[3 Hours]   [Total Marks: 80]

(1) Q.1 is compulsory.(2)Attempt any 3 from the remaining 5 questions.(3)Use graph paper, if required.(4)Assume suitable data if required and justify the same

1. a) What you mean by extractive distillation.   5
    b) Explain ΔL law of crystallization   5
    c) Differentiate between physical adsorption and chemisorptions.   5
    d) Explain industrial applications of adsorption.   5

2. a) Explain McCabe Thiele method for multistage tray towers.   10
    b) A feed consisting of 1200 gram moles of mixture containing 30 percent naphthalene and 70   10
        percent dipropylene glycol is differentially distilled at 100 mm Hg pressure and final
        distilled contains 55 percent of feed solution. Determine the amount of distillate and
        concentration of naphthalene in residue and distillate. VLE data is given below in percent

X	8.4	11.6	28	50.6	68.7	80.6	88
y	22.3	41.1	62.9	74.8	80.2	84.4	88

3. a) Explain factors involved in choice of solvent in extraction   10
    b) A solution containing 5% acetaldehyde and 95% toluene is to be extracted with water in a   10
        five stage crosscurrent extraction unit to extract acetaldehyde. Toluene and water are
        essentially insoluble. If 25 kg of water each time are used per 100 kg of feed, calculate the
        amount of acetaldehyde extracted and final concentration of the exit solution. Equilibrium
        relationship, Y=2.20 X

4. a) A copper sulphate solution at 0.18 mol per liter is passed through a 99.3 g, 30.5 cm high   10
        bed of amberlite ion exchange resin at 82.2 cm^3/min. Out let data were as follows:

Time	7	8	8.5	9	10	11	12	13	13.5	14.5	15
Water conc. (mol/lit)	0	0.0033	0.0075	0.0157	0.0527	0.1026	0.1433	0.1634	0.1709	0.1778	0.18

        If the breakthrough curve is defined here as being when C/C_0 reaches 0.05, (a) Find
        breakthrough time (b) Fraction of total resin capacity used by breakthrough time.
    b) For multistage cross current adsorption, explain material balance and explain the   10
        procedure to estimate minimum amount of adsorbent.

5. a) Explain nucleation theories.   5
    b) What you mean by super saturation? Explain various methods of super saturation.   5
    c) A salt solution weighing 10,000 kg with 30 wt. percent Na_2CO_3 is cooled to 293K. The salt   10
        crystallizes the decahydrate. What will be the yield of $Na_2CO_3 \cdot 10H_2O$ crystals if the
        solubility is 21.5 kg anhydrous Na_2CO_3 per 100 kg water. For (a)No water evaporated(b) 3
        percent of total weight of solution is lost by evaporation of water in cooling.

6. Write short notes   20
    a   Steam distillation
    b   Solvent selection for liquid liquid extraction
    c   Bollman extractor
    d   classification of membrane separation operations

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