

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Power System Operation & Control (Professional Elective-III)
Course Code:	2ET1090706T
Pre-requisite Course:	--

Course Objectives:

1. To analyze power system operating conditions using load flow study techniques such as Gauss–Seidel, Newton–Raphson, and Fast Decoupled methods.
2. To explain and analyze the impact of load changes on power system frequency and evaluate the role of primary and secondary frequency control.
3. To apply stability analysis techniques to ensure secure and reliable operation of power systems.

Teaching and Examination Scheme:

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

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Load Flow Studies: Network model formulation, formation of Ybus, and Zbus, power flow problem, different types of buses, Approximate power flow, Gauss Seidel method, Newton-Raphson method, Decoupled power flow studies, Fast decoupled power flow studies, Comparison of power flow methods.	12	25
2	Economic load dispatch and Unit Commitment: Economic dispatch of thermal units and methods of solution, Transmission losses, B matrix loss formula, and Composite generation production cost function-solution by gradient search techniques, Constraints in unit commitment, Spinning reserve, Dynamic programming solution.	08	18
3	Automatic generation control: Single area load frequency control, Speed governing system and characteristics, Multi area load frequency control, Flat frequency, Flat tie line load and tie-line load bias control, Economic dispatch and AGC.	05	12
4	Control of Voltage and Reactive Power: Introduction, Generation and absorption of reactive power, Relation between voltage, power and reactive power at a node, Single machine infinite bus systems, Methods of voltage control.	05	12
5	Power System Stability: Dynamics of a synchronous machine, Power angle equation, Node elimination technique, Simple system, Steady state stability, Transient stability, Equal area criteria.	09	18
6	Power System Transients: Introduction, Types of system transients, Travelling Waves & propagation of surges, Generation of over voltages on transmission lines.	03	07
7	Preventive, Emergency and Restorative control: Overview of energy control center function, Normal and alert state in a power system, Emergency control, Blackout, Power system restoration.	03	08

Text Books:

1. Power System Engineering- Nagrath & Kothari, TMH publishing Company Ltd, Third Edition- 2019.
2. Electrical Power Systems- C. L. Wadhwa, New Age International Publishers, 8th edition, 2022.

Reference Books:

1. Power System Analysis and Stability- S. S. Vadhera, Khanna Publisher, 4th edition, 2003.
2. Power System Operation and Control- Sivanagaraju, Sreenivasan, Pearson, First edition, 2009.
3. Element of Power System Analysis- W. D. Stevenson, Mc Graw Hill.
4. Power Generation Operation and Control- A. J. Wood and B.F. Wollenberg, John Wiley & Sons, 3rd Edition, 2014.

ICT/ MOOCS:

1. <http://nptel.ac.in/courses/108101040/>
2. <https://nptel.ac.in/courses/108/102/108102047/>
3. <https://nptel.ac.in/courses/108/107/108107028/>
4. <https://nptel.ac.in/courses/108/106/108106026/>
5. <https://nptel.ac.in/courses/108/104/108104052/>

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand methods for load flow studies of power system.	2 Understanding
CLO2	Select the unit generation scheduling as per economic dispatch.	1 Remembering
CLO3	Analyze the effect of load variation on frequency of power system network.	4 Analyzing
CLO4	Implement equal area criteria for power system stability analysis.	3 Applying
CLO5	Estimate the operating state and select appropriate voltage and reactive power control of the power system.	2 Understanding

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PS O1	PS O2	PS O3	PSO 4
CLO1	H	H	H	H	H	M	M	L	M	M	H	M	H	H	H	L
CLO2	H	M	H	H	H	H	M		M	M	M	M	H	M	H	L
CLO3	H	H	M	M	H	H	L		L	L	M	M	H	H	M	
CLO4	H	H	M	H	H	M	L		M	L	L	L	H	M	M	M
CLO5	H	M	H	H	H	H	M	L	M	M	M	M	H	H	H	

H: High, M: Medium, L: Low