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Total number of pages:[2]

Total number of questions:06

B.Tech. || CHE || 5th Sem

Mass Transfer-II

Subject Code: BTCH-502

Paper ID:

(for office use)

Time allowed: 3 Hrs

Max Marks: 60

Important Instructions:

- All questions are compulsory
- Assume any missing data

PART A (2marks x 10)

Q. 1. Short-Answer Questions:

- What is meant by total reflux condition and minimum reflux condition?
- What is meant by overall stage efficiency and Murphree efficiency?
- Give the equation for q-line in Mc Cabe Thiele method.
- How do you represent the saturated liquid and saturated vapour on x-y diagram?
- Define the terms plait point and raffinate.
- Give the expressions for Freundlich isotherm and Langmuir isotherm.
- Sketch the Shanks system.
- What is the effect of increase in temperature on extraction equilibrium?
- What do you understand by key components? Differentiate between light key and heavy key component.
- What is adsorption hysteresis?

PART B (8marks x 5)

Q. 2. A continuous fractionator is used to separate 20000 kg/hr of 50wt% carbon disulphide in carbon tetra chloride mixture into overhead product containing 90wt% carbon disulphide and bottom product containing 90wt% carbon tetra chloride. A reflux ratio of 1.7 times the minimum is used. Feed is at its boiling point. Calculate a) molar flow rate of product streams b) number of ideal stages and feed stage c) the real number of stages if the overall efficiency of the column is 65%. The equilibrium data is:

x	0	0.06	0.11	0.14	0.26	0.39	0.53	0.66	0.76	0.86	1
y	0	0.16	0.266	0.332	0.495	0.634	0.747	0.83	0.88	0.93	1

OR

- Describe open steam operation in fractionation using x-y plot.
- Discuss about the multi component distillation.

CO1,
CO2

Q. 3. Nicotine in water solution containing 1% nicotine is to be extracted with kerosene at 20°C. Water and kerosene are essentially insoluble. Determine the %

CO3

extraction of nicotine if 100 kg feed solution is extracted once with 150 kg solvent. Repeat for three theoretical extractions using 50 kg solvent each.

x' nicotine/ water	0	0.001011	0.00246	0.00502	0.00751	0.00998	0.0204
y' nicotine/ kerosene	0	0.000807	0.001961	0.00456	0.00686	0.00913	0.001870

OR

Describe the operation of Bollman extractor with a neat sketch.

CO3

- Q. 4. Derive the condition for minimum amount of adsorbent in a two stage cross current operation using Freundlich isotherm. In multistage countercurrent adsorption, how do you find the number of stages? Show graphically.

CO4

OR

Sodium sulphate crystals are to be produced from a batch of 8600 kg solution (29.6 wt% sodium sulphate) at 104°C. The solution is cooled with 4.5% evaporation losses such that mother liquor contains 18.3 wt% sodium sulphate. Estimate the yield of crystals and quantity of mother liquor if there are ten moles water of hydration per mole sodium sulphate in the crystals.

CO4

- Q. 5. What are the desired characteristics of a solvent for extraction?

CO3

OR

Discuss the various equilibrium representations for leaching under various conditions of solubility. How does the increase in temperature affect the operation of leaching?

CO3

- Q. 6. What is meant by differential distillation? How is it different from batch distillation? Derive the Rayleigh equation for differential distillation.

CO1,

CO2

OR

Discuss the analysis of distillation columns using H-x-y diagram. With the help of neat sketch show the conditions of total reflux as per this method.

CO1,

CO2