27/10/2011 1 o'clock

VK-9011/75

Printed Pages : 4 CH-501

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 9011 Roll No.

B. Tech.

(SEM. V) EXAMINATION, 2007-08

MASS TRANSFER - I

Time : 3 Hours] *[Total Marks : 100*

Note : *(1) Attempt all questions. All question carry equal marks.*

(2) Assuming missing data if any.

1 Attempt any four of the following :

(a) A binary mixture follows Raoults's Law. Show that the relative volatility is the ratio of partial pressures of more volatile component to that of the less volatile component. 5

(b) Sketch the vapour-liquid equilibrium at constant temperature having positive deviation from Raoult's law. 5

(c) A liquid mixture containing 35 mole % A and 65 mole % B is subjected to differential distillation at atmospheric pressure. The liquid distilled is 95 mole %. Calculate the composition of the residue. The equilibrium data are given below : 5

x_A	0.425	0.4	0.375	0.35	0.325	0.3	0.275	0.25
y_A	0.53	0.5	0.47	0.45	0.42	0.39	0.36	0.33

(d) What is flash vaporization? Obtain the equations to describe flash vaporization equations. 5

(e) What is steam distillation? Under which condition is it advantageous to use steam distillation? 5

(f) Describe a simple multistage distillation operation. 5

2 Attempt any four of the following :

(a) What is Ponchon Savarit method? How will you determine minimum reflux ratio using this method? 5

(b) Derive the q-line using mass and energy balances. What is its slope? 5

(c) What is optimum reflux ratio for a multi-plate distillation column? On which factors does it depend? 5

(d) Does the column diameter of packed distillation tower depend on equilibrium data? How can it be determined? 5

(e) What do you understand by HTU and NTU? Is there any difference between overall NTU and individual NTU? How is height of packed tower determined using HTU and NTU ? 5

(f) A distillation column used to distill binary system containing 40 mole % of more volatile A. The feed is saturated liquid. The compositions of the distillate and bottom product are 75 mole % and 5 mole% methanol respectively. Determine the number of plates if the reflux ratio is 2.75. At which plate, the feed is introduced ? 5

Equilibrium Data :

x_A	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.85
y_A	0.19	0.335	0.49	0.59	0.66	0.71	0.75	0.765	0.8

3 Attempt any two of the following :

(a) What are various ways in which the equilibrium data for a system of three liquids can be represented? 10

(b) Describe construction and operation of any equipment used for continuous multi-stage liquid-liquid extraction. 10

(c) Plot the equilibrium data on triangular coordinate system. The concentration of pyridine in feed is 60%. It is desired to reduce concentration of pyridine in a two stage cross flow extractor using pure solvent chlorobenzene. The solvent rate in each stage is equal to the feed rate in that stage. What amount of solvent is required in the second stage? What is the concentration of raffinate phase. Solve graphically. 10

Equilibrium data: Water-Pyridine-Chlorobenzene

Weight%			*Weight%*		
Pyridine	*Chlorobenzene*	*Water*	*Pyridine*	*Chlorobenzene*	*Water*
0	99.95	0.05	0	0.08	99.92
11.05	88.28	0.67	5.02	0.16	94.82
18.95	79.9	1.15	11.05	0.24	88.71
24.1	74.28	1.62	18.9	0.38	80.72
28.6	69.15	2.25	25.5	0.58	73.92
31.55	65.58	2.87	36.1	1.85	62.05
35.05	61.0	3.95	44.95	4.18	50.87
40.6	53.0	6.40	53.2	8.90	37.90
49.0	37.8	13.2	49.0	37.8	13.2

4 Attempt any two of the following :

(a) Describe the construction of any equipment used for continuous solid-liquid extraction. Explain with help of a sketch. Explain its operation. 10

(b) How to represent equilibrium data for leaching? How is operating the determined? How to estimate number of stages graphically? 10

(c) No stage in an extractor behaves as an ideal plate. Why? What is then meant by an ideal stage? How is the overall efficiency of a stage defined? Discuss various factors affecting the stage efficiency. 10

5 Attempt any two of the following :

(a) (i) Describe the principles of reverse osmosis. 5

(ii) What is thermal diffusion? Where is it used? 5

(b) What is Freundlich isotherm? Apply it to obtain equilibrium relationship for the adsorption process. How to use it for multi-stage operation. 10

(c) Why is the adsorption wave observed in an unsteady state fixed-bed adsorbers? Discuss breakpoint and break-through curve. 10