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Code : 15ME52T

Register Number | | | | | | | | | | |

V Semester Diploma Examination, Oct./Nov.-2019

APPLIED THERMAL ENGINEERING

Time : 3 Hours] **[Max. Marks : 100**

Note : (i) Answer any **six** questions from Part – A, any seven questions from Part – B.

(ii) Use of steam tables and mollier chart is permitted.

(iii) Assume any missing data suitably.

PART – A

1. Define the following terms : **5**
   (a) Saturation temperature
   (b) Enthalpy of Evaporation
   (c) Superheated Steam
   (d) Specific Volume of Wet Steam
   (e) Dryness fraction of Steam

2. List out five comparisions between water tube and fire tube boilers. **5**

3. Explain in detail the functions of "Safety Valve" and "Fusible Plug". **5**

4. State the factors which affects the cooling of water in a cooling tower. **5**

5. Sketch and label low level jet condenser. **5**

6. Describe the velocity compounding of steam turbine. **5**

7. Write the classification of air compressor. **5**

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8. Define the following : 5

(a) Refrigeration

(b) C.O.P.

(c) Relative humidity

(d) Den point depression

(e) Specific humidity

9. Explain winter air-conditioning system with a neat sketch. 5

PART – B

10. Determine the Quantity of heat required to produce 1 kg of steam at a pressure of 6 bar and at a temperature of 25 °C, under the following conditions :

(a) When the steam is wet having a dryness fraction of 0.9;

(b) When the steam is dry saturated;

(c) When it is superheated at a constant pressure to a temperature of 250 °C.

Assume the mean specific heat of superheated steam to be 2.3 $\frac{kJ}{kg - °k}$. 10

11. The internal energy of 1 kg. of steam at pressure of 14 bar is 2420 kJ, calculate the dryness fraction of steam. Find the increase in internal energy if this steam is superheated at constant pressure to a temp 295 °C. Take C_p of Superheated steam as 2.3 kJ/kg°k. 10

12. (a) With a neat sketch, explain separating type steam calorimeter. 5

(b) Distinguish between forced draught and induced draught. 5

13. Sketch and explain the working of a La-mount Boiler. 10

14. (a) Explain types of steam nozzles and define the term "nozzle efficiency". 5

(b) Compare merits and demerits of surface condenser over jet condenser. 5

A turbine having a set of 16 nozzles receives steam at 20 bar and 400 °C. The pressure of steam at the nozzle exit is 12 bar. If the discharge rate is 260 kg/min and the nozzle efficiency is 90%, calculate the Cross-sectional area at the nozzle exit. If the steam has a velocity of 80 m/sec. at entry to the nozzle, find the percentage increase in discharge. **10**

16. The velocity of steam at inlet to a simple impulse turbine is 1000 m/s and the nozzle angle is 20°. The mean blade speed is 400 m/s and the blades are symmetrical. The mass flow rate of steam is 0.75 kg/sec. The friction effects on the blades are negligible.

Estimate :

(a) the blade angles

(b) tangential force on the blades

(c) axial thrust

(d) the diagram power,

(e) the diagram efficiency **10**

17. Steam flows from the nozzle of an impulse turbine with a velocity of 730 m/sec. and enters a ring of blades having a mean velocity of 180 m/sec. The nozzle angle is 20° and outlet blade angle is 25°. Steam flows at the rate of 1.2 kg/sec. Take blade velocity co-efficient as 0.72.

Determine :

(a) Blade efficiency

(b) Power developed

(c) Energy lost in the blades / sec: **10**

18. A single acting, single stage reciprocating air compressor has a bore of 200 mm and stroke of 300 mm. It runs at a speed of 500 rpm. Air is compressed according to law $PV^{1.3} = C$, from a pressure of 97 kPa and compression pressure is 550 kPa. It is delivered at this pressure. The initial temperature is 20 °C. Determine the delivery temperature, amount of air delivered and the power required to drive the compressor. Neglect clearance.

Take $R = 0.29 \frac{kJ}{kg - °k}$. **10**

19. (a) Explain with a neat sketch, the vapour compression refrigeration system. **5**

(b) Differentiate between impulse and reaction Turbine. **5**