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C14–M–504

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BOARD DIPLOMA EXAMINATION, (C–14)

OCT/NOV—2017

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. Find out the condition of steam if its pressure is 10 bar and enthalpy is 2600 kJ/kg. 3

2. List out any six properties of steam. ½×6=3

3. List out important special features of modern high pressure boilers. 1+1+1

4. What is boiler mountings with boiler accessories? 3

5. Define critical pressure ratio. Write an expression for it in terms of inlet pressure, throat pressure and index of expansion. 1+2=3

6. Draw the line diagrams of convergent, divergent and convergent-divergent nozzles. 1+1+1=3

7. Write the advantages of steam turbines over steam engines. 3

8. What is governing of steam turbines? List any two methods of governing of a steam turbine. 1+2=3

9. State the functions of a steam condenser. 3

10. Draw a line diagram of shell and tube surface condenser and label the parts. 2+1=3

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.

11. If 1 kg of steam with a dryness fraction of 0·8 expands adiabatically, according to the law $pv^{1\,13}$ constant from a pressure of 10 bar to 2·8 bar, determine the *(a)* final condition of steam, *(b)* work done, *(c)* heat transfer and *(d)* change in internal energy. 3+2+2+3=10

12. Describe the working of Benson boiler with a line diagram and label its parts. 4+4+2=10

13. During test on a boiler the following data were collected :

Steam pressure—10·5 bar abs

Steam condition—dry and saturated

Feed water temperature—35 °C

Rate of evaporation—12 kg/kg of coal

Calorific value—37500 kJ/kg

Determine the *(a)* factor of covalent of evaporation, *(b)* equivalent evaporation and *(c)* thermal efficiency. 4+3+3=10

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. 6+4=10

15. *(a)* Describe supersaturated flow of steam in a nozzle with the aid of Moellier diagram.

(b) List out the differences between jet and surface condensers. 5+5=10

16. *(a)* Describe about pressure compounding of steam turbine.

(b) Write any six differences between impulse and reaction steam turbines. 4+6=10

17. Steam issues from a nozzle at 900 m/s. The velocity of moving blade is 350 m/s and the mass of steam flow is 2·5 kg/s. The nozzles are inclined at 15° to the plane of the wheel; neglecting friction, and inlet, outlet angles of blade are equal. Find the *(a)* power developed, *(b)* blade angle at inlet, *(c)* blade efficiency and *(d)* axial thrust. 5+1+2+2

18. The following observations were made during a trial on a steam condenser :

Barometric pressure—760 mm of Hg
Vacuum reading—710 mm of Hg
Rate of cooling water—18 kg/sec
Inlet temperature of cooling water—18 °C
Outlet temperature of cooling water—28 °C
Quantity of steam condensed—25 kg/minute
Hot-well temperature—30 °C
Mean temperature of condensate—33 °C

Determine *(a)* vacuum efficiency, *(b)* condenser efficiency, *(c)* dryness fraction of exhaust steam, *(d)* sub-cooling of condensate and *(e)* amount of air leakage per kg of steam condensed.

Assume R for air 0 287 kJ/kg-K and specific heat of water 4 182 kJ/kg-K. 2+2+3+1+2=10

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