Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2023

Programme Name: B.Tech (APE Gas) **Semester : IV**
Course Name : Mass Transfer **Duration : 3 h**
Course Code : CHCE 2022 **Max. Marks: 100**
Nos. of page(s) : 02

Instructions: In case of data missing make necessary assumptions

S.No.	**Section A** (Attempt all questions)	**Marks**	**CO**
Q 1	State Fick's law and compare (i) Molecular diffusion and Eddy diffusion (ii) N-type flux and J-type flux.	12 M	CO1
Q 2	With the help of a typical drying curve, explain the following: i) Constant and falling rate periods ii) Equilibrium moisture content iii) Bound moisture iv) Free moisture content	12 M	CO1
Q 3	What are the desired characteristics of solvent used for Liquid-Liquid extraction? Also, explain the effect of temperature and pressure on Liquid-Liquid equilibria?	12 M	CO3
Q 4	Derive the operating line equation for steady state continuous counter current mass transfer.	12 M	CO2
Q 5	With neat schematic diagram, describe different types of packing materials used to carry out absorption operation. Also, explain their characteristics.	12 M	CO3
	Section B (Attempt all questions)		

Q 6	A continuous fractionating column is to be designed for separating 10,000 kg per hour of a liquid mixture containing 40 mole percent methanol and 60 mole percent water into an overhead product containing 97 mole percent methanol and a bottom product having 98 mole percent water. A mole reflux ratio of 3 is used. Calculate (i) moles of overhead product obtained per hour and (ii) number of ideal plates and location of the feed plate if the feed is at its bubble point.	20 M	CO4

x	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
y	0.417	0.579	0.669	0.729	0.78	0.825	0.871	0.915	0.959

Q 7	500 kg of an aqueous solution containing 50% acetone is contacted with 800 kg of chlorobenzene containing 0.5 mass% acetone in a mixer -settler unit, followed by separation of the extract and the raffinate phases. Determine the composition of the extract and the raffinate phases and the fraction of acetone extracted.	20 M	CO2

Equilibrium Data:

Aqueous Phase (Raffinate)			Organic Phase (Extract)		
Water	Chlorobenzene	Acetone	Water	Chlorobenzene	Acetone
x_A	x_B	x_C	y_A	y_B	y_C
0.9989	0.0011	0	0.0018	0.9982	0
0.8979	0.0021	0.1	0.0049	0.8872	0.1079
0.7969	0.0031	0.2	0.0079	0.7698	0.2223
0.6942	0.0058	0.3	0.0172	0.608	0.3748
0.5864	0.0136	0.4	0.0305	0.4751	0.4944
0.4628	0.0372	0.5	0.0724	0.3357	0.5919
0.2741	0.1259	0.6	0.2285	0.1508	0.6107
0.2566	0.1376	0.6058	0.2566	0.1376	0.6058