MEHP – 201 Power System Operation Control

Unit 1. CONTROL CENTER OPERATION OF POWER SYSTEMS:
Introduction to SCADA, control center, digital computer configuration, automatic generation control, area control error, operation without central computers, expression for tie line flow and frequency deviation, parallel operation of generators, area lumped dynamic model.

Unit 2 AUTOMATIC GENERATION CONTROL
Automatic voltage regulator, Automatic load frequency ;control, A VR control loops of generators, performance of A VR, ALFC of single area systems, concept of control area, multi-area systems, POOL operation- two area systems, tie-line bias control.

Unit 3 CONTROL OF VOLTAGE AND REACTIVE POWER:
Introduction, generation and absorption of reactive power, relation between voltage, power and reactive power at a node, single machine infinite bus system methods of voltage control, sub synchronous resonance, voltage stability, voltage collapse.

Unit 4 POWER SYSTEM OPTIMIZATION:
Optimal system operation with thermal plants, incremental production costs for steam power plants, constraints in economic operation, flow chart, transmission loss as a function of plant generation, the B- coefficients, examples.

Unit 5 UNIT COMMITMENT:
Statement of the problem, need and importance of Unit commitment, methods- priority list method, dynamic programming method, constraints, spinning reserve, examples.

Unit 6 POWER SYSTEM SECURITY:
Introduction, factors affecting power system security, power system contingency analysis, detection of network problems, network sensitivity methods, calculation of network sensitivity factor, contingency ranking.

Reference Books:
1. GL Kusic, Computer aided power system analysis, PHI
2. IJ Nagarath and DP Kothri, Modern power system Analysis, TMH.
3. AJ Wood & BF Wappemberg Power Generation, Operation & control, John W
4. Ed Hardschin Edmund Real Time control of power systems
5. Dr K R Padiyar Power system dynamics stability and control
6. Dr. Prabhashankar Kundlur, Power system stability and control Literatur

MEHP – 202 Insulation Engineering

Unit 1 CONDUCTION AND BREAKDOWN PHENOMENA:

Mechanism of conduction in gases, Liquids and solids. CoJona breakdown in composite insulation, mechanism of breakdown, electric and thermal breakdown of insulating materials used in power system and apparatus. Line and Substation Insulation

Types: of line insulators in use, its characteristics, principles of design, strings of insulators, distribution of voltage along the strings and methods of equalizing the distribution, choice of number of insulators in a string and minimum clearances in air to ground and between phases.

Types of station apparatus, insulators, their characteristics and principles of design, a detailed study of condenser bushings.

Pollution, its causes, flashover its mechanism in insulators in polluted atmosphere, a detailed discussion of insulation design and maintenance in polluted atmosphere.

Unit 2 INSULA TION OF POWER TRANSFORMER:

Electrical behavior of characteristics of insulators under D C voltage and circuit breakers, General information, special problems of insulation design of power transformers, construction and arrangement of insulation of power transformers. Construction and arrangement of insulation of power transformers.

Rational design of power transformer insulation, an elementary discussions of transient phenomenon in transformer windings, methods of transient voltage stress control of effect on economy.

Electrical characteristics, methods and problems of insulation testing of power transformers, methods of fault detections and location. Insulations of voltage, current transformers and other special transformers,

Unit 3 INSULATION OF HIGH VOLTAGE ROTATING MACHINES:

Requirements of machines insulation and its typical construction, new materials used as insulation, corona in machine insulation and measures used for its elimination transient in machine windings and its effect on insulation design.

Unit 4 INSULATION OF HIGH VOLTAGE POWER CABLES:

Types of High Voltage and extra high voltage cables construction and arrangement of cable insulation, stresses control and other design consideration

INSULA TION OF POWER CONDENSERS:

Types of insulation used, its characteristics behavior and design principle, arrangement, and construction, insulation of impulse, high frequency and other condensers.

Unit 5 PREVENTIVE INSULATION TESTING:

Problem and methods of preventive testing processes in a multiplayer dielectric, measurements on ton and capacitance as methods of insulation control partial discharges in insulation physics of partial discharges, their detection and measurement of leakage current and insulation resistance, radiation, sound waves, voltage distributions and method to improve the voltage distribution across line post and bushing insulator of transformer, cables.

REFERENCE BOOKS:

1. High Voltage Engineering- By razvig, Khanna Pub. Delhi.
2. High Voltage Technology- by Alston, Oxford press
3. Basic process of Gascous Electronics- by L B Loab University of Califoni press, Berkely
4. Dielectric and Waves- by R Von Hipple, John wiley and Sons
5. Bradwell A Electrical Insulation, Peter Peregrinus Ltd London
6. Sillars R N, Electrical insulating Materials and their Applications
7. Arora R Mosch W High Votlage insulation Engineering Wiiley Eastern Ltd.

MEHP – 203 Electromagnetic Energy Transmission

Unit 1
Limped circuit and field concepts. Quasi static fields and distributed circuits steady state waves on loss less lines.

Unit 2
Uniform transmission line, distributed circuit approach, steady state waves on loss less lines, line termination, impedance transformation, standing waves.

Unit 3
Waves on dissipative lines steady state and transient waves on dissipative 3 lines, Exact and T equivalents, Nominal and T circuits, ABCD constants. Natural and forced oscillations.

Unit 4
Uniqueness theorems of electro statics, Maxwells coefficients, application to multi circuit power lines.

Unit 5
Boundary valve problems, application of greens functions and conformal mapping Numerical methods, for field calculation Experimental methods of field plotting.

Reference Books:
1. Electromagnetic energy transmission and dadiation by Adler Chu and Fano. John Wiley
2. Field theory for engineers Moon and spencer, von Nastrand
3. Calculation of electrostatic and electromagnetic fields by G Buch holtz.

MEHP – 204 Over Voltages in Power System

Unit 1

Introduction to over voltages phenomena power systems:
Transient of transmission lines infinite line definition and its transient behavior finite line analyses. Analysis for different line terminations problems Bewely lattice diagram problems.

Unit 2

Use of transient network analyzer, digital and hybrid computer for solving large-scale problems.

Unit 3

Characteristics of lighting discharges theory of cloud formation origin of lighting iso Keronic level leader development return stroke.

Unit 4

Different types of lighting interaction back flashover shielding angle calculation for line grounding rods counter poise problems Origin and characteristics of switching over voltages and temporary over voltages problems of switching surges.

Unit 5

Behavior of apparatus and line insulation under all types of over voltages concept of BIL protection of apparatus against over voltages surge arresters insulation co-ordination.

Reference Books:

1. Greenwood, Power System transients orient Longman
2. R.S. Jha A course in high voltage Engineering, Dhanpat rai and sons
3. Rakosh Das Begamudre Extra high voltage AC transmission engg Wiley East
4. Ragaller K Surges in high voltage network plenum press
5. E Kuffel and W.S. Zaengl High Voltage Engineering Fundamentals Pergamon
6. M.S. Naidu and V. Kamaraju High Voltage Engineering second edition TMH
7. C.L. Wadhwa High Voltage Engineering New Age International.

MEHP – 205 Computer Control of Power Systems

Unit 1

Bus incidence matrix, primitive admittance matrix, Y -Bus by singular transformation. Algorithm for formation of bus impedance for single- phase system.

Unit 2

Load frequency; control, turbine speed governing system modeling. Block diagram representation of single area, study state and dynamic response, two area load frequency control

Unit 3

Load flow studies, static load flow equations, types of buses, Gaus siedel interative method using Y bus including PV bus, acceleration of convergence. Newton raphson method in polar co-ordinates Fast decoupled load flow method. Representation of transformer fixed tap setting transformer tap changing under load transformer.

Unit 4

Economic operation of power system: Optimal distribution of loads between units within a plant. Transmission loss as a function of plant generation, determination of loss coefficient. Automatic economic load dispatch using computer.

Unit 5

Transient stability studies: Numerical solutions of differential equations, modified Eulers method runge Kutta IV order method Milnes predictor corrector method. Swing equation representation of synchronous machine for transient stability studies, load representation Network performance ~ equation. Solution techniques with flowcharts.

Reference Books:

1. Stag and El-Abiad, computer methods in Power System Analysis, TMH
2. Nagrath & Kothari, Modern Power System Analysis Tata Mc Graw Hill
3. Power System Analysis & Design, Glover Sharma, Thomson publications
4. M A Pai, Computer Techniques in Power System, Tata McGraw Hill.