Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- IVth SEMESTER–EXAMINATION – MAY/JUNE- 2012

Subject code: 140502 **Date: 25/05/2012**

Subject Name: Chemical Engineering Thermodynamics -I

Time: 10:30 am – 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.][**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define: 1) Process 2) System 3) Specific Heat 4) Equilibrium State 5) Closed System 6) Enthalpy 7) Internal Energy **07**

(b) Write a short note on Thermodynamic Diagrams. **07**

Q.2 **(a)** Explain the P-V-T behaviour of pure fluids with the help of neat diagram. **07**

(b) Derive a mathematical expression of the first law of thermodynamics for a steady state flow process between a single entrance and a single exit. **07**

OR

(b) A refrigeration machine operating at a condenser temperature of 290 ^{o}K needs 1 kW of power ton of refrigeration. Determine the following: **07**

a). The coefficient of performance.

b). The heat rejected to the condenser.

c). The lowest temperature that can be maintained.

Q.3 **(a)** Show that the maximum fluid velocity attainable for flow through a pipe of uniform cross section is equal to the speed of the sound in the fluid. **07**

(b) Derive maxwell thermodynamics relations. **07**

OR

Q.3 **(a)** Explain. 1). Clausius Inequality. 2). Kelvin – Planck Statement. **07**

(b) Prove that entropy of universe is increasing **07**

Q.4 **(a)** What is an ejector or jet pump? Explain with drawing of steam-jet ejector. **07**

(b) State various equations of state for real gases. Discuss virial equation in brief. **07**

OR

Q.4 **(a)** Explain the linde process for gas – liquefaction. **07**

(b) One kilo mol CO_2 occupies a volume of 0.381 m^3 at 313 ^{0}K.Compare the pressures given by a). Ideal gas equation b). van der Waals equation. Take the van der Waals constants to be a = 0.365 Nm^4/mol^2 and b = 4.28 x 10 $^{-5}$ m^3/mol. **07**

Q.5 **(a)** Discuss vapour compression cycle of refrigeration with the help of neat diagrams. **07**

(b) Define mach number. How is it important in establishing the relation between the velocity and the area of cross-section for flow through nozzles? **07**

OR

Q.5 **(a)** Mercury has a density of 13.69 x 10^3 kg/m^3 in the liquid state and 14.193 x 10^3 kg/m^3 in the solid state, both measured at the melting point of 234.33 ^{0}K at 1bar.If the heat of fusion of mercury is 9.7876 kJ/kg, What is the melting point of mercury at 10 bar? **07**

(b) Define: 1). Residual properties 2). Enthalpy departure 3). Entropy departure.4). Standard heat of formation 5). Standard heat of combustion. 6). Standard heat of reaction.7). Phase rule. **07**

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