Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer2018– 19 Examination

Semester: 4 **Date: 01/05/2019**
Subject Code: 03103252 **Time: 2:00 PM to 4:30 PM**
Subject Name: Chemical Engineering Thermodynamics-I **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions **(15)**

1. At constant volume process
A) dH = dQ B) dU = dQ C) dW = PdV D) None of the above
2. The Joule-Thomson coefficient for an ideal gas is
A) One B) Zero C) Two D) Three
3. Entropy change in a process is defined as
A) $dS = dQ_R*T$ B) $dS = T/ dQ_R$ C) $dS = 1/T$ D) $dS = dQ_R/T$
4. Isenthalpic process means
A) dQ = 0 B) dWs = 0 C) dH = 0 D) dP = 0
5.Work function(A) is written as
A) A=U + T*S B) A=U - T*S C) A=U + T D) A = U - T
6. A property which depends upon the mass of the system is known as_____
7. Enthalpy is the summation of _____ and _____
8. A gas behaves like an ideal gas when it is at_____
9. Mathematical expression of efficiency for heat pump is _____
10. First law of thermodynamics for a flow process is_____
11. Coefficient of volume expansion(**β**) is defined as_____
12. Canonical or special variables for Gibbs free energy are _____
13. 1 ton of refrigeration is equal to_____ kJ/Sec
14.Coefficient of compressibility(**κ**) is defined as_____
15. Entropy is a _____ function

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Define the following terms: System, surroundings, homogeneous and heterogeneous systems, path and state function and intensive and extensive property.

B) Write a short note on compressibility charts and principle of corresponding states

C) Derive an expression for work at constant temperature and heat process from first law of thermodynamics.

D) Derive an expression for work required to for a refrigerator to transfer the heat from low temperature reservoir to high temperature reservoir. To maintain the temperature of a solution at 261 K, 1000 kJ of heat per minute is continuously removed from it. The surrounding temperature is 288 K. What is the least amount of power necessary to accomplish this?

Q.3 A) Explain the Carnot principle with neat diagram **(07)**

B) Derive the fundamental thermodynamic property relations and Maxwell's equations **(08)**

OR

B) Explain the effect of temperature on standard heat of reaction **(08)**

Q.4 A) Derive Calusius Clapeyron Equation. Mercury has a density of $13.69*10^3$ kg/m3 in the liquid state and $14.193* 10^3$ kg/m3 in the solid state, both measured at the melting point of 234.33 K at 1 bar. If the heat of fusion of mercury is 9.7876 kJ/kg, what is the melting point of mercury at 10 bar? **(07)**

OR

A) Derive the expression for change in entropy (ΔS) at constant volume, pressure and isothermal process. **(07)**

B) Twenty kilograms of air is compressed from 1 bar, 300 K to 5 bar in a single stage compressor. The process is Polytropic with n = 1.25. The specific heat of air at constant pressure in kJ/kmol K is: **(08)**

$C_P = 27.4528 + 6.1839 * 10^{-3}T - 8.9932 * 10^{-7}T^2$

Determine:

(a) The work done by the compressor per cycle and

(b) The amount of heat transferred to the surroundings.