

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

CLASS: B. TECH
BRANCH: BIOENGINEERING & BIOTECHNOLOGY

SEMESTER : V
SESSION : MO/2022

SUBJECT: BE303 MASS TRANSFER OPERATION

TIME: 3:00 Hours

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. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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Q.1(a)	Define Fick's 1 st law of diffusion with mathematical notations.	[2]	1 2
(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 are 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 flux of oxygen when i. Nitrogen is non-diffusing ii. There is equimolar counter diffusion	[8]	1 2
Q.2	A distillation column is used to separate methanol from water. The feed is a mixture that containing 40 mole % methanol. The overhead product is 97 mole % methanol and bottom one was 0.5 mole %. Consider, saturated liquid feed is provided, relative volatility is 3.32, and reflux ratio is 3.5. Calculate, number of theoretical plates, minimum number of plates, and feed plate location.	[10]	2 5
Q.3(a)	Calculate the fraction extracted in a LLE, if $E = 2$.	[2]	3 2
(b)	A clarified fermentation beer (H) containing 260 mg/L of antibiotic is to be extracted using butyl acetate (L). $K = 57$. We plan to use $H = 450$ L/h and $L = 37$ L/h to recover 99% antibiotics. How many stages are required for this separation?	[8]	3 5
Q.4	60 ton/day of oil-sand (25% oil, 75% sand) is to be leached with 40 ton/day naptha in a counter current extractor. The final extract contains 40% oil and 60% naptha. The underflow from each unit contains 35% solvent and 65% sand. If the overall efficiency is 80%, graphically determine how many extractors will be required?	[10]	4 5
Q.5(a)	Write the advantage of using carbon-di-oxide as supercritical fluid.	[2]	5 2
(b)	Write a short note on aqueous two phase extraction.	[3]	5 2
(c)	Draw a labeled diagram of a continuous distillation column with reflux.	[5]	5 3

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