POWER SYSTEM OPERATION AND CONTROL

Course Code: 13EE1127

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Pre requisites:

Power Generation Engineering, Power Transmission Engineering.

Course Outcomes:

After completion of the course, the student will be able to

CO 1 Distinguish various characteristics of thermal plants, optimal allocation of load on to various units.

CO 2 Solve Hydro thermal scheduling problems.

CO 3 Determine load frequency control.

CO 4 Analyze Power System contingency analysis.

CO 5 Determine the voltage stability and apply FACTS Devices compensation.

UNIT-I (12 Lectures)

ECONOMIC OPERATION OF POWER SYSTEMS-1:

Introduction, Optimal operation of Generators on Bus Bar, Cost Curve – Incremental fuel Vs Production costs, input-output characteristics, Optimum generation allocation with line losses neglected.

Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula.

UNIT-II (12 Lectures)

HYDROTHERMAL SCHEDULING:

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, Mathematical formulation, Solution Technique, Algorithm.

UNIT-III (12 Lectures)

AUTOMATIC GENERATOR AND VOLTAGE CONTROL:

Introduction, Load Frequency Control (Single Area Case), Turbine Speed Governing System, Model of Speed Governing System, Turbine Model, Generator Model, Complete Block Diagram Representation of LFC of an Isolated Power System, Steady State Analysis, Dynamic Response, Alternator voltage regulator scheme, Block Diagram representation.

CONTROL AREA CONCEPT:

Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control, Two Area Load Frequency Control.

UNIT-IV

POWER SYSTEM SECURITY:

System state classification, security analysis, contingency analysis, sensitivity factors

UNIT-V (12 Lectures)

VOLTAGE STABILITY:

Introduction, Comparison of Angle and Voltage Stability, Reactive Power Flow and Voltage Collapse, Mathematical Formulation of Voltage Stability Problem, Voltage Stability Analysis, Prevention of Voltage Collapse, State of the Art, Future Trends and Challenges.

COMPENSATION IN POWER SYSTEMS:

Introduction, Loading capability, Load compensation, Line compensation, Series compensation, Shunt Compensation, Comparison between STATCOM and SVC, FACTS, FACTS controllers.

TEXT BOOKS:

1. D.P.Kothari and I.J.Nagrath, *"Modern Power System Analysis"*, Tata Mc-Graw Hill Publishing Company, 3rd Edition, 2008.

REFERENCES:

1. C.L.Wadhwa, *"Electrical Power Systems"*, New Age International Publishers, 6th Edition, 2009.
2. O. I. Elgerd, *"Electric Energy Systems Theory"*, Tata McGraw Hill Publishing Company, Second Edition, 2007.
3. A. J. Wood and B.F.Wollenberg, *"Power Generation, Operation and Control"*, John-Wiley & Sons, Second edition, 2006.
4. T.J.E.Miller, *"Reactive Power Control in Electric Systems"*, John Wiley & Co, 1982.
5. Prabha Kundur, *"Power System Stability and Control"*, McGraw Hill Education, 2005.