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C14–M–504

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BOARD DIPLOMA EXAMINATION, (C–14)

OCT/NOV—2018

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.

(4) Use of steam tables is permitted.

1. Determine the specific enthalpy of wet steam with dryness fraction 0·85 at a pressure of 9 bar.

2. Define internal energy of steam. Mention the mathematical expression for internal energy of steam.

3. List any six accessories of a steam boiler.

4. In a boiler test, steam at a pressure of 14 bar, having a dryness fraction 0·9, is generated at the rate of 8 kg per kg of coal burnt. The heating value of coal fired is 35000 kJ/kg and temperature of feed water is 45 °C. Calculate the thermal efficiency of the boiler.

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5. Dry saturated steam enters a steam nozzle at a pressure of 12 bar and discharged at 1 bar. If the steam at exit is 0·9 dry, find the velocity of steam at exit.

6. Define critical pressure ratio. Write an expression for it.

7. What is compounding? What are different methods of compounding?

8. What are the advantages of steam turbine over steam engine?

9. State the function of steam condenser.

10. Calculate the vacuum efficiency of a condenser from the following data :

Vacuum at steam inlet to condenser = 725 mm

Barometer = 760 mm

Hot well temperature = 26·4 °C

PART—B

10×5=50

Instructions : (1) Answer *any* **five** questions.

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

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

(4) Use of steam tables is permitted.

11. 2 kg of steam at a pressure of 800 kPa and 0·8 dry is heated at constant pressure until the final temperature is 250 °C. Determine the following using steam tables :

(a) The heat added

(b) Change in internal energy

Assume C_p for superheated steam as 2·1 kJ/kg-K.

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12. A boiler generates 18000 kg/hr of steam at 12 bar with 95% quality. Feed water temperature is 110 °C. Rate of coal firing is 2000 kg/hr. If HCV of coal is 27500 kJ/kg, find the—

(a) factor of evaporation;

(b) equivalent evaporation;

(c) thermal efficiency of boiler.

13. Explain the working of a La Mont boiler with a neat sketch.

14. Determine the diameters of throat and exit for a steam nozzle to convey 10 kg/min where the inlet conditions are 12 bar and 250 °C and the final pressure is 2 bar. Neglect initial velocity of steam and effect of friction.

15. *(a)* A nozzle discharges 0·9 dry steam at 12 bar abs, into a reservoir where the pressure is 0·15 bar abs. The diameter of the nozzle at the throat is 10 mm. If the flow is frictionless adiabatic, what mass of steam will pass through the nozzle per minute? 5

(b) Explain the working of high level jet condenser with the help of a neat sketch. 5

16. A De-Laval steam turbine is supplied with 1 kg steam per sec from a set of nozzles whose pressure range is 10 bar to 0·2 bar. The nozzle angle is 22° and blade exit angle is 30°. The mean blade speed is 250 m/sec. If the nozzle efficiency is 80%, find the—

(a) power developed;

(b) blade efficiency;

(c) inlet angle of blade.

17. What are the methods of turbine governing? Explain any one of them in brief.

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18. During a trail on steam condenser, the following observations were recorded :

Condenser vacuum = 680 mm Hg

Barometer reading = 764 mm Hg

Mean condensate temperature = 36 °C

Hot well temperature = 30 °C

Condensate formed per hour = 1800 kg

Rise in temperature of cooling water = 12 °C

Quantity of cooling water = 1260 kg/min

Determine the following :

(a) Condenser vacuum corrected to standard barometer

(b) Vacuum efficiency

(c) Undercooling of condensate

(d) Condenser efficiency

(e) Condition of steam as it enters the condenser

(f) Mass of air present per kg of condensate

Assume R for air = 2·287 kJ/kg-K, specific heat of water = 4·2 kJ/kg-K.

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