POWER SYSTEM OPERATION AND CONTROL

VII Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB28	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course deals with the concept of power system management to meet load demand at optimal op-erating cost and various ways in controlling electrical power generation of Thermal and Hydrothermal plants and modeling of electrical and hydraulic. This course also gives the knowledge of Load Fre- quency Control in multi areas and classification of Loads and its Compensation. This course addresses the various real time issues like Power Factor and its improvement.

II. OBJECTIVES:

The course should enable the students to:

I	The economic operation of Thermal and Hydro Power Systems.
II	The solid foundation in mathematical and engineering fundamentals required to control the governing system in Turbine models.
III	The optimization techniques used in the power system and Load FrequencyControl (LFC).
IV	The Power Factor Control and Reactive Power Control in Transmission Systems.
V	The Load Compensation technique for different Loads.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Solve** the optimum load scheduling with various constraints in Thermal and Hydro power Stations using conventional optimization techniques and general transmission line loss formula.	Apply
CO 2	**Develop** the mathematical models of the mechanical and electricalcomponents in the power generation for deriving the transfer function of the power system.	Apply
CO 3	**Distinguish** single area and two area load frequency control for minimizing the transient and steady state deviations using variouscontrollers.	Analyze
CO 4	**Choose** different types of compensating equipment for controllingvoltage, reactive power and power factor for improving the reliability in compensated and uncompensated transmission lines.	Apply
CO 5	**Interpret** the types of loads in the power systems from theircharacteristic factors.	Understand

IV. SYLLABUS:

MODULE-I	ECONOMIC OPERATION OF POWER SYSTEMS	Classes: 12

Optimal scheduling of thermal power system: Optimal operation of generators in thermal power stations, heat rate curve, cost curve, incremental fuel and production costs, input output characteristics, optimum generation allocation without and with transmission line losses coefficients, general transmission line loss formula, unit commitment; Optimal scheduling of hydrothermal system: Hydro electric power plant models, scheduling problems, short term hydro thermal scheduling problem.

MODULE-II	MODELING OF GOVERNOR, TURBINE AND EXCITATION SYSTEMS	Classes: 09

Modeling of governor: Mathematical modeling of speed governing system, derivation of small signal transfer function; Modeling of turbine: First order turbine model, block diagram representation of steam turbines and approximate linear models; Modeling of excitation system: Fundamental characteristics of an excitation system, transfer function, block diagram representation of IEEE type-1 model.

MODULE-III	SINGLE AREA AND TWO AREA LOAD FREQUENCY CONTROL	Classes: 09

Load frequency control of single area system: Necessity of keeping frequency constant, definitions of control area, single area control, block diagram representation of an isolated power system, steady state analysis, dynamic response, uncontrolled case.

Load frequency control of two area system: Uncontrolled case and controlled case, tie line bias control; Load frequency controllers: Proportional plus integral control of single area and its block diagram representation, steady state response, load frequency control and economic dispatch.

MODULE-IV	COMPENSATION FOR POWER FACTOR IMPROVEMENT AND REACTIVE POWER CONTROL	Classes: 09

Voltage control: Equipment for voltage control, effect of series capacitors, line drop compensation, effect of AVR, power factor control using different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (fixed and switched), power factor correction, capacitor allocation, economic justification, procedure to determine the best capacitor location; Reactive power control: Reactive power compensation in transmission systems, advantages and disadvantages of different types of compensating equipment for transmission systems; Uncompensated and compensated transmission lines: Shunt and series compensation.

MODULE-V	LOAD COMPENSATION	Classes: 06

Load Compensation: characteristics of loads, factors associated with loads, relation between the load factor and loss factor; specifications of load compensator; Classification of loads: Residential, commercial, agricultural and industrial loads and characteristics.

Text Books:

1. C L Wadhwa, “Electrical power systems”, New age International, 3rd Edition, 2005.
2. I J Nagarath, D P Kothari, “Modern power system analysis”, Tata McGraw-Hill, 2nd Edition, 2006.

Reference Books:

1. Singh S N, “Electric Power Generation, Transmission and Distribution”, Prentice Hall of India Pvt. Ltd., New Delhi, 2nd Edition, 2002.
2. T J E Miller, “Reactive power control in Electrical system”, Wiley Interscience Publication, 1982.
3. V K Mehta and Rohit Mehta, “Principles of Power System”, S Chand, 3rd revised Edition, 2015.
4. Turan Gonen, “Electrical Power Distribution System Engineering”, CRC Press, 3rd Edition, 2014.
5. V Kamaraju, “Electrical Power Distribution Systems”, TMH, Publication, Edition, 2009
6. O I Elgerd, “Electrical Energy Systems Theory”, Tata McGraw-Hill, 2nd Edition, 2007.

Web References:

1. https://www.electrical4u.com/working-or-operating-principle-of-dc-motor
2. https://www.freevideolectures.com
3. https://www.ustudy.in › Electrical Machines
4. https://www.freeengineeringbooks.com

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1. https://www.textbooksonline.tn.nic.in 2. https://www.freeengineeringbooks.com 3. https://www.eleccompengineering.files.wordpress.com 4. https://www.books.google.co.in