POWER GENERATION, OPERATION AND CONTROL

Course Code: 13EE2101 **L P C**
4 0 3

Pre requisites: Power Generation Engineering, Power Transmission Engineering and Power System Operation and Control.

Course Outcomes:
At the end of the course, the student will be able to
CO 1: Solve Unit Commitment problem using simple priority list scheme and dynamic programming technique for a given power system.
CO 2: Estimate the frequency deviation for a given change of load and design control systems for making steady-state frequency error to zero.
CO 3: Select appropriate voltage control techniques for improving voltage profile in a transmission system.
CO 4: Estimate system security level using contingency analysis and understand state estimation.
CO 5: Solve optimal power flow problem using Gradient Method and Newton's Method.

UNIT-I
UNIT COMMITMENT - Introduction, Constraints in Unit Commitment - Spinning Reserve, Thermal Unit Constraints, Other Constraints, Hydro-Constraints, Must Run, Fuel Constraints; Unit Commitment Solution Methods - Priority-List Methods, Forward Dynamic Programming Approach, Backward Dynamic Programming Approach and Lagrange Relaxation Solution.

UNIT-II
CONTROL OF ACTIVE POWER
Active Power and Frequency Control, Control of Generating Unit Power Output, Composite Characteristics of Power Systems, Response Rates of Turbine-Governing Systems, Fundamentals of Automatic Generation Control, Implementation of AGC, Under frequency Load Shedding.

UNIT-III

CONTROL OF RECTIVE POWER

Reactive Power and Voltage Control – Production and Absorption of Reactive Power, Methods of Voltage Control, Shunt Reactors, Shunt Capacitors, Series Capacitors, Synchronous Condensers, Static Var Systems; Principles of Transmission System Compensation.

UNIT-IV

POWER SYSTEM SECURITY AND STATE ESTIMATION

Introduction, factors Affecting Power System Security, Contingency Analysis: Detection of Network Problems - Overview of Security Analysis, Linear Sensitivity Factors, AC Power Flow Methods, Contingency Selection, Concentric Relaxation, Bounding.

Power System State Estimation, Maximum Likelihood Weighted Least-Squares Estimation - Maximum Likelihood Concepts, Matrix Formulation, State Estimation of an AC Network - Development of Method, Typical Results of State Estimation on an AC Network.

UNIT-V

OPTIMAL POWER FLOW

Introduction, Solution of the Optimal Power Flow, The Gradient Method, Newton's Method; Linear Sensitivity Analysis. – Sensitivity coefficients of an AC Network Model.

TEXT BOOKS:

1. Allen J.Wood and Bruce F.Wollenberg, "*Power Generation, Operation and Control*",2nd Edition, John Wiley & Sons Inc, 1996.
2. P.Kundur, "*Power System Stability and Control*", McGraw-Hill Inc, 1997.

REFERENCES:

1. Olle E.Elgerd, "*Electrical Energy Systems Theory – An introduction*" 2nd Edition, Tata McGraw Hill, 1983.
2. T.J.E.Miller, "*Reactive Power Control in Electric Systems*", Wiley, 1982.