


Name:			
Enrolment No:			
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, May 2022			
Course: Mass Transfer Equipment Design and Separation Processes Program: M.Tech. Chem. Engg. (with spl in PDE) Course Code: CHPD7010		Semester : II Time : 03 hrs. Max. Marks : 100	
Instructions: Assume suitable data, if necessary.			
SECTION A (5Qx4M=20Marks)			
S. No.	Short answer type questions.	Marks	CO
Q 1	Define light key and heavy key component.	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	Explain at least two advantages of vacuum distillation.	10	CO1
Q 7	Describe the qualitative physical significance of HTU and NTU, in relation to packed bed absorbers.	10	CO2
Q 8	Analyze the usefulness of liquid extraction for separations not possible by other methods. OR Discuss the properties of supercritical fluid solvents (SCFS).	10	CO3
Q 9	Identify and explain a few industrial examples of drying.	10	CO4
SECTION-C			

(2Qx20M=40 Marks)			
S. No.	Long answer type questions.	Marks	CO
Q 10	<p>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.</p> <p>Data: $\alpha_{LK} = 2.567$ x_{LK} in distillate = 0.95 x_{HK} in distillate = 0.05 x_{LK} in residue = 0.163 x_{HK} in residue = 0.416</p> <p>Fenske's equation</p> $N_m = \frac{\log \left[\left(\frac{x_{LK}}{x_{HK}} \right)_d \left(\frac{x_{HK}}{x_{LK}} \right)_b \right]}{\log \alpha_{LK}}$ <p>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</p> <p>Gilliland's correlation</p> $f(N) = \frac{N - N_m}{N + 1} = 1 - \exp \left[\left(\frac{1 + 54.4\psi}{11 + 117.2\psi} \right) \left(\frac{\psi - 1}{\psi^{0.5}} \right) \right]$ <p>where, $\psi = \frac{R - R_m}{R + 1}$</p>	20	CO1
Q 11	<p>Discuss the constructional features of 'Plate and Frame Membrane Module'. Diagram is not necessary.</p> <p style="text-align: center;">OR</p> <p>Discuss the constructional features of 'Spiral Wound Membrane Module'. Diagram is not necessary.</p>	20	CO5