ME 214 (R-22)

Total No. of Questions : 10] [Total No.of Pages : 02

II/IV B. Tech. DEGREE EXAMINATIONS, AUGUST - 2024

First Semester

MECHANICAL ENGINEERING

BASIC THERMODYNAMICS

Time : **Three Hours** Maximum : **70** Marks

Answer ONE Question from each Unit. 5x14=70 M

All Questions carry equal marks.

UNIT - I

1. a) Explain briefly thermodynamic system with a figure.

   b) A mass of gas is compressed in a quasi-static process from 90 kPa, 0.1 m^3 to 0.6 MPa, 0.04 m^3. Assuming that the pressure and volume are related by pv^n = constant, find the work done by the gas system.

(OR)

2. a) A temperature scale in degrees N is to be defined. The boiling and freezing points on this scale is 3000 N and 1000N respectively. (i) Correlate this with centigrade scale and Fahrenheit scale, (ii) Find the temperature on new scale corresponding to 60^0 C.

   b) Differentiate heat and work.

UNIT - II

3. a) Explain law of conservation energy concept with neat figure.

   b) A gas contained in a cylinder fitted with a frictionless piston expands against a constant external pressure of 1 atm from a volume of 5 litres to a volume of 10 litres. In doing so it absorbs 400 J of thermal energy from its surroundings. Determine the change in internal energy of system.

(OR)

4. 6kg of certain gas at a pressure of 10 bar and 30^oC occupies the volume of 0.6. It expands adiabatically to a pressure of 1 bar and volume 0.73. Determine the work done during the process. Gas constant, ratio of specific heat, values of two specific heats, change in internal energy and change in enthalpy.

P.T.O.

UNIT - III

5. a) Explain second law of thermodynamics.
   b) Air in a closed vessel of fixed volume 0.15 m^3 exerts pressure of 12 bar at 250°C. If the vessel is cooled so that the pressure falls to 3.5 bar, determine the final pressure, heat transfer and change of entropy.

(OR)

6. A vessel of volume 0.04 m^3 contains a mixture of saturated water and steam at a temperature of 250°C. The mass of the liquid present is 9 kg. Find the pressure, mass, specific volume, enthalpy, entropy and internal energy.

UNIT - IV

7. a) Derive the expressions for mixtures of ideal gases for the enthalpy and entropy.
   b) Establish the inequality of Clausius.

(OR)

8. a) Calculate the entropy change of the universe as a result of the following processes : (i) A copper block of 600 grams mass and with Cp of 150 J/kg-K at 1000C is placed in a lake at 80C. (ii) Two such blocks at 100 and 00C are joined together.
   b) Write down the applications of entropy.

UNIT - V

9. a) Compare the thermal efficiency of Otto, dual and diesel cycles on the basis of same compression ratio and same heat input ?
   b) In an Otto cycle air at 1 bar and 290K is compressed isentropic ally until the pressure is 15 bar, the heat is added at constant volume until the pressure rises to 40bar. Calculate the air standard efficiency and mean effective pressure for the cycle.
   Take Cv = 0.717 KJ/Kg K and Runiv = 8.314 KJ/KgK.

(OR)

10. a) Explain Brayton cycle with neat sketch.
    b) The compression ratio of an air standard dual cycle is 10 and the maximum pressure on the cycle is limited to 60 bar. The pressure and temperature of the cycle at the beginning of compression process are 1 bar and 350K. Calculate the thermal efficiency and Mean Effective Pressure. Assume cylinder bore = 200 mm, Stroke length = 350mm,
    Cp = 1.005K J/Kg K, Cv = 0.718KJ/KgK.