ME405: POWER PLANT ENGINEERING
CREDITS = 5 (L=3, T=0, P=2)

Course Objective:
The course is designed to give fundamental knowledge of construction and working of various types of thermal power plants

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
3	0	2	5	70	30	30	20	150

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 modification, External and internal irreversibilities, **High Pressure Boilers and Boiler draught:** Unique features and 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 **Steam turbine:** (Principle of operation, types of steam turbines, 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 turbine.	10

Unit No.	Topics	Teaching Hours
3	**Condensers and Cooling Towers:** ypes of condensers, sources of air in condenser, Effects of air leakage, Methods of obtaining maximum vacuum in condenser, vacuum & condenser efficiency, Mass of cooling water required, Edward air pump, Necessity of cooling ponds and cooling towers, Condenser water cooling systems, Types of cooling towers and cooling ponds. **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.	08
4	**Gas turbine:** Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.	05
5	**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.	05
6	**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.	05
	TOTAL	**45**

List of References:

1. *"Power Plant Engineering",* P.K. Nag, Tata McGraw-Hill.
2. *"Power Plant Technology*", El Wakil M. M., Tata McGraw-Hill.
3. *"A Text book of Power Plant Engineering"*, R.K.Rajput, Laxmi Publication.
4. *"Gas Turbines",* V Ganeshan, McGraw Hill Education.
5. *"Power Plant Engineering",* Elliot T. C., Chen K and Swanekamp R. C., McGraw Hill.

Course Outcomes (COs):

After learning the course the students should be able to:

1. Outline the different power generation methods, its economics and national energy situation.
2. Apply the basic thermodynamics and fluid flow principles to different power generation methods.

3. Analyze thermodynamic cycles of steam power plant and understand construction, working and significance of its various systems.
4. Analyze thermodynamic cycles of gas turbine power plant and combined cycle power plant.
5. Analyze thermodynamic cycles of nuclear power plant.
6. Analyze Economics of Power Generation.