

EE601PC: POWER SYSTEMS ANALYSIS**B.Tech. III Year II Sem.**

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Prerequisite: Power Systems-I & Power Systems –II**Course Objectives:**

- To understand and develop Y_{bus} and Z_{bus} matrices
- To know the importance of load flow studies and its importance
- To analyse various types of short circuits
- To know rotor angle stability of power systems

Course Outcomes: After this course, the student will be able to

- Develop the Y_{bus} and Z_{bus} matrices
- Analyze load flow for various requirements of the power system
- Analyze short circuit studies for the protection of power system
- Estimate stability and instability in power systems

UNIT - I

Power System Network Matrices: Graph Theory: Definitions and Relevant concepts in Graph Theory, Network Matrices. Transmission Network Representations: Bus Admittance frame and Bus Impedance frame. Formation of Y_{bus} : Direct and Singular Transformation Methods, Numerical Problems. Formation of Z_{Bus} : Modification of existing Z_{Bus} Matrix for addition of a new branch, & complete Z_{Bus} building algorithm Numerical Problems.

UNIT – II

Power Flow Studies – I: Introduction: Necessity of Power Flow Studies, Bus classification and Notations, Convergence & Bus mismatch criteria. Load Flow Methods: Gauss-Seidal Method in complex form without & with voltage control buses, line flows and loss calculations, Newton Raphson method in Polar and Rectangular form, derivation of Jacobian elements, Numerical Problems for one or two iterations.

UNIT – III

Power Flow Studies - II: Introduction to sensitivity & decoupled sub matrices of J-matrix, Decoupled load flow method and its assumptions, Fast Decoupled load method and its assumptions, Comparison of Different Methods – DC load Flow method, Numerical problems for one or two iterations.

UNIT – IV

Short Circuit Analysis: Per-Unit Systems. Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems. Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems. Symmetrical Components, sequence impedances and networks, Numerical Problems. Unsymmetrical Fault Analysis: Fault current calculations for LG, LL, LLG faults with and without fault impedance, Numerical Problems.

UNIT – V

Power System Stability Analysis: Introduction to Power System Stability issues. Rotor dynamics & Swing equation, Power angle equation with & without neglecting line resistance, Steady State Stability, Determination of Transient Stability through Equal Area Criterion for single machine infinite system, Critical clearing angle & time, Numerical problems. Multi-machine transient analysis: Classical representation of system and its assumptions, Solution of Swing Equation by Point-by-Point Method, Methods to improve Stability.

TEXT BOOKS:

1. "I. J. Nagrath & D. P. Kothari", "Modern Power system Analysis", Tata McGraw-Hill Publishing Company, 4th Edition 2011.
2. "Hadi Saadat", "Power System Analysis", TMH Edition, 2002.

REFERENCE BOOKS:

1. "M. A. Pai", "Computer Techniques in Power System Analysis", TMH Publications, 3rd Edition 2014.
2. Grainger and Stevenson, "Power System Analysis", Tata McGraw Hill, 2003.
3. Abhijit Chakrabarthy and Sunita Haldar, "Power System Analysis Operation and Control", 3rd Edition, PHI, 2010.