4ME43: POWER PLANT ENGINEERING
CREDITS - 3 (LTP: 3, 0, 0)

Course Objective:
Outline various types of thermal power plants

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Thermal Power Plant:** General layout of modern thermal power plant, Site selection, Presents status of power generation in India. Rankine Cycle: Basic Rankine cycle and modifications, External and internal irreversibility, **High Pressure Boilers and Boiler draught**: Unique features, Types, advantages of high pressure boilers, Methods of superheat control, **Boiler Draught**: Natural draught – estimation of height of chimney, Maximum discharge condition, Forced, Induced and balanced draught, Power requirement by fans.	12
2	**Steam Nozzles:** Types of nozzles, velocity of steam, discharge through nozzle, critical pressure ratio and condition for maximum discharge, physical significance of critical pressure ratio, nozzle efficiency, Effect of back pressure, supersaturated flow. **Steam Turbine**: Principle of operation, types of steam turbines-Impulse and Reaction, compounding of steam turbines, impulse turbine – velocity diagram, calculation of work, power and efficiency, condition for maximum efficiency, Reaction turbines – velocity diagram, degree of reaction, reheat factor, governing of steam turbine – throttle, nozzle and bypass governing, Methods of attachment of blades to turbine rotor , Labyrinth packing, Losses in steam turbines.	10
3	**Condensers and Cooling Towers:** Types of condensers, sources of air in condenser, Effects of air leakage, Methods of obtaining maximum vacuum in condenser, vacuum & condenser efficiency, controlled extraction, condensate extraction system, vaccum system Mass of cooling water required, Edward air pump, Necessity of cooling ponds and cooling towers, Condenser water cooling	10

Unit No.	Topics	Teaching Hours
	systems, Types of cooling towers and cooling ponds. steam balancing, API 611 & API 612 **Feed Water Treatment:** Necessity of feed water treatment, Different impurities found in feed water, Effect of impurities, pH & its role in corrosion and scale formation, Internal & external water treatment systems – Hot lime soda process, Zeolite ion exchange process, Demineralization plants, Reverse osmosis process, Sea water treatment using reverse osmosis, De-aeration.	
4	**Nuclear Power Plant:** Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling, Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants, Nuclear waste and its disposal, Nuclear power plants in India.	6
5	**Economics of Power Generation:** Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.	4
	Total	**42**

List of References:

1. P.K. Nag, "*Power Plant Engineering*", 3rd edition, Tata McGraw-Hill, 2017
2. El Wakil M. M., "*Power Plant Technology*", Tata McGraw-Hill. 2017 Edition
3. R. K. Rajput, "*A Text book of Power Plant Engineering*", Fifth Edition, Laxmi Publication. Fifth Edition, 2016
4. V Ganeshan, "*Gas Turbines*", Fifth Edition, McGraw Hill Education, 2017
5. Elliot T. C., Chen K and Swanekamp R. C., "*Power Plant Engineering",* McGraw Hill.
6. R Yadav, *"Steam and gas turbine*" 7th Edition, Central Publishing House, Amdavad.

Course Outcomes (COs):

After learning the course the students should be able to:

1. Outline national energy scenario and analyze Rankine cycle.
2. Analyze Steam nozzles and Steam turbines.
3. Outline Steam condensers, cooling towers and feed water treatments.
4. Outline various nuclear reactors.
5. Analyze Economics of Power Generation.