M.TECH FIRST SEMESTER

EEPC1T6B **POWER SYSTEM SECURITY (ELECTIVE II)** **Credits: 4**

Lecture: 4 periods/week **Internal assessment: 30 marks**
Semester end examination: 70 marks

Objective

This course aims at estimating the state of the power system network under different contingencies and to ensure steady state voltage stability and security of the system.

Outcomes

After studying this course student will be able to

1. Understand the need for power system security, security measurement and assessment.
1. Analyze the techniques for security enhancement.

UNIT I - PRELIMINARIES FOR POWER SYSTEM SECURITY PROBLEMS

Per unit quantities - Modeling of generators, transformers, off nominal tap setting and phase shifting transformers, transmission lines and loads. Primitive parameters - Bus admittance matrix - bus impedance matrix - reduction due to zero bus currents and zero bus voltages - Solution through factored matrices - Solution of non-linear algebraic equation and non-linear differential equations.

UNIT II – POWER FLOW ANALYSIS WITH FACTS

Formulation of power flow problem - solution through Newton Raphson method - DC power flow solution - Power flow solution using FACTS devices - Optimal power flow solution.

UNIT III – POWER SYSTEM STATE ESTIMATION

DC and AC network, orthogonal decomposition algorithm, detection identification of bad measurements, network observability and pseudo measurements, application of power system state estimation, introduction to supervisory control and data acquisition.

UNIT IV POWER SYSTEM STABILITY

Power system stability-security- reliability, deregulation, factors affecting power system security, security assessment, static and dynamic – online and offline, security enhancement.

UNIT V - CONTINGENCY ANALYSIS

Importance of contingency analysis - addition / removal of one line - construction of a column of bus impedance matrix from the bus admittance matrix - calculation of new bus voltages due to addition / removal of one line - calculation of new bus voltages due to addition / removal of two lines.

UNIT VI - POWER SYSTEM SECURITY ASSESSMENT

Network sensitivity factors, contingency selection, contingency ranking, performance indices and methods, direct methods, indirect methods, sensitivity factors, generation shift factors,line outage distribution factors.

UNIT VII - SECURITY CONSTRAINED OPTIMIZATION

SCOPF, basis of evolutionary optimization techniques, preventive, emergency and restorative controls though non- linear programming (NLP) and linear programming(LP)methods.

UNIT VIII - SECURITY IN DEREGULATED ENVIRONMENT

Need and conditions for deregulation, electricity sector structure model, power wheeling transactions, congestion management methods, available transfer capability (ATC), system security in deregulation.

Reference Books

1. G W Stagg and A H El Abiad, "*Computer Methods in Power System Analysis*", McGraw Hill, 1968.
2. J J Grainger and W D Stevension, "Power *System Analysis*", McGraw-Hill, Inc., 1994.
3. D P Kothori and I J Nagrath, "Modern *Power System Analysis*", Tata McGraw Hill Education Private Limited, 2011.
4. Hadi Saadat, "*Power System Analysis*" McGraw-Hill, 2004.
5. M A Pai," *Computer Techniques in Power System Analysis"*, Tata McGraw Publishing Company Limited, 2006.
6. K.R.PADIYAR , Power System Dynamics: Stability and Control, II Edition, B.S.Publications. P.M. Anderson and A.A. Fouad, Power system control and stability, John Wiley & sons
7. B M Weedy , Electric Power Systems, III Edition, John Wiley & Sons
8. P.Venkatesh, B.V.Manikandan, S.Charlesraja, A.Srinivasan, Electrical Power Systems: Analysis, Security and Deregulation, PHI