

**Time: 3 Hours**

**Total Marks: 80**

**N.B.:**

- Mass Transfer Operations -II QP CODE: 10042432

DATE: 11/12/2023

- (i) Question No.1. Is compulsory.
- (ii) Attempt any three questions out of remaining five questions.
- (iii) Assume suitable data and justify the same.
- (iv) Figures to the right indicate full marks

**Q1 Explain any Four. [20]**

- (a) Explain any one Equipment for Leaching
- (b) Write a short note on azeotropes
- (c) Explain the  $\Delta L$  law of crystal growth.
- (d) Write a note on Nano filtration.
- (e) Discuss the types of adsorption.

**Q2 (a) Derive the equation for operating line of Rectifying section and Stripping Section in a Fractioning column [10]**

- (b) A Mixture containing 35 mole percent of A and 65 mole percent B is to be distilled in a distillation column. The concentration of A in the distillate is 92 mole% and 96 % of component A is recovered in distillate. The feed is all vapour. The reflux ratio is 4 and relative volatility is 2.4. How many equilibrium stages are required in each section of column? What is the minimum reflux ratio. [10]

x	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
y	0	0.21	0.375	0.507	0.615	0.706	0.783	0.848	0.906	0.956	1

**Q3 (a) With neat diagram explain countercurrent multistage extraction material balance. [10]**

- (b) If 1000 kg/h of nicotine(C) and water (A) solution containing 1 % nicotine is to be counter currently extracted with kerosene at 20 °C to reduce the nicotine content to 0.1%. Determine Minimum kerosene rate b. The number of stages required if 1150 kg of kerosene is used per hour [10]

x kg nicotine/kg water	0	0.001011	0.00246	0.00502	0.00751	0.00998	0.0224
Y kg nicotine/kg kerosene	0	0.000807	0.001961	0.00456	0.00686	0.00913	0.01870

- Q4 (a)** Discuss the adsorption in fixed bed .Explain breakthrough curve and adsorption zone [10]
- (b)** A solution of washed raw cane sugar is colored by the presence of impurities .It is to be decolourised by treatment with an adsorptive carbon in a contact filtration plant .The data for an equilibrium isotherm is given below.The original solution has a colour concentration of 9.6 and it is desired to reduce colour to 10% of its original value. [10]

Kg of carbon/kg of solution	0	0.001	0.004	0.008	0.02	0.04
Equilibrium colour	9.6	8.6	6.3	4.3	1.7	0.7

- Q5 (a)** Explain multistage cross current leaching with neat diagram. [10]
- (b)** What is crystallization? Explain nucleation theories. [10]

**Q6 Write Short notes (Any four)** [20]

- (a) Forced circulation evaporative crystallizer.
- (b) Tray efficiency
- (c) Batch distillation
- (d) Freundlich adsorption isotherm
- (e) Reverse Osmosis

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