

**THE KAVERY ENGINEERING COLLEGE***(An Autonomous Institution)***B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025***Fifth Semester**Chemical Engineering***CH3551 – Mass Transfer II***Regulations – 2021**Duration : 3 Hrs**Maximum : 100 Marks***PART – A (ANSWER ALL QUESTIONS) (Marks 10\*2=20)**

| <i>Q.No</i> | <i>Questions</i>                                                 | <i>BTL</i> | <i>CO</i> | <i>Marks</i> |
|-------------|------------------------------------------------------------------|------------|-----------|--------------|
| 1.          | Define the absorption factor and state its importance.           | L1         | 1         | 2            |
| 2.          | Define the height of a transfer unit (HTU).                      | L1         | 1         | 2            |
| 3.          | State Raoult's Law and its application in distillation.          | L1         | 2         | 2            |
| 4.          | What is the minimum reflux ratio ( $R_{min}$ )?                  | L1         | 2         | 2            |
| 5.          | Write the properties of a good solvent for extraction?           | L2         | 3         | 2            |
| 6.          | Define the distribution coefficient in liquid-liquid extraction. | L1         | 3         | 2            |
| 7.          | Name two common types of leaching equipment.                     | L1         | 4         | 2            |
| 8.          | Give the advantages of leaching by percolation.                  | L1         | 4         | 2            |
| 9.          | What is an adsorption isotherm? Name two types.                  | L1         | 5         | 2            |
| 10.         | What is ultrafiltration?                                         | L1         | 5         | 2            |

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

| <i>Q.No</i> | <i>Questions</i>                                                                                                                     | <i>BLT</i> | <i>CO</i> | <i>Marks</i> |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|--------------|
| 11.         | a i Discuss the design procedure for a packed-type gas absorber.                                                                     | L6         | 1         | 8            |
|             | ii Elaborate the concepts of NTU and HTU.                                                                                            | L6         | 1         | 8            |
|             | Or                                                                                                                                   |            |           |              |
| b           | A soluble gas is absorbed in water using packed tower. The equilibrium relationship is $Y_e = 0.06 X_e$ and terminal conditions are: | L6         | 1         | 16           |

|   | Top   | Bottom |
|---|-------|--------|
| X | 0     | 0.08   |
| Y | 0.001 | 0.009  |

If the individual height of transfer units based on liquid phase and gas phase respectively are  $H_x = 0.24$  m and  $H_y = 0.36$  m, estimate the height of packing.

|     |   |                                                                                                                                                                                                                                                                                                                                                                                                        |    |   |    |
|-----|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----|
| 12. | a | A mixture of 40% A and 60% B is to be separated by distillation using a reflux ratio 3.5 so as to form an overhead product containing 95mol% of A and a bottom product containing 95mol% of B. The feed is saturated vapour. The relative volatility of A to B is 2.5. Determine the following: (i) Minimum reflux ratio (ii) Number of theoretical plates (iii) Minimum number of theoretical plates. | L3 | 2 | 16 |
|-----|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----|

Or

- b Explain the procedure to determine the minimum number of theoretical plates by Ponchon Savarit method and McCabe Thiele method. L3 2 16
13. a Construct any two industrial extraction equipment's with neat diagram and mention the various applications. L3 3 16
- Or
- b 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. L3 3 16
- 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.
14. a Explain the working principle of various leaching equipment's with neat diagram. L2 4 16
- Or
- b Explain how the material balance is set up to determine the amount of solvent needed to achieve a specific solute concentration batch leaching experiment. L2 4 16
15. a Explain the various types of commercial adsorbents and List their applications. L2 5 16
- Or
- b Compare the separation mechanisms of adsorption, ion exchange, and membrane separation processes. Discuss the advantages and disadvantages of each process. L2 5 16