Name:	
Enrolment No:	UNIVERSITY OF TOMORROW

UPES
End Semester Examination, December 2024

Course: Mass Transfer-II   Semester: V
Program: B.Tech Chemical Engineering   Time   : 03 hrs.
Course Code: CHCE3029   Max. Marks: 100

Instructions: In case of data missing make necessary assumptions

SECTION A (6Qx10M=60Marks)
Attempt all questions

S. No.		Marks	CO
Q1	How commercial solid-liquid extraction systems are classified? What factors are affecting the rate of solid-liquid extraction?	10	CO1
Q2	Use a typical drying curve to describe the following: i) Bound moisture iii) Free moisture content. ii) Equilibrium moisture content iv) Critical moisture content	10	CO1
Q3	i) Using a graph, illustrate the operating line and equilibrium curve for counter-current stripping, applying material balance equations to support your explanation. ii) What is absorption and what are the key characteristics of an effective absorbent?	5+5	CO2
Q4	Explain the factors involved in selection of adsorbents and provide examples of some common industrial adsorbents.	10	CO2
Q5	Experiments on decolorization of sugar syrup yielded the following equilibrium relationship $Y=0.003X^2$. Where Y is kg colour/kg solution. X is kg colour/kg carbon. 1000 kg sugar solution containing 2% colour is agitated with 30 kg of adsorbent. Calculate the % colour removed if i) All 30 kg adsorbent is used in one step ii) 20 kg of adsorbent is used initially, followed by another 10 kg adsorbent	10	CO3
Q6	How the cooling towers have been classified. With neat schematic explain the working of induced draft towers.	10	CO1

	SECTION-B (2Qx20M=40 Marks)		
	Attempt all questions		
Q7	If 100 kg of a solution of acetic acid (c) and water (A) containing 30% acid is to be extracted two times with isopropyl ether (B) at 20 °C, using 50 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? Equilibrium Data: *(table below)*	20	CO3

Water layer (wt%)x100			Isopropyl ether layer (wt%)x100		
Acetic acid	Water	Isopropyl ether	Acetic acid	Water	Isopropyl ether
0.69	98.1	1.2	0.18	0.5	99.3
1.41	97.1	1.5	0.37	0.7	98.9
2.89	95.5	1.6	0.79	0.8	98.4
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
44.30	45.1	10.6	31.10	10.8	58.1
46.40	37.1	16.5	36.20	15.1	48.7

Q8	A batch of solid for which the material is dried from 25 to 6% (on wet basis) moisture has the initial weight of solid to be 160 kg. The drying surface is 1 m²/40 kg dry weight. Determine the time of drying for constant rate period and falling rate period using graphical method. The data are as follows: *(table below)* Where X= kg moisture / kg dry solid N= rate of drying x 10^3, kg evaporated /m² -sec.	20	CO4

X	0.35	0.25	0.2	0.18	0.16	0.14	0.12	0.10
N	0.3	0.3	0.3	0.266	0.239	0.208	0.180	0.150