

MEPS – 201 Reactive Power Control & Facts

UNIT 1

Description and definition of

Introduction to FACTS: Basic Types of controllers – Benefits from FACTS technology- Static Var Compensator (SVC):

Principle of operation, configuration and control. Thyristor Controlled Series compensator (TCSC): Principle of operation, configuration and control, Application for damping electromechanical Oscillations, Application for mitigation of SSR. Static Compensator (STATCOM): Principle of operation, configuration and control. Static Synchronous Series Compensator (SSSC): Principle of operation, configuration and control. Thyristor Controlled Phase Angle Regulator (TCPAR): Principle of operation, configuration and control, Unified Power Flow Controller (UPFC): Principle of operation, configuration and control, Simulation of UPFC, Steady state model of UPFC. Interline Power Flow Controller (IPFC): Principle of operation, configuration and control.

UNIT 2

Oscillation Stability Analysis and Control: Introduction – Linearised model of power systems installed with FACTS based Stabilisers – Heffron-Phillips model of a SMIB system installed with SVC, TCSC and TCPS – Heffron-Phillips model of a SMIB system with UPFC – Heffron-Phillips model of a Multi-machine system installed with SVC, TCSC and TCPS

UNIT 3

Analysis and Design of FACTS based stabilisers: Analysis of damping torque contribution by FACTS based stabilisers installed in SMIB systems, Design of robust FACTS based stabilisers installed in SMIB systems by phase compensation method. Selection of installing locations and feed back signal for FACTS based stabilizers

UNIT 4

Transient Stability control with FACTS: Introduction – Analysis of Power systems installed with FACTS devices: Power transmission control using Controllable Series Compensation(CSC), Power Transmission Control using SSSC, Power Transmission Control using UPFC, Power Transmission Control using Phase Shifting Transformer(PST), Power Transmission Control using UPFC, Control of FACTS devices for transient stability improvement – General considerations of FACTS control strategy: CSC,SSSC, SVC, STATCOM and UPFC control strategy – General Structure of the FACTS devices control.

References:

1. Reactive Power Control in Power Systems, T J E Miller John Wiley.
2. Computer modeling of Electrical Power Systems, J Arriliga, N R Watson, Wiley
3. Understanding FACTS' N G Hingorani and L Gyugyi, IEEE Press.
4. Flexible ac Transmission Systems (FACTS), Y.H. Song, A.T.Johns,IEEE P.

MEPS – 202 Energy Conservation and Management

Unit 1

General energy problem: Energy use patterns and scope for conservation. Energy audit: Energy monitoring, Energy accounting and analysis, Auditing and targeting. Energy conservation policy, Energy management & audit, Energy audit, Types of energy audit, energy management (audit), qualities and function of energy managers, language of an energy manager, Questionnaire, Check list for top management, Loss of energy in material flow, energy performance, Maximizing system efficiency, Optimizing, input energy requirements, Energy auditing instruments, Material load energy balance diagram.

Unit 2

Thermodynamics of Energy Conservation, Basic principle, Irreversibility and second law, efficiency analysis of systems, Primary energy sources, optimum use of prime-movers, energy efficient house keeping, energy recovery in thermal systems, waste heat recovery techniques, thermal insulation, Thermal energy audit in heating, ventilation and air conditioning. Maintenance and Energy audit, friction, lubrication and tribo-logical innovations. Predictive and preventive maintenance

Unit 3

Load curve analysis & load management DSM, Energy storage for power systems (Mechanical, Thermal, Electrical & Magnetic) Restructuring of electric tariff from energy conservation consideration, Economic analysis depreciation method, time value of money, Evaluation method of projects, replacement analysis, special problems inflation risk analysis. Pay back period, Energy economics, Cost Benefit Risk analysis, Pay back period.

Unit 4

Energy efficient electric drives, Energy efficient motors V.S.D. power factor improvement in power system, Energy Conservation in transportation system especially in electric vehicle. Energy flow networks, Simulation & modeling, formulation & Objective & constraints, alternative option, Matrix chart.

Unit 5

Energy conservation task before industry, Energy conservation equipments, Co-Generation, Energy conservation in Sugar, Textiles, Cement, process industry, Electrical Energy Conservation in building, heating, lighting, domestic gadgets

Reference Books:

1. Energy Management – W.R. Murphy & G. McKey Butler worths.
2. Energy Management Head Book- W.C. Turner, John Wiley
3. Energy Management Principles- Craig B. Smith, Pergamon Press
4. Energy Conservation- Paul O Callagan- Pergamon Press
5. Design & Management of energy conservation. Callaghan,
6. Elect, Energy Utilization & Conservation. Dr. Tripathi S.C.,

MEPS – 203 Power Quality and Conditioning

UNIT 1

Understanding Power quality, types of power quality disturbances, power quality indices, Causes and effects of power quality disturbances

UNIT 2

Causes and effects of harmonics, converter configuration and their contribution to supply harmonics, other sources of harmonics

UNIT 3

Radio interference, supply standards, elimination/suppression of harmonics, classical solutions & their drawbacks, passive input filters, design of harmonic filters, Improved power quality converter topologies, (single and three phase), transformer connections, Elimination/suppression of harmonics using active power filters – topologies, and their control methods, PWM converter as a voltage source active filter, current source active filter,

UNIT 4

Active waveshaping of input line current, constant frequency control, constant tolerance band control, variable tolerance band control, discontinuous current control, Electromagnetic interference (EMI), EMI generation, EMI standards, and elimination.

Reference Books:

1. Power Quality – by R.C. Duggan
2. Power system harmonics – by A.J. Arrillaga
3. Power electronic converter harmonics – by Derek A. Paice
4. Power Electronics – Mohan, Undeland, Robbins

MEPS – 204 Restructured Power Systems

Fundamentals of restructured system, Market Architecture, Load Elasticity, Social welfare maximization, OPF: Role in vertically integrated systems and in restructured markets, Congestion Management, Optimal Bidding, Risk assessment and Hedging, Transmission Pricing and Tracing of power, Ancillary Services, Standard Market Design, Distributed Generation in restructured markets, Developments in India, IT applications in restructured markets, Working of restructured power systems : PJM.

Reference Books:

1. Understanding electric utilities and de-regulation, Lorrin Philipson, H. Lee Willis, Marcel Dekker Pub., 1998.
2. Power system economics: designing markets for electricity Steven Stoft, John Wiley & Sons, 2002.
3. Operation of restructured power systems. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boelen, Kluwer Academic Pub., 2001.
4. Restructured electrical power systems: operation, trading and volatility Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker Pub., 2001

MEPS – 205 Power System Transients

UNIT 1

Origin and nature of transients and surges. Equivalent circuit representations. Lumped and distributed circuit transients. Line energisation and de-energisation transients. Earth and earthwire effects.

UNIT 2

Current chopping in circuit breakers. Short line fault condition and its relation to circuit breaker duty. Trapped charge effects. Effect of source and source representation in short line fault studies. Control of transients.

UNIT 3

Lightning phenomena. Influence of tower footing resistance and earth resistance. Traveling waves in distributed parameter multi-conductor lines, parameters as a function of frequency.

UNIT 4

Simulation of surge diverters in transient analysis. Influence of pole opening and pole closing. Fourier integral and Z transform methods in power system transients. Bergeron methods of analysis and use of EMTP and EMTDC/PSCAD package.

UNIT 5

Insulation Coordination : overvoltage limiting devices, dielectric properties, breakdown of gaseous insulation, tracking and erosion of insulation, high current arcs.

Reference Books :

1. Power System Transients by Vanikov
2. Power System Transients by C. S. Indulkar and D.P. Kothari
3. Power Circuit breaker theory and design by Flurscheim C.H.
4. EMTP Rulebook
5. EMTDC/PSCAD Rulebook