

**B.Tech Sem - VI (2007 Course) (Chemical Engg.) : WINTER - 2018**

**SUBJECT: MASS TRANSFER-II**

Day : Tuesday  
Date : 13/11/2018

**W-2018-2837**

Time : 10.00 AM TO 01.00 PM  
Max. Marks: 80

**N. B. :**

- 1) **Q. No.1 and Q. No.5 are COMPULSORY.** Attempt **ANY TWO** questions from Section-I and **ANY TWO** from Section-II.
- 2) Figures to the right indicate **FULL** marks.
- 3) Both the sections should be written in the **SEPARATE** answer books.
- 4) Use of non programmable **CALCULATOR** is allowed.
- 5) Assume suitable data, if necessary.

**SECTION – I**

- Q.1**
- a) What is relative volatility? Explain its significance in distillation. **(04)**
  - b) What is the significance of azeotropic distillation? Explain with neat diagram azeotropic distillation of acetic acid – water mixture using butyl acetate. **(06)**
  - c) State the q-line equation and show the effect of feed temperature on the slope of q-line. **(04)**
- Q.2**
- a) Derive Rayleigh's equation for simple distillation. **(06)**
  - b) A mixture containing benzene and toluene with 50 mole% benzene is flashed distilled such that 70% of the feed is distilled out. Estimate the composition of the distillate and residue. Equilibrium data: **(07)**

x	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
y	0.22	0.38	0.51	0.63	0.7	0.78	0.85	0.91	0.96

- Q.3** A continuous fractionating column operating at atmospheric pressure, is to separate a mixture containing 30 mole% CS<sub>2</sub> and 70 mole % CCl<sub>4</sub> into an overhead product of 95 mole% CS<sub>2</sub> and a bottom product containing 95 mole% CCl<sub>4</sub>. The feed enters as liquid at its boiling point. Assume an overall efficiency of 70% and a reflux ratio of 3.16. Determine the number of stages to be provided. Equilibrium data in mole% : **(13)**

x	0	2.96	11.06	25.8	53.18	66.3	75.75	86.64
y	0	8.23	26.6	49.5	74.7	83.0	88.0	93.2

- Q.4**
- a) What are the various types of packing used in distillation column? Explain the significance of its shape with neat diagrams. **(07)**
  - b) Explain the different types of trays used in distillation columns. **(06)**

**SECTION - II**

- Q.5**
- a) What are the effects of temperature and pressure on a triangular diagram in liquid –liquid extraction? **(05)**
  - b) Describe briefly the Langmuir and Freundlich adsorption isotherm. **(05)**
  - c) What are the different types of membrane separation operations? **(04)**

**P.T.O.**

- Q.6** A 5% (by weight) solution of acetaldehyde in toluene is extracted with water (13)  
in a three stage crosscurrent 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 relation is given by  $Y = 2.3 X$ , where  $Y = \text{kg acetaldehyde} / \text{kg}$   
water and  $X = \text{kg acetaldehyde} / \text{kg toluene}$ . Assume that the toluene and  
water are immiscible with each other.
- Q.7 a)** Equilibrium water adsorbed by an adsorbent in contact with moist air is (08)  
given by  $Y = 0.04 X$ , where  $Y = \text{kg water} / \text{kg dry air}$  and  $X = \text{kg water}$   
adsorbed / kg silica gel. 0.5 kg of adsorbent containing 5% moisture on dry  
basis is placed in a collapsible vessel in which there is  $5\text{m}^3$  of moist air. The  
partial pressure of water vapor is 15 mm Hg. The total temperature and  
pressure are 760 mm Hg and 298 K respectively. Calculate the quantity of  
water adsorbed.
- b)** Explain what is Length of Unused Bed (LUB) in adsorption in packed (05)  
column?
- Q.8 a)** Explain a reverse osmosis system with diagram, used for water purification. (07)
- b)** What are ultra-filtration and microfiltration processes? Explain with (06)  
example.

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