Name: **Enrolment No:**	

UPES

End Semester Examination, May 2023

Course: Mass Transfer Equipment Design and Separation Processes **Semester : II**

Program: M.Tech. Chemical Engineering **Time : 03 hrs.**

Course Code: CHPD7010 **Max. Marks : 100**

No. of pages: 02

Instructions: Assume suitable data, if necessary.

SECTION A

(5Qx4M=20Marks)

S. No.	Short answer type questions.	Marks	CO
Q 1	Recall and write at least two points of comparison between binary and multicomponent distillation.	4	CO1
Q 2	Recall and write about the choice of solvent for gas absorption w.r.t volatility.	4	CO2
Q 3	Enlist at least four important characteristics of mixer-settlers.	4	CO3
Q 4	Define the terms in relation to drying, bound moisture and unbound moisture.	4	CO4
Q 5	Identify at least two advantages of membrane separation technology.	4	CO5

SECTION B

(4Qx10M= 40 Marks)

S. No.	Medium answer type questions.	Marks	CO
Q 6	Define the terms pertaining to a distillation column, i) Minimum reflux ratio, ii) Optimum reflux ratio. Also, describe why annual total cost of the distillation column initially decreases, attains a minimum value and finally increases with reflux ratio.	10	CO1
Q 7	Analyze the phenomenon of flooding in gas absorbers.	10	CO2
Q 8	Analyze the advantages of supercritical fluid solvents over liquid solvents. **OR** Describe with flow diagram, a batch supercritical extraction (SCE) plant.	10	CO3
Q 9	Illustrate with diagram and description, cross-circulation drying in a tray dryer.	10	CO4

SECTION-C
(2Qx20M=40 Marks)

S. No.	Long answer type questions.	Marks	CO
Q 10	For a multicomponent distillation, estimate the number of equilibrium stages for desired separation, for different values of reflux ratios (1.7, 2, 2.5, 3, 3.5, 4). Use FUG method. Minimum reflux ratio (R_m) determined by Underwood's method is 1.4509. Use following data and equation/ correlation. Tabulate the results. **Data:** α_{LK} = 2.567 x_{LK} in distillate = 0.95 x_{HK} in distillate = 0.05 x_{LK} in residue = 0.163 x_{HK} in residue = 0.416 Fenskey's equation $$N_m = \frac{\log\left[\left(\frac{x_{LK}}{x_{HK}}\right)_d \left(\frac{x_{HK}}{x_{LK}}\right)_b\right]}{\log \alpha_{LK}}$$ where, α_{LK} = Average relative volatility of light key with respect to heavy key $(x_{LK}, x_{HK})_d$ = Mole fraction of light key and heavy key in distillate $(x_{LK}, x_{HK})_b$ = Mole fraction of light key and heavy key in residue Gilliland's correlation $$f(N) = \frac{N - N_m}{N+1} = 1 - \exp\left[\left(\frac{1+54.4\psi}{11+117.2\psi}\right)\left(\frac{\psi - 1}{\psi^{0.5}}\right)\right]$$ where, $\psi = \frac{R - R_m}{R+1}$	**20**	**CO1**
Q 11	Discuss the constructional features of 'Plate and Frame Membrane Module'. Diagram is not necessary. **OR** Discuss the constructional features of 'Spirally Wound Membrane Module'. Diagram is not necessary.	**20**	**CO5**