Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 160501 **Date: 05/05/2017**

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.**

Q.1		A continuous fractionating column is to be designed to separate 30,000 kg/h of a mixture of 40% benzene and 60% toluene into an overhead product containing 97% (wt%) benzene and bottom product containing 98% (wt%) toluene. A reflux ratio of 3.5:1 is to be used. The benzene and toluene form an ideal solution with relative volatility of 2.5. The feed has the boiling point of 95 ^{0}C at a pressure of 1 atm. Calculate a) moles of overhead and bottom products per hr. b) If the feed is liquid at its boiling point, determine the number of ideal plates and the position of feed plate.	**14**
Q.2	**(a)**	Write a short note on azeotropic distillation with suitable example.	**07**
	(b)	Define the term 'q'. Derive equation for q-line and discuss location of q-line for various feed conditions in brief.	**07**
		OR	
	(b)	Derive the Rayleigh equation for simple distillation.	**07**
Q.3	**(a)**	Write a short note on adsorption isotherm and its hysteresis.	**07**
	(b)	Name any five industrial adsorbents and discuss their preparation methods.	**07**
		OR	
Q.3	**(a)**	Write a short note on ion exchange emphasizing its principles, equilibria and applications.	**07**
	(b)	Discuss in brief with neat sketch the adsorption wave.	**07**
Q.4	**(a)**	Derive and discuss the mechanism for cross circulation drying.	**07**
	(b)	State and discuss various equations for time of drying under constant drying and falling rate period.	**07**
		OR	
Q.4	**(a)**	State the classification of rotary driers and explain anyone of them in brief.	**07**

	(b)	A 100 kg batch of granular solids containing 30% moisture is to be dried in a tray dryer to 16% moisture by passing a current of air at 350 K across its surface at a velocity of 1.8 m/s. If the constant rate of drying under these conditions is 0.7×10^{-3} kg/m^2.s, if the critical moisture content is 15%, calculate the drying time. Given that the surface area available for drying is 0.03 m^2/kg dry solid.	**07**
Q.5	**(a)**	A benzene (A) – gas (B) mixture is saturated at 1 standard atmosphere and 50 ^{0}C temperature. Calculate the absolute humidity if gas B is chosen as nitrogen and carbon dioxide. Vapor pressure of nitrogen at 50 ^{0}C = 0.362 std atm.	**07**
	(b)	Define and discuss with suitable equations the following terms: i) Humid Volume ii) Humid Heat iii) Enthalpy	**07**

OR

Q.5	**(a)**	Explain the concept of wet bulb temperature with neat sketch. Also derive the relation in terms of wet bulb depression. Also write the physical significance of wet bulb depression = 10 ^{0}C.	**07**
	(b)	Enlist the various cooling towers used in industries and explain any one of them with neat sketch.	**07**

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