C 26881 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, MAY 2012

ME 09 406—THERMODYNAMICS

(2009 Admissions)

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. State the first law of thermodynamics for a closed system undergoing a change of state.
2. What is meant by 'Perpetual Motion Machine of First kind' ?
3. Define enthalpy of a gas.
4. Define dryness fraction.
5. Define the terms :
   (a) Specific humidity.
   (b) Dew point temperature.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

1. Define and explain Zeroth law of thermodynamics.
2. Draw neatly the sequences of operation of Carnot engine on p-v and T-s diagrams. Show that the entropy change during the cycle is zero.
3. Explain the difference between a Perfect gas and a Real gas. What are the reasons of deviation of a Real gas from Perfect gas ?
4. What is sensible heating and cooling ? Explain.
5. Explain Dalton's law of partial pressures.
6. Explain the process of steam generation. Define dryness fraction of steam.

(4 × 5 = 20 marks)

Part C

Answer any **four** *questions.*

1. What is steady flow process ? Write down SFEE and assumptions you make for the following cases.
   (a) Boiler
   (b) Compressor
   (c) Nozzle.

Turn over

2. Air undergoes a cyclic process in a cylinder and piston arrangement. First the atmosphere a air at 1 bar 27°C. Is compressed adiabatically to 10 bar, then expended isothermally up to initial pressure, then brought to initial conditions under constant pressure, find out.

   (a) Change in internal energy

   (b) Change in enthalpy

   (c) Heat transfer

   (d) Work transfer for each process and also for the cycle.

3. One kg of ice at -5°C is exposed to the atmosphere which, is at 25°C. The ice melts and comes into thermal equilibrium with the atmosphere. Determine the entropy increase of the universe. Cp for ice is 2.039 kJ/kg K and the enthalpy of fusion of ice is 333.3 kJ/kg.

4. Prove that irreversibility is created (entropy generated) whenever heat transfer with finite temperature difference occurs.

5. A rigid tank of 0.03 m^3 volume contains a mixture of liquid water and water vapour at 80 kPa. The mass of the mixture in the tank is 12 kg. Calculate the heat added and the quality of the mixture when the pressure inside the tank is raised to 7 MPa.

6. Derive the equation :

$$\frac{(\partial V/\partial T)_s}{(\partial V/\partial T)_p} = \frac{1}{\gamma - 1}.$$

7. Using Maxwell's relations deduce the two Tds equations.

8. A room of dimensions 5m x 3m x 3m contains an air water vapour mixture at 1 bar, 300C and 70% relative humidity. Calculate :

   (a) Mass of air

   (b) Mass of Water Vapour.

   The universal gas constant is 8.3143 kJ /kg - Mole K and molecular mass of air and water vapour is 29 and 18 respectively.

(4 × 10 = 40 marks)