green's functions including Fourier transform technique and Ohm-Rayleigh technique, dyadic Green's functions, determination of Green's functions for free space, transmission lines, waveguides, and microstrips.

Unit 3

Integral Equations:

Formulation of typical problems in terms of integral equations: wire antennas, scattering, apertures in conducting screens and waveguides, discontinuities in waveguides and microstriplines; Solution of Integral equations: General Method of Moments (MoM) for the solution of integro-differential equations, choice of expansion and weighting functions, application of MoM to typical electromagnetic problems.

Unit 4

Finite Element Method:

Typical finite elements, Solution of two-dimensional Laplace and Poisson's equations, solution of scalar Helmholtz equation.

Finite-difference Time-domain Method:

Finite differences, finite difference representation of Maxwell's equations and wave equation, numerical dispersion, Yee's finite difference algorithm, stability conditions, programming aspects, absorbing boundary conditions.

Suggested Books:

1. Collin, R.E., "Field Theory of Guided Waves", 2 Ed., Wiley-IEEE 1991 Press.
2. Peterson, A.F., Ray, "Computational Methods for 1998 Electromagnetics", Wiley- IEEE Press.
3. Harrington, R.F., "Field Computation by Moment Methods", Wiley-1993 IEEE Press.
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