Register Number: …….

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Third Semester

MECHANICAL ENGINEERING

U07ME302: Engineering Thermodynamics

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

Part A (10 x 1 =10 Marks)

1. Density is defined as

a) ρ=mass/volume m/v kg/m^3 b) weight/volume w/v n/m^3

c) v/m m^3/kg d) None of the above

2. A system comprising of a single phase, is known as

a) Open system b) closed system c) homogeneous system d) heterogeneous system

3. Which is the expression for COP of a heat pump?

a) Heat extracted rejected/work input b) heat rejected/ work input

c) (T1-T2)/T1 d) heat extracted/heat input

4. The absolute zero pressure can be obtained at a temperature of

a) 0^0C b) 273^0C c) 273K d) none of the above

5. In carnot cycle, the algebraic sum of the entropy changes for the cycle is

a) Positive b) negative c) zero d) none of the above

6. The absolute zero pressure exists

a) At sea level b) at 273K

c) at vacuum conditions d) When molecular momentum of the system becomes zero

7. Equal volume of all gases, at the same temperature and pressure, contain equal number of molecules. This is according to

a) Charle's law b) Avagadro's law c) Joule's law d) Gay lussac law

8. Vander waal's equation

a) Has three roots of identical value at the critical point

b) is valid for all pressures and temperatures

c) is valid for dynamic gases only

d) all of these

9. Joule Thomson coefficient for an ideal gas having equation PV = RT is

a) Zero b) 0.5 c) unity d) infinite

10. in a reversible polytropic process

a) Enthalpy remains constant b) entropy remains constant

c) Some near transfer occurs d) internal energy remains constant

PART B (10 x 2 = 20 Marks)

11. What is meant by closed system? Give an example.
12. Define zeroth law and first law of thermodynamics.
13. State classius statement of second law of thermodynamics.
14. Define entropy
15. Sketch the flow diagram of rankine cycle.
16. What is wet and dry steam?
17. State Avagadro's law
18. State Boyle's law.
19. Define dew point temperature.
20. What is dew point temperature? How is it related to dry bulb and wet bulb temperature at the saturation condition?

PART C (5 x 14 = 70 Marks)

21. a) (i) Derive steady flow energy equation for turbine (4)

(ii) A room for four persons has two fans, each consuming 0.18kW power and three 100W lamps.Ventilation air at the rate of 80 kg/hr enters with an enthalpy of 84 kJ/kg and leaves with an enthalpy of 59 kJ/kg. if each person puts out heat at the rate of 630 kJ/khr, determine the rate at which heat is to be removed by a room cooler so that a steady state is maintained in the room. (10)

(OR)

b) One kg of gas expands at constant pressure from 0.085 m^3 to 0.13 m^3. If the initial temperature of the gas is 225^0C, find the final temperature, net heat transfer, change in internal energy and the pressure of gas.

22. a) 5 kg of air at 2 bar and 30^0C is compressed to 24 bar pressure according to the law $PV^{1.2}$ = constant. After compression air is cooled at constant volume to 30^0C. Determine,

i) Volume and temperature at the end of compression,

ii) Change of entropy during compression,

iii) Change in entropy during constant volume cooling.

Take Cp=1.005 kJ/kg K. CV=0.718 kJ/kg K.

(OR)

b) A reversible heat engine operating between reservoirs at 900K and 300K drives a reversible refrigerator operating between two reservoirs at 300K and 250K. The heat engine receives 1800kJ heat from 900K reservoir. The net output from the combined engine refrigerator is 360kJ. Find the heat transferred to the refrigerator and the net Heat rejected to the reservoir at 300K.

23. a) (i) Draw a P-T diagram and label various phases of pure substances. (4)

(ii) Steam at 4 bar and 0.7 dry expands at constant volume until 5.5 bar. Find the final condition of steam and the heat absorbed by 1kg of steam. (10)

(OR)

b) A steam power plant uses steam at boiler pressure of 150 bar and temperature 550^0C with reheat at 40 bar and 550^0C at condenser pressure of 0.1 bar. Find the quality of steam at turbine exhaust, cycle efficiency and the steam rate.

24. a) (i) Derive maxwell's equations. (10)

(ii) Explain Dalton's law of partial pressure. (4)

(OR)

b) 0.45 kg of CO and 1kg of air is contained in a vessel of volume 0.4 m^3 at 15^0C. Air has 23.3% of O_2 and 76.7% of N_2 by mass.Calculate the partial pressure of each constituent and total pressure in the vessel.Molar masses of CO, CO2 and N_2 are 28, 32 and 28 kg/kmol.

25. a) A sling psychrometer reads 40^0C DBT and 30^0C WBT. Calculate specific humidity, Relative humidity, dew point temperatures, enthalpy and specific volume of air mixture. Assume atmospheric air pressure 1.0132 bar.

(OR)

b) (i) Draw the psychrometric chart and show any two psychometric process on it. (4)

(ii) Air at 16^0C and 25% relative humidity passes through a heater and then through a humidifier to reach find dry bulb temperature of 30^0C and 50% relative humidity. Calculate the heat and moisture added to the air. What is the sensible Heat factor? (10)

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