Code No. 6063 / M

FACULTY OF ENGINEERING

B.E. 2/4 (M/P) II – Semester (Main) Examination, June 2014

Subject: Thermodynamics

Time: 3 Hours **Max.Marks: 75**

Note: 1) Answer all questions from Part A. Answer any five questions from Part B.
2) Use of Steam tables and Mollier diagram is permitted.
3) Assume any missing data suitably.

PART – A (25 Marks)

1 What is the principle of constant volume ideal gas thermometer?
2 Define extensive property with examples.
3 What is perpetual motion machine of first kind?
4 Write down the heat transfer relation for closed system undergoing polytropic process.
5 How is COP of a heat pump evaluated?
6 Define Gibbs function.
7 Define critical point of a pure substance.
8 Draw phase diagram for water on P-T coordinates.
9 List two differences between Otto and Diesel cycles.
10 State Dalton's law of partial pressures.

PART – B (50 Marks)

11 (a) Differentiate between microscopic and macroscopic approaches in thermodynamics. 5
(b) Explain the working principle of constant pressure ideal gas thermometer. 5

12 (a) Obtain the steady flow energy equation for a device with two inlets and two outlet flows. 5
(b) 3 Kg of air at State 1 at a pressure of 150 kPa and temperature 360^{o} K is compressed polytropically to 750 kPa according to law $PV^{1.2}$=constant. The air is then cooled to initial temperature at constant pressure. The air is then brought to state 1 by following PV=C. Draw the cycle on PV-diagram and determine net work and heat. 5

13 A heat pump is used to heat a bunglow in the winter and then reversed to cool the bunglow in the summer. The interior temperature is to be maintained at 25^{o}C. Heat transfer through the walls and roof is estimated to be 2800 kJ/hr ^{o}C temperature difference between the inside and outside.
i) If the outside temperature in winter is 5^{o}C, what is the minimum power required to drive the heat pump?
ii) If the power input is the same as in part (i), what is the maximum outside temperature for which the inside temperature can be maintained at 25^{o}C? 10

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14 (a) A piston cylinder arrangement is filled with a wet steam of quality 0.8 at a pressure of 0.1 MPa. Energy is added at constant pressure till the temperature of steam rises to 300°C. Calculate the heat added and the work done. 6

(b) Derive Maxwell's relations. 4

15 Explain the processes of Otto Cycle using T-s and P-v plots. Derive equation for cycle efficiency. 10

16 In a steady flow system, a fluid flows at the rate of 5 kg/sec. It enters at a pressure of 620 kPa, velocity of 300 m/sec, internal energy 2100 kJ/kg and specific volume 0.37 m^3/kg. It leaves the system at a pressure of 130 kPa, a velocity of 150 m/sec, internal energy 1500 kJ/kg and specific volume 1.2 m^3/kg. During its flow through system there is a heat loss of 30 kJ/kg. Determine the power capacity of the system in kW. State whether it is from or to the system. Neglect change in P.E. 10

17 (a) Prove that Kelvin Planck's and Clausius statements of second law are equivalent. 5
(b) How is thermal equilibrium different from thermodynamic equilibrium? 5

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