POWER SYSTEM OPERATION & CONTROL

Course Code	23EE3701	**Year**	IV	**Semester(s)**	I
Course Category	Professional Core	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Power Systems, Power Systems Analysis
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand the basic concepts of economic operation, hydrothermal scheduling, unit commitment, load frequency control, and reactive power compensation in power systems.(L2)
CO2	Apply economic dispatch methods and hydrothermal scheduling for optimal power generation (L3)
CO3	Apply load frequency control concepts to model single-area and two-area interconnected systems and various FACTS controllers in power systems.(L3)
CO4	Analyze optimal operation of generators, hydrothermal scheduling and unit commitment.(L4)
CO5	Analyze single-area control system, tie-line power control in two-area systems and reactive power compensation techniques in transmission systems.(L4)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1									1	2	
CO2	3	2	1	1								3	1
CO3	3	2	1	1								3	1
CO4	3	3	2	2								3	
CO5	2	3	2	2	1	1						2	3

SYLLABUS

Unit No.	Contents	Mapped CO
I	**Economic Operation of Power Systems** Optimal operation of Generators in Thermal power stations - – Heat rate curve – Cost Curve – Incremental fuel and Production costs – Input–output characteristics – Optimum generation allocation with line losses neglected – Optimum generation	CO1 CO2 CO4

	allocation including the effect of transmission line losses – Loss Coefficients – General transmission line loss formula.	
II	**Hydrothermal Scheduling** Mathematical Formulation – Short term Solution Technique. **Unit Commitment** Need for unit commitment – Constraints in unit commitment – Cost function formulation – Solution methods – Priority ordering – Dynamic programming.	**CO1** **CO2** **CO4**
III	**Load Frequency Control-I** Modelling of steam turbine – Generator – Mathematical modelling of speed governing system – Transfer function – Necessity of keeping frequency constant. Definitions of Control area – Single area control system – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation – Steady state response.	**CO1** **CO3** **CO5**
IV	**Load Frequency Control-II** Block diagram development of load frequency control of two area system: uncontrolled case and controlled case – Tie-line bias control – Load frequency control and economic dispatch control.	**CO1** **CO3** **CO5**
V	**Compensation in Power Systems** Overview of Reactive Power control – Reactive power compensation in transmission systems – Advantages and disadvantages of different types of compensating equipment for transmission systems – Load compensation – Specifications of load compensator – Compensated transmission lines. Introduction of FACTS devices – Need of FACTS controllers – Types of FACTS devices	**CO1** **CO3** **CO5**

Learning Resources

Text Books:

1. Power Generation - Operation and Control by Allen J Wood - Bruce F WollenBerg 3rd Edition - Wiley Publication 2014.
2. Electric Energy systems Theory – by O.I.Elgerd - Tata McGraw–hill Publishing Company Ltd. - Second edition.
3. Modern Power System Analysis – by I.J.Nagrath & D.P.Kothari Tata McGraw Hill Publishing Company Ltd - 2nd edition.

Reference Books:

1. Power System Analysis and Stability by S.S.Vadhera - Khanna Publications - 4th edition - 2005
2. Power System Analysis by Grainger and Stevenson - Tata McGraw Hill.
3. Power System Analysis by HadiSaadat – – Tata McGraw–Hill 3rd edition - 2010.
4. Power System stability & control - Prabha Kundur - TMH - 1994.

E-Resources:

1. https://nptel.ac.in/courses/108104191
2. https://nptel.ac.in/courses/108104052