7658

BOARD DIPLOMA EXAMINATION, (C-20)

MAY/JUNE—2023

DME - FIFTH SEMESTER EXAMINATION

HEAT POWER ENGINEERING—II

Time : 3 Hours] [*Total Marks* : 80

PART—A

3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. Write the expressions for internal energy for wet, dry and super-heated steam.

2. The specific volume of steam at 10 bar pressure is recorded as 0.1749 m^3/kg. Find the quality of the steam.

3. Wet steam is sent from steam mains through the combined separating-throttling calorimeter. The dryness fraction of steam measured in separating calorimeter is 0.905 and that in throttling calorimeter is 0.965. Determine the dryness fraction of steam in the mains.

4. State the function of mountings and accessories in a steam boiler.

5. Define boiler draught.

6. Write the equation of continuity in a steam nozzle and state each element.

7. Dry saturated steam enters a steam nozzle at a pressure of 15 bar and discharged at 2 bar. If the steam at exit is 0.9 dry, find the velocity of steam at exit.

8. Define the degree of reaction in a reaction turbine.

9. Write any three comparisons between jet and surface condensers.

10. Define vacuum efficiency.

PART—B

8×5=40

Instructions : (1) Answer **all** questions.

(2) Each question carries **eight** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* Define saturation temperature.

(b) Steam enters an engine at 850kN/m^2 and 0.9 dry. It exhausts at 101.3 kN/m^2 with 0.82 dry. Calculate the drop in enthalpy of steam through the engine.

(OR)

(c) If 5 kg of steam with dryness fraction 0.9 expands adiabatically according to the law $pv^{1.13}$ = constant, from a pressure of 8 bar to 1.5 bar. Determine *(i)* final dryness fraction, *(ii)* work done and *(iii)* change in internal energy.

12. *(a)* With a sketch, explain the construction and working of a Benson boiler.

(OR)

(b) Define the factor of evaporation and boiler HP.

(c) In a boiler test, steam at a pressure of 1.4 MN/m^2, having a dryness fraction 0.95, is generated at the rate of 8 kg per kg of coal burnt. The calorific value of coal fired is 35000 kJ/kg and temperature of feed water is 47 °C. Calculate the thermal efficiency of the boiler.

13. *(a)* The dry saturated steam at a pressure of 10 bar is expanded isentropically in a nozzle to a pressure of 1 bar. Determine analytically the quality of steam at exit and exit velocity. Compare these results with Mollier chart.

(OR)

(b) Steam initially dry and saturated expands in a nozzle from 12 bar to 1 bar abs. If the frictional loss in the nozzle is 10% of total enthalpy drop, calculate the mass of steam discharged when exit diameter of the nozzle is 15 mm.

14. *(a)* State the necessity of reducing the speed of rotor in steam turbines.

(b) Explain the velocity compounding and pressure compounding in steam turbines.

(OR)

(c) The following particulars refer to a stage of a Parson's reaction turbine comprising one ring of fixed blades and one ring of moving blades.

Blade velocity = 140 m/s, absolute velocity at inlet = 300 m/s, the blade out let angle = 20°, the rate of steam flow = 7.6 kg/s.

Determine *(i)* the blade inlet angle and *(ii)* power developed by the stage.

15. *(a)* With a neat sketch, explain the working of Edward's air pump.

(OR)

(b) Explain the working of high-level jet condenser with a sketch.

PART—C

10×1=10

Instructions : (1) Answer the following question.

(2) The question carries **ten** marks.

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. In a boiler trial the following data were recorded :

Steam produced per hour = 2710 kg, feed water temperature = 40 °C, boiler pressure = 11.5 bar, dryness fraction = 0.9, coal used per hour = 330 kg, calorific value of coal = 29120 kJ/kg, mass of flue gases = 10 kg/kg of coal, specific heat of flue gases = 1.05 kJ/kg-K, temperature of flue gases = 350 °C, boiler room temperature = 30°C.

Determine the equivalent evaporation and draw up heat balance per kg of coal.

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