GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– VI (New) EXAMINATION – WINTER 2019

Subject Code: 2160501   **Date: 04/12/2019**

Subject Name: Mass Transfer Operation - 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.**

			MARKS
Q.1	(a)	List assumptions of McCabe-Thiele method and its limitations.	03
	(b)	Write short note on adsorbents with their characteristics. Also state few industrial applications of adsorption.	04
	(c)	A mixture of 45 mol% Benzene and remaining Toluene is continuously fractioned in a tower. Feed is liquid at its boiling point and is introduced at 5 kmol/s rate. This gives 98 % benzene in distillate and 98 % toluene in bottoms. Find amount of Distillate and Bottoms. Find minimum reflux ratio and number of plates when total reflux is used. Equilibrium data in mole fraction is given as:	07

x	1	0.78	0.58	0.41	0.26	0.13	0.017
y	1	0.9	0.78	0.63	0.49	0.26	0.039

Q.2	(a)	Explain constant pressure equilibria with neat sketch.	03
	(b)	With neat sketch, explain drum dryer.	04
	(c)	Carry out material balance for feed tray and derive equation for q line. How feed condition affects the q line? Draw and explain.	07
		OR	
	(c)	Give detailed classification of cooling towers and discuss about any one in detail with neat sketch.	07
Q.3	(a)	Briefly explain freeze drying.	03
	(b)	Discuss about various types of adsorption.	04
	(c)	Define saturated humidity, Humid heat and humid volume. A gas (B)–benzene (A) mixture is saturated at 1 std atm, 50° C. Calculate the absolute humidity if B is (a) nitrogen and (b) carbon dioxide. Vapor pressure of nitrogen at 50°C is given as 0.362 std atm.	07
		OR	
Q.3	(a)	Compare forced draft and induced draft cooling tower.	03
	(b)	Derive Rayleigh's equation for simple distillation.	04
	(c)	Write Freundlich equation and explain. Write material balance for a single stage adsorption and apply Freundlich equation in it.	07
Q.4	(a)	Define reflux ratio. Explain total and minimum reflux. How reflux ratio affects the number of stages.	03
	(b)	Discuss about the factors which affects the drying. How is drying different than evaporation?	04
	(c)	Explain Extractive distillation by citing proper example. Also write requirements of solvent to be used in distillation.	07
		OR	

Q.4	(a)	Define: Free Moisture, Grosvenor Humidity, Blowdown	03
	(b)	Explain ideality and Raoult's law. Also discuss about positive deviation.	04
	(c)	Derive equation for Adiabatic Saturation Curve.	07
Q.5	(a)	Briefly explain adsorption hysteresis.	03
	(b)	Write brief note on Pressure Swing Adsorption (PSA).	04
	(c)	A commercial dryer requires 6 hr to dry the moist material from 32 % to 8 % moisture on wet basis. The critical moisture content is 16 % (wet) and equilibrium moisture content is 0.05 kg moisture/kg dry solid. How much excess time is required to dry material from 37 % to 7 %, if the drying conditions remains the same.	07

OR

Q.5	(a)	Discuss about range and approach with reference to cooling tower.	03
	(b)	Discuss the principle of Ion Exchange and its application.	04
	(c)	Derive equation for time required in constant and falling rate drying.	07

****