Reg. No. : | | | | | | | | | | | | |

# Question Paper Code: 1145231

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV/ DEC 2024
Fifth Semester
Mechanical Engineering
ME8595 – THERMAL ENGINEERING - II
(Regulation 2017)

Time: Three Hours Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. What is the effect of super saturation in the nozzles?

2. List the applications of steam nozzle.

3. Define equivalent evaporation from and at 100°C.

4. Recall the term fusible plug.

5. Explain 'Degree of Reaction' in a steam turbine.

6. What are the different losses that occur in a steam turbine?

7. Tell the meaning of heat-to-power ratio.

8. Brief the principle of heat pump.

9. Compare vapour compression and vapour absorption system.

10. Point out the various sources of heat gain of an air-conditioned space.

PART – B (5 x 13 = 65 Marks)

11. (a) Create the expression for critical pressure ratio in terms of index of expansion.(13)

(OR)

(b) Dry saturated steam at a pressure of 8 bar enters a convergent divergent nozzle and leaves it at a pressure of 1.5 bar. If the steam flow process is isentropic and the corresponding expansion index is 1.135, find the ratio of cross sectional area at exit and throat for maximum discharge. (13)

12. (a) Develop with neat sketch any three of the following mounting: (13)

(i) Water level indicator
(ii) Pressure gauge
(iii) Feed check value
(iv) Blow of cock
(v) High steam and low water safety value
(vi) Junction or stop value.

(OR)

(b) The following data were obtained in a boiler trial: (13)
Feed water supply per hour = 690 kg at 28°C ;
Steam produced = 0.97dry at 8 bar ;
Coal fired per hour = 91kg of calorific value 27255 kJ/kg ;
Ash and unburnt coal collected beneath fire bars = 7.5 kg/hr of calorific value 3700 kJ/kg ;
Mass of the flue gasses per kg of coal burnt = 17.4kg ;
Temperature of flue gases 325°C ;
Room temperature = 17°C;
Specific heat of flue gases 1.005 kJ/kgK.
Estimate the boiler efficiency and draw up a heat balance sheet.

13. (a) A single stage impulse turbine rotor has a diameter of 1.2 m running at 3000 rpm. The nozzle angle is 18°. Blade speed ratio is 0.42. The ratio of the relative velocity at outlet to relative velocity at inlet in 0.9. The outlet angle of the blade is 3o smaller than the inlet angle. The steam flow rate is 5 kg/s. Draw the velocity diagram and find the following : (i) Velocity of whirl (ii) Axial thrust on the bearing (iii) Blade angles (iv) Power developed. (13)

(OR)

(b) Develop the working of velocity and pressure velocity compounding methods with neat sketch. (13)

14. (a) Explain in detail about low temperature Energy Recovery Options and Technologies. (13)

(OR)

(b) (i).Explain any three types of recuperators. (6)
(ii).What are waste heat recovery boilers? Explain the need and benefits? (7)

15. (a) An $NH_3$ refrigerator produces 30 tonnes of ice from and at 0°Cin a day of 24 hours. The temperature range in compressor is from 25°C to -5°C. The vapour is dry saturated at end of compression. Assume a COP of 60% theoretical. Calculate power required to drive the compressor. Assume latent heat of ice 335 kJ/kg. The properties of NH3 as given in the table. (13)

| Temp($^oC$) | $h_f$(kJ/kg) | $h_g$ (kJ/kg) | $S_f$(kJ/kg k) | $S_g$ (kJ/kg k) |
|---|---|---|---|---|
| 25 | 298.9 | 1465.8 | 1.124 | 5.039 |
| -15 | 112.34 | 1426.5 | 0.4572 | 5.549 |

(OR)

(b) Identify unitary and central air conditioning systems and their application in contemporary industries. (13)

## PART – C (1 x 15 = 15 Marks)

16. (a) What are the basic requirements of combustion equipment? Explain briefly the following methods of burning of coal :
(i) Stoker firing
(ii) Pulverized fuel firing (15)

(OR)

(b) Give two examples of residual heat recovery sources, What are the direct and indirect benefits of residual heat recovery system? (15)

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