

COURSE TITLE	POWER SYSTEM OPERATION AND CONTROL
COURSE CODE	01EE1709
COURSE CREDITS	3

Objective:

- 1 To provide insight into the diverse methodologies employed in monitoring, controlling, and operating power systems.

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

- 1 Determine the steady-state and dynamic response of interconnected power system.
- 2 Explain the concept of power system security, state estimation, and load forecasting.
- 3 Analyze the effect of reactive power on voltage regulation in a transmission line and compare various methods for its control.
- 4 Describe the core principles and key entities of a restructured electricity market.

Pre-requisite of course:Power System-II, Interconnected Power System

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	Automatic Generation and Voltage Control Introduction, Load Frequency Control (Single Area Case), Load Frequency Control and Economic Despatch Control, Two-Area Load Frequency Control, Automatic Voltage Control, Load Frequency Control with Generation Rate Constraints (GRCs), Speed Governor Dead-Band and Its Effect on AGC, Digital LF Controllers, Decentralized Control	7
2	Power System Security Introduction, System State Classification, Security Analysis, Contingency Analysis	5
3	Power System State Estimation Introduction, Least Squares Estimation, The Basic Solution, Static State Estimation of Power Systems, Tracking State Estimation of Power Systems, External System Equivalency, Treatment of Bad Data, Network Observability and Pseudo measurements, Application of Power System State Estimation, Introduction to PMU and WAMS	7

Contents : Unit	Topics	Contact Hours
4	Reactive Power and Voltage Control Introduction, Reactive power requirement of an uncompensated line, Operation of a transmission line at no load condition and heavy load condition, Voltage regulation of the transmission line and its relation with reactive power, Reactive power-voltage (Q-V) coupling concept, Governing effects on reactive power flow, Methods of voltage control for transmission line	9
5	Load Forecasting Introduction, Forecasting Methodology, Estimation of Average and Trend Terms, Estimation of Periodic Components, Estimation of $y_s(k)$, Time Series Approach, Long-Term Load Predictions Using Econometric Models, Reactive Load Forecasting	6
6	Introduction to Power System Deregulation and Restructuring Introduction, Motivation for Restructuring of power system, Electricity market entities and model, Operation of Electricity Markets, Criteria for Successful Market, Operation based on various parameters, Competition in the Energy Market, Benefits of Deregulation, Basic terminologies, Deregulation – International scenario, Framework of Indian power sector, Availability based tariff (ABT), Open Access issues	8
Total Hours		42

Textbook :

- 1 Modern Power System Analysis, D. P. Kothari, I J Nagrath, R K Saket, McGraw Hill, 2022
- 2 Power System Analysis, John Grainger, William Stevenson, Jr., McGraw Hill Education, 2017

References:

- 1 Power Generation Operation and Control, Power Generation Operation and Control, Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheblé, John Wiley and Sons, 2013
- 2 An Introduction to Reactive Power Control and Voltage Stability in Power Transmission Systems, An Introduction to Reactive Power Control and Voltage Stability in Power Transmission Systems, A Chakrabarti, D P Kothari, A K Mukhopadhyay, Abhinandan De, PHI Learning Pvt. Ltd., 2010
- 3 Electrical Power Systems, Electrical Power Systems, P. Venkatesh, B.V. Manikandan, S.C. Raja, A. Srinivasan, PHI Learning Pvt. Ltd., 2012
- 4 Power System Analysis, Power System Analysis, Hadi Saadat, Mc-GrawHill series publication, 2004
- 5 Advanced Power System Analysis and Dynamics, Advanced Power System Analysis and Dynamics, L.P. Singh, New Age International Private Limited, 2012

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs, etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the classroom.
- 3 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, and Virtual Laboratory.

Supplementary Resources:

- 1 <http://nptel.ac.in/courses/108101040/>