

THE KAVERY ENGINEERING COLLEGE*(An Autonomous Institution)***UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026***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.	List the factors affecting absorption factor.	L1	1	2
2.	What is the need for packing materials in a packed bed absorption column?	L1	1	2
3.	Differentiate between the terms boiling point and bubble point.	L2	2	2
4.	How does the reflux ratio influence the number of theoretical stages required and the purity of the products of distillation?	L2	2	2
5.	What is the effect of temperature on extraction efficiency when the feed solvent and extracting solvent are partially miscible?	L1	3	2
6.	Draw the schematic diagram of cross current extraction and mention the name of each stream entering and leaving.	L4	3	2
7.	Distinguish between leaching and decoction in solid-liquid extraction with respect to the operating condition.	L2	4	2
8.	Compare the leaching operation carried out at low temperature and high temperature in the aspects of efficiency, purity of the desired solute extracted, and recovery of used solvent.	L2	4	2
9.	Write any two characteristics of monolayer adsorption.	L1	5	2
10.	Define the terms osmosis and osmotic pressure in membrane based separation of component dissolved in a liquid.	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 A packed tower is to be designed to absorb SO ₂ from air by scrubbing the gas with water. The entering gas contains 20% of SO ₂ by volume and the leaving gas contains 0.5% of SO ₂ by volume. The entering water is SO ₂ free. The water flow to be used is twice the minimum. The airflow rate on SO ₂ free basis is 975 kg/h m ² . The temperature is 30°C and pressure is 1 atm. $y^* = 21.8x$, where x and y are mole fractions. Find the NTU.	L3	1	16
	Or			
	b An air NH ₃ mixture containing 20 mole % of NH ₃ is being treated with water in a packed tower to recover NH ₃ . The incoming gas rate is 700 kg/h. The water used is 1.5 times the minimum and enters the tower free of NH ₃ . Under these conditions, 95% of NH ₃ is absorbed from the incoming feed. If all the operating conditions remain unchanged, how much taller the tower should be to absorb 99% of NH ₃ , under the given conditions $y^* = 0.75x$ where x and y are mole fractions of NH ₃ in liquid and gas phase respectively.	L3	1	16

12. a A liquid mixture containing 50 mole % acetone and rest water is differentially distilled at 1 atm. pressure to vaporize 25% of the feed. Compute the composition of the composited distillate and residue. VLE data at 1 atm. pressure is given below:

x, mole fraction of acetone in liquid	0.1	0.2	0.3	0.4	0.6	0.7	0.9
y, mole fraction of acetone in vapour	0.76	0.82	0.83	0.84	0.86	0.87	0.94

Or

- b Continuous fractionating column operating at 1 atm is designed to separate 13600 kg/hr of a solution of benzene and toluene. Feed is 0.4-mole fraction benzene. Distillate contains 0.97 mole fraction benzene and residue contains 0.98 mole fraction toluene. A reflux ratio of twice the minimum is used. Feed is liquid at its saturation temperature and reflux is returned at saturation. Determine:
 (i) Quantities of products in kg/hr
 (ii) Minimum reflux ratio
 (iii) Number of theoretical plates
 The average relative volatility for the given system is 2.56.

13. a 1000 kg/hr of an acetone-water mixture containing 20% by weight of acetone is to be counter-currently extracted with trichloroethane. The recovered solvent to be used is free from acetone. The water and trichloroethane are insoluble. If 90% recovery of acetone is desired estimate the number of stages required if 1.5 times the minimum solvent is used. The equilibrium relationship is given by $y = 1.65x$, where x and y are weight fractions of acetone in water and trichloroethane respectively.

Or

- b A 5% (by weight) solution of acetaldehyde in toluene is extracted with water in a three stage cross-current unit. If 100 kg of water is used per stage for 500 kg of feed, calculate (using graphical method) the percentage extraction of acetaldehyde and the weights of final raffinate and mixed extract. The equilibrium relationship is given by the equation, $Y = 2.3 X$ where Y = kg acetaldehyde/kg water and X = kg acetaldehyde/kg toluene. Assume that toluene and water are immiscible with each other.

14. a Demonstrate the working principle of the following leaching systems:
 (i) In-situ leaching
 (ii) Percolation tanks
 (iii) Countercurrent leaching

Or

- b Explain the operations of the following solid-liquid extraction equipment:
 (i) Kennedy extractor
 (ii) Bollman extractor

15. a Explain the detailed note on the adsorption isotherms explaining the types of adsorption, governing equations, mechanisms of adoption and factors affecting.

Or

- b i Explain the principle of ion exchange and the mechanism of separation and purification by ion exchange and the methods of regeneration of ion-exchange resins.
- ii Give a detailed comparison between reverse osmosis and electrodialysis.