Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

V SEMESTER B.Tech, Odd semester makeup examination, Dec 2018

SUBJECT: Mass Transfer -II [CHE 3101]

REVISED CREDIT SYSTEM, (26/12/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates: Answer ALL the questions. Missing data may be suitable assumed.

1A.	Prove that internal reflux ratio $\frac{L_n}{G_{n+1}}$ is different for each and every tray in absorption section of P-S method and also draw the detailed diagram.	4
1B.	150 kmol of feed having 65 mole % of benzene (A) and toluene (B) is differentially distilled with 60 kmoles distilled as composite distillate at 1 atm. Calculate the compounded composition of the product if α is constant at 2.5	4
1C	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 of distillation	2
2.	A dilute aq. Solution of Ethanol is to be concentrated from 30% to 80% in a tray tower at atmospheric pressure. The feed rate is 500 Kmoles/hr and contains 40% of vapour. The bottom product must not contain more than 5 % Ethanol (all are in mole %). Determine the minimum reflux ratio, number of theoretical stages, condenser and reboiler heat loads at 1.5 times of minimum reflux ratio. (McCabe Thiele method). H_{G1}=45000 kJ/kmol; $H_{L0}=H_D$= 8900 kJ/kmol; H_W=8450 kJ/kmol, H_F=23,500 kJ/kmol.	10

x	0	0.016	0.020	0.0891	0.143	0.281	0.477	0.7	0.89
y	0	0.158	0.191	0.427	0.493	0.568	0.644	0.756	0.89

3 If 120 kg of solution contains acetic acid (30%), water (67), Isopropyl ether (3%) is to be extracted using isopropyl ether as solvent which contains acetic acid of 4% at 20 ^{0}C in three stages. In each stage solvent used is 20 kg. Determine the quantities and compositions of various streams. **Use only Rectangular coordinates.** 10

Water layer			Isopropyl ether layer		
Wt % acetic acid, $100x$	Water	Isopropyl ether	Acetic acid, $100y^*$	Water	Isopropyl ether
1.41	97.1	1.5	0.37	0.7	98.9
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	58.9	4.4	21.60	6.9	71.5
46.40	37.1	16.5	36.20	15.1	48.7

4A	Explain briefly the hallow fiber membrane module and its characteristics Define the transmembrane pressure and give the equation for the same	3 2
4B	Explain the types of moistures encountered in drying phenomena with the help of diagram	3
4C	Explain the shanks system used in leaching process	2
5A	Explain extractive distillation with the help of diagram and one example. Explain the various reboilers used in distillation column (atleast four)	2 2
5B	Describe the phenomena of equilibrium in drying operation for sodium nitrate with the help of diagram	3
5C	Give material balance equations for single stage leaching operation with the help diagram	3