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BOARD DIPLOMA EXAMINATION, (C-16)

MARCH / APRIL — 2021

DME — FOURTH SEMESTER EXAMINATION

THERMAL ENGINEERING - II

Time : Three Hours]   [*Maximum Marks* : 80

PART-A   3×10=30

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

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

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

1.   A container contains 5 kg of wet steam at a pressure of 8 bar. If it is 10% wet, calculate the volume of the container.

2.   Write at least six differences between fire tube boilers and water tube boilers.

3.   4 kg of steam 95% dry expands adiabatically from 1.1 MPa to 0.12 MPa. Determine using steam tables the final quality of steam.

4.   5 kg of dry and saturated steam at a pressure of 14 bar expands to 1.4 bar. Find the quality of steam at the end of expansion if the index of expansion is 1.3.

5.   Superheated steam enters a convergent-divergent nozzle at a velocity of 80 m/s and with a mass flow rate of 0.8 kg/s. The pressure and temperature of the steam at the entry of the nozzle are 20 bar and 300° C and the condition at the exit is 2 bar and 10% wet. Determine the exit velocity of the steam.

6.   Write at least six differences between Impulse Turbines and Reaction Turbines.

7. What are jet condensers and surface condensers ?

8. Write the applications of gas turbines.

9. List out the applications of Rocket engines.

10. What are the characteristics of an automobile clutch ?

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PART-B   10×5=50

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

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

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

11. A shell of 150 litres capacity contains steam at a pressure of 15 bar and the steam is 10% wet. Calculate :

(*a*)   Mass of steam

(*b*)   Total entropy

(*c*)   Heat required to superheat it to 375° C at the above pressure.

12. Describe the construction and working principle of Cochran boiler with a neat sketch.

13. A vessel of 1200 litres capacity contains steam at a pressure of 18 bar and at a temperature of 270° C. It is expanded to a pressure of 1.4 bar according to $PV^{1.3}$ = constant. Determine :

(*a*)   The final condition of steam

(*b*)   The total change in internal energy

(*c*)   Total work done

(*d*)   The total change in entropy

14. A convergent-divergent nozzle receives wet steam of 2% wet at a pressure of 26 bar with an approach velocity of 100 m/s and expands it to a back pressure of 0.3 bar. Nozzle efficiency is 85% and all the frictional losses take place in the divergent portion only. Determine :

(*a*)   The critical throat pressure

(*b*)   The discharge of steam

(*c*)   The area of cross section of the nozzle at its exit

15. In an impulse turbine the nozzles are inclined at 18° to the wheel tangent. Steam leaves the nozzles at 800 m/s with a flow rate of 10 kg/s. The blade speed is 280 m/s. The relative velocity of steam as it flows over the blades is reduced by 10% due to friction. Determine :

(*a*) The suitable inlet and outlet angles for the blades to ensure the axial thrust to be zero

(*b*) Work done

(*c*) Power developed

(*d*) Diagram efficiency.

16. Explain with a neat sketch the working principle of constant volume gas turbine.

17. Write the working principle of RAM jet engine with a neat diagram.

18. Explain the working principle of multi plate clutch.

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