

Day : Monday
Date : 20/11/2017

W-2017-2173

Time: 10.00 AM TO 01.00 PM
Max. Marks: 60.

N.B.:

- 1) All questions are **COMPULSORY**.
- 2) Figures to the **RIGHT** indicate full marks.
- 3) Draw neat labeled diagrams **WHEREVER** necessary.
- 4) Assume suitable data if necessary.

- Q.1** a) What is Raoult's law? Discuss with neat diagram, positive and negative deviations from Raoult's law. (05)
- b) Differentiate between azeotropic and extractive distillation. How toluene isooctane mixture can be separated using extractive distillation? (05)

OR

- Q.1** It is desired to separate a feed mixture containing 40% heptane and 60% ethyl benzene, such that 60% of the feed is distilled out. Estimate the composition of the residue and distillate when the distillation is carried out by using equilibrium or flash distillation. (10)

x	0	0.08	0.185	0.251	0.335	0.489	0.651	0.79	0.914	1.0
y	0	0.233	0.428	0.514	0.608	0.729	0.814	0.910	0.963	1.0

- Q.2** Derive q-line equation: (10)

$$y_q = \frac{q}{q-1} x_q - \frac{x_f}{q-1}$$

OR

- Q.2** A fractionating column separates a liquid mixture entering at 5000 kmol/h containing 50 mole %A and 50 mole% B into an overhead product of 95 mole % A and a bottom product of 96 mole % of B. A reflux ratio twice the minimum will be used and the feed enters at its B.P. Determine the number of theoretical stages required and the location of feed plate. (10)

Equilibrium data:

x	0.03	0.11	0.26	0.53	0.76	0.86	1.0
y	0.08	0.27	0.50	0.71	0.88	0.93	1.0

x, y are mole fractions of A in liquid and vapour phase respectively.

- Q.3** a) It is desired to reduce the colour of the solution from 9.0 units to 2.0 units. Determine the quantity of fresh carbon required per 100 kg of the solution for single stage operation. (07)

Equilibrium data:

x	100	200	300	460	600	800	1000
y	0.186	0.59	1.15	1.86	3.64	5.87	8.51

- b) Differentiate between physical adsorption and chemisorption. (03)

OR

- Q.3** a) Draw schematic flow diagram of two stages cross current adsorption process and state the material balances. Also show the graphical representation of two stage cross current adsorption process. (07)
- b) What are the basic principles of ion exchange process? (03)

P.T.O.

- Q.4** a) What should be the criterion for choice of solvents in liquid-liquid extraction? (04)
 b) What is importance of binodial solubility curve in liquid-liquid extraction? (06)
 Discuss with neat diagram binodial solubility curve and the effect of increased temperature on it.

OR

- Q.4** Water-dioxane solution is to be separated by extraction process using benzene as solvent. At 25°C the equilibrium distribution of dioxane between water and benzene is as follows: (10)

x', wt % of dioxane is water	5.1	18.9	25.2
y', wt % of dioxane is benzene	5.2	22.5	32.0

At these concentrations water and benzene are substantially insoluble. 1000 kg of a 25% dioxane and 75% water solution is to be extracted with benzene to remove 95% dioxane. The benzene is dioxane free.

Calculate the solvent requirement for single batch operation.

- Q.5** 60 tons per day oil sand (25 mass% oil and 75 mass % sand) is to be extracted with 40 tons per day of naphtha in a continuous countercurrent leaching battery. The final extract from the battery is to contain 40 mass % oil and 60% mass naphtha, and the underflow from each unit is expected to consist of 35 mass% solution and 65 mass % sand. If overall efficiency of the battery is 50%. How many stages will be required? (10)

OR

- Q.5** a) Draw a flow diagram for single stage leaching operation and describe the graphical representation and material balances. (05)
 b) Classify the leaching processes. (05)
- Q.6** a) Discuss the concept of osmotic pressure and permeability in membrane separation techniques. (05)
 b) What is Nano-filtration? Discuss the merits and demerits of the process. (05)

OR

- Q.6** Develop flux equation for pressure driven membrane processes and discuss Electro-dialysis in detail. (10)

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