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

CLASS: B. Tech **SEMESTER: 5th**
BRANCH: BIOTECH **SESSION: MO/2025**

SUBJECT: BE303 MASS TRANSFER OPERATIONS

TIME: 2 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

				CO	BL
Q1	(a)	Define with equation, Fick's first law of diffusion.	[2]	CO1	BL2
	(b)	Ammonia diffuses through nitrogen gas under equimolar counter diffusion at total pressure of 1 atm. T = 298K. Diffusion path is 0.15 m. partial pressure of ammonia at one point is 1.5×10^4 Pa and other point 5×10^3 Pa, diffusivity is 2.3×10^{-5} m^2/s. Calculate flux.	[3]	CO1	BL4
Q2	(a)	Define Bubble point and Dew point with the help of temperature concentration phase diagram.	[2]	CO2	BL3
	(b)	Draw a labeled diagram of a distillation column with reflux.	[3]	CO2	BL3
Q3		A plant must distil a mixture containing 75 mole % methanol and 25 mole % water. The overhead product is 95 mole % methanols, and bottom product is 2 mole % methanols. If q = 1, α = 3.32 and R_D is 1.4, calculate, (a) minimum number of plate, (b) feed plate location from top, (c) actual number of plates if efficiency is 72%.	[5]	CO2	BL5

X	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Y	0	0.42	0.58	0.67	0.73	0.78	0.82	0.87	0.91	0.96	1

Q4	(a)	In a ternary equilibrium graph Draw and indicate the point whose composition concentration is 30% A; 50% B and 20% C.	[2]	CO3	BL3
	(b)	Explain Binodal curve of LLE.	[3]	CO3	BL3
Q5	(a)	Water containing 6.9 mg/L of a steroid is extracted with initially pure methylene dichloride. The equilibrium constant for steroid is 160 and ratio of water to solvent is 80. What is the concentration of organics after extraction? What fraction of steroid has been removed?	[5]	CO3	BL5

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