Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. REGULAR EXAMINATIONS- NOV 2018

SUBJECT: Mass Transfer -2 [CHE 3101]

REVISED CREDIT SYSTEM, (23/11/2018)

Time: 3 Hours **MAX. MARKS: 50**

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

1A	Calculate the bubble and dew point at 1.5 atm for the solution consisting of pentane, hexane and octane and the solution compositions and data provided in below table Component | composition | A | B | C n-Pentane (A) | 0.5 | 6.87632 | 1075.78 | 233.205 n-Hexane (B) | 0.2 | 6.91058 | 1189.64 | 226.28 n-Octane (C) | 0.3 | 6.89386 | 1264.37 | 216.64 Log (P)= A-(B/(C+T)), P is in mm Hg, T is ^{0}C	**7**
1B	Explain azeotropic and extractive distillations with the help of one example and diagram	**3**
2A	A dilute aq. solution of ethanol is to be concentrated from 25% to 80% in a tray tower distillation column at atmospheric pressure. Feed is entering with a feed rate of 10500 Kg/hr & an enthalpy of 20000 KJ/Kmol. The bottom product must not contain more than 3.5 % ethanol. (all are in wt %, MW of ethanol is 46, water is 18). Calculate the condenser and reboiler heat loads at 1.5 times of minimum reflux ratio. H_F=10000 kJ/kmol, H_{G1}=48500 kJ/kmol, $H_{L0}=H_D=H_w$=8950 kJ/kmol, condenser heat duty at minimum reflux ratio is 3.16×10^6 kJ/hr. Assume no heat losses in the distillation column.	**7**
2B	Explain the different stages of drying phenomena with the help of equilibrium diagram for $CuSO_4$ solution?	**3**
3A	Isotonic saline solution, which has the same osmotic pressure as blood, can be prepared by dissolving 9.23 grams of NaCl in enough water to produce 250 mL of solution at 25°C. What is the osmotic pressure of this solution?	**2**
3B	Calculate the number of theoretical stages required for given separation at total reflux conditions. Relative volatility is 2.4, product quality of more volatile component mole fractions are 0.98 & 0.05.	**1**
3C	Derive the q- line equation for McCabe Thiele method. Calculate the minimum reflux ratio with following conditions: relative volatility is 2.3, feed and distillate concentrations are 0.35 & 0.95 respectively. Partially vaporized feed enters the distillation column with 2:3 ratio of liquid to vapor.	**7**
4A	Explain the equilibrium diagrams encountered in Leaching (atleast three types).	**3**

4B Dioxane (25%) in water (75%) solution is to be separated/extracted using pure benzene as solvent to remove 95% of the dioxane from the 200 kg of solution. Benzene and water are essentially insoluble. Find the amount of dioxane extracted in three stages where solvent used were, first stage equal amount of water, in second stage half of the water, in third stage 25% of water. The equilibrium data is given below. **7**

Wt% of Dioxane in water	5.1	18.9	25.2
Wt% of Dioxane in Benzene	5.2	22.5	32

5 A solution (120 kgs) contains pyridine (C), chlorobenzene (B) and water (A) contains 30% of C is to be extracted with chlorobenzene (B) which contains 2% of C at 20^0 C. If the extraction is done three times using 40 kg of solvent in each stage, determine the quantities and compositions of the various streams. How much solvent would be required if the same final raffinate concentration were to be obtained with one stage. **(Triangular coordinates)** **10**

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