KURUKSHETRA UNIVERSITY KURUKSHETRA
M.TECH. (ELECTRICAL POWER SYSTEM)
w.e.f the session 2013-14

L	T	P
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Sessional : 40 Marks
Exam : 60 Marks
Total : 100 Marks
Duration of Exam : 03 Hrs

MTPS-101
Advanced Power System Analysis

UNIT 1

Network Modelling: System graph, loop, cut set and Incidence matrices, Primitive network and matrix, Formation of various network matrices by singular transformation.

Bus Impedance Algorithm: Singular transformation, Direct inspection, Building Block algorithm for bus impedance matrix, Addition of links, addition of branches, (considering mutual coupling), modification of bus impedance matrix for network changes, Formation of bus admittance matrix and modification, Gauss elimination, Node elimination (Kron's reduction), LU factorization.

UNIT 2

Balanced and unbalanced network elements: Representation of three phase network elements, representation under balanced and unbalanced excitation, transformation matrices, symmetrical components, sequence impedances, unbalanced elements and three phase power invariance.

Short circuit studies: Network representations for single line to ground fault, line to line fault,

LL-G fault, and 3-phase faults, network short circuit studies using Z bus, Short circuit calculations for various types of faults in matrix form.

UNIT 3

Load flow studies: Load flow and its importance. classification of buses, load flow techniques, Iterative solutions and computer flow charts using Gauss-Seidel and Newton-Raphson methods, Decoupled and fast decoupled methods, Representation of regulating and off nominal ratio transformers and modification of Y_{bus}, comparison of methods, numerical examples. Introduction to AC-DC load flow problems: formation and solutions.

UNIT 4

Power system security: Introduction to Power system security, Addition and removal of multiple lines, piece-wise solution of interconnected systems, analysis of single and multiple contingencies, analysis with sensitivity factors, system reduction for contingency and fault analysis.

State estimation in power systems: Method of least-squares, State estimation of AC network, Detection and identification of bad measurements, Application of power system state estimation.

Reference:

1. John J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill, New York, 1994.
2. I. J. Nagrath and D P Kothari, "Power System Engineering" McGraw Hill, New York, 1994.
3. M. A. Pai, 'Computer Techniques in Power System Analysis', 2nd Edi., TMH-New Delhi.

Text:

1. G.W. Stagg and A.H EI-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. N. V. Ramana, "Power System Analysis", Pearson Education, Noida, 2012.
4. K Uma Rao, "Computer Techniques and Models in Power System", I K Publications, New Delhi, 2007.
5. T K Nagsarkar and M S Sukhija, " Power System Analysis", Oxford University Press, New Delhi, 2010

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MTPS-103
Power System Protection & Relaying

UNIT 1

Protective Relaying Fundamental: Need for protective systems, Zones of protection, classification of protective relays and protective schemes, Advantages and disadvantages of different relays.

Current transformers and potential transformers: Operating principle, construction, characteristics, performance and specifications.

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

Static relays: Over current relays- Instantaneous over current relays, definite time over current relays, directional over current 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, distance relaying.

Reference:

1. TSM Rao, “Power System Protection – Static Relays”, Tata McGraw Hill.

Text:

1. B Bhalja, R P Maheshwari and N G Chothani, “Protection and Switchgear”, Oxford University Press, New Delhi, 2011.
2. Badri Ram and Vishwakarma, “Power System protection and Switchgear”, Tata McGraw Hill.
3. B. Ravindernath and M. Chander, “Power System Protection and Switchgear”, New Age Publication, New Delhi, 2012.
4. S. P Patra, S.K Basu and S. Choudhary, “Power System Protection”, Oxford IBH Pub.
5. C L Wadhwa, “Electrical Power Systems”, New Age Publication, New Delhi, 2012

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MTPS-105
EHVAC Transmission

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.

UNIT-2

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. Corona Effects, Corona loss, attenuation of traveling waves, audible noise, limits for audible noise, AN measurement and meters, Day night equivalent noise level,

UNIT-3

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-4

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.

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.

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MTPS-107
ELECTRIC DRIVES & CONTROL

UNIT-1

Introduction: Definition, Part of the electric drive, Types of loads, steady state & transient stability of Drive, state of art of power electronics and drives, thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating.

UNIT-2

D.C. Drives: Review of braking and speed control of D.C. motors, multi-quadrant operation, loss minimization in adjustable speed drives. Mathematical modeling of dc drives, stability analysis, modern control techniques: variable structure, adaptive control, Chopper-Controlled DC Drives.

UNIT-3

Induction motor drives: Review of braking and speed control of induction motors, constant V/F, constant air gap flux, controlled voltage, controlled current and controlled slip operation. Mathematical modeling of induction motor drives, transient response and stability analysis Introduction to Cyclo-converter fed induction motor drive. Pulse Width Modulation for Electric Power Converters

UNIT-4

Synchronous motor drives: Adjustable frequency operation, voltage fed drive, current fed self-controlled drive. Application of electric drives in steel mills, paper mills, textile mills and machine tools etc. A. C. motor drives in transportation system and traction.

Text/Reference:

1. Dubey G K, “Fundamentals of Electrical Drives”, Narosa Publishing House, New Delhi.
2. S K Pillai, “A First Course on Electrical Drives”, New Age International (P) Ltd., New Delhi.
3. Krishan R, “Electric Motor Drives: Modeling Analysis and Control”, PHI Pvt Ltd. New Delhi-2001.
4. Bose B K, “Power Electronics and Variable Frequency Drives: Technology and Applications”, IEEE Press, 1997.
5. Bose B K , “Modern Power Electronics and AC Drives”, Pearson Educational, Delhi,

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Sessional : 40 Marks
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Duration of Exam : 03 Hrs

MTPS-102
POWER SYSTEM OPERATION & CONTROL

UNIT-1

.Load Characteristics and modeling, Thermal UNITs cost models, Formulation and solution of optimum dispatch without considering transmission losses using Lagrange's methods, General transmission loss formula and B-Coefficients, Incremental transmission loss formula, Optimum dispatch considering transmission losses, Penalty factor technique, Iterative computational procedure for dispatch problem.

UNIT-2

Hydroelectric plant model, Energy scheduling, Incremental water rate, Coordination equations for short-range hydrothermal scheduling with fixed head hydro plant, Computational flow-chart, Optimal scheduling of hydrothermal system using discretization and gradient vector approach.

UNIT-3

Load forecasting, Power Systems interconnection, Un-integrated and integrated operation, UNIT commitment problem, Solution of the problem by priority list scheduling and using dynamic programming principle and Lagrangian relaxation technique, Economics of inter-change of energy, Effects of transmission losses, SCADA systems.

UNIT-4

Load frequency control problem, Models of various subsystems of a generating UNIT, Governor Characteristics, Steady-state and dynamic analysis, Control area concept, Incorporating proportional and integral type controllers. Area control error, LFC and economic dispatch, Two-area LFC, Tie-line Control, Control of active and reactive power, Shunt and series compensation and associated analysis

Text/Reference:

1. Allen J. Wood, and Bruce F. Wollenberg, "Power Generation, Operation and Control", John Wiley & Sons, Inc., New York.
2. Olle I. Elgerd, "Electric Energy Systems Theory – An Introduction", Mc Graw-Hill Book Company, New York.
3. John J. Grainger and William D. Stevenson, Jr, "Power System Analysis", Mc Graw Hill Book Company, Inc., New York.
4. P S R Murty, "Power System Operation and Control", Tata McGraw-Hill Publishing Company Ltd., New Delhi.
5. I J Nagrath and DP Kothari, "Power System Engineering", Tata McGraw Hill Publishing Co., Ltd. New Delhi.
6. B R Gupta, "Generation of Electrical Energy", S. Chand & Co. Ltd. N. Delhi.

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Duration of Exam : 03 Hrs

MTPS-104
HVDC TRANSMISSION

UNIT-1

Comparison of AC and DC transmission, Application of DC transmission Planning of HVDC transmission, HVDC Converters: Converter configuration, Graetz Circuit. Converter Bridge, Twelve-pulse converter, detailed analysis of converters.

UNIT-2

HVDC System Control: Principles of DC link control, Converter control characteristics, firing angle control. Current and extinction angle control, Starting and stopping of DC link, Power control.

UNIT-3

Reactive Power Control: Sources of reactive power, Static VAR systems, Reactive power control during transients, Harmonics and Filters, Generation of harmonics, Smoothing reactors, AC and DC filters used for harmonic Elimination.

UNIT-4

Converter Faults and Protection: Converter faults, Protection against over currents and over voltages, AC and DC Systems: Parallel operation of AC and DC systems, Methods of control of power.

Text/Reference:

1. EW Kimbark, "Direct current Transmission", Vol. I, Wiley Interscience.
2. J. Arrillaga, "High Voltage Direct Current Transmission", Peter Peregrines.
3. K R Padiyar, "HVDC Power Transmission Systems", New Age International (P) Ltd., Publishers, 3rd Edition.

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Duration of Exam : 03 Hrs

MTPS-106
POWER APPARATUS & MACHINES

UNIT-1

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

UNIT-2

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

UNIT-3

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

UNIT-4

Parallel operation of dissimilar transformers, Harmonics and Inrush current phenomenon, effect of load and three phase connections, Sequence impedances in transformers.
Special Machines: Servomotors, stepper motors, BLDC motors.

Text/Reference:

1. P S Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers, New Delhi.
2. Fitzgerald and Kingsley, "Electric Machinery", McGraw Hill Co. New Delhi
3. MIT Staff, "Magnetic Circuits and Transformers", MIT Press Cambridge.
4. L F Blume,"Transformer Engineering", John Wiley & Sons, Inc, N.Y.
5. A Langsdorf, "Theory of alternating current Machinery", McGraw Hill Co. New Delhi.
6. E Openshaw Taylor, "The performance and design of A.C. commutator motors; Including the single-phase induction motor Unknown Binding", Wheeler Publicationss, 1971.

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Total : 100 Marks
Duration of Exam : 03 Hrs

MTPS -108
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

ANN 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.

Fuzzy Control System: Introduction, simple fuzzy logic controllers with examples, special forms of fuzzy logic models, classical fuzzy control problems

UNIT-4

Genetic Algorithm & Modeling: Basic concepts, principle, encoding, fitness function, reproduction, crossover modeling, inversion and deletion, mutation and bit-wise operator.

Fuzzy logic- GA based structural optimization.

Text/References:

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

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Duration of Exam : 03 Hrs

MTPS-205
SYSTEM ENGINEERING

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. S S Rao, "Optimization theory and applications", Wiley Eastern Ltd.
2. K V Mittal, "Optimization methods", Wiley Eastern Ltd.
3. R P Sen, "Operation Research, Algorithms and application", PHI, 2010.
4. N A Kheir, "System modeling and computer simulation", Marcel Decker, New York.
5. Korn G A, "Interactive Dynamic System Simulation", McGraw Hill, N.Y.

MTPS-207
FLEXIBLE A C TRANSMISSION SYSTEM

UNIT-1

Note: The question paper will have 5 sections. Section-1 will have one question from whole syllabus. The remaining 8 questions will be divided into 4 sections (2 questions per UNIT per section) and the students will have to attempt exactly one question from each of the sections.

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Sessional : 40 Marks
Exam : 60 Marks
Total : 100 Marks
Duration of Exam : 03 Hrs

FACTS concept and general power system consideration, Brief idea about the power semiconductor devices, Voltage source converter, Static shunt Compensator: SVC and STATCOM.

UNIT-2

Static series compensator: GCSC, TSSC, TCSC and SSSC. Static voltage and phase angle regulator: TCVR and TCPAR

UNIT-3

Combined Compensator: unified power flow controller and interline power flow controller coordination of FACTS controller

UNIT-4

Special purpose Facts controllers NGH-SSR damping scheme and thyristor-controlled braking resistor

Text/Reference:

1. Narain G Hingorani, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", Wiley-IEEE Press, 1999.
2. K R Padiyar, "FACTS controllers in power Transmission and Distribution", New Age Publications, New Delhi.
3. R Mohan Mathur and R K Verma, "Thyristor based FACTS controllers for electrical transmission systems", IEEE Press A John Wiley and sons Inc. Publication
4. Y H Song and Allan T Johns, "Flexible Transmission systems", lEE press.
5. TS E Miller, "Reactive Power Control in Electric Systems", Wiley-Interscience, 1982.

MTPS-209
ADVANCED MICROPROCESSOR & MICROCONTROLLERS

Note: The question paper will have 5 sections. Section-1 will have one question from whole syllabus. The remaining 8 questions will be divided into 4 sections (2 questions per UNIT per section) and the students will have to attempt exactly one question from each of the sections.

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UNIT-1

Design of basic microprocessor architectural Concepts : Microprocessor architecture, word Lengths, addressable memory, Microprocessor's speed architectural characteristics , registers, instruction, memory addressing architecture, ALU, GPR's Control logic & internal data bus.

UNIT-2

Microprocessor Instructions & Communication: Instruction Set ,Mnemonics, Basic Instruction Types, Addressing modes ,Microprocessor I/O connecting I/O put to Microprocessor ,Polling and Interrupts , Interrupt and DM. Controllers.

Microprocessor I/O: Data Communication, parallel I/O serial communication, Serial interface and UART modems, I/O devices, D/A,A/D interface, special I/O devices.

UNIT-3

Microcontroller: Introduction 8051 architecture and programming model. Internal RAM and registers, I/O parts, Interrupt system & Instruction sets.

UNIT-4

Advanced microprocessors: Intel X86 family of advanced Microprocessor, programming model for 86 family. X85 addressing modes, instruction set, hardware. Motorola 68 XXX family of microprocessor, 68XXX addressing modes, instruction set, hardware.

Developing Microprocessor Based Products: Introduction to the Design Process, Preparing the specifications, Developing a design, Implementing and Testing and design, Regulatory Compliance Testing, design tool for Microprocessor Development.

Text/Reference Books:

1. A Nagoor Kani, "Microprocessor and Microcontroller", TMH, 2012.
2. A P Godse and D A Godse, "Microprocessor and Microcontroller", Technical Publications, 2012.
3. D. V. Hall, "Microprocessor & Interfacing", TMH, 1986.
4. C.M. Gilmore, "Microprocessors Principals and Application", MGH
5. Raj kamal, "Embedded System, Architecture & Programming", TMH
6. Berry B. Berry, " Inter Series of microprocessors", PHI
7. Peatman, "Microprocessor Based System Design", Pearson
8. Barry B. Brey, "The Intel Microprocessors", Pearson Education, 2011

MTPS-211
ADVANCED DIGITAL SIGNAL PROCESSING

Note: The question paper will have 5 sections. Section-1 will have one question from whole syllabus. The remaining 8 questions will be divided into 4 sections (2 questions per UNIT per section) and the students will have to attempt exactly one question from each of the sections.

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Exam : 60 Marks
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UNIT-1

Introduction of DSP: Introduction to Signal Processing, Discrete Linear Systems, superposition Principle, UNIT-Sample response, stability & causality Criterion.

Fourier Transform & inverse Fourier transform: Frequency domain design of digital filters, Fourier transform, use of Fourier transform in Signal processing. The inverse fourier transform, Sampling continuous function to generate a sequence, Reconstruction of continuous -time signals from Discrete-time sequences.

UNIT-2

Digital Filter Structure & Implementation: Linearity, time invariance & causality, the discrete convolution, the transfer function, stability tests, steady state response, Amplitude & Phase Characteristics, stabilization procedure, Ideal LP Filter, Physical reliability & specifications.FIR Filters, Truncation windowing & Delays, design example, IIR Filters: Review of design of analog filters & analog frequency transformation. Digital frequency transformation. Design of LP filters using impulse invariance method, bilinear transformation, Phase equalizer, digital all pass filters.

UNIT-3

Implementation of Filters: Realization block diagrams, Cascade & parallel realization, effect of infinite-word length, transfer function of degree 1&2, Sensitivity comparisons, effects of finite precision arithmetic on Digital filters.

UNIT-4

DFT & FFT & Z transform with Applications: Discrete Fourier transform, properties of DFT, Circular Convolution, Fast Fourier Transform, Realizations of DFT. The Z-transform, the system function of a digital filter, Digital Filter implementation from the system function, the inverse Z- transform, properties & applications, Special computation of finite sequences, sequence of infinite length & continuous time signals, computation of Fourier series & time sequences from spectra.

Text/ Refrence Books

1. J G Proakis, “Digital Signal Processing using Matlab”, Pearson Education, 2012
2. Alam V. Oppenheim and Ronald W. Schafer, “Digital Signal Processing” PHI.
3. Rabiner & Gold, “Theory & application of digital Signal Processing”, PHI 1992.
4. Roman kuc, “Introduction to Digital Signal Processing,” Tata McGraw Hill Edition.
5. Richard G. Lyons, “Understanding Digital Signal Processing”, Pearson Education, 2010
6. Paulo S. R. Diniz, Eduardo A. B. da Silva, Sergio L. Netto, “Digital Signal Processing: System Analysis and Design”, Springer, 2010.

MTPS-213
POWER SYSTEM PLANNING
UNIT 1

Note: The question paper will have 5 sections. Section-1 will have one question from whole syllabus. The remaining 8 questions will be divided into 4 sections (2 questions per UNIT per section) and the students will have to attempt exactly one question from each of the sections.

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Sessional : 40 Marks
Exam : 60 Marks
Total : 100 Marks
Duration of Exam : 03 Hrs

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. Endreyni, " Reliability Modeling in Electric Power System", John Wiley, New York
6. McDonald J R, "Modern Power System Planning", McGraw Hill International.

MTPS-215
TRANSIENTS IN POWER SYSTEM

UNIT-1

Travelling Waves On Transmission Line: Lumped and Distributed Parameters, Wave Equation, Reflection, Refraction, Behavior of Travelling waves with the line terminations – Lattice Diagrams – Attenuation and

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Sessional : 40 Marks
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Total : 100 Marks
Duration of Exam : 03 Hrs

Distortion – Multi-conductor system and Velocity wave. Computation of Power System Transients: Statistical approach for transient's calculations, principle of digital computation – Matrix method of solution, Modal analysis, Z-transforms, Computation using EMTP – Simulation of switches and non-linear elements.

UNIT-2

Lightning, switching and temporary over-voltages: Lightning-Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and reclosing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

UNIT-3

Behaviour of Winding Under Transients condition: Initial and Final voltage distribution -Winding oscillation - traveling wave solution - Behavior of the transformer core under surge condition – Rotating machine – Surge in generator and motor

UNIT-4

Insulation Co-ordination: Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level – overvoltage protective devices – lightning arresters, substation earthing, Protection of Power Systems against transients.

Text/Reference:

1. Akihiro Ametani, Naoto Nagaoka, Yoshihiro Baba, Teruo Ohno, "Power System Transients: Theory and Applications", CRC Press, 2013.
2. L.V. Bewley, "Traveling waves in Transmission Systems", Dover, 1963.
3. R. Rudenberg, "Electric Stroke waves in Power Systems", Harvard University Press, Cambridge, Massachusetts.
4. Allan Greenwood, "Electric Transients in Power Systems", Wiley Interscience.
5. CS Indulkar and DP Kothari, "Power System Transients, Statistical Approach", PHI Pvt Ltd., New Delhi.
6. VA Venikov, "Transient phenomena in Electrical Power Systems", Pergamon Press, London.
7. Klaus Ragaller, "Surges in High Voltage Networks", Plenum Press, New York, 1980..
8. Pritindra Chowdhari, "Electromagnetic transients in Po r System", John Wiley and Sons Inc., 1996.
9. Naidu M S and Kamaraju V, "High Voltage Engineering", TMH Publishing Company Ltd., New Delhi, 2004.

MTPS-217
POWER SYSTEM RESTRUCTURING & DEREGULATION

UNIT 1

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

Note: The question paper will have 5 sections. Section-1 will have one question from whole syllabus. The remaining 8 questions will be divided into 4 sections (2 questions per UNIT per section) and the students will have to attempt exactly one question from each of the sections.

L T P
4 0 -

Sessional : 40 Marks
Exam : 60 Marks
Total : 100 Marks
Duration of Exam : 03 Hrs

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.

MTPS-219
ELECTRIC POWER DISTRIBUTION & AUTOMATION

UNIT-1

Introduction: Basis of distribution automation, power delivery systems, control hierarchy, DA concept, Distribution automation system, basis architectures and implementation strategies for DA.

Note: The question paper will have 5 sections. Section-1 will have one question from whole syllabus. The remaining 8 questions will be divided into 4 sections (2 questions per UNIT per section) and the students will have to attempt exactly one question from each of the sections.

L T P
4 0 -

Sessional : 40 Marks
Exam : 60 Marks
Total : 100 Marks
Duration of Exam : 03 Hrs

Central Control and Management: Need of power control, operation environment of distribution networks, evolution of Distribution management systems, basic distribution management function, basis of a real time control system outage management, decision support applications, database structures and interfaces.

UNIT-2

Distribution Automation and Control Functions: Introduction, Demand side management, Voltage/VAR control, fault detection, restating function, reconfiguration of distribution systems, power quality.

Intelligent Systems in Distribution Automation: Distribution automation function, artificial intelligent methods, intelligent systems in DA, fault detection, classification and location in distribution systems.

UNIT-3

Renewable Energy Options and Technology: Distributed generation, classification of renewable energy, renewable energy options, other non-renewable energy sources, distributed
generation concepts and benefits, examples.

Distribution Management Systems: DMS and EMS, function of EMS, SCADA, remote terminal UNITs, distribution management systems, Distribution system analysis, Feeder automation, Load management systems, GIS customer information system, automatic meter reading, advance billing, Advances in AMR technology, cost benefit analysis in DS.

UNIT-4

Communication System for Control and Automation: Communication and distribution automation, DA communication and link options, wireless communication, wire communication, DA communication and control, DA communication architecture, DA communication user interface.

References:

1. James A. Momoh, “Electric Power Distribution Automation Protection and Control”, CRC Press, Taylor and Francis, 2008”
2. James N-Green and R.Wilson, “Control and Automation of electric Power Distribution Systems”, CRC Press, Taylor and Francis, 2008.
3. Turan Gonen, “Electric Power Distribution System Engineering”, CRC Press, 2007
4. Abdelhay A. Sallam, “Electric Distribution Systems”, Wiley-IEEE Press, 2011.

Note: The question paper will have 5 sections. Section-1 will have one question from whole syllabus. The remaining 8 questions will be divided into 4 sections (2 questions per UNIT per section) and the students will have to attempt exactly one question from each of the sections.