

COURSE TITLE : POWER PLANT ENGINEERING
COURSE CODE : 5023
COURSE CATEGORY : E
PERIODS/ WEEK : 4
PERIODS/ SEMESTER : 60
CREDIT : 4

TIME SCHEDULE

MODULE	TOPIC	PERIODS
1	Fuels and combustion, Steam boilers, steam engine and steam turbine	15
2	Condensers, Cooling Towers and Thermal power plant	15
3	Hydro electric power plant, Diesel power plant and Gas Turbines & Jet propulsion	15
4	Renewable energy power plants and nuclear power plant	15
TOTAL		60

COURSE OUTCOME :

sl.no.	sub	student will be able to
1	1	Understand the fuels and combustion.
	2	Review the steam boiler, steam engine , steam turbine and condenser Boilers for process heating, Power generation & Co-generation; & Modern high pressure boilers including FBC (Fluidized Bed Combustion Boiler), understand the steam piping & accessories and insulation
	3	Comprehend the Steam boilers compounding of steam turbine and steam engine
2	4	Appreciate the condensers, vacuum efficiency of condensers and cooling towers
	5	Understand the working of thermal power plants
	6	Comprehend the working of hydro electric power plant and diesel power plant
3	7	Understand the working of gas turbine and jet propulsion
	8	Appreciate the working of nuclear power plant and non conventional power plant

SPECIFIC OUTCOME

MODULE I

- 1.1.0 Fuels & Combustion
- 1.1.1 List the various types of Fuels.
- 1.1.2 State the Merits & Demerits of various types of fuels
- 1.1.3 Describe the requirements of a good fuel.
- 1.1.4 Explain the properties of fuel– flashpoint, fire point & pour point,
- 1.1.5 Define Octane number & Cetane number
- 1.1.6 Deduce combustion equation & combustion volume
- 1.1.7 Explain calorific values- LCV & HCV

- 1.1.8 Explain the Bomb Calorimeter & Junker's Gas Calorimeter to determine the calorific value of fuel
- 1.1.9 Explain the factors affecting combustion- 3T (Turbulence, Temperature & time)
- 1.1.10 Analyse the products of combustion

Review the steam boiler, steam engine, steam turbine and condensor, Boilers for process heating, Power generation & Co-generation; & Modern high pressure boilers including FBC (Fluidized Bed Combustion Boiler)

1.2.0 Comprehend the Steam boilers compounding of steam turbine and steam engine

- 1.2.1 Review the steam boilers
- 1.2.2 Explain the steam piping and insulation
- 1.2.3 Explain the boiler draught (natural, forced. Induced, balanced)
- 1.2.4 Appreciate the working of Steam Turbine
- 1.2.5 List the advantages of steam turbines over steam engines
- 1.2.6 Classify steam turbines
- 1.2.7 Explain the impulse turbines and reaction turbines
- 1.2.8 Explain the working of a simple De-Laval turbine and Parson's reaction turbine with sketches
- 1.2.9 State the purpose of compounding of steam turbines
- 1.2.10 Explain the pressure compounding, velocity compounding and pressure-velocity compounding
- 1.2.11 Describe the working of compounding of steam engine.
- 1.2.12 Explain the modern steam turbines(reheating ,bleeding ,regenerating etc)

MODULE II

2.1.0 Appreciate the condensers, vacuum efficiency of condensers and cooling towers

- 2.1.1. List the different types of Steam Condensers
- 2.1.2 State the functions of steam condensers
- 2.1.3 Classify steam condensers
- 2.1.4 Illustrate the working of jet condensers and surface condensers
- 2.1.5 Define vacuum efficiency
- 2.1.6 Compute the vacuum efficiency
- 2.1.7 Define condenser efficiency
- 2.1.8 Compute the condenser efficiency
- 2.1.9 List the factors affecting vacuum efficiency
- 2.1.10. State the function of cooling towers
- 2.1.11. Explain the different types of cooling towers

2.2.0 Understand the working of the thermal power plant

- 2.2.1 Illustrate line diagram of condensing steam power plant.
- 2.2.2 Explain the working of air pumps
- 2.2.3 Explain the thermodynamic vapour power cycles, Carnot - Rankine cycles(Simple Problems)

MODULE III

- 3.1.0 Comprehend the working of hydro electric power plant and diesel power plant
- 3.1.1 Explain the working of a Hydro electric power plant

- 3.1.2 Explain the working of diesel power plant with a block diagram.
- 3.2.0 Understand the working of gas turbine and jet propulsion**
- 3.2.1 State the working principle of Gas Turbines
- 3.2.2 State the application of gas turbine
- 3.2.3 List the types of gas turbines
- 3.2.4 Explain with flow diagram and T-S diagram, the working of constant pressure gas turbine (both open type and closed type)
- 3.2.5 Explain the work done by constant pressure closed gas turbine(no derivation)
- 3.2.6 Explain the work done by constant pressure open type gas turbine(no derivation)
- 3.2.7 Compute the work done by above turbines (simple problems only)
- 3.2.8 List the fuels used in gas turbines
- 3.2.9 List the advantages and limitations of gas turbines
- 3.2.10 Compare gas turbines with steam turbines.
- 3.2.11 Explain the principle of Jet propulsion
- 3.2.12 Illustrate the working of turbo jet engine, turbo- prop engine and prop-jet engine
- 3.2.13 Explain the principles of Rocket propulsion
- 3.2.14 Explain the ram jet engine.
- 3.2.15 Explain the pulse jet engine.

MODULE IV

4.1.0 Appreciate the working of nuclear power plant and non conventional power plant

- 4.1.1 Explain the theory of Nuclear Power Engineering
- 4.1.2 Explain Nuclear reaction, fission, fusion and chain reaction.
- 4.1.3 Explain the principal parts of a reactor
- 4.1.4 Describe the reaction controlled by control rods
- 4.1.5 List the various types of Nuclear reactors and the main products of a reactors
- 4.1.6 List the Nuclear fuel materials - uranium, thorium, plutonium.
- 4.1.7 Describe the moderator - graphite, beryllium, beryllium oxide, light and heavy oxide
- 4.1.8 Describe the of coolants - water, liquid metal, gas and organic liquids
- 4.1.9 Explain the working of a Nuclear power plant with the help of a schematic diagram.
- 4.1.10 Explain the renewable sources of energy
- 4.1.11 Illustrate the working of solar grain drier and solar cooker
- 4.1.12 Explain the principle of solar cells, flat plate collectors and parabolic concentrators
- 4.1.13 Identify the types of wind mills and their uses
- 4.1.14 Describe the working of wind mills
- 4.1.15 Describe the working of Bio gas Plant
- 4.1.16 Describe the working of Tidal power Plant
- 4.1.17 Describe the working of Geothermal Plant

GENERAL INFORMATION:

Use of Steam Tables and Mollier Charts may be permitted for Examination

CONTENT DETAILS

MODULE I

Fuels & Combustion

Fuels - types - Merits - Demerits - requirements of a good fuel- properties – flash- fire - pour point- Octane number- Cetane number- combustion equation –Combustion volume- calorific values- HCV - LCV - Bomb Calorimeter - Junker's Gas Calorimeter - calorific values- products of combustion -analysis.

Steam generators

Steam generator – Application - Modern high pressure boiler - La-Mont boiler, Benson boiler – Boiler piping and insulation. **Draught**-natural - forced - induced - balanced.

Steam turbines

Principle - operation – impulse – reaction - Types - De-Lavel turbine- Parson's turbine- modern steam turbine – reheating- bleeding - regeneration.-Compounding –pressure- Velocity- Pressure-velocity compounding- Compound steam engine.

MODULE II

Steam Condensers

Introduction - functions -Types - Jet condensers - counter flow and parallel flow type- Surface condensers –Condenser efficiency-Vacuum efficiency – definition- Factors affecting the vacuum efficiency-Mass of cooling water requirement -Cooling tower - function - types-Mass flow rate of water – Simple Problems.

Steam power plant

Working - Condensing steam power plant - Air pumps - Edward air pump - cooling towers - Forced draft - induced draft.

Thermodynamic vapour power cycles - Carnot - Rankine cycles – Simple Problems

MODULE – III

Hydro Electric Power plant- Diesel Power Plant- working.

Gas turbines-Working-Types - constant pressure - open - closed type - work done (simple problems only) - fuels - application - advantages - limitations

Jet Propulsion-Principle- working-Turbo - jet engine - Turbo - prop engine, Prop-jet engine- Rocket propulsion- Principles - Advantages -disadvantages- Applications.

MODULE – IV

Nuclear Power Engineering-Introduction-Nuclear reaction- Fission and fusion - chain reaction- Principal parts of a Reactor- Main parts of a reactor- Brief description of reaction control by Control rods- Brief description of the fuel material- Uranium- Thorium- Plutonium- moderators – Graphite, Beryllium - Beryllium oxide- light - heavy oxide- coolants – water- liquid metal- gas -organic liquids - Nuclear reactors-name different types – working of Boiling water reactor (BWR) - Pressurized water reactor (PWR) - Fast Breeder Reactor (FBR) power plants -Working of a nuclear power plant - schematic diagram.

Renewable sources of energy -

Solar Energy - solar grain drier - solar cooker - solar photovoltaic cells - flat plate collectors for power generators - parabolic concentrators for power generation - wind energy- working of wind mills – wind turbines - biogas energy- working of biogas plant – tidal energy -_working of tidal power plant - geothermal energy- working principle -

TEXT BOOKS

1. Text Book of Thermal Engg., -R.S. Khurmi & J.K. Gupta
2. Non-Conventional Energy sources - G.D. Rai

REFERENCE BOOKS

1. Heat Power Engineering - N. Rangassamy & E. Sundara moorthy
2. Elements & Heat Engines, Vol. I, II & III - R.C. Patel and C. J Karan chandani
3. Introduction to Non conventional Energy resources - Rajaetal.
4. Power plant Engineering - Ramalingam
5. Power plant Engineering -P.K.Nag.
6. Thermal Engg - SK Kulshrestha