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 Educational Objectives:

1.To introduce Unit Commitment problem, its constraints and solutions using optimization techniques.
2.To explain load frequency control and estimate the frequency deviation through modeling and reducing the error through control system design for single area as well as interconnected systems.
3.To identify various methods of voltage control and study the reactive power compensation of transmission system.
4.To explain power system security and analyze the same using contingency analysis and introduce state estimation concepts for real-time control applications.
5.To obtain optimal power flow solution using Gradient method and Newton's Method**.**

Course Outcomes: At the end of the course, the student will be able to

1.Solve Unit Commitment problem using simple priority list scheme and dynamic programming technique for a given power system.
2. Estimate the frequency deviation for a given change of load and design control systems for making steady-state frequency error to zero.
3.Select appropriate voltage control techniques for improving voltage profile in a transmission system.
4.Estimate system security level using contingency analysis and understand state estimation.
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.