

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 °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 CO₂ occupies a volume of 0.381 m³ at 313 °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 Nm⁴/mol² and b = 4.28 x 10⁻⁵ m³/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 10³ kg/m³ in the liquid state and 14.193 x 10³ kg/m³ in the solid state, both measured at the melting point of 234.33 °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**
