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BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – Dip.ME-2023
Course Name – Power Plant Engineering
Course Code - DMEPE501B
(Semester V)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Select the primary cycle used in steam power plants.

a) Brayton Cycle b) Otto Cycle
c) Rankine Cycle d) Diesel Cycle

(ii) Classify the type of fuel suitable for a gas turbine plant.

a) Diesel b) Natural Gas
c) Uranium d) Wood

(iii) Choose the correct component responsible for steam generation.

a) Turbine b) Generator
c) Boiler d) Condenser

(iv) Match the correct benefit of high-pressure boilers.

a) High maintenance cost b) Lower thermal efficiency
c) Compact design and high efficiency d) Low steam temperature

(v) Identify common nuclear fuels used in reactors.

a) Uranium-235 b) Coal
c) Hydrogen d) Methane

(vi) Determine the main objective of control rods in nuclear reactors.

a) Generate heat b) Absorb neutrons
c) Cool reactor d) Reduce emissions

(vii) Identify the main components of a gas turbine plant.

a) Boiler b) Compressor
c) Cooling Tower d) Heat Pump

(viii) Match the key benefit of combined cycle power plants.

a) Lower capital cost b) Higher efficiency
c) Simpler design d) Smaller footprint

(ix) Select correct application of waste heat recovery in industry.

a) Office lighting b) Water purification

c) Power generation d) Air conditioning only

(x) Identify the main working principle of geothermal plants.

a) Nuclear Reaction b) Combustion of Fuel
c) Use of Earth's Heat d) Solar Radiation

(xi) Summarize the function of photovoltaic systems.

a) Store energy b) Convert light to electricity
c) Increase wind speed d) Heat air

(xii) Classify power generation costs.

a) Fixed and Variable Costs b) Color-coded Costs
c) Seasonal Costs d) Natural Costs

(xiii) Determine the function of cooling towers in power plants.

a) Absorb sound b) Remove dust
c) Dissipate waste heat d) Generate electricity

(xiv) Identify a major pollutant from coal-based power plants.

a) Nitrogen b) Oxygen
c) Sulfur Dioxide d) Hydrogen

(xv) Determine the effect of high-temperature flue gases on chimney design.

a) No chimney required b) Smaller chimney
c) Larger, stronger chimney d) None of these

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Classify gas turbine cycles with TS and PV diagrams. (3)
3. List and compare major renewable power sources used worldwide. (3)
4. Explain the role of electrostatic precipitator. (3)
5. Identify major nuclear fuels, coolants and moderators used in reactors. (3)
6. Design a basic power supply layout for a small plant. (3)

OR

A boiler supplies 5000 kW of heat energy to produce steam. The steam enters a turbine that delivers 1800 kW of mechanical work, which is then supplied to an alternator producing 1700 kW of electrical power. Calculate: Turbine efficiency and Alternator efficiency. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Analyze the thermal efficiency of Rankine cycle, write the methods to enhance the performance of Steam power plant. (5)
8. Identify the major components required in a steam power plant layout. Draw the layout of a steam power plant. (5)
9. Recommend optimal site selection criteria for constructing a new nuclear power station. (5)
10. Identify the main components of a gas turbine power plant. (5)
11. Analyze the role of heat recovery steam generators (HRSG) in gas turbine plants. (5)
12. In a steam power plant operating on a Rankine cycle, steam enters the turbine at 40 bar and 400°C with a specific enthalpy of 3210 kJ/kg and leaves the turbine at 0.1 bar, where the specific enthalpy at turbine exit is 2400 kJ/kg. The condensate water at condenser exit has a specific enthalpy of 200 kJ/kg. Neglect pump work. Calculate the work done per kg of steam. Determine the heat supplied in the boiler. Find the thermal efficiency of the cycle. (5)

OR

Steam in a Rankine cycle enters the turbine at a specific enthalpy 3200 kJ/kg and leaves the turbine at 2100 kJ/kg. The condensate at the condenser exit has a specific enthalpy 300 kJ/kg. Neglect pump work. a) Calculate the turbine work per kg of steam (kJ/kg). b) Calculate the heat supplied in the boiler per kg of steam (kJ/kg). c) Determine the thermal efficiency of the cycle (percentage). (5)

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