Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Fifth Semester - Regular) Examinations, November 2025

23BCHPC35003 - Mass Transfer-II

(Chemical Engineering)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

		CO #	Blooms Level
Q.1.	Answer ***ALL*** questions		
a.	Discuss about plait point, tie line and solubility curve with neat sketch.	CO1	K2
b.	What are the factors affecting the rate of drying?	CO4	K1
c.	Write the properties of good adsorbent.	CO3	K1
d.	State Mier's Super saturation Theory.	CO4	K2
e.	Define decoction, elution and lixiviation in leaching.	CO2	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions

		Marks	CO #	Blooms Level
2. a.	1000 kg/hr of a nicotine-water solution containing 1% nicotine is to be extracted with kerosene to reduce the nicotine content to 0.1%. Water and kerosene are immiscible solvents. What is the minimum solvent requirement, kg/hr? If 1150kg/hr of solvent is used, how many theoretical stages are required?	10	CO1	K3

x'	0	0.00101	0.00246	0.00502	0.00998	0.0204
y'	0	0.00087	0.00196	0.00456	0.00913	0.0187

(OR)

b. A 2.25 kg of pyridine-water solution containing 50% pyridine is to be counter-currently extracted with chlorobenzene to reduce the pyridine concentration to 2% in final raffinate. Determine the number of theoretical stages required if 2.3 kg of solvent is used? The equilibrium data is as below: 10 CO1 K3

Extract phase			Raffinate phase		
Pyridine	Chlorobenzene	Water	Pyridine	Chlorobenzene	Water
0	99.95	0.05	0	0.08	99.92
11.05	88.28	0.67	5.02	0.16	94.82
18.95	79.9	1.15	11.05	0.24	88.71
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

3.a.	Oil is to be extracted from meal by means of benzene using continuous counter current extraction unit. The unit is expected to treat 1000kg of meal per hour. The untreated meal contains 365kg of oil and 30kg of benzene. The solvent used contains 14kg of oil and 590kg of benzene. The exhausted solids are to contain	10	CO2	K3

55kg of un extracted oil. Find the number of ideal stages required. The experimental data is following:

y	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
1/N	0.500	0.505	0.515	0.530	0.550	0.571	0.595	0.620

(OR)

b. Seeds containing 30% by weight oil are to be extracted in a counter-current plant and 94% of the oil is recovered in a solution containing 45% by weight oil. If the seeds are contacted with fresh solvent and 1 kg of solution is removed in the underflow in association with every 2 kg of insoluble matter, determine the theoretical stages required? 10 CO2 K3

4.a. Experiments on decolorisation of oil yielded the following equilibrium relationship:

$X=0.5Y^{0.5}$

Where X= gm of color removed/gm of adsorbent

Y= color in oil, gm of color/gm of color-free oil 10 CO3 K3

200 kg of oil containing 1 part of color to 3 parts of oil is agitated with 60kg of the adsorbent. Calculate the % of color removed if: All 70kg adsorbent is used in one step. 40kg adsorbent is used initially, followed by another 30kg of adsorbent.

(OR)

b. An aqueous solution containing solute is coloured by small amount of impurity. Decolorisation experiments of an aqueous solution yielded the following equilibrium relation:

$Y=4.5*10^{-2}\ X^{1.5}$

Where X= color unit/kg of carbon, Y= color unit/kg solution. 10 CO3 K3

100 kg of initial solution with color concentration of 9.6 is to be treated with an adsorbent. Calculate the quantity of fresh adsorbent required to reduce the color to 5% of its original value in 2-stage counter-current operation assuming that color concentration in the solution leaving first stage is 4 times the final color of the solution.

5.a. Describe in details about rotary dryer. 5 CO4 K2

b. With a neat sketch describe the construction, working principle and application of pulse column. 5 CO1 K2

(OR)

c. Describe about Rotocel extractor in details with neat sketch. 5 CO2 K2

d. Describe in details about Agitated tank Crystallizer. 5 CO3 K2

6.a. A 100 kg bath of granular solid containing 30% moisture is to be dried in a tray dryer to 16% moisture by passing a current of air at 350K across its surface at a velocity of 1.8 m/s. If the constant rate of drying under these condition is $0.7*10^{-3}$ kg/m^{2}s and critical moisture content is 15%, calculate the drying time. All the moisture contents are on wet basis. 10 CO4 K3

(OR)

b. Describe the time of drying under constant drying conditions. 10 CO4 K2

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