Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)
B. Tech (Fifth Semester - Regular) Examinations, November – 2024
22BCHPC35004 – Mass Transfer-II
(Chemical Engineering)

Time: 3 hrs   Maximum: 70 Marks

Answer ALL questions
(The figures in the right hand margin indicate marks)

PART – A   (2 x 5 = 10 Marks)

Q.1. Answer *ALL* questions

		CO #	Blooms Level
a.	Differentiate between stage type and differential extractor.	CO1	K1
b.	Define decoction, elution and lixiviation in leaching.	CO2	K1
c.	Write Mier's supersaturation theory.	CO2	K1
d.	Differentiate between physical and chemical adsorption.	CO3	K1
e.	Write the application of spray dryer.	CO4	K1

PART – B   (15 x 4 = 60 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 1150 kg/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

		Marks	CO #	Blooms Level
b.	Explain the selection criteria of solvent for proper extraction.	5	CO1	K2

(OR)

		Marks	CO #	Blooms Level
c.	25% of dioxane in water solution of 1000kg is to be extracted with benzene to remove 95% of dioxane. If the extraction were done with equal amount of solvent in 5 cross current stages, how much solvent would be required?	10	CO1	K3

$X^{'}$	0.0537	0.233	0.337
$Y^{'}$	0.0548	0.29	0.47

		Marks	CO #	Blooms Level
d.	Describe about perforated plate column in details with neat sketch.	5	CO1	K2
3.a.	Seeds containing 20% by weight oil are to be extracted in a counter-current plant and 90% of the oil is recovered in a solution containing 50% 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 2kg of insoluble matter, determine the theoretical stages required?	10	CO2	K3
b.	Describe about Rotocel extractor in details with neat sketch.	5	CO2	K2

(OR)

		Marks	CO #	Blooms Level
c.	Crushed oil seeds containing 55% oil by weight are to be extracted at the rate of 4000 kg/hr using 6000kg/hr of hexane containing 5% oil by weight as the solvent. A counter current 2-stage extraction system is used. The oil seeds retain 1kg of solution per kg of oil free cake. Calculate the percent recovery of oil	10	CO2	K3

obtained under above conditions.

d.	Describe about Bollman extractor in details with neat sketch.	5	CO2	K2
4.a.	The equilibrium water adsorbed by a silica gel in contact with moist air varies with the humidity of air, as: $Y = 3.5 \times 10^{-2} X$. Where X= kg water adsorbed/kg of dry gel, Y= humidity of air, kg moisture/kg dry air. 0.5 kg silica gel containing 6% (dry basis) adsorbed water is placed in a collapsible vessel in which there are 9 m^3 of moist air, the partial pressure of water being 15 mm Hg. The total pressure and temperature are kept at 1 atm and 298 K. Calculate the amount of water picked up from the moist air in the vessel by silica gel.	10	CO3	K3
b.	Explain the methods of crystallization.	5	CO3	K2

<div align="center">(OR)</div>

c.	Experiments on decolorisation of oil yielded the following equilibrium relationship: $y = 0.5x^{0.5}$ Where y = gm of color removed/gm of adsorbent x = color in oil, gm of color/1000gm of color-free oil 100 kg of oil containing 1 part of color to 3 parts of oil is agitated with 25kg of the adsorbent. Calculate the % of color removed if: All 25kg adsorbent is used in one step. 12.5 kg adsorbent is used initially, followed by another 12.5kg of adsorbent.	10	CO3	K3
d.	Describe in details about Swanson Walker Crystallizer.	5	CO3	K2
5.a.	Slabs of paper pulp $100 \times 100 \times 1.5 cm^3$ are to be dried under constant drying conditions from 67% to 30% moisture. The value of equilibrium moisture for the material is 0.5%. If critical moisture is 60% and rate of drying at critical point is 1.5kg/m^2hr, calculate the drying time. The dry weight of each slab is 2.5kg. Drying is taking place in 2 big faces of the slab. All the moisture contents are on wet basis. The falling rate may be assumed to be linear.	10	CO4	K3
b.	Explain rate of drying with suitable plot.	5	CO4	K2

<div align="center">(OR)</div>

c.	Derive the total time of drying.	8	CO4	K3
d.	Describe in details about drum dryer.	7	CO4	K2

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