

Branch Name:	Electrical Engineering
ProgramCode:	ET213
CourseName:	Power system Modeling and Simulation
CourseCode:	2ET2130101T
Pre-requisiteCourse:	Fundamental of power system, basics of Network Analysis

Course Objectives:

1. To understand the network topology and load flow analysis of power system.
2. To understand different concepts of power system security, the concept of state estimation.
3. To identify various concept of state estimation and different numerical techniques used in power system.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No	Topic	Total Hours	Weightage (%)
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.	05	12%
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.	09	20%
3	Power System Security and Load Forecasting: 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, Overview of security analysis, Linear Sensitivity Factors, Objectives of forecasting, Load growth patterns and their importance in planning, Load forecasting Based on discounted multiple regression technique, Weather sensitive load forecasting, Use of AI in load forecasting.	15	36%
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	09	20%

	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.		
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.	05	12%

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 McGraw Hill.

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 Eliahi, McGraw-Hill.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Apply recent techniques and computer application for modeling of practical and large interconnected power system networks using programming languages.	3 Applying
CLO2	Understand and identified recent methodologies for simulation and analysis of power system networks like real and reactive power flows and optimal scheduling.	2 Understanding
CLO3	Evaluate effect of outage of any important component of power system on the operation and reliability of power systems.	5 Evaluate
CLO4	Understand the algorithm required to find out parameters for monitoring and control of power system in real time from actual measurement data.	2 Understanding 5 Evaluate
CLO5	Learn about different components of electrical power system.	1 Remembering
CLO6	Analyze computer Algorithms used to solve algebra-differential pertaining to power system to assess the stability performance of power systems.	2 Understanding

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	L				M	M		M		L					H	M
CLO2				M			L				M		M			L
CLO3		L	L		L	M		M				M		H		
CLO4		M	L	M			H				M			M		L
CLO5				H		M						M				L
CLO6				M			L				M		M			L

H: High, M: Medium, L: Low