Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022

Subject Code:2160501 Date:01/06/2022

Subject Name:Mass Transfer Operation - II

Time:10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Explain Raoult's Law and Relative Volatility	**03**
	(b)	Discuss the factor on which the rate of drying depends	**04**
	(c)	A rectification column is feed with 100 kmol/h of a mixture containing 50 mol % hexane and 50 mole % octane at 101.325 kPa absolute pressure. The feed is at its boiling point. The distillate is to contain 90 mole % hexane and the bottoms 10 mole % hexane. The reflux ratio used is 3. Calculate the kmol/h distillate and kmol/h bottoms, and number of theoretical trays needed for this separation.	**07**

The equilibrium data for this system is given below

x	1.0	0.69	0.4	0.192	0.045	0
y	1.0	0.932	0.78	0.538	0.1775	0

Q.2	**(a)**	List assumptions of McCabe-Thiele method and its limitations.	**03**
	(b)	Given the importance of providing reflux in distillation column and how it affects the purity of the product obtained.	**04**
	(c)	Define quantity 'q'. Derive equation for q -line and discuss location of 'q' line for typical feed condition in brief.	**07**
		OR	
	(c)	Explain Differential Distillation and derive Rayleigh's Equation	**07**
Q.3	**(a)**	Discuss about various types of adsorption	**03**
	(b)	Write short note on desirable characteristics of Packing material used in packed distillation column.	**04**
	(c)	Write and explain Freundlich equation. Write material balance for a single stage adsorption and apply Freundlich equation in it.	**07**
		OR	
Q.3	**(a)**	Briefly explain about Adsorption hysteresis	**03**
	(b)	Discuss about ion exchange process used in softening of water.	**04**
	(c)	With reference to breakthrough curve of adsorption in a fixed bed, deduce the expression to calculate the degree of saturation of the adsorbent bed.	**07**
Q.4	**(a)**	Discuss the concept of Pressure Swing Adsorption (PSA)	**03**
	(b)	Compare forced draft and induced draft cooling tower.	**04**
	(c)	Derive equation for Adiabatic Saturation Curve.	**07**
		OR	
Q.4	**(a)**	Define: Free Moisture, Humidity, Blowdown	**03**
	(b)	Discuss about range and approach with reference to cooling tower.	**04**
	(c)	Give detailed classification of cooling towers and discuss about any one in detail with neat sketch.	**07**

Q.5	**(a)**	Briefly explain freeze drying	**03**
	(b)	Explain with the sketch, the principle and working of rotary drier.	**04**
	(c)	Derive the equation for time required in constant and falling rate period of the batch drying operations.	**07**

OR

Q.5	**(a)**	Explain with the sketch, the principle and working of spray drier.	**03**
	(b)	Define and explain followings: a) Equilibrium moisture b) Bound moisture c) Unbound moisture d) Critical moisture content	**04**
	(c)	A wet solid is to be dried from 35% to 10% moisture under constant drying conditions in five hours. If the equilibrium moisture content is 4% and the critical moisture content is 14%. All moisture content data is on wet basis. How long it will take to dry solids to 6% moisture under the same conditions.	**07**

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