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C20-M–504

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BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER / NOVEMBER—2024

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. Define the terms 'sensible heat' and 'latent heat of evaporation' of water.

2. Determine the mass and enthalpy of 0·5 m^3 of wet steam at a pressure of 10 bar with a degree of wetness equal to 10%.

3. List out the devised calorimeters to measure the dryness fraction of wet steam.

4. Classify steam boilers based on any three criteria.

5. Write any three advantages of water tube boilers over fire tube boilers.

6. Show the types of steam nozzles with the line diagrams.

7. Dry and saturated steam enters the nozzle with 135 m/s and expands from 10 bar to 0·1 bar. Find the velocity of steam at exit.

8. Write any three differences between impulse steam turbine and reaction steam turbine.

9. Write any three advantages of surface condensers over jet condensers.

10. The vacuum in a condenser is 690 mm Hg, while the barometer reads 760 mm Hg. The mean condensate temperature is 30 °C. Find the 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 cylinder contains 0·5 m^3 of steam at 400 kN/m^2 and 200 °C. If the steam is cooled at constant pressure until the volume becomes 0·1 m^3. Calculate the final dryness fraction, the work and heat energy transferred.

(OR)

2 kg of steam initially at a pressure of 12 bar and a temperature of 250 °C expands polytropically to 1·2 bar. Find *(a)* final condition, *(b)* work done, *(c)* heat transfer and *(d)* change in entropy. Assume the index of expansion as 1·25.

12. Explain the Cochran boiler with a neat sketch and write the function of any three boiler mountings in the Cochran boiler.

(OR)

A boiler plant supplies 5500 kg of steam per hour at 7·5 bar and 0·97 dry from feed water at 35 °C. The boiler uses 660 kg of coal per hour having calorific value of 31500 kJ/kg. Determine *(a)* thermal efficiency of boiler and *(b)* equivalent evaporation.

13. Explain the steam injector with a neat diagram.

(OR)

Dry saturated steam enters a convergent nozzle at a pressure of 10 bar and with a velocity of 90 m/s. The exit pressure is 5 bar and steam leaves the nozzle at a velocity of 435 m/s. The friction loss is 8 kJ/kg of steam flow. Determine *(a)* velocity coefficient, *(b)* final condition and *(c)* area at the exit if the inlet area is 1260 mm^2.

14. Explain the velocity compounding of steam turbines with a line diagram.

(OR)

Steam issues from a nozzle at 800 m/s. The velocity of moving blade 200 m/s and the mass of steam flow is 2 kg/s. The nozzles are inclined at 16° to the plane of the wheel, taking friction factor 0·8 and outlet angle of blade as 30°. Find *(a)* power developed, *(b)* blade angle at inlet, *(c)* blade efficiency and *(d)* axial thrust.

15. Draw the layout of a steam condensing plant with a line diagram and write the function of each accessory.

(OR)

The absolute pressure in the surface condenser is 0·1134 bar, when the barometer indicates 757 mm Hg. The condenser temperature is 40 °C. Determine vacuum efficiency and mass of air present in the condenser per kg of steam.

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 reaction turbine running at 360 RPM consumes 5 kg/s steam. Tip leakage is 10%. The discharge tip angle for both the blades is 20°. The axial velocity of flow is 0·75 times blade velocity. The power developed by a certain pair is 5 kW, where the pressure of the steam is 2 bar and dryness fraction 0·95. Find the drum diameter and blade height.

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