SCHEME OF COURSE WORK

Course Details:

Course Title	**: Power System Optimization**		
Course Code	**:15EE2109**	**L P C**	**:3 0 3**
Program:	**: M.Tech.**		
Specialization:	**: Power System Control and Automation**		
Semester	**: II**		
Prerequisites	**: Optimization Techniques, Economic Load Dispatch**		
Courses to which it is a prerequisite	**: Power System Optimization**		

Course Outcomes (COs):

1	After completion of the course, the student will be able to solve economic load dispatch problem to calculate power transmission loss coefficients in power systems.
2	After completion of the course, the student will be able to solve economic load dispatch problem in thermal generating systems.
3	After completion of the course, the student will be able to solve optimal hydrothermal scheduling problem in power systems.
4.	After completion of the course, the student will be able To solve Multi-objective optimization problems of any utility or industry.
5.	After completion of the course, the student will be able To use evolutionary programming for solving generation scheduling problem.

PROGRAMME OUTCOMES (POs)

The Graduate will be able to:

PO-1: Acquire in depth knowledge in the area of power system control and automation.
PO-2: Attain the ability to prepare models with respect to any kind of problem on hand and try to solve related to power system control and automation.
PO-3: Obtain the capability of problem solving and original thinking to arrive at feasible and optimal solutions considering societal and environmental factors.
PO-4: Have sufficient knowledge base, sufficient to apply the techniques and tools to solve power system problems.
PO-5: Use the state-of-the-art tools for modeling, simulation and analysis of problems related to power systems.
PO-6: Attain the capability to contribute positively to collaborative and multidisciplinary research to achieve common goals.
PO-7: Demonstrate knowledge and understanding of power system engineering and management principles and apply the same for efficiently carrying out projects with due consideration to economical and financial factors.
PO-8: Communicate confidently, make effective presentations and write good reports to engineering community and society.
PO-9: Recognize the need for life-long learning and have the ability to do it independently.
PO-10: Become socially responsible and follow ethical practices to contribute to the community for sustainable development of society.
PO-11: Independently observe and examine critically the outcomes of his actions and reflect on to make corrective measures and move forward positively.

Course Outcome versus Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	M	W	W	S	S	W	S	W	W	W	W
CO-2	M	S	S	S	W	W	S	W	W	W	W
CO-3	M	W	M	M	W	W	M	W	W	W	W
CO-4	M	W	M	W	W	W	M	W	W	W	W
CO-5	M	W	W	S	W	W	M	W	W	W	W

S - Strongly correlated, *M* - *Moderately* correlated, *Blank* - *No correlation*

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	**Sample questions**	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	**Economic Load Dispatch of Thermal Generating Unit – I** Introduction Generator Operating Cost Economic Dispatch Problem on a Bus Bar - Optimal Generation Scheduling.	CO-1	For a 3 generator system, the fuel cost coefficients and the operating generator limits are given. The B-coefficients for transmissions loss are given. Determine the economic schedule for loads 160 MW and 210 MW.	▫ Lecture ▫ Discussion ▫ Problem solving	Assignment (Week 2 - 4)
2	Economic Dispatch Using Newton - Raphson Method - Economic Dispatch Using the Approximate Newton-Raphson Method - Economic Dispatch using Efficient Method.	CO-1	Determine the economic schedule to meet the demand of 150 MW using Newton Raphson Method.	▫ Lecture ▫ Discussion ▫ Problem solving	Mid-Test 1 (Week 9)
3	Classical Method to Calculate Loss Coefficient Loss Coefficients Calculation Using Y BUS Loss	CO-1	Use the classical method to determine the B-coefficients for a 5-bus system. Bus 5 is taken as the slack bus. The series impedance and line charging of each line is given.	▫ Lecture ▫ Discussion ▫ Problem solving	Quiz (Week 2 - 4)
4	Transmission Loss Formula: Functions of Generation and Loads.	CO-1	Consider the given 5-bus system and obtain the optimum schedule.	▫ Lecture ▫ Discussion Problem solving	
5	**Economic Load Dispatch of Thermal Generating Unit – II** Economic Dispatch Using Exact Loss Formula - Economic Dispatch Using Loss Formula which is a function of Real and Reactive Power	CO-2	Consider the given 5-bus system find the economic generation schedule using Exact Loss Formula.	▫ Lecture ▫ Discussion Problem solving	
6	Economic Dispatch for Active and	CO-2	Consider the given 5-bus system and obtain the optimum	▫ Lecture ▫ Discussion	

	Reactive Power Balance - Evaluation of Incremental Transmission Loss - Economic Dispatch Based on Penalty Factors.		generation schedule.	Problem solving	
7	Optimal Power Flow Based on Newton Method - Optimal Power Flow Based on Newton Method	CO-2	Consider the given 3-bus system find the economic generation schedule.	▫ Lecture ▫ Discussion Problem solving	
8	**Optimal Hydrothermal Scheduling:** Introduction - Hydro Plant Performance Models - Short-Range Fixed-Head Hydrothermal Scheduling - Newton-Raphson Method for Short-Range Fixed-Head Hydrothermal Scheduling	CO-3	A hydro thermal system is given which consists of one thermal and one hydro generating station. The operating cost of the thermal station and the rate of discharge of hydro generating station is given. Find the optimum generation schedule.	▫ Lecture ▫ Discussion Problem solving	
9	**Mid Test-1**				
10	Approximate Newton-Raphson Short-Range Fixed-Head - Hydrothermal Scheduling Problem, Short-Range Variable-Head Hydrothermal Scheduling Problem-Classical Method	CO-3	Consider a fundamental hydro thermal system. The objective is to find the optimum generation schedule for a typical day. Incremental fuel cost of the thermal plant is given.	▫ Lecture ▫ Discussion ▫ Problem solving	
11	Approximate Newton-Raphson Method for Short-Range Variable-Head Hydrothermal Scheduling Problem - Hydro Plant Modelling for Long-Term Operation	CO-3	Calculate the fuel cost of a generating station.	▫ Lecture ▫ Discussion Problem solving	
12	**Multi-Objective Generation Scheduling:** Introduction - Multi-objective Optimization- State-of-the-Art - Fuzzy Set Theory in Power Systems, The surrogate Worth Trade-off (SWT).	CO-4	Write an algorithm for SWT.	▫ Lecture ▫ Discussion Problem solving	
13	Approach for Multi-objective Thermal Power Dispatch Problem - Multi-objective Thermal Power Dispatch Problem- Weighting Method -.	CO-4	Write an algorithm for non-inferior solution for multi-objective dispatch.	▫ Lecture ▫ Discussion Problem solving	Assignment (Week 2 - 4)
14	Multi-objective Dispatch for Active and Reactive Power Balance - Multi-objective Short-Range Fixed-Head Hydro-thermal Scheduling-Approximate Newton-Raphson Method	CO-4	Write an algorithm for non-inferior solution for multi-objective dispatch using Newton-Raphson approximate method.	▫ Lecture ▫ Discussion Problem solving	Quiz (Week 2 - 4)
15	**Evolutionary Programming for Generation Scheduling:** Introduction - Fitness Function - Genetic Algorithm Operators - Random Number Generation -	CO-5	Find the value of x represented by 1100110001101, a string of 12 binary digits. The value of x lies between 2.5 to 10	▫ Lecture ▫ Discussion Problem solving	Mid-Test 2 (Week 18)

	Economic Dispatch Problem - Genetic Algorithm Solution Methodology -				
16	Genetic Algorithm Solution Based on Real Power Search, Economic Dispatch with valve point loading, Economic dispatch with Ramp Rate Limits	CO-5	Explain about Economic dispatch with Ramp Rate limits.	▫ Lecture ▫ Discussion Problem solving	
17	Prohibited Operating Zones – Evolutionary search method for Economic Dispatch.	CO-5	Explain about Evolutionary Programming for Economic Dispatch - I	▫ Lecture ▫ Discussion Problem solving	
18	**Mid Test-2**				
19/20	END EXAM				