SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL No: | | | | | | | | | | | | |

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B.Tech. || CHE || 6th Sem

Mass Transfer-II (RG)

Subject Code: BTCH-601A

Paper ID: M118 (for office use)

2015 batch

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:

(a) What is meant by external reflux ratio? Differentiate between minimum reflux condition and optimum reflux?

(b) Show the feed line on x-y diagram for various possible states of feed.

(c) What is meant by cuts in batch distillation?

(d) Define the term relative volatility. What is its importance in distillation?

(e) What are various types of nucleation?

(f) What is meant by a hypersorber?

(g) Sketch the various types of equilibrium representations for extraction.

(h) Define heavy key and light key components.

(i) Define the terms miscella and marc. Are these terms specific to some industry? If yes, name it.

(j) What is adsorption hysterisis?

PART B (8marks x 5)

Q. 2. 5,000 kg/hr of a 50% n-heptane in n-octane mixture is to be separated into two products – one containing 90% n-heptane and other 90% n-octane. A reflux ratio of 2 times the minimum is used. The relative volatility is about 1.7 and the feed is a saturated liquid. Find the minimum reflux ratio, minimum number of stages and the number of ideal stages in the column. CO1 CO2

OR

A 50 mol % mixture of acetone-methanol is differentially distilled with 50% of the feed distilled. Compute the composition of composite distillate and residue. The equilibrium data is: CO1 CO2

x	0	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1
y	0	0.102	0.186	0.32	0.428	0.513	0.586	0.656	0.725	0.8	1

Q. 3. 1000 kg/hr of nicotine in water solution containing 1% nicotine is to be extracted countercurrently with kerosene at 20°C to reduce the nicotine content to 0.2%. Determine the minimum kerosene rate. Also find the number of theoretical stages if 1500 kg/hr kerosene is used. The equilibrium data is CO3

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	0.00187

OR

Describe the working of Bollman extractor with a neat sketch. CO3

Q. 4. Discuss the cross current adsorption with balance equations. Represent the operation graphically. If the equilibrium follows Freundlich equation, derive the condition for minimum amount of adsorbent in a two stage cross current operation. 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. a) Describe the various equilibriums possible in leaching. CO3

b) Represent multi stage counter current leaching on N-x,y diagram and give the relevant equations.

OR

Discuss the characteristics of solvent for extraction? Give some industrially important uses of extraction. CO3

Q. 6. How is extractive distillation different from azeotropic distillation? Discuss azeotropic distillation in detail. CO1, CO2

OR

a) Using H-x-y diagram, explain the construction for minimum reflux and total reflux condition. CO1, CO2

b) Derive Rayleigh equation for differential distillation.