

6 th Semester		Power System Operation and Control	L-T-P 3-0-0	3 Credits
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Module I: (10 hours)

Review of the structure of a Power System and its components. Per unit calculations. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel, Coupled and Decoupled Newton-Raphson methods for the solution of the power flow equations. Regulating Transformers.

Module II: (8 hours)

Economic Operation and Management of Power System: **Basic Pricing Principles: Generator Cost Curves, Utility Functions**, Economic Operation with and without Transmission losses, Transmission loss coefficient, Economic Dispatch, Unit Commitment, **Function of Load Dispatch Centres. Demand side-management.**

Module III: (10 hours)

Control of Frequency and Voltage: Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators, ALFC of Single and Two Area Systems.

Module IV: (12 hours)

Power System Stability: The Stability Problem, Rotor Dynamics and the Swing Equation, The Power-Angle Equation, Synchronizing Power Coefficients, Equal- Area Criterion for Stability, Multi-machine Stability Studies: Classical Representation, Step-By-Step Solution of the Swing Curve, Factors Affecting Transient Stability.

Books:

- [1] J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.
- [2] O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.
- [3] D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 4th Edition, 2011.
- [4] Power System Analysis- By Hadi Saadat, TMH, 2002 Edition, Eighth Reprint.
- [5] C.L. Wadhwa, “Electrical Power Systems”, New Age International Publishers, 6th Edition.
- [6] A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc, 1999.

Digital Learning Resources:

Course Name: Power System Analysis
 Course Link: <https://nptel.ac.in/courses/108/105/108105067/>

Course Instructor: Prof. A K Sinha, IIT Kharagpur

Course Name: Power System Analysis
Course Link: <https://nptel.ac.in/courses/117/105/117105140/>
Course Instructor: Prof. D Das, IIT Kharagpur

Course Name: Power System Analysis
Course Link: <https://nptel.ac.in/courses/108/104/108104051/>
Course Instructor: Prof. Arindam Ghosh, IIT Kanpur

Course Name: Computer Aided Power System Analysis
Course Link: <https://nptel.ac.in/courses/108/107/108107028/>
Course Instructor: Dr. Vinay Pant and Dr. B. Das, IIT Roorkee