

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

CLASS: B.Tech  
BRANCH: FT

SEMESTER : V  
SESSION : MO/2025

SUBJECT: FE307 MASS TRANSFER IN FOOD PROCESSING

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

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	CO	BL
Q.1 Answer the following questions for a <b>cocurrent</b> process.	1	4
(a) Derive the equation of operating line for E → R interphase mass transfer. [3]		
(a) Sketch the operating line in the X–Y coordinate space. [2]		
Q.2 Answer the following questions for a <b>countercurrent</b> process.	1,2	4
(a) Derive the equation of operating line for R → E interphase mass transfer. [3]		
(b) Sketch the operating line in the X–Y coordinate space. [2]		
Q.3 Answer the following on interphase mass transfer.	1	4
(a) Show the concentration profiles developed for a gas diffusing into liquid and derive an equation for the operating line of the operation. Also show the operating line in a sketch. [3]		
(b) Sketch the concentration profiles developed in a gas → liquid interphase mass transfer when all the resistance to mass transfer lies in the <b>liquid</b> phase. [2]		
Q.4 Solve the following.	1	3
In an industrial facility, H <sub>2</sub> gas at 2 bar and 298 K flows through a 4 m long pipe of inner diameter 2.5 cm and thickness 1.25 cm. Previous experiments carried out by process engineers indicated that H <sub>2</sub> concentrates on the inner wall up to 4.8×10 <sup>-3</sup> kmol/m <sup>3</sup> and diffuses across the walls of the tube at the rate of 1.8×10 <sup>-6</sup> cm <sup>2</sup> /s. On early morning of 1 <sup>st</sup> April 2025, alarms sounded presence of H <sub>2</sub> in the ambient, although nobody noticed the leakage for the next 24 hrs, the day being All Fools' Day holiday. Now, you have been appointed as the lead investigator for this accident. Based on this information,		
(a) Estimate the mass of H <sub>2</sub> accumulated in the static ambient during the 24 hr period. [3]		
(b) If a 4 m <sup>3</sup> hollow spherical containment dome 2 mm thick is to be built surrounding the pipe, what will be the rate of leakage through the dome in windy ambient? [2]		
Q.5 Answer the following.	2	3
(a) Show a <b>crossflow cascade</b> and its operating lines on separate diagrams. [2]		
(b) Show a <b>counterflow cascade</b> and operating lines on separate diagrams. Clearly indicate how the overall operating line could be plotted. [3]		

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