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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 [Cp = 0.5 kJ kg^{-1} K^{-1}] weighing 40 kg and at a temperature of 450°C is quenched in 150 kg of oil [Cp = 2.5 kJ kg^{-1} 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: 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.	**07**
		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 (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	**07**
		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 Pc,Vc, Tc, 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**

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