B.Tech.
V SEMESTER EXAMINATION, 2015-16
NCH-501: MASS TRANSFER-II

Time: 3 Hrs. **Max. Marks: 100**

Section A

1.		Attempt **all** parts. All parts carry **equal** marks. Write answer of each part in **short**	**2*10=20**
	(a)	Write characteristics of multistage column?	
	(b)	Draw enthalpy concentration diagram for flash distillation?	
	(c)	Comment on the efficiency of single stage distillation?	
	(d)	Write usefulness of poncho savarit method?	
	(e)	Draw diagram of cross flow multistage extraction?	
	(f)	Comment on the cost of supercritical unit?	
	(g)	Define decoction?	
	(h)	What is lixiviation?	
	(i)	Describe adsorption?	
	(j)	Write a name of ion exchange equipment?	

Section B

		Attempt any **five** questions from this section	**10*5=50**
2		Explain with diagram heteroazeotrope?	
3		Derive equation of reflux ratio using poncho savarit method and explain bydrawing diagram?	
4		Comment on system of two partial soluble liquids and one solid?	
5		Derive and show continuous counter current extraction with reflux?	
6		What is adsorption equilibria? Explain for binary gas vapor mixtures?	

7		Draw multistage counter current leaching and show it on N-x-y plot with relevant equations?		
8		Draw and explain continuous counter decantation?		
9		Explain the working of rotating fixed bed adsorber?		

Section C

Attempt any **TWO** questions from this section **15*2=30**

10 1000 kg/hr of a mixture containing 42 mole percent heptane and 58 mole percent ethyl benzene is to be fractionated to a distillate containing 97 mole percent heptane and a residue containing 99 mole percent ethyl benzene using a total condenser and feed at its saturated liquid condition. The enthalpy-concentration data for the heptane-ethyl benzene at 1 atm pressure are as follows:

$x_{heptane}$	0	0.08	0.18	0.25	0.49	0.65	0.79	0.91	1.0
$y_{heptane}$	0	0.28	0.43	0.51	0.73	0.83	0.90	0.96	1.0
$H_l\ 10^{-3}$ x kJ/kmol	24.3	24.1	23.2	22.8	22.05	21.75	21.7	21.6	21.4
$H_v\ 10^{-3}$ x kJ/kmol	61.2	59.6	58.5	58.1	56.5	55.2	54.4	53.8	53.3

Calculate the following:

a. Minimum reflux ratio
b. Minimum number of stages at total reflux
c. Number of stages at reflux ratio of 2.5
d. Condenser duty
e. Reboiler duty

11 A counter-current adsorber uses silica gel for adsorbing NO_2 from a dilute mixture with air. Gas enters the adsorber at the rate of 1000 lb/hr containing 1.5% NO_2 by volume and 90% of NO_2 is removed. The entering gel will be free from NO_2. Calculate the minimum weight of the gel required per hour. The following equilibrium data is given:

Partial pressure of NO_2 mm Hg	0	2	4	6	8	10
gm NO_2 / 100 gm gel	0	0.4	0.9	1.65	2.00	3.65

12 2000 kg/hr of an acetic acid - water solution containing 30% acid is to be counter-currently extracted with isopropyl ether to reduce the acid concentration to 2% in the solvent free raffinate product. Determine the minimum amount of solvent required for this extraction. Determine the number of theoretical stage if 5000 kg/hr of solvent is used.

Water layer			Ether layer		
$100x_c$	Water	Ether	$100y_c$	Water	Ether
1.41	97.1	1.5	0.37	0.7	98.9
2.89	95.5	1.6	0.79	0.8	98.4
6.42	91.7	1.9	1.93	1.0	97.1
13.30	84.4	2.3	4.82	1.9	93.3
25.50	71.1	3.4	11.40	3.9	84.7
36.70	59.9	4.4	21.60	6.9	71.5
44.30	45.1	10.6	31.10	10.8	58.1
46.40	37.1	16.5	36.20	15.1	48.7
0.69	98.1	1.2	0.18	0.5	99.3