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Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



V SEMESTER B.TECH (CHEMICAL ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2015

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.

	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-	
1A	(B/(C+T))	15

	Xi	А	В	С
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

¹BP (zp, Hp) moles formed when M (zm, Hm) moles and N(zn, Hn) moles of solutions
adiabatically mixed. Prove the straight line MN pass through P on H-x, y diagram**5**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

Z				<u></u>	1			/ 1			Z U
_	x	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
	у	0.417	0.579	0.669	0.729	0.78	0.825	0.871	0.915	0.959	
3A	Brief	ly explain	the Azeotr	opic distill	ation with	help of t	flow sheet	and give o	ne exampl	e	5
3B	Give follow i) ii) iii	the materi ving sectio Over all For One i) Reboiler	al and ener ons with the distillation tray in ener section	rgy balance e help of fl n column riching and	e in PS me low sheet l exhaustin	thod of o	continuous n each	rectificati	on columr	for the	10

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3C	Briefly exp	lain the various	reboilers	s used in dis	tillation co	lumn (atle	ast 5)			5
4A	Briefly explain the various types (system) of equilibrium encountered in Extraction with the help of diagram									9
4B	Dioxane(25%) in water (75%) solution is to be separated/extracted using pure Benzene assolvent to remove 95% of the Dioxane from the 100 kg of solution. Benzene and Water areessentially insoluble. If the extraction was done in two stages. Find the amount of dioxaneextracted with the following condition. Solvent used was, first stage equal amount of waterand in second stage half of the water. The equilibrium data was given below.Wt% of Dioxane in water5.118.925.2Wt% of Dioxane in Benzene5.222.532									11
	 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 Chlorobenzene Water s.no. Pyridine Chlorobenzene Water 									20
5	(wt%) 0 11.05 18.95 24.1 31.55 40.6	(Wt%) 99.95 88.28 79.9 74.28 65.58 53	(wt%) 0.05 0.67 1.15 1.62 2.87 6.4	1 2 3 4 6 8	(wt%) 0 5.02 11.05 18.9 36.1 53.2	(wt%) 0.08 0.16 0.24 0.38 1.85 8.9		(wt%) 99.92 94.82 88.71 80.72 62.05 37.9		
6A.	49 Explain the	37.8 shanks counter	13.2 current	9 leaching sys	49 stem with fl	37.8 ow sheet		13.2		6
6B.	Define the following terms i) retentate & permeate ii) flux iii) retention factor iv) transmembrane pressure									6
6C.	Give the to sheet	tal and compone	ent bala	nce of singl	e stage lead	ching proc	cess wi	ith the hel	p of flow	8