

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV EXAMINATION – WINTER 2017

Subject Code:140502
Date:21/11/2017
Subject Name: Chemical Engineering Thermodynamics-I
Time: 02.30 PM TO 05.00 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) Explain PVT Behavior of pure Substance with the help of PV and PT diagram? **07**
 (b) Differentiate between (1) Intensive Vs. Extensive property (2) State Vs. Path Function? **07**
- Q.2** (a) State the mathematical statement of second law of thermodynamics. **07**
 (b) A steel casting [$C_p = 0.5 \text{ kJ kg}^{-1} \text{ K}^{-1}$] weighing 40 kg and at a temperature of 450°C is quenched in 150 kg of oil [$C_p = 2.5 \text{ kJ kg}^{-1} \text{ K}^{-1}$] at 25°C .
 If there are no heat losses, what is the change entropy of
 (i) the casting (ii) the oil and (iii) both considered together? **07**
OR
- (b) Discuss thermodynamic diagrams. **07**
- Q.3** (a) Write in Brief about Maxwell relation. State the importance of it? **07**
 (b) An ideal gas with $C_v = 1.5R$ undergoes the following mechanically reversible changes in a series of non-flow processes as given below: **07**
 a) From an initial state of 70°C and 1 bar, it is compressed adiabatically to 150°C .
 b) It is then cooled from 150°C to 70°C at a constant pressure.
 c) Finally the gas is expanded isothermally to its original state.
 Calculate Q, W, U and H for each of the three processes and for the cycle.
OR
- Q.3** (a) Explain concept of Entropy in brief. **07**
 (b) Discuss important properties of a refrigerant. **07**
- Q.4** (a) Explain Liquefaction of gas with T-S diagram? **07**
 (b) A refrigeration machine operating at a condenser temperature at 290 K needs 1kW of power per ton of refrigeration. Determine **07**
 (1) COP (2) heat rejected to the condenser (3) the lowest temperature that can be maintained. Given that :1 Ton of refrigeration =12660 kJ/h=3516.67 W
OR
- Q.4** (a) Explain the importance of departure function in thermodynamic study? **07**
 (b) Explain Cascade Refrigeration with suitable diagram? **07**
- Q.5** (a) What is mach number? Show that the maximum fluid velocity attainable for flow through a pipe of a uniform cross-section is equal to the sonic velocity. **07**
 (b) Explain working principle of a heat pump. **07**
OR
- Q.5** (a) Derive the expression for P_c, V_c, T_c , and constant a and b for redlich Kwong equation of state? **10**
 (b) Define (1) Heat of reaction (3) Hess's law of constant heat summation. **04**
