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C20-M–504

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BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER / NOVEMBER—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 enthalpy, specific volume and entropy of super-heated steam.

2. State the significance of critical point

3. Find the mass of 2 m^3 of steam under the pressure of 40 bar and temperature 460°C.

4. Write the merits of water tube boiler over fire tube boiler.

5. Write the function of a fusible plug.

6. Define critical pressure ratio and write expression for it.

7. A steam nozzle is supplied with steam having an initial velocity of 50 m/s. The initial and exit enthalpies are h_1=3100 kJ/kg and h_2=2700 kJ/kg. Neglecting friction, find the exit velocity of steam.

8. Define reheat factor in a steam boiler.

9. State the functions of a steam condenser.

10. Define condenser efficiency and write the expression for it.

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)* Draw a neat sketch of Mollier diagram and show the salient points on it.

(b) Calculate the heat added to 1 kg of water at 15° C to form super-heated steam at 8·5 bar and temperature 205°C. Take C_p=2 kJ/kg for super-heated steam.

(OR)

(c) Draw a neat sketch of separating calorimeter and describe the method of finding the quality of steam.

(d) In a separating calorimeter the following data is recorded :

Amount of water collected = 0·85

Mass of water leaving the calorimeter = 9·5 kg

Find the dryness fraction.

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

(OR)

(b) A boiler plant supplies 5400 kg of steam per hour at 7·5 bar abs and 0·98 dry from feed water at 41°C. The boiler uses 670 kg of coal per hour having calorific value of 31000 kJ/kg. Determine the thermal efficiency of boiler and the equivalent evaporation.

13. *(a)* The dry saturated steam at a pressure of 5 bar is expanded isentropically in a nozzle to a pressure of 0·2 bar. Determine analytically the quality of steam at exit and exit velocity. Compare these results with Mollier chart.

(OR)

(b) A convergent nozzle receives 10 kg/s of steam at 40 bar and 260°C and discharges it at 14 bar. Determine the throat diameter. Neglect friction and initial velocity. C_p=2·1 kJ/kg-K for super-heated steam.

14. *(a)* State the function of a governor in steam turbines.

(b) Explain throttle governing and nozzle governing.

(OR)

(c) In a simple impulse turbine, the nozzle delivers 25 kg of steam per second. The nozzle angle is 15°. The steam issue from the nozzle with a velocity of 900 m/s. The blade velocity is 350 m/s and the inlet and outlet angles of the blade are equal. Neglecting friction, calculate the blade angles and power developed.

15. *(a)* Draw a neat sketch of a typical condensing plant and explain the function of each element.

(OR)

(b) Explain the low-level counter flow 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. *(a)* Explain supersaturated flow and its effects in a nozzle.

(b) Steam at 15 bar and 300°C expands in a nozzle to a pressure of 1 bar. If the efficiency of the nozzle is 88%, using Mollier chart calculate the mass of steam discharged when the exit area is 180 mm^2.

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