Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

V SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: MASS TRANSFER-II [CHE 3101]

REVISED CREDIT SYSTEM
(03/12/2016)

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

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

1A. 100 kmol/hr of feed having 65 mole % of benzene (A) and toluene (B) is flash vaporized at 1 atm. Calculate the composition of residue α is constant at 2.2 ; Data : H_F= 4000 kJ/kmol Q=1000 MJ/kmol/hr of feed H_D= 20000 KJ/kmol and H_W= 7000 kJ/kmol — 7

1B. Calculate the bubble and dew point of the solution and its composition at 3 atm.
Log (P)= A-(B/(C+T)), P is in mm Hg, T is ^{0}C — 10

Component	composition	A	B	C
n-Pentane (A)	0.3	6.87632	1075.78	233.205
n-Hexane (B)	0.5	6.91058	1189.64	226.28
n-Octane (C)	0.2	6.89386	1264.37	216.64

1C. Briefly explain the steam distillation — 3

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 200 Kmoles/hr with an enthalpy of 20000 KJ/Kmol. The bottom product must not contain more than 3.5 % Ethanol (all are in mole %). Determine Minimum reflux ratio and Calculate the condenser and reboiler heat loads at minimum reflux ratio for partial condenser.
The enthalpy and concentration and equilibrium data (mole %) are given below H is in KJ/kmol, x,y are in mole %. — 20

x,y	0	0.0891	0.207	0.37	0.477	0.779	1
H_L	7540	6880	7097	7750	8105	8945	9523
H_V	48150	48300	48436	48450	48631	48950	48990

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

3A. Briefly explain the following i) Extractive distillation ii) Azeotropic distillation with examples — 6

3B. Briefly describe the atleast four important properties required for good solvent in LLE — 6

3C. Derive the operating line equation of absorption section in McCabe Thiele method — 8

4. (20)

A solution is continuously and counter-currently extracted at the rate of 2.5 kg/s (Feed contains 50% water (A), 48% pyridine (C) and 2% chlorobenzene (B)) with chlorobenzene (contains 2% pyridine) to reduce the pyridine concentration to 5%.
(Triangular coordinates)

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

ii) Determine the minimum solvent rate for half the feed rate (F=1.25 kg/s)

Pyridine	Chloro-benzene	Water		Pyridine	Chloro-benzene	water
0	99.95	0.05		0	0.08	99.92
11.05	88.28	0.67		5.02	0.16	94.82
24.1	74.28	1.62		18.9	0.38	80.72
28.6	69.15	2.25		25.5	0.58	73.92
35.05	61	3.95		44.95	4.18	50.87
40.6	53	6.4		53.2	8.9	37.9
49	37.8	13.2		49	37.8	13.2

5A. Explain the types of modules used in membrane separations? (atleast three) (6)

5B. Explain various types of equilibrium diagrams encounter in Leaching with diagram (6)

Explain the effect of temperature on leaching (atleast two important points) (2)

5C. Give the component and complete balance in Leaching (all three components) (6)