V SEMESTER B.TECH (CHEMICAL ENGINEERING)

MAKEUP EXAMINATION, JAN 2016

SUBJECT: MASS TRANSFER -II (CHE309)

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitably assumed.

1A A liquid mixture contains n-Pentane (1), n-Hexane (2), n-Heptane (3) differentially distilled at 1 atm and 70 ^{0}C with vaporization of 40 mole% of the charge. Raoults applies. Compute the distillate and residue composition. The solution composition (mole %) and Antoine equation constants are given below with the units of Temp as ^{0}C and pressure is mm Hg. Log(P)= A-(B/(C+T)) **15**

	x_i	A	B	C
1	0.35	6.87632	1075.78	233.205
2	0.4	6.91058	1189.64	226.28
3	0.25	6.89386	1264.37	216.64

1B P (z_p, H_p) moles formed when M (z_m, H_m) moles and N(z_n, H_n) moles of solutions adiabatically mixed. Prove the straight line MN pass through P on H-x,y diagram **5**

2 A continuous fractionating column is to be designed for separating 10,000 kg per hour (MW= 110) of a liquid mixture containing 40 mole percent "A" and 60 mole percent "B" into an overhead product containing 97 mole percent "A" and a bottom product containing "B" (97%) mole percent. (H_{G1}=12.55 KJ/kgmole, H_D= 3.4 KJ/Kgmole). Calculate the number of theoretical stages required for given separation with a reflux ratio of 2.5 and feed is entering the distillation with 50% vapor. The equilibrium data (mole fraction) is provided below **20**

x	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
y	0.417	0.579	0.669	0.729	0.78	0.825	0.871	0.915	0.959

3A Briefly explain the Azeotropic distillation with help of flow sheet and give one example **5**

3B Give the material and energy balance in PS method of continuous rectification column for the following sections with the help of flow sheet **10**

i) Over all distillation column
ii) For One tray in enriching and exhausting section each
iii) Reboiler section

3C Briefly explain the various reboilers used in distillation column (atleast 5) **5**

4A Briefly explain the various types (system) of equilibrium encountered in Extraction with the help of diagram **9**

4B Dioxane(20%) in Water (80%) solution is to be separated/extracted using pure Benzene as solvent to remove 95% of the Dioxane from the 200 kg of solution. Benzene and Water are essentially insoluble. If the extraction was done in two stages. Find the amount of dioxane extracted with the following condition. Solvent used was, first stage equal amount of water

and in second stage half of the water. The equilibrium data was given below.

Wt% of Dioxane in water	5.1	18.9	25.2
Wt% of Dioxane in Benzene	5.2	22.5	32

5 (20)

A solution is continuously and counter-currently extracted at the rate of 2 kg/s (F, contains 80% water (A), 20 % pyridine (C)) with chlorobenzene (solvent contains 1% pyridine) to reduce the pyridine concentration in feed to 3%. All are in wt % (**Triangular coordinates**)

i) Determine the minimum solvent rate required for this separation.

ii) Find the number of theoretical stages if the solvent rate is 1.5 times the minimum solvent rate

Pyridine (wt%)	Chloro-benzene (wt%)	Water (wt%)	s.no.	Pyridine (wt%)	Chloro-benzene (wt%)	Water (wt%)
0	99.95	0.05	1	0	0.08	99.92
11.05	88.28	0.67	2	5.02	0.16	94.82
18.95	79.9	1.15	3	11.05	0.24	88.71
24.1	74.28	1.62	4	18.9	0.38	80.72
31.55	65.58	2.87	6	36.1	1.85	62.05
40.6	53	6.4	8	53.2	8.9	37.9
49	37.8	13.2	9	49	37.8	13.2

6A. Explain the shanks counter current leaching system with flow sheet **6**

6B. Define the following terms i) retentate & permeate ii) flux iii) retention factor iv) transmembrane pressure **6**

6C. Give the total and component balance of single stage leaching process with the help of flow sheet **8**