

**B.TECH SEM - VI (2007 COURSE) (CHEMICAL ENGG.) :**

**SUMMER - 2018**

**SUBJECT: MASS TRANSFER-II**

Day : **Friday** S-2018-2699 Time : **02.30 PM TO 05.30 PM**  
Date : **01/06/2018** 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 constant pressure equilibrium? Explain in brief with suitable diagram. (06)
- b) What is the effect of reflux ratio on the number of stages required in binary distillation operation? (04)
- c) Why some mixtures show positive or negative deviation from ideality? (04)
- Q.2** a) 1000 moles of benzene (A) and toluene (B) mixture containing 40 mole % of benzene is subjected to a differential distillation at 1 atm. pressure till the composition of the benzene in the residue is reduced to 10%. Calculate the total moles of mixture distilled if average relative volatility is 2.16. (07)
- b) Derive Fenske's equation for obtaining the number of plates at total reflux. (06)
- Q.3** A mixture of benzene and toluene containing 38 mole % of benzene is to be separated to give a product of 90 mole % benzene at the top and the bottom product with 4 mole % benzene. The feed enters the column at its boiling point. Vapor leaving the column is simply condensed and provide product and reflux. It is proposed to operate the distillation unit with the reflux ratio of 3.0. Locate the feed plate and determine the number of plates required for the desired separation. (13)  
Data: Relative volatility,  $\alpha=2.5$
- Q.4** a) Draw a neat diagram and describe the conditions of flooding and weeping in distillation column. (07)
- b) Describe the priming characteristics of distillation column. (06)

**SECTION-II**

- Q.5** a) What are the applications of adsorption? (05)
- b) What is the selection criteria for solvent in liquid-liquid extraction? (05)
- c) Explain the process of Ion Exchange. (04)

**P.T.O.**

**Q.6** A solution of nicotine in water is to be extracted with kerosene at 293K. (13)  
 Water and kerosene are essentially immiscible. Equilibrium relationship is ,  
 $Y=0.9X$

Where,  $Y = \frac{\text{Kg of nicotine}}{\text{Kg of kerosene}}$  and  $X = \frac{\text{Kg of nicotine}}{\text{Kg of water}}$

Determine the % extraction of nicotine if 100 kg of feed is to be extracted with

- i) 150 kg of solvent in single stage
- ii) 50 kg of solvent each in three crosscurrent stages.

Compare the results.

**Q.7 a)** What are the desirable properties of an adsorbent? (04)

**b)** A solution is to be decolorized by treatment with adsorptive carbon. The original solution has a color of 9.6 measured on an arbitrary scale. It is desired to reduce the color to 0.96. Calculate the minimum quantity of fresh carbon required per kg of solution for continuous countercurrent adsorption. (09)

Isotherm data:

Kg of carbon/ kg of solution	0	0.001	0.004	0.008	0.02	0.04
Equilibrium color	9.6	8.6	6.3	4.3	1.7	0.7

**Q.8 a)** What is the most commonly used membrane operation used for removing dissolved salts? Explain its functioning in detail. (07)

**b)** Explain the functioning of membranes used for the removal of micro molecular sizes. (06)

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