GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

Subject Code: 3130507   **Date: 30/11/2019**

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)**	Write short note on "Gibb's phase rule".	**03**
	(b)	Distinguish between intensive and extensive properties with suitable example.	**04**
	(c)	Explain the P-V-T behavior of pure fluids with the help of neat diagram.	**07**
Q.2	**(a)**	Distinguish between state function and path function.	**03**
	(b)	Explain about principle of corresponding states.	**04**
	(c)	State first law of thermodynamics? Derive the expressions for 1st law of thermodynamics for non-flow process.	**07**

OR

	(c)	Heat is transferred to10 kg of air which is initially at 100 kPa and 300 K until its temperature reaches 600 K. Determine the change in internal energy and change in enthalpy, amount of heat supplied and the work done for a Constant volume process. Assume air as an ideal gas. Given that: R=8.314 kJ / kmol K, Cp=29.099 kJ / kmol K, Cv =20.785 kJ / kmol K and molecular weight of air =29	**07**
Q.3	**(a)**	State various equations of state for real gases.	**03**
	(b)	Define the following i. Sensible heat ii. Latent heat iii. Standard heat of combustion iv. Standard heat of formation	**04**
	(c)	Explain about Van- Der-Waals equation of state.	**07**

OR

Q.3	**(a)**	Discuss Virial equations and their applications.	**03**
	(b)	Define the statements for the second law of thermodynamics i. Clausius Statement ii. Kelvin – Planck Statement	**04**
	(c)	Discuss effect of temperature on heat of reaction and derive necessary equation.	**07**
Q.4	**(a)**	Write a short note on Third law of thermodynamics.	**03**
	(b)	Describe absorption refrigeration cycle.	**04**
	(c)	Explain and prove Carnot's principle with neat sketch**.**	**07**

OR

Q.4	**(a)**	Write a short note on Jet ejector.	**03**
	(b)	Using Maxwell's equation prove that : $dH = CpdT + V(1 – \beta T)dP$ Where β is coefficient of volume expansion	**04**

(c) Derive the expression for change in entropy when an ideal gas changes **07** its state from (P_1, V_1, T_1) to (P_2, V_2, T_2) for following process-
    1) Constant volume process.
    2) Constant pressure process.
    3) Isothermal process.

Q.5 **(a)** Assuming air is mixture of 21 % oxygen and 79% nitrogen by volume **03** calculate entropy of 1 kmol air relative to pure oxygen and nitrogen, all at the same temperature and pressure.

(b) Discuss briefly about single and multistage compressors. **04**

(c) What is the criterion of exactness? Using the criterion of exactness derive **07** the Maxwell equation.

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OR

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Q.5 **(a)** Discuss any three major desirable properties of good refrigerant. **03**

(b) Write a short note on Thermodynamic Diagrams. **04**

(c) A refrigeration machine operating at a condenser temperature at 290 K **07** needs 1 kW of power per ton of refrigeration.
Determine:
1) Coefficient Of Performance(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

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