Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V- EXAMINATION – SUMMER 2016

Subject Code: 150503 **Date: 09/05/2016**

Subject Name: Chemical Engineering Thermodynamics-II

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 the procedure for Bubble T calculation.	**07**
	(b)	Discuss the lagrangian undetermined multiplier method for multi reaction equilibria.	**07**
Q.2	**(a)**	A binary liquid mixture consists of 60 mol % ethylene and 40 mol % propylene. At 423 K, the vapor pressure of ethylene and propylene are 15.2 atm and 9.8 atm respectively. Calculate the total pressure and equilibrium composition of the vapor phase by assuming ideal solution.	**07**
	(b)	Derive Gibbs-Duhem equation.	**07**
		OR	
	(b)	Derive the equation for fugacity of liquid.	**07**
Q.3	**(a)**	List the methods to evaluate fugacity coefficient in mixture and explain any one briefly.	**07**
	(b)	Explain the concept of activity coefficient.	**07**
		OR	
Q.3	**(a)**	Discuss Lewis Randall rule and Henry's law briefly.	**07**
	(b)	Define non ideality of mixture and compare positive and negative deviation from ideality.	**07**
Q.4	**(a)**	Calculate the fugacity of i-butane at 20 atm and 90 ^{o}C using the virial equation of state. Take second virial coefficient B = $-4.28*10^{-4}$ m^3/mol.	**07**
	(b)	List the various activity models and describe their limitations.	**07**
		OR	
Q.4	**(a)**	Prove that enthalpy change of mixing for ideal gas is zero.	**07**
	(b)	Calculate the free energy change of mixing of 0.7 moles of helium with 0.3 moles of argon at 25 ^{o}C and 1 atm. Assume that the gases behave ideally.	**07**
Q.5	**(a)**	A system initially charged with 3 mol CH_4 and 4 mol H_2O is undergoing the reaction: $CH_4 + H_2O \rightarrow CO + 3H_2$ and $CH4 + 2H_2O \rightarrow CO_2 + 4H_2$. Derive the expression for the mole fractions of the components in terms of extent of the reactions.	**07**
	(b)	Derive the phase equilibrium criteria in terms of chemical potential.	**07**
		OR	
Q.5	**(a)**	Explain the solid gas reaction equilibrium by taking the example of decomposition of $CaCO_3$.	**07**
	(b)	Explain the phase rule for reaction equilibria.	**07**

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