Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024

Subject Code:3160501 Date:20-11-2024

Subject Name:Mass Transfer Operations II

Time:02:30 PM TO 05:00 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)**	Define relative volatility. Discuss its importance.	**03**
	(b)	Explain the effect of temperature on the adsorption operation.	**04**
	(c)	Explain the various types of cooling towers and discuss their selection criteria.	**07**
Q.2	**(a)**	Define the following terms 1) Free moisture 2) Reflux ratio 3) Wet bulb temperature	**03**
	(b)	Explain principles of ion exchange in brief. Also list its applications.	**04**
	(c)	Explain the effect of increasing pressure on vapour liquid equilibrium for a binary mixture. Justify using T-xy, P-xy and xy diagrams.	**07**
		OR	
	(c)	Differentiate between extractive and azeotropic distillation and discuss their selection criteria.	**07**
Q.3	**(a)**	Explain range and approach with reference to cooling tower.	**03**
	(b)	State the various industrial applications of adsorption.	**04**
	(c)	A feed of 60 mole% hexane and 40 mole % octane is fed to a pipe still through a pressure reducing valve into a flash disengaging chamber. The vapour and liquid leaving the chamber are assumed to be in equilibrium. If 50 mole% of feed is vaporized, find the composition of the top and bottom products. Equilibrium data is as follows:	**07**

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

OR

Q.3	**(a)**	Define the following terms 1) Dew point 2) Adiabatic Saturation temperature 3) Absolute Humidity	**03**
	(b)	Compare and contrast physisorption and chemisorption.	**04**
	(c)	100 moles of mixture of components A and B containing 60 mole % of A is subjected to a differential distillation at atmospheric pressure till the composition of A in the residue is 30%. Calculate the total moles of distillate and residue. Average relative volatility is constant at 2.25.	**07**
Q.4	**(a)**	List out the various types of reboilers used in industry. Explain any one in detail.	**03**
	(b)	Write a short note on Rotary Dryer	**04**
	(c)	Explain Freundlich equation. Derive the relation for single stage adsorption using the Freundlich equation.	**07**
		OR	

Q.4	**(a)**	Briefly discuss about optimum reflux ratio.	**03**
	(b)	Write a short note on Tray Dryer	**04**
	(c)	What is pressure swing adsorption (PSA)? With a neat and clean diagram, discuss PSA with industrial applications and advantages.	**07**
Q.5	**(a)**	Enlist the principal adsorbents generally used in adsorption.	**03**
	(b)	Enlist the assumptions of McCabe-Thiele method for determination of number of stages in a distillation column.	**04**
	(c)	A slab of paper pulp 1.5 m * 1.5 m having 5 mm thickness is to be dried under constant drying condition from 18% to 8% on dry basis. Equilibrium moisture is 2.5 % while critical moisture is 0.46 kg moisture/ kg dry pulp. Drying rate at the critical point is found out to be 1.4 kg/ m^2 hr. Density of pulp is 0.22 g/cc. If drying takes place from two large faces, calculate the drying time.	**07**

OR

Q.5	**(a)**	Explain the adsorption wave in adsorption operation.	**03**
	(b)	Define the quantity ‘q’. Discuss the different types of feed to a distillation column and their ‘q’ values using relevant diagram.	**04**
	(c)	A wet solid of 28% moisture is to be dried to 0.5% moisture in a tray dryer. A laboratory test shows that it requires 8 hours to reduce the moisture content of the same solid to 2%. The critical moisture content is 6% and the equilibrium moisture is 0.2%. The falling rate of drying is linear in the free moisture content. Calculate the trying time of the solid if the drying conditions similar to those in the laboratory test are maintained. All moistures are expressed as percent of ‘bone dry’ mass of the solid.	**07**

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