Q. Code:939163

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Sixth Semester

CH18601 – MASS TRANSFER II

(Chemical Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Determine the number of theoretical stages in absorption tower.	**5**
CO 2	Evaluate different types of distillation process.	**5**
CO 3	Apply Mass Transfer concepts in Liquid Liquid Extraction.	**3**
CO 4	Assess batch and continuous leaching process.	**5**
CO 5	Analyse different types of separation process.	**4**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Explain the absorption factor graphically.	**1**	**3**
2.	List the pros and cons of using $L_{s,\,min}$ in the absorption tower.	**1**	**2**
3.	Explain T-x,y boiling point diagram.	**2**	**2**
4.	Write the 'q' value for the feed conditions of Sub – cooled liquid and Superheated vapour.	**2**	**3**
5.	State plait point and binodal solubility curve.	**3**	**2**
6.	When do you prefer liquid–liquid extraction?	**3**	**2**
7.	List the various factors affecting the rate of leaching operation.	**4**	**2**
8.	Briefly explain heap leaching with example.	**4**	**2**
9.	Discuss Freundlich equation for adsorption.	**5**	**2**
10.	Explain the principle of ion exchange.	**5**	**2**

PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	It is desired to absorb 90 % of acetone from a gas containing 1 mol% acetone in air in a counter current stage tower. The total inlet gas to the tower is 30 kmol/h and the total inlet pure water flow to be used to absorb acetone is 90 kmol/h. The process is to operate isothermally at 300K and a total pressure of 1 atm. The equilibrium relation is y= 2.53 x, where x and y denote the molfractions of acetone in liquid and vapour phases. Determine the number of theoretical stages required for this operation by graphical method.	**(14)**	**1**	**3**

(OR)

(b) An air-ammonia mixture containing 5% ammonia by volume is absorbed in water using a packed tower at 20°C and 1 atm pressure to recover 98% ammonia and the inert gas flow rate is 1200 kg /hr m^2. Determine **(14) 1 3**

(i) Minimum mass velocity of liquid.

(ii) Number of transfer units using 1.25 times the minimum liquid flow rate.

The equilibrium relationship for the system is given by y = 1.154 x where x and y are expressed in mole fraction units

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 vapor and one-third liquid. Find the number of theoretical stages required if the reflux ratio of 1.5 times the minimum is used. (Relative volatility = 2.5) **(14) 2 3**

(OR)

(b) A stream of aqueous methanol having 45 mol% methanol is to be separated into a top product having 96 mol% methanol and a bottom product containing 4 mol% methanol. The feed is at its bubble point and the operating pressure is 101.3 kPa. A reflux ratio of 1.5 is suggested. (i) Determine the number of ideal trays. (ii) Find the actual number of trays if the overall tray efficiency is 40% (iii) find the feed plate location. **(14) 2 3**

VLE data:

x	0	0.02	0.06	0.08	0.1	0.2	0.4	0.6	0.8	1
y	0	0.134	0.304	0.365	0.418	0.579	0.729	0.825	0.915	1

13. (a) **(i)** Discuss the effect of temperature on LLE diagram with sketch **(7) 3 3**

(ii) Explain with a neat sketch the principle and working of any one LLE column **(7) 3 3**

(OR)

(b) Explain the equilateral triangular diagram for the systems of three liquids – one pair partially soluble with example. **(14) 3 3**

14. (a)	A 100 tonnes of underflow feed containing 20 tonnes of solute, 2 tonnes of water, 78 tonnes of inerts are to be leached with water to give an overflow of concentration, 15% solute. 95% recovery is desired. The underflow from each stage carries 0.5 kg of solution / kg of inert. Estimate the number of stages needed.	**(14)**	**4**	**3**
	(OR)			
(b)	Demonstrate the graphical method of finding stages for variable underflow system of multistage countercurrent leaching	**(14)**	**4**	**3**
15. (a)	Enumerate the characteristics to be possessed by industrial adsorbents. Write any one method of preparation of adsorbents.	**(14)**	**5**	**3**
	(OR)			
(b)	Explain the following: **(i)** osmosis and reverse osmosis **(ii)** Ion exchange and Liquid membranes	**(7+7)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	Explain the principle of membrane technology and its impact on applications in desalination plants	**(10)**	**5**	**5**

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