BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: BTECH. **SEMESTER : IV**
BRANCH: CHEM. ENGG **SESSION : SP/2025**

SUBJECT: CL215 MASS TRANSFER OPERATIONS-I

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	What are the mechanisms involved in mass transfer?	[2]	1	1
Q.1(b)	Prove that for an ideal gas mixture: $D_{AB} = D_{BA}$	[3]	1	2
Q.2(a)	How is the convective mass transfer coefficient determined experimentally?	[2]	2	2
Q.2(b)	What are the major dimensionless numbers used in convective mass transfer, and what do they represent?	[3]	2	2
Q.3(a)	A volatile compound benzene costs Rs 50 per kg is stored in a 10-meter diameter cylindrical tank and open at the top. A stagnant air film of 10 mm thick is covering the surface of the compound beyond which the compound is absent. If the temperature is 25 °C, vapor pressure of benzene is 150 mmHg and its molar diffusivity is 0.02m^2/hr. i) identify the type of diffusion, ii) find the rate of mass transfer, and iii) loss in Rupees per day.	[5]	1	3
Q.4(a)	The equilibrium distribution of a solute A between air and water at low concentration at a particular temperature is given below: $$y = 1.2\,x$$ At a certain point in a mass transfer device, the concentration of solute A in the bulk air is 0.04 mole fraction and that in the bulk aqueous phase is 0.025. In which direction does the transport of the solute A occurs (i.e. from the gas to the liquid or from liquid to gas)? Calculate the overall gas-phase and overall liquid phase driving forces for mass transfer? At the same point the local individual mass transfer coefficients for the transport of A are, $k_y = 7.2\frac{kmol}{h}m^2\Delta y$ and $k_x = 4.6\frac{kmol}{h}m^2\Delta x$. Calculate the (a) the interfacial concentrations in both the gas phase and liquid phase (b) overall mass transfer co-efficient Kx and Ky. and (c) the local mass flux N_A. Also mention which resistance controls the role of mass transfer?	[5]	2	3
Q.5(a)	Ammonia (A) is being absorbed in water from a mixture with nitrogen (B). The partial pressure of solute in bulk gas is 40 mm Hg and that at the gas-liquid interface is negligibly small. Diffusion occurs through stagnant film of thickness 1 mm. The total pressure is 1 atm and the temperature is 25^0C. Diffusivity of NH_3 in N_2 is 0.23 cm^2/s. calculate the absorption flux of NH_3 as well as mass transfer co-efficient k_G , k_y, k_c , and k_Y.	[5]	2	3

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