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

CLASS: BTECH **SEMESTER: Vth**
BRANCH: BIOENGINEERING & BIOTECHNOLOGY **SESSION: MO/24**

SUBJECT: BE303 MASS TRANSFER OPERATION

TIME:3 hour **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 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

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Q.1(a)	Draw and describe the temperature concentration diagram at constant pressure.	[5]	1	3
(b)	In an oxygen-nitrogen gas mixture at 1 atm (1.013×10^5 kg/m. s^2), 25 °C, the concentration of two plates 0.2 cm apart is 10% and 20% (by volume), respectively. If the diffusivity of oxygen in nitrogen is 0.215 cm^2/s, and R = 8314 $kg.m^2/s^2$. K. mole; Calculate the oxygen flux when (i) Nitrogen is non-diffusing and (ii) Equimolar counter diffusion.	[5]	1	4
Q.2	A distillation column is used to separate methanol from water. The feed is a mixture that contains 55 mole % methanol. The overhead product is 90 mole % methanol, and the bottom is 5 mole %. Consider a saturated liquid feed is provided; relative volatility is 3.32, and a reflux ratio twice the minimum is used. Calculate the number of theoretical plates, the minimum number of plates, and the feed plate location.	[10]	2	5
Q.3(a)	In a ternary equilibrium diagram, indicate the point representing A = 20%, B = 40%, and C = 40%. Describe the Plait point in a binodal curve with a diagram.	[5]	3	3
(b)	An organic solute will be extracted from a dilute aqueous solution using a solvent with K_D = 6.8. For a continuous counter-current extractor, how many ideal stages are required if the solvent flow is 0.35 times the solution flow and 99% solute recovery is required?	[5]	3	5
Q.4(a)	What are the factors that influence leaching? Explain any one leaching equipment.	[5]	4	2
Q.4(b)	500 kg of ore containing 20% copper is leached in agitators with 1000 kg of fresh solvent. Assume 90% overall efficiency calculate the number of extractors required for 95% extraction of copper in overflow solution.	[5]	4	5
Q.5(a)	With a neat diagram, explain the Pervaporation method.	[5]	5	3
(b)	Write a short note on Super-critical fluid extraction.	[5]	5	3

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