

Subject Code: 1ET2130101	Subject Title: Power system Modeling and Simulation
Pre-requisite Subject	Fundamental of power system, basics of Network Analysis

Course Objective: The objective of this subject is to understand the network topology and load flow analysis of power system. Different concepts of power system security, the concept of state estimation and different numerical techniques used in power system.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
3	-	2	5	60	40	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Network Formulation and Graph Theory: Introduction, Network Equations, Graph Theory, Development of Network Matrices from Graph Theoretic Approach, Augment Cut-set Incidence Matrix Cut-set and Circuit Equations, Building Algorithm for the Bus Impedance Matrix Modification of ZBUS matrix due to changes in the primitive network.	6	16%
2	Load Flow Studies: Introduction, Different techniques such as Gauss-Saidal method, Newton Raphson method, De-Coupled method, Fast Decoupled method, Modified Fast Decoupled, Concept of Optimal Power Flow, Solution of Optimal power flow by Gradient method, Solution of Optimal power flow by Newton's method Linear Programming Methods, DC load flow, Continuation Power flow.	8	22%
3	Power System Security: Introduction, Factors Affecting Power System Security, Short Circuit Studies of a Large Power System Networks, Symmetrical Fault Analysis Using Bus Impedance Matrix, Algorithm for Formation of Bus Impedance Matrix, Contingency Analysis: Detection of Network Problems, Overview of security analysis, Linear Sensitivity Factors, Contingency Selection, Concentric Relaxation, Bounding.	10	28%
4	Introduction to State Estimation in Power Systems: Introduction, Power system state estimation, Maximum Likelihood Concept, Weighted Least Squares Estimation, Introduction, Matrix Formulation, State Estimation of an AC network, Development of Method, State Estimation by Orthogonal Decomposition, An Introduction to Advanced topics in state estimation, Detection and Identification of Bad measurements, Estimation of 22 quantities not being measured, Network Observability and Pseudo measurements, Application of Power Systems State Estimation.	8	22%
5	Numerical Integration Techniques: Numerical integration techniques: One step methods, Taylor series based methods, Forward-Euler's method, Runge-Kutta methods, Trapezoidal method, backward-Euler's method, Power system applications: Transient stability analysis.	4	12%

Course Outcome:

After learning the course the students should be able to

1. Recent techniques and computer application for modeling of practical and large interconnected power system networks using programming languages.
2. Recent methodologies for simulation and analysis of power system networks like real and reactive power flows and optimal scheduling.
3. Effect of outage of any important component of power system on the operation and reliability of power systems.
4. Algorithm required to find out parameters for monitoring and control of power system in real time from actual measurement data.
5. Computer Algorithms used to solve algebro-differential pertaining to power system to assess the stability performance of power systems.

List of Text Books:

1. Computer-Aided Power Systems Analysis (2nd Edition), George Kusic, CRC Press –Indian Edition
2. Power Generation Operation & Control, John Wiley & Sons, Inc, 1996- A. J. Wood and B. F. Wollenberg
3. Power System Analysis By Stevenson and Grainger TATA McGrawHill

List of Reference Books:

1. AC-DC Power System Analysis, IEE London UK, 1998- Jos Arrillaga and Bruce Smith
2. Power System Analysis, Tata McGraw Hill, New Delhi, 1999- Hadi Sadat
3. Computational methods for Electric Power Systems, CRC press- Mariesa Crow
4. Computer Methods in Power System Analysis, Glenn Stagg and Elabadi, McGraw-Hill

List of Experiments:

1. Formulation of Y-Bus using MATLAB programming
2. Formulation of Z-Bus using MATLAB programming.
3. Load Flow analysis of given power system.
4. Short Circuit analysis of given power system
5. Simulate and analysis of contingency selection.
6. Simulation and analysis of State Estimation using MATLAB programming.
7. Simulation of stability analysis of power system.
8. Simulation and analysis of different Numeric Techniques used in power system.
 - (i) Simulation and analysis of Taylor series method.
 - (ii) Simulation and analysis of Euler's method.
 - (iii) Simulation and analysis of Runge-Kutta method.