



VIT

Vellore Institute of Technology

SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
FALL SEMESTER 2025-2026

REG.NO.: 138CM0050

SLOT:

Programme Name & Branch : B.Tech Chemical Engineering
Course Code : BCHE302L
Course Name : Mass transfer-II
Faculty Name(s) : Dr.G.S.Nirmala
Class Number(s) : VL2025260101234
Date of Examination : 17-08-25
Exam Duration : 90 minutes

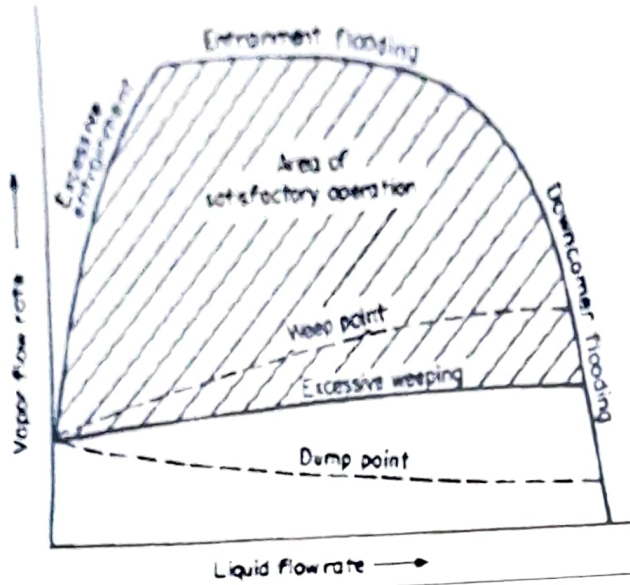
Maximum Marks: 50

General instruction(s):

- Graph sheets will be provided
- Assume any missing data

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Q. No	Question	Marks																		
1.	What are the specific conditions that necessitate the use of steam distillation? Describe the working principle of steam distillation and highlight its major applications	10																		
2.	A mixture of 100kg mol which contains 60 mol % n-pentane (A) and 40 mol % n-heptane (B) is vaporized at 101.3 kPa pressure under differential conditions until 40 kg mol is distilled. What is the average composition of the total vapour distilled and the composition of the liquid left? <table border="1"> <tr> <td>X</td> <td>1.0</td> <td>0.867</td> <td>0.594</td> <td>0.398</td> <td>0.254</td> <td>0.145</td> <td>0.059</td> <td>0</td> </tr> <tr> <td>Y</td> <td>1.0</td> <td>0.984</td> <td>0.925</td> <td>0.836</td> <td>0.701</td> <td>0.521</td> <td>0.271</td> <td>0</td> </tr> </table> x,y are mol fractions of n-pentane	X	1.0	0.867	0.594	0.398	0.254	0.145	0.059	0	Y	1.0	0.984	0.925	0.836	0.701	0.521	0.271	0	10
X	1.0	0.867	0.594	0.398	0.254	0.145	0.059	0												
Y	1.0	0.984	0.925	0.836	0.701	0.521	0.271	0												
3.	A continuous fractionation column has been installed to distill 3000kg/h of a mixture of 40% benzene and 60% toluene (by weight). The overhead and bottom products are found to contain 97% Benzene and 97% toluene respectively. The feed consists of 3/4th vapour and 1/4th Liquid. A reflux ratio of 3.5 has been used. (a) Find the number of plates and locate the feed plate (b) If overall plate efficiency is 60%, how many actual trays are required? Data: VLE for Benzene-Toluene system <table border="1"> <tr> <td>x</td> <td>0</td> <td>0.20</td> <td>0.40</td> <td>0.60</td> <td>0.8</td> <td>1</td> </tr> <tr> <td>y</td> <td>0</td> <td>0.38</td> <td>0.61</td> <td>0.78</td> <td>0.92</td> <td>1</td> </tr> </table>	x	0	0.20	0.40	0.60	0.8	1	y	0	0.38	0.61	0.78	0.92	1	10				
x	0	0.20	0.40	0.60	0.8	1														
y	0	0.38	0.61	0.78	0.92	1														
4.	a) Using the q line equation draw the feed line at different conditions b) Explain the sieve tray performance of a distillation column	10																		



5. A feed of ethanol-water (30 wt% ethanol) is to be enriched in to a top product at 101.32 kPa pressure to give a distillate containing 88 wt % ethanol and bottom product containing 4 wt% alcohol. The feed enters the column at a rate of 5000kg/h and its enthalpy is 116.3kJ/kg. The reflux is at its bubble point and the reflux ratio is 1.5

The enthalpy concentration kJ/Kmol and the vapour liquid equilibrium data at the operating pressure of 1 atm are given below

x,y	0	0.041	0.089	0.143	0.20	0.28	0.37	0.47	0.61	0.77	1
		7	1	6	7	1		7		9	
H _L	754	7125	6880	6915	7097	7397	7750	8105	8471	894	9523
	0									5	
H _v	481	4825	4830	4832	4843	4845	4845	4863	4869	489	
	50	0	0	8	6	0	0	1	4	50	
x	0	0.016	0.041	0.143	0.370	0.610	0.706	0.860	0.950	1	
y	0	0.158	0.304	0.493	0.603	0.703	0.756	0.864	0.945	1	

(a) Calculate R_{min}

(b) Estimate ΔD and ΔW