

Time: 3 Hours

Max Marks: 80

N.B. (1) Question No 1 is compulsory**(2) Attempt any three questions out of remaining five questions****(3) Assumption made, if any should be clearly stated****(4) Figures to the right indicate full marks.**

- Q1 Solve any Four out of Five 20**
- Give the difference between ideal and non-ideal solution
 - Explain Chemical Potential
 - Define Activity and activity coefficients
 - Explain Refrigerator capacity
 - Explain Properties of refrigerant used in refrigeration system
- Q2 10 10**
- Derive Gibbs-Duhem equation.
 - Define excess property and Property change of Mixing and show that the property change of mixing and excess properties are identical.
- Q3 10 10**
- Discuss in brief phase equilibria in single component system
 - Explain in brief UNIQUAC equation and UNIFAC method
- Q4 10**
- The vapour pressures of acetone (1) and acetonitrile (2) can be evaluated by the Antoine equations.

$$\ln p_1^s = 14.5463 - \frac{2940.46}{T-35.93} \quad \ln p_2^s = 14.2724 - \frac{2945.47}{T-49.15}$$
 where T is in K and P is in kPa. Assuming that the solution formed by these are ideal, calculate
 - x_1 and y_1 at 327 K and 65 kPa
 - T and y_1 at 65 kPa and $x_1 = 0.4$
 - P and y_1 at 327 K and $x_1 = 0.4$
 - What are azeotropes? With proper phase diagrams, distinguish between minimum and maximum boiling azeotropes
- Q5 10 10**
- Explain:
 - Equilibrium conversion
 - Effect of Temperature on Equilibrium constant
 - Discuss the phase rule for non-reacting and reacting systems .Determine the number of degrees of freedom in a gaseous system consisting of CO, CO₂, H₂, H₂O and CH₄ in chemical equilibrium.
- Q6 10 10**
- Define Refrigeration. Discuss Vapour absorption refrigeration cycle
 - Explain in detail criteria of Chemical Reaction equilibrium
