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Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, September 2014
(2008 Scheme)
(Special Supplementary)
08.305 : THERMODYNAMICS (M)

Time : 3 Hours Max. Marks : 100

Instructions *:1) Answer* ***all*** *questions from Part – **A** and* ***any one*** *question from* ***each*** *Module in Part – **B**.*

2) ***Use*** *of thermodynamic tables and charts is* ***permitted****.*

PART – A

1. Estimate the density of nitrogen at 30° C and 300 kPa, if compressibility factor is 0.85.
2. Distinguish between PMM- I and PMM-II.
3. Explain the law of corresponding states.
4. Discuss the principle of increase of entropy.
5. Draw the phase equilibrium diagram of a pure substance on T-S coordinates indicating different phases, processes and regimes of heating.
6. What are the causes of irreversibility ? Explain.
7. State and discuss the third law of thermodynamics.
8. Define Gibbs function and explain its significance.
9. How do you obtain the inversion curve ? Explain its significance.
10. State and prove Dalton's law of partial pressures. **(10×4=40 Marks)**

P.T.O.

PART – B

Module – I

11. a) Derive the expression of law of corresponding states from Van der Waal equation of state for real gases. 10

b) A vessel of volume 0.04m^3 contains a mixture of saturated water and saturated steam at a temperature of 250° C. The mass of liquid present is 9 kg. Find the pressure, the mass, the specific volume, the enthalpy, the entropy and the internal energy. 10

OR

12. a) What is ideal gas temperature ? Explain with appropriate graph. 5

b) Prove that energy is a property. 4

c) Show the energy balance for the gas undergoing bottle filling process from a pipeline with all assumptions. 5

d) In a steam power station, steam flows steadily through a 0.2 m diameter pipeline from the boiler to the turbine. At the boiler end, the steam conditions are found to be : p = 4 MPa, t = 400° C, h = 3213.6 kJ/kg, and v = 0.073 m^3 /kg. At the turbine end, the conditions are found to be : p = 3.5 MPa, t = 392° C, h = 3202.6 kJ/kg, and v = 0.084 m^3/kg. There is a heat loss of 8.5 kJ/kg from the pipeline. Calculate the steam flow rate. 6

Module – II

13. a) Discuss Kelvin-Planck statement and Clausius statements of second law of thermodynamics and prove that they are equivalent. 10

b) What are the causes of irreversibility ? Explain in detail the irreversible processes with suitable examples. 10

OR

14. a) Derive an expression for maximum work obtainable from 2 bodies of finite heat capacities at temperatures T_1 and T_2 respectively. 10

b) One kg of water at 273 K is brought into contact with a heat reservoir at 373 K. When the water has reached 373 K, find the entropy change of water, of heat reservoir and of the universe. If water is heated from 273 K to 373 K by first bringing it in contact with a reservoir at 323 K and then with a reservoir at 373 K, what will the entropy change of universe be ? 10

Module – III

15. a) A certain gas has Cp = 1.968 and Cv = 1.507 kJ/kg-K. Find its molecular weight and the gas constant.
A constant volume chamber of 0.3 m^3 capacity contains 2 kg of this gas at 5C. Heat is transferred to the gas until the temperature is 100° C. Find the work done, heat transferred and the changes in internal energy, enthalpy and entropy. 8

b) Derive the T.ds equations. 6

c) Derive $Cp - Cv = -T\left[\left(\frac{\partial V}{\partial T}\right)_p{}^2\left(\frac{\partial P}{\partial V}\right)_T\right]$. 6

OR

16. A gaseous mixture consists of 1 kg of O_2 and 2 kg of N_2 at a pressure of 150 kPa and a temperature of 20° C. Determine the changes in internal energy, enthalpy and entropy of the mixture when the mixture is heated to a temperature of 100° C.

a) At constant volume and

b) At constant pressure

[Given : Cv_{02} = 0.658 kJ/kgK, Cv_{N2} = 0.743 kJ/kgK]. 20