23/05/2025 SE CHEMICAL SEM-IV C-SCHEME CET-II QP CODE: 10081010

Time: 3hour **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

Q.1 **Solve any Four** **20**

a) Give the difference between Ideal and Non Ideal solution

b) State Raoult's law. Show that it is simplified form of Lewis Randall Rule

c) Explain Effect of Temperature on Chemical Potential

d) Explain Refrigerator capacity

e) A refrigeration machine operating at a condenser temperature of 290 K needs 1 kW of power per ton of refrigeration. Determine the following:
i)The coefficient of performance
ii)The heat rejected to the condenser
iii)The lowest temperature that can be maintained

Q.2a) Define **10**
i)Equilibrium constant
ii) Extent of reaction or reaction coordinate.

b) A mixture of 1 mole of CO and 1 mole of water vapour is undergoing the water- gas shift reaction at a temperature of 1100 K and a pressure of 1 bar. **10**

$$CO\ (g) + H_2O\ (g) \rightarrow CO_2\ (g) + H_2\ (g)$$

The equilibrium constant for the reaction is K=1.Assume that the gas mixture behaves as ideal gas. Calculate
a) The fractional dissociation of steam
b) The fractional dissociation of steam if the reactant stream is diluted with 2 mol nitrogen.

Q.3a) Explain VLE in ideal and non-ideal solutions. **10**

b) Define Refrigeration. Discuss Vapour compression refrigeration cycle **10**

Q.4a) Define excess property and Property change of Mixing and show that the property change of mixing and excess properties are identical. **10**

b) Derive various forms of Gibbs-Duhem equation **10**

Q.5a) Explain different methods of determination of partial molar properties **10**

b) Derive Van't Hoff Equation **10**

Q.6a) The vapour pressures of aceton(1) and acetonitrile(2) can be evaluated by the Antoine equations. **10**

$$\ln p_1^s = 14.5463 - \frac{2940.46}{T-35.93}$$

$$\ln p_2^s = 14.2724 - \frac{2945.47}{T-49.15}$$

where T is in K and P is in kPa. Assuming that the solution formed by these are ideal, calculate
a) x_1 and y_1 at 327 K and 65 kPa
b) T and y_1 at 65 kPa and $x_1 = 0.4$
c) P and y_1 at 327 K and $x_1 = 0.4$

b) Explain Boiling point diagram (T-x-y plot) and equilibrium diagram (x-y plot) for binary solution **10**

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