

Total No. of Questions : 10]

SEAT No. :

**P3649**

**[5560]-605**

[Total No. of Pages : 2

**T.E. (Chemical)**

**CHEMICAL ENGINEERING THERMODYNAMICS-II**

**(2015 Pattern) (Semester -I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8 and Q9, or Q10.
- 2) Neat diagrams be drawn whenever necessary.
- 3) Assume suitable data, if necessary.

**Q1) a)** Derive the Fundamental property relation for open systems. **[10]**

OR

**Q2) a)** What is Poynting factor? **[4]**

b) Derive the relation to show the variation of activity coefficient with respect to **[6]**

i) Temperature

ii) Pressure

**Q3) a)** Explain the Procedure for Bubble Point. **[6]**

b) Define the Modified Raoult's Law and Raoult's Law. **[4]**

OR

**Q4) a)** Write short note on **[10]**

i) VLE Data

ii) Azeotropes

**Q5) a)** What is Equilibrium and Its Stability, Justify your answer with suitable example. **[8]**

b) Explain and Derive the Equation for Thermodynamics Consistency. **[8]**

OR

**Q6) a)** Derive the equation for. **[16]**

i) Equilibrium and Stability

ii) Liquid-Liquid Equilibrium

**P.T.O.**

**Q7) a)** Develop expressions for the mole fractions of reacting species as a function of reaction co-ordinate for [16]

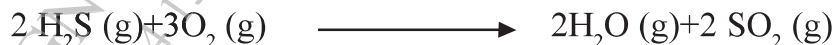
- i) A system initially containing 2 mol  $\text{NH}_3$  and 5 mol  $\text{O}_2$  and undergoing the reaction



- ii) A system initially containing 3 mol  $\text{NO}_2$ , 4 mol  $\text{NH}_3$ , 1 mol  $\text{N}_2$



- iii) A system initially containing 3 mol  $\text{H}_2\text{S}$  and 5 mol  $\text{O}_2$ .



OR

**Q8) a)** Write short note on Effect of Temp on the Equilibrium Constant with required Equations. [6]

- b) What is reaction co-ordinate? Derive the Equation for Reaction Coordinates. [10]

**Q9) a)** Determine the number of degrees of freedom for each of the following systems. [10]

- i) A system of two miscible non reacting species which exists as an azeotrope in VLE.  
ii) A system prepared by partially decomposing  $\text{CaCO}_3$  into an evacuated space.  
iii) A system prepared by partially decomposing  $\text{NH}_4\text{Cl}$  into an evacuated space.  
iv) A system consisting of the gases  $\text{CO}$ ,  $\text{CO}_2$ ,  $\text{H}_2$ ,  $\text{H}_2\text{O}$  and  $\text{CH}_4$  in chemical equilibrium.

- b) Explain the relation of equilibrium constant to compositions for Liquid phase reactions. [8]

OR

**Q10) a)** What is Fuel Cell? Explain in Brief along with necessary equation and diagram. [8]

- b) Define the following terms with necessary equations. [10]

- i) Phase Rule  
ii) Duhum's Theorem  
iii) Phase Rule for reacting system  
iv) Reaction Equilibria

