P P SAVANI UNIVERSITY

Fifth Semester of B. Tech. Examination

December 2022

SECH 3021 Mass Transfer Operation II

25.11.2022, Friday **Time: 10:00 a.m. To 12:30 p.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1	Solve MCQ (Any Five)	**[05]**	**CO**	**BTL**
(i)	The equilibrium characteristics of the solubility of a gas in liquid helps to determine the a) Rate b) Concentration c) Time d) No existence of equilibrium characteristics			
(ii)	A new phase is given for the separation by distillation. a) True b) False			
(iii)	Solubility of a gas increases with increase in temperature. a) True b) False			
(iv)	McCabe –Thiele method excludes _____ information. a) Entropy b) Enthalpy c) Flow rate d) Number of theoretical stages			
(v)	The component A and B has the same boiling point. Can the separation is done by ordinary separation? a) True b) False			
(vi)	The Enriching section operating line intercept at the origin in McCabe-Thiele method when a) Reflux ratio = Zero b) Reflux ratio= Infinity c) Reflux ratio= One d) Reflux ratio= 1.5 to 2 times Reflux minimum			
(vii)	If there is no reflux to a fractionating column then a) Large condenser size is needed b) Less reboiler size needed c) Minimum number of trays d) None of the mentioned			
Q - 2 (a)	Define : Reflux ratio, Total reflux, minimum reflux	**[05]**	1	1
Q - 2 (b)	Explain McCabe and Thiele method for tray calculation with Assumption	**[05]**	1	3
	OR			
Q - 2 (a)	Explain separation in Enriching and Stripping section of continuous rectification column also	**[05]**	1	3
Q - 2 (b)	Draw a schematic diagram of a conventional fractionating column and explain how mass transfer takes place between two phases in the column.	**[05]**	1	3
Q - 3 (a)	Distinguish Plate and Packed towers. Explain Flooding and loading in packed towers	**[05]**	2	4
Q - 3 (b)	Explain in detail about choice of solvent used for absorption and absorption with chemical reaction	**[05]**	3	1
	OR			
Q - 3 (a)	Write the any five properties of a good solvent for extraction	**[05]**	3	1
Q - 3 (b)	Explain how will you find out the final composition of the solute in the raffinate	**[05]**	3	3

	for immiscible solvent and diluents in single and multistage cross current extraction			
Q - 4	Attempt any one/two.	**[05]**		
(i)	Write the stepwise procedure for calculating the number of stages when A and B are immisicible for continuous counter extraction operation.		1	3

SECTION – II

Q - 1	Solve MCQ (Any Five)	**[05]**		
(i)	Liquid-liquid mixture is separated with solvent extraction by adding _____ solvent. a) Soluble b) Insoluble c) Partially soluble d) All of the mentioned			
(ii)	Which of the following forces is involved in physical adsorption? a) Gravitational force b) Magnetic force c) Van der Waals force d) Electromagnetic force			
(iii)	A finely divided substance is more effective as an adsorbent. a) True b) False			
(iv)	Solvent lean phase are known as a) Extract b) Raffinate c) Residue d) None of the mentioned			
(v)	The removal of soluble materials from the solid is known as _____ a) Elution b) Decoction c) Extraction d) None of the mentioned			
(vi)	In order to reduce the time required for the removing solute the sugar beets are cut into slices known as a) Cossettes b) Coset c) Consort d) All of the mentioned			
(vii)	_____ is the single stage device in extractor types. a) Mixer settler b) Sieve trays c) Agitator vessel d) Packed column			
Q - 2 (a)	Explain physical adsorption Explain adsorption for concentrated solutions	**[05]**	4	3
Q - 2 (b)	Discuss the types of adsorption, nature of adsorbents and also list-out important industrial adsorbents	**[05]**	4	3
	OR			
Q - 2 (a)	Explain chemisorptions Explain adsorption of solute for dilute solutions	**[05]**	4	3
Q - 2 (b)	What do you mean by Ion Exchange? Describe techniques and application of ion exchange.	**[05]**	4	3
Q - 3 (a)	Write the material balance for the Single stage and Multistage Counter Current Extraction with neat sketch	**[05]**	5	3
Q - 3 (b)	Describe selection criteria for solvent in Extraction.	**[05]**	5	3
	OR			
Q - 3	Nicotine in water containing 1%Nicotine is to be extracted with kerosene at 200°C water. Water and kerosene are insoluble. Estimate the percentage extraction of Nicotine for the following cases. (i) If 100 kg of feed solution is extracted in a single stage with 150 kg of solvent. (ii) If 100 kg of feed solution is extracted in three theoretical stages using 50kg of fresh solvent in each stage. Equilibrium data: X' 0 0.00101 0.00246 .0.00502 0.00751 0.00998 0.0204 Y' 0 0.00081 0.001962 0.00456 0.00686 0.00913 0.0197 Where X' is kg nicotine/kg water and Y' is kg nicotine/kg kerosene.	**[10]**	5	4

Q - 4	Solve		**[05]**	
(i)	Describe working of pressure swing adsorber		4	3

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CO : Course Outcome Number BTL : Blooms Taxonomy Level

Level of Bloom's Revised Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create