SCHEME OF COURSE WORK:

Course Details:

Course Title	Hybrid Power Plant Engineering					
Course Code	19ME2251	**LTPC**	**3**	**0**	**0**	**3**
Program	M.Tech.					
Specialization	Thermal Engineering					
Semester	I					
Prerequisites	Engineering Thermodynamics and Thermal Engineering					
Course to which is a prerequisite	NA					

Course Outcomes:

CO1	Analyze advanced steam and gas turbine cycles
CO2	Discuss binary and advanced power cycles
CO3	Explain advances in nuclear and MHD power plants
CO4	Explain how to combine different power plants and pollution caused by power plants
CO5	Design for different loads and explain economic analysis of power plant

Program Outcomes:

PO Code	**Program Outcome (PO)**
PO1	exhibit in-depth knowledge in thermal engineering specialization
PO2	think critically and analyse complex engineering problems to make creative advances in theory and practice
PO3	solve problem, think originally and arrive at feasible and optimal solutions with due consideration to public health and safety of environment
PO4	use research methodologies, techniques and tools, and will contribute to the development of technological knowledge
PO5	apply appropriate techniques, modern engineering tools to perform modeling of complex engineering problems with knowing the limitations
PO6	understand group dynamics, contribute to collaborative multidisciplinary scientific research
PO7	demonstrate knowledge and understanding of engineering and management principles and apply the same with due consideration to economical and financial factors
PO8	communicate complex engineering problems with the engineering community and society, write and present technical reports effectively
PO9	engage in life-long learning with a high level of enthusiasm and commitment to improve knowledge and competence continuously
PO10	exhibit professional and intellectual integrity, ethics of research and scholarship and will realize the responsibility towards the community
PO11	examine critically the outcomes of actions and make corrective measures

Course Outcome Vs Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		M	S			M					
CO2	M	S		S		S	M					
CO3	M	S	S	M			M					
CO4		S	S	M			M					
CO5		S	S	S			M					

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

Assessment Methods:

Assignment/Quiz/Seminar/Case Study, Mid term exam and End term examination.

Teaching-Learning and Evaluation

Week	Topic/Content	CO	Sample Questions	Teaching-Learning Strategy	Assessment method & Schedule
1	Rankine Cycle – performance – thermodynamic analysis of cycles, cycle improvements	CO1	Explain with neat diagrams the four circuits of a modern steam power plant.	Lecture and problem solving	Assignment (week 4-6) Mid term exam (week 9)
2	Superheaters, reheaters – condenser and feed water heaters – operation and performance – layout	CO1	What are the different types of superheaters? Explain the working of any one of them with a neat sketch. What are the different types of feed water heaters? Explain the working of any one of them with a neat sketch	Lecture and problem solving	Assignment (week 4-6) Mid term exam (week 9)
3	Gas turbine cycles – optimization – thermodynamic analysis of cycles – cycle improvements – multi spool arrangement. intercoolers, reheaters, regenerators – operation and performance – layouts	CO1	Discuss the effect of regeneration and reheating in gas turbine power plants.	Lecture and problem solving	Assignment (week 4-6) Mid term exam (week 9)
4	Binary and combined cycle – coupled cycles		Explain the working binary and combined power cycles.	Lecture	Assignment (week 4-6) Mid term exam (week 9)
5	Comparative analysis of combined heat and power cycles – IGCC – AFBC/PFBC cycles	CO2	Explain the constructional details and working of IGCC-AFBC/PFBC cycles.	Lecture	Assignment (week 4-6) Mid term exam (week 9)
6	Thermionic steam power plant	CO2	Explain the working of a thermionic steam power plant with a neat sketch.	Lecture and problem solving	Assignment (week 4-6) Mid term exam (week 9)

7	Overview of Nuclear power plants – radioactivity – fission process – reaction rates	CO3	State the Law of disintegration of Radio activity and derive an equation for the same. Also derive an equation for half life period and mean life period	Lecture	Assignment (week 14-16) Mid term exam (week 18)
8	diffusion theory, elastic scattering and slowing down – criticality calculations – critical heat flux – power reactors – nuclear safety.	CO3	Explain with a neat diagram the boiling water reactor in a nuclear power plant	Lecture	Assignment (week 14-16) Mid term exam (week 18)
9	Mid Term Examination				
10	MHD and MHD – steam power plants	CO3	Explain the working of a MHD power generator with a neat sketch.	Lecture	Assignment (week 14-16) Mid term exam (week 18)
11	Advantages of combined working – load division between power stations – storage type hydro-electric plant in combination with steam plant – run of river plant in combination with steam plant – pump storage plant in combination with steam or nuclear power plant.	CO4	Explain the working of a pumped storage power plant with a neat sketch. What are the advantages and disadvantages of combined power cycles/plants?	Lecture and problem solving	Assignment (week 14-16) Mid term exam (week 18)
12	Coordination of hydro-electric and gas turbine stations – coordination of hydro-electric and nuclear power station – coordination of different types of power plants.	CO4	Explain the working hydro-electric and gas turbine combined power station. Explain the working hydro-electric and nuclear combined power station	Lecture	Assignment (week 14-16) Mid term exam (week 18)
12-13	Air and water pollution –acid rains – thermal pollution – radioactive pollution –standardization – methods of control.	CO4	Explain various methods to control radioactive pollution. What is thermal pollution? Explain methods to prevent thermal pollution.	Lecture	Assignment (week 14-16) Mid term exam (week 18)
14	Load curves–effects of variable load on power plant design and operation–peak	CO5	The following load is to be supplied by a power station: Load (MW) 30 90 60 100 50	Lecture and problem solving	Assignment (week 14-16)

	load plant– requirements of peak load plants		Time (hours) 0-6 6-12 12-14 14-18 18-24 a. Draw the load curve and load duration curve b. Choose the suitable generating units to supply the load c. Calculate the load factor and plant capacity factor		Mid term exam (week 18)
15	Cost of electrical energy–selection of type of generation– selection of generating equipment	CO5		Lecture and problem solving	Assignment (week 14-16) Mid term exam (week 18)
16	Performance and operating characteristics of power plants	CO5	Explain the performance and operating characteristics of power plants	Lecture	Assignment (week 14-16) Mid term exam (week 18)
17	Revision of syllabus				
18	Mid Term Examination-II				
19-20	End Term Examination				