

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

**CLASS: BTECH  
BRANCH: FOOD TECHNOLOGY**

**SEMESTER: V  
SESSION: MO/2025**

**SUBJECT: FE307 MASS TRANSFER IN FOOD PROCESSING**

**TIME: 3 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.

		CO	BL
Q.1 Answer the following questions			
Q.1(a) In an oxygen-nitrogen gas mixture at 1 bar and 29 °C, the concentrations of oxygen at two planes 5 mm apart are 5 and 15 mol %, respectively. Calculate the mass diffusion flux of oxygen for EMCD.	[5]	1	3
Q.1(b) Obtain relationships to convert $k_G$ , $k_y$ , and $k_c$ in terms of the other two.	[5]	1	3
Q.2 Answer the following questions			
Q.2(a) Obtain operating line of R→E cocurrent interphase mass transfer operation.	[5]	3	4
Q.2(b) Obtain operating line of E→R countercurrent interphase mass transfer operation.	[5]	3	4
Q.3 Answer the following questions			
Q.3(a) Define Murphree, point, and overall tray efficiencies.	[5]	1	4
Q.3(b) Prove that $E_{MG} = E_{OG}$ when liquid is fully mixed.	[5]	1	4
Q.4 Answer the following questions			
Q.4(a) Derive an equation for f-line and sketch f-lines for $f = 0, 1.0$ and $(0 \ 1.0)$	[5]	2	3
Q.4(b) Sparkle & Bubbly Brewing desires to study the effect of feed quality ( $q$ ) on the number of trays of an alcohol distillation column. The master brewer suggested to include effects of randomness in feed quality in the study and, in response, Dr. Rummy Glass defined an equation $q = 0.5 + \text{rand}(0 \ 1)$ ; where $\text{rand}()$ is a random number generator function. The study was assigned to interns. You being one among them, obtain the number of trays with the help of a scientific calculator for $x_F = 0.35$ , $x_D = 0.9$ , $x_B = 0.1$ , $R_D = 1.8$ and infer the location of feed tray using the following equilibrium data. $x$ 0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.5 0.6 0.7 0.8 0.85 0.9 0.95 1.0 $y$ 0 0.12 0.2 0.3 0.4 0.45 0.5 0.57 0.6 0.7 0.8 0.85 0.9 0.93 0.96 0.98 1.0	[5]	2	4
Q.5 Answer the following questions			
Q.5(a) Sketch the drying curve and rate of drying curve for a batch drying operation.	[5]	5	3
Q.5(b) A batch drying experiment on kiwi fruit slices yielded the following data. $X$ 0.05 0.07 0.09 0.10 0.15 0.17 0.20 0.35 0.36 0.37 0.38 0.39 $N$ 0.00 0.05 0.10 0.15 0.23 0.25 0.30 0.30 0.29 0.28 0.27 0.25 Where $X$ is expressed in (kg moisture/kg dry solid) and $N$ in kg evaporated/m <sup>2</sup> s. Find $X^*$ , identify the constant rate region, and obtain approximate time spent in that region if the exposed area is 1 m <sup>2</sup> and dry weight of the slices is 40 kg.	[5]	5	3

:::24/11/2025:::M