B.TECH SEM - VI (2007 COURSE) (CHEMICAL ENGG.) :
WINTER - 2017
SUBJECT: MASS TRANSFER-II

Day: **Monday**
Date: **20/11/2017**

W-2017-2494

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

N.B:

1) **Q.No. 1 and Q. No. 5** are **COMPULSORY**. Out of remaining attempt any **TWO** question from each section.
2) Answer to both the sections should be written in **SEPARATE** answer book.
3) Figures to the right indicate **FULL** marks.
4) Assume suitable data if necessary.
5) Draw neat diagrams **WHEREVER** necessary.

SECTION-I

Q.1 **a)** Discuss positive deviation from ideality in distillation. **(07)**

b) Determine the material balance equations for enriching and exhausting sections of rectification column. **(07)**

Q.2 **a)** Describe Azeotropic distillation. **(06)**

b) An ethanol – water mixture containing 36% by weight of ethanol is differentially distilled at 1 atm pressure and the mixture is reduced to a maximum ethanol concentration of 6 mole %. Determine the composition of the distillate. **(07)**
M.W. of ethanol = 46
The VLE data is

X	0.18	0.16	0.14	0.12	0.10	0.08	0.06
y	0.517	0.502	0.485	0.464	0.438	0.405	0.353

Q.3 **a)** Discuss the terms, minimum and total reflux ratio used in distillation. **(04)**

b) A fractionating column operating at 1 atm pressure is supplied at the optimum location with a saturated liquid feed containing 40 mole % ethanol and 60 mole % water. The column produces a saturated liquid overhead product containing 80 mole % ethanol and a saturated liquid bottom product containing 20 mole % ethanol. The reflux ratio is 2.0. **(09)**
Find.

i) The number of theoretical stages required to give the separation.

ii) The optimum feed plate location.

X	0	0.2	0.4	0.6	0.8	1.0
y	0	0.355	0.6	0.767	0.898	1.0

P.T.O

Q.4 **a)** Discuss Murphree tray efficiency and overall efficiency of a tray in distillation. **(04)**

b) Discuss the condition of flooding, coning and dumping in distillation column. **(05)**

c) State q- line equation and show the effect of condition of feed on the slope of q- line. **(04)**

SECTION-II

Q.5 **a)** Discuss binodal solubility curve in liquid- liquid extraction. **(05)**

b) Explain the phenomena of adsorption hysteresis. **(05)**

c) Describe the working principle of reverse osmosis in separation process. **(04)**

Q.6 A 25 % solution of dioxane in water is to be continuously extracted at a rate of 1000 kg/ hr in countercurrent fashion with benzene to remove 95% of dioxane. Equilibrium data are given in table below. **(13)**
The benzene is dioxane – free.

a) What is the minimum solvent requirement, kg/hr?

b) If 900 kg/ hr of solvent is used, how many theoretical stages are required

w.t% of dioxane in water	5.1	18.9	25.2
w.t% of dioxane in benzene	5.2	22.5	32.0

Q.7 Experiment on decolourization of oil yielded the following equilibrium relationship **(13)**

$Y = 0.004X^2$

Where

Y= gm of color/ gm of color free oil

X= gm of color/ gm of adsorbent

1000 kg oil containing 1 part of color to 3 parts of oil is agitated with 25 kg of the adsorbent. Calculate the % of color removed if,

a) All 25 kg adsorbent is used in one step.

b) 12.5 kg adsorbent is used initially, followed by another 12.5 kg of adsorbent.

Q.8 Write a note on: **(13)**

a) Separation by molecular sieves

b) Electro dialysis

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