

(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. ADDITIONAL OPE END SEMESTER

EXAMINATIONS MAR 2021

SUBJECT: MASS TRANSFER II [CHE 3152]

(23/03/2021)

Time: 3 Hours

MAX. MARKS: 50

10

10

03

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.

A mixture containing 62 mole % ethyl benzene and 38 mole % heptane is to be distilled by continuous fractionation. The flowrate of the mixture is 1200 kg/h. The distillate is expected to contain 95 mole % heptane and residue containing 97 mole % ethyl benzene. The feed is saturated liquid and a total condenser is used. The required data for the above-mentioned system is as follows:

х	0	0.08	0.18	0.25	0.49	0.65	0.79	0.91	1
у	0	0.28	0.43	0.51	0.73	0.83	0.90	0.96	1

1A.

3A.

H _L (kJ/kmol) x 10 ⁻³	24.3	24.1	23.2	22.8	22.05	21.75	21.7	21.6	21.4
H _V (kJ/kmol) x 10 ⁻³	61.2	59.6	58.5	58.1	56.5	55.2	54.4	53.8	53.3

Using Ponchon-Savarit method, calculate the (i) condenser and reboiler heat load, (ii) minimum reflux ratio, (iii) minimum number of stages at total reflux and (iv) number of stages at reflux ratio of 2.5

A mixture containing 40 mole % of A and 60 mole % of B is to be continuously distilled to give distillate containing 90 mole % of A and residue containing 10 mole % of A. The relative volatility is 2.4. The feed is liquid and at its boiling point. Calculate the number of theoretical plates required at total reflux. Also calculate the minimum reflux ratio.

A mixture containing 40 mole % of A and 60 mole % of B is continuously flash vaporized to vaporize 70 mole % of the feed. The residual stream contains 25 mole % of A. Calculate the heat added per mole of the vapor (in kJ).

· · · /	
Stream	Enthalpy (kJ/mole)
Feed	2
Liquid	5
Vapor	30

3B. 1000 moles of liquid feed containing 50% isopropyl alcohol and 50% water is differentially distilled at the final distillate contains 60% of the feed solution. Calculate the concentration of

	isopropyl alcohol in distillate and residue.										
	v	0.0045	0.0127	0.0678	0 1330	0.3204	0 3752	0 4720	0.4056		
	A V	0.0045	0.0127	0.0078	0.1330	0.5204	0.5752	0.4720	0.4950		
20	Discuss about	spiral we	und men	branes ar	d hundle	of hollow	v fibers w	ith schem	10.5000		02
3C.	representation. Which among these is generally used in RO systems?										
	900 kg of crushed oil seeds (22% oil, 78% meal) is extracted in a three-stage cross-current										
	unit using 600 kg of pure hexane in each stage. The equilibrium data are as follows:										
		0 1				-					
	Overflow (100 kg) solution					Underflow (100 kg) slurry					
	WA (kg)	W	/ B (kg)	Wc (k	g) V	V'A (kg)	W'	в (kg)	W'c (k	g)	
	0.3		99.7	0		67.2	3	32.8	0		
	0.45		90.6	8.95		67.1	2	9.94	2.96		
	0.54	8	34.54	14.92	2	66.93	2	8.11	4.96		
	0.70		/4.4/	24.83	3	66.58	2	5.06	8.36		
1.4	0.77	(<u>59.46</u>	29.77	-	66.26	2	3.62	10.12		
4A.	0.91	(50.44	38.65)	<u>65.75</u>	2	20.9	13.35		08
	0.99		04.40 44.46	44.50) -	<u>65.33</u>		9.07	15.0		
	1.19		14.40	54.33))	64.39	1	<u>6.02</u>	19.59		
	1.28		24.55	64.17	7	62.02	14	4.13	22.10		
	1.20		04.55 04.63	73.80)	61 54	1.	2.07	23.90		
	1.40	4	24.03	75.65	2	01.34	5	.01	20.03		
(i) Calculate the fraction of oil extracted in a three-stage cross-current unit									using PS		
method.											
	(ii) Also, c	calculate t	the fraction	on of oil e	xtracted i	n a single	stage con	ntactor fo	r the same		
	volum	e (1800kg	g) of the s	solvent an	d comme	nt on the	result.				
	Identify the appropriate and economical pressure driven membrane processes for the										
	separation of following mixtures:										
4R	(i) Clarifi	cation of	apple juic	ce							02
	(ii) Desalination of sea water										02
	(iii) Reduction of alcohol content of beer										
	(iv) Removal of ionic substance from water										
	A feed of 1200 kg aqueous solution of pyridine per hour (40% by mass) is to be extracted										
	with pure benzene to reduce the solute content in the raffinate to 4%. Determine the number										
	of ideal stages required if the solvent rate is 1.5 times the minimum. (Use rectangular										
	coordinate system)										
	Watan Lavan					Ronzono Lovor					
	Pyridine n	nass % Renzene me		ne mass	% P	Duriding mags 0/		Renzene mass (2/0	
	1 yridine , ii	1435 /0	DCIIZCI	0	/0 1	3 78	11435 70	DCIIZC	94 54	/0	
5A.	3 55			0		9.75			87.46		10
	7.39		0			18.35		79.49			10
	13.46	<u>í</u>	0.15			26.99		71.31			
	22.78	3		0.25		31.42		66.46			
	32.15	5	0.44			34.32		64.48			
	42.47	7		2.38		36.85	5		59.35		
	48.87	7		3.99		39.45	5		56.43		
	49.82	2	4.28			39.27		55.72			
	56.05	5		19.56		48.39)		40.05		