Total number of printed pages - 02   <u>**B.TECH**</u>
<div align="right"><u>**PCCH4306**</u></div>

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6th Semester Regular / Back Examination 2016 - 17
MASS TRANSFER – II
BRANCH : Chemical
Time : 3 Hours
Max Marks : 70
Question Code : Z247

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Answer Question No. 1 which is compulsory and any FIVE from the rest.
The figures in the right-hand margin indicate marks.
Assume suitable notations and any missing data wherever necessary.
Answer all parts of a question at a place.

1.   **Answer the following questions :**   **2 x 10**

   (a) What are the situations where liquid-liquid extraction becomes attractive over distillation as a separation process?

   (b) What is extraction factor ?

   (c) What is a binodalsolubility curve?

   (d) What are the factors that retard coalescence in the settler part of a mixer-settler unit?

   (e) What are the differences between using percolation and agitation in a leaching process?

   (f) For vegetables, how the drying time is related to its flavor?

   (g) Which type of materials have high equilibrium MC ?

   (h) Mention the applications of vacuum dryers ?

   (i) What are the forces that are responsible for adsorbate components getting adsorbed on adsorbent surfaces?

   (j) What are the characteristics of adsorbents ?

2.   Discuss in detail the criteria for selection of solvents for LLE.   **10**

3.   1000 kg of an aqueous solution containing 50 % acetone is contacted with 800 kg of chlorobenzene containing 0.5 mass % acetone in a mixer-settler unit, followed by separation of the extract and the raffinate phases. Determine the composition of the extract and the raffinate phases and the fraction of acetone extracted.Equilibrium and tie line data are given below.

Aqueous phase, raffinate			Organic phase, extract		
Water	Chlorobenzene	Acetone	Water	Chlorobenzene	Acetone
x_A	x_B	x_C	x_A	x_B	x_C
0.999	0.001	0.0	0.002	0.998	0.0
0.898	0.002	0.1	0.005	0.887	0.108
0.797	0.003	0.2	0.008	0.769	0.222

0.694	0.006	0.3	0.017	0.608	0.375
0.586	0.014	0.4	0.031	0.475	0.495
0.463	0.037	0.5	0.072	0.336	0.592
0.274	0.126	0.6	0.228	0.151	0.601
0.257	0.138	0.6	0.257	0.137	0.606

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4. Crushed oil seeds containing 28 mass % oil, is extracted with hexane to reduce the oil content to 0.8 % in the underflow. 1 kg of the solvent is used per kg of the feed. Using the following equilibrium data, determine the number of stages required.

Overflow (100 kg), solution			Underflow (100 kg), slurry		
W_A (kg)	W_B (kg)	W_C (kg)	W'_A (kg)	W'_B (kg)	W'_C (kg)
0.3	99.7	0.0	67.2	32.8	0.0
0.45	90.6	8.95	67.1	29.94	2.96
0.54	84.54	14.92	66.93	28.11	4.96
0.70	74.47	24.83	66.58	25.06	8.36
0.77	69.46	29.77	66.26	23.62	10.12
0.91	60.44	38.65	65.75	20.9	13.35
0.99	54.45	44.56	65.33	19.07	15.6
1.19	44.46	54.35	64.39	16.02	19.59
1.28	38.50	60.22	63.77	14.13	22.10
1.38	34.55	64.17	63.23	12.87	23.90
1.48	24.63	73.89	61.54	9.61	28.85

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5. Derive the equation for total drying time from the drying rate data. **10**

6. Discuss in detail the construction and operation of rotary dryer with a neat diagram. **10**

7. A rotary counter-current dryer is fed with ammonium nitrate containing 6 % moisture at 100 kg/min and discharges the nitrate with 0.2 % moisture. The air enters at 135^0C and leaves at 80^0C. The humidity of entering air being 0.007 kg H_2O/kg dry air. The nitrate enters at 21^0C and leaves at 65^0C. Calculate the kg dry air passing through the dryer and the humidity of the air leaving the dryer. Specific heat of ammonium nitrate, dry air, and water vapour are 0.45, 0.238, and 0.48. **10**

8. **Write short notes on any TWO:** **5 x 2**
   (a) Equilateral triangular diagram
   (b) Solid characteristics for leaching operation
   (c) Induced draft cooling tower
   (d) Characteristics of adsorbents