

## REAL TIME CONTROL OF POWER SYSTEMS

<b>Course Code</b>	20EE4702A	<b>Year</b>	IV	<b>Semester(s)</b>	I
<b>Course Category</b>	Professional Elective-IV	<b>Branch</b>	EEE	<b>Course Type</b>	Theory
<b>Credits</b>	3	<b>L-T-P</b>	3-0-0	<b>Prerequisites</b>	PSA
<b>Continuous Internal Evaluation:</b>	30	<b>Semester End Evaluation:</b>	70	<b>Total Marks:</b>	100

<b>Course Outcomes</b>	
<b>Upon successful completion of the course, the student will be able to</b>	
CO1	<b>Understand</b> the various concepts and applications in real time control of power systems. (L2)
CO2	<b>Apply</b> the knowledge of power systems in real time computer control. (L3)
CO3	<b>Develop</b> voltage stability analysis and application of ANN, PMU techniques in real time control of power systems. (L3)
CO4	<b>Analyze</b> the various real time functions in power systems. (L4)
CO5	<b>Learn</b> various real time functions of power system and <b>submit a report.</b>

<b>Contribution of Course Outcomes towards achievement of Program Outcomes &amp; Strength of correlations (3: High, 2: Medium, 1: Low)</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	2			1	1	1						1	3	2
CO3	3			2								2	3	2
CO4		3		1	1	1						2	3	2
CO5	3	3							3	3			3	2

<b>SYLLABUS</b>		
<b>Unit No.</b>	<b>Contents</b>	<b>Mapped CO</b>
I	<b>State Estimation:</b> Introduction, need of state estimation, block diagram of state estimation, static state estimations - theory of Least Square Estimation and Weighted Least Square Estimation methods for linear and nonlinear measurements, applications of state estimation.	<b>CO 1 CO 2 CO 4 CO 6</b>
II	<b>Bad Data Processing:</b> Bad data observability, pseudo measurements, treatment of bad data, bad data detection using chi-square test, bad data identification and suppression of bad data.	<b>CO 1 CO 2 CO 4 CO 6</b>
III	<b>Computer Control of Power Systems:</b> Need for real time and computer control of power systems, operating states of a power system, Energy Control Centers, functions of ECC, hierarchical level of Energy Control Centers.	<b>CO 1 CO 2 CO 4</b>

	Supervisory control and Data Acquisition system - functions, functional block diagram, software and hardware components, applications of SCADA.	<b>CO 6</b>
IV	<b>Voltage Stability:</b> Concept of voltage stability, voltage instability, voltage collapse and voltage security, factors affecting voltage stability, measures to improve voltage stability, relation between voltage stability to rotor angle stability, voltage stability analysis using 'P-V' curves and 'Q-V' curves.	<b>CO 1</b> <b>CO 3</b> <b>CO 4</b> <b>CO 6</b>
V	<b>Application of ANN in Power System:</b> Basic concepts and definitions, algorithms for state estimation, short term load forecasting. Concept of PMU-Block diagram of PMU-Applications of PMU in power systems.	<b>CO 1</b> <b>CO 3</b> <b>CO 4</b> <b>CO 6</b>

### Learning Resources

#### Text Books

5. Abhijit Chakrabarti, Sunita Halder, "Power System Analysis: Operation and Control", PHI publications, 2008.
2. Carson.W.Taylor, "Power systems voltage stability", McGraw-Hill, 1994.

#### Reference Books

1. John Grainger and William Stevenson, "Power System Analysis", Tata McGraw Hill, 2017.
2. Hadi Saadat, "Power System Analysis", McGraw Hill, 2004.
3. I.J.Nagrath and D.P.Kothari, "Modern Power System Analysis", Tata McGraw Hill Publishing Company Ltd, 4th edition, 2011.

#### Web Links

1. <https://nptel.ac.in/courses/108106022>