Roll No. | | | | | | | | |

B.E / B.Tech (Full Time) End Semester DEGREE EXAMINATION, NOV / DEC 2011

Fourth Semester

Common to Manufacturing / Industrial Engineering

ME 9215 - THERMODYNAMICS

(Regulation 2008)

Time : 3 Hours | Answer ALL Questions | Max. Marks 100

PART- A (10 x 2 = 20 Marks)

1. Define Temperature.
2. What is mean by a pure substance?
3. State the Clausius statement of second law of thermodynamic.
4. What is mean by irreversibility?
5. What is the basic principle of a reaction type steam turbine?
6. What are the properties of environmental friendly refrigerants?
7. Define Dalton's Law of partial pressure.
8. How the specific heats of gas mixtures vary with temperature?
9. What is mean by grey body radiation?
10. Define forced convection.

Part – B (5 x 16 = 80 marks)

11. The following observations were taken with a separating and a throttling calorimeter arranged in series:

Water separated = 2 kg, steam discharged from the throttling calorimeter = 20.5 kg, temperature of steam after throttling = 110°C, initial pressure = 12 bar abs., barometer = 760 mm of Hg, final pressure = 5 mm of Hg.

Estimate the quality of steam supplied.

12. a) A centrifugal pump delivers 50 kg of water per second. The inlet and outlet pressures are 1 bar and 4.2 bar respectively. The suction is 2.2 m below the centre of the pump and delivery is 8.5 m above the centre of the pump. The suction and delivery pipe diameters are 20 cm and 10 cm respectively. Determine the capacity of the electric motor to run the pump.

OR

b) A heat pump operates between two identical bodies which are at temperature T_1 and cools one of the bodies to a temperature T_2 ($T_2 < T_1$). Prove that for this operation the minimum work required by the heat pump is given by

$$W = c_p \left[\frac{T_1^2}{T_2^2} + T_2 - 2T_1 \right]$$

Where c_p is the specific heat which is same for both the bodies.

13. a) Explain a classification and a construction of four stroke internal combustion engine.

OR

b) Explain with necessary H-S diagram the principle, operation and limitation of vapour compression refrigeration system.

14. a) Explain with necessary mathematical illustration of adiabatic mixing of effective gases.

OR

b) A perfect gas mixture consists of 4 kg of N_2 and 6 kg of CO_2 at a pressure of 4 bar and a temperature of 25°C. Calculate c_v and c_p of the mixture.
If the mixture is heated at constant volume to 50°C, find the change in internal energy enthalpy and entropy of the mixture.

Take : $c_{v\,(N_2)}$ = 0.745 kJ/kg K, $c_{v(CO_2)}$ = 0.653 kJ/kg K
$C_{p\,(N_2)}$ = 1.041 kJ/kg K, $c_{p(CO_2)}$ = 0.842 kJ/kg K.

15. a) A wire 1.5 mm in diameter and 150 mm long is submerged in water at atmospheric pressure. An electric current is passed through the wire and is increased until the water boils at 100°C. Under the condition if convective heat transfer coefficient is 4500 $W/m^{2\circ}$ C find how much electric power must be supplied to the wire to maintain the wire surface at 120°C?

OR

b) Explain the radiation exchange between black bodies separated by a non-absorbing medium.