

THE KAVERY ENGINEERING COLLEGE
(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

Fourth Semester

Chemical Engineering

CH3451- Mass Transfer I

(Use of steam tables and mass transfer data book Can be Permitted)

Regulations - 2021

Duration : 3 Hrs

Maximum : 100 Marks

PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q.No	Questions	BLT	CO	Marks
1.	State Fick's law of diffusion.	1	1	2
2.	What are the methods for measurement of gas phase diffusion coefficient?	1	1	2
3.	Define J_D factor and give its significance.	1	2	2
4.	What is interphase mass transfer?	1	2	2
5.	Write short notes on wet bulb temperature.	1	3	2
6.	Compare humidifier and dehumidifier.	2	3	2
7.	Define equilibrium moisture content.	1	4	2
8.	Mention the applications of dryers.	1	4	2
9.	Classify the types of crystallizers.	1	5	2
10.	Define theory of super saturation.	1	5	2

PART – B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)

Q.No	Questions	BLT	CO	Marks
11.	a Derive an expression for finding the mass flux of a component in a binary gas mixture. (i) Diffusion of gas A through non-diffusing B (ii) Equimolar counter diffusion under steady state	2	1	13
	Or			
	b Explain the method of measurement and calculation of diffusivities.	2	1	13
12.	a Derive the relation between individual and overall transfer coefficient.	3	2	13
	Or			
	b i Discuss about the differential and stage wise contact operations.	3	2	5
	ii Obtain an expression for overall mass transfer coefficient in terms of film coefficients.	3	2	8
13.	a A mixture of nitrogen-acetone vapour at 800 mmHg and 25°C has percentage saturation of 80%. Calculate i. absolute humidity, ii. partial pressure of acetone, iii. absolute molal humidity and iv. volume percent of acetone. Assuming vapour pressure of acetone at 25°C is 190 mmHg	3	3	13
	Or			

b	An air (B) – water vapour (A) sample has dry bulb temperature 55°C and an absolute mass humidity of 0.030 kg of water/kg of dry air at 1 standard atmospheric pressure. Find the percentage humidity, absolute molal humidity, humid volume, humid heat, enthalpy and partial pressure of water vapour. Vapour pressure of water at 55°C = 118 mmHg Heat capacity of air = 1005 J/kg°C Heat capacity of water vapour = 1884 J/kg°C Latent heat of water vapour = 2502.3 kJ/kg	3	3	13
14.	a Explain drying rate curve and calculation of drying rates under constant rate and falling rate. Or	2	4	13
	b Classify the dryers. With the help of neat sketch explain the construction and working of different types of dryers.	2	4	13
15.	a i Differentiate between batch and continuous crystallization.	2	5	7
	ii Explain the principle of wet bulb thermometry.	2	5	6
	Or			
	b i Explain about the different types of crystallizers.	2	5	8
	ii Explain why homogeneous nucleation is difficult to occur.	2	5	5

*PART – C (Marks 1*15 = 15)*

<i>Q.No</i>	<i>Questions</i>	<i>BLT</i>	<i>CO</i>	<i>Marks</i>
16.	a A stock containing 1.526 kg moisture per kg of dry solid is dried to 0.099 kg moisture per kg dry solid by counter current air flow. Fresh air entering contains 0.0152 kg water per kg dry air and the exit air has 0.0526 kg water per kg dry air. What fraction of air is recycled if 52.5 kg of dry air flows per 1 kg of dry solid inside the drier? Or	EV	4	15
	b A crystallizer is charged with 7500 kg of an aqueous solution containing 29.6% of anhydrous sodium sulphate. The solution is cooled and 10% of the initial water is lost by evaporation. $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ crystallizes out. If the mother liquor (after crystallization) is found to contain 18.3% anhydrous Na_2SO_4 . Calculate the yield of crystals and weight of the mother liquor.	EV	5	15