

THE KAVERY ENGINEERING COLLEGE
(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025

Fifth Semester

Chemical Engineering

CH3551 - Mass Transfer II

Usage of Data Book is Permitted

Regulations - 2021

Duration : 3 Hrs

Maximum : 100 Marks

PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q.No	Questions	BLT	CO	Marks
1.	Write the principle of absorption.	L1	1	2
2.	Differentiate NTU and HTU.	L2	1	2
3.	State Raoult's law.	L1	2	2
4.	What assumptions are made in the Ponchon - Savarit method?	L2	2	2
5.	Define liquid-liquid extraction and list its main applications.	L1	3	2
6.	Analyze the advantages and limitations of using spray, packed, and mechanically agitated contactors in liquid-liquid extraction processes.	L4	3	2
7.	Compare the Leaching and extraction with example.	L2	4	2
8.	How would you apply the leaching principle to improve the efficiency of Shank's system for a given solute?	L3	4	2
9.	What specific characteristics should an adsorbent possess to enhance the separation rate in adsorption processes?	L3	5	2
10.	How can the concept of osmosis be applied in real-world scenarios, such as in biological systems or industrial processes?	L2	5	2

PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

Q.No	Questions	BLT	CO	Marks
11. a	An absorption column is employed to recover Benzene from a gas mixture containing 5% (mol) benzene. A nonvolatile absorption oil is used which contains 0.2 weight percent Benzene. Other data are: Gas rate to the column: 3300 m ³ /hr at 25°C and 1atm. Vapour pressure of benzene at 25°C is 106 mm Hg. Molecular weight of absorption oil: 230.	L3	1	16
	i. Determine the minimum oil circulation rate of 90% of Benzene is the fuel gas is to be absorbed.			
	ii. For 1.5 times the minimum oil circulation rate determines the number of ideal plates. Benzene forms ideal solution with oil.			

Or

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|-----|---|---|----|---|----|
| | b | How can the principles of multi-component distillation, azeotropic distillation, and extractive distillation be applied in industrial processes to improve separation efficiency? With neat sketch. | L2 | 1 | 16 |
| 12. | a | A mixture containing benzene and toluene with 40% benzene and 60% toluene is to be separated in a fractionating column to give product containing 96% benzene and bottom product containing 95% toluene. Feed is a mixture of two-third vapour and one-third liquid. Find out the Number of theoretical stages required if reflux ratio of 1.5 times the minimum is used. Data: Relative volatility $\alpha_{AB} = 2.5$. | L3 | 2 | 16 |

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| | b | Explain in detail the principles of differential distillation, steam distillation, and multistage continuous rectification columns, with neat sketches. | L2 | 2 | 16 |
| 13. | a | Design a liquid-liquid extraction system with supercritical CO ₂ as the solvent for an industrial application, considering solvent selection, equipment, and operational parameters. | L4 | 3 | 16 |

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| | b | Critically assess the benefits and challenges of using supercritical extraction over traditional liquid-liquid extraction methods in environmental applications. | L4 | 3 | 16 |
| 14. | a | What are the principles of solid-liquid equilibria, and how do they influence the design and operation of batch and continuous leaching equipment? | L2 | 4 | 16 |

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| | b | Using hexane as a solvent, soybean flakes containing 20% oil are leached. If 100 kg of solvent is used for 100 kg of flakes and the value of NNN for the slurry under flow is constant at $N=1.5$. calculate the overflow compositions assuming the solvent is fresh. | L4 | 4 | 16 |
| 15. | a | What are the key differences between steady-state moving bed adsorbers and unsteady-state fixed bed adsorbers? And specify the industrial applications. | L2 | 5 | 16 |

Or

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| | b | Explain following separation operation terms: | L2 | 5 | 16 |
| | i. | Reverse osmosis | | | |
| | ii. | Electro dialysis | | | |
| | iii. | Ultrafiltration | | | |