Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2018

Subject Code:2160405   **Date:01/05/2018**

Subject Name:Principles of Process Engineering-III

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.**

			MARKS
Q.1	(a)	State assumptions of McCabe Thiele method to calculate number of stages.	03
	(b)	i. What is the effect of temperature and pressure on adsorption equillibria for gas-solid adsorption? ii. Mention Frieundlich- Adsorption isotherm.	04
	(c)	Define: i. Bound Moisture ii. Unbound Moisture iii. Free Moisture iv. Supersaturation v. Nucleation	07
Q.2	(a)	Explain Adsorption Hysteresis.	03
	(b)	Explain Clausius- Clapeyron Equation and state its usefulness.	04

	(c)	Explain the following terms for air- water system:
		  i. Absolute Humidty
		  ii. Dew point
		  iii. Dry bulb temperature
		  iv. Wet bulb
		  v. Humid volume
		  vi. Humid heat
		  vii. Saturated and unsaturated mixture.
			07

OR

	(c)	Explain multi- stage cross current adsorption operation with neat sketch and also determine the equation for intermediate concentration of liquid stream for minimum total adsorbent in case of 2- stage cross- current operation.	07
Q.3	(a)	Compare Azeotropic and Extractive distillation.	03
	(b)	Outline the McCabe-Thiele design method for obtaining number of theoretical trays by graphical method.	04
	(c)	A feed solution contains 100 moles of Benzene- Toluene mixture having 70 mol % benzene. One third of feed is vaporized. The total pressure is 1 atmosphere. Calculate the distillate and bottom composition by using flash distillation. Average relative volatility of solution mixture is 2.5.	07

OR

Q.3	(a)	What is reflux ratio? Write a note on different types of reflux ratio used in distillation?	03
	(b)	Define following: (1)Distillation (2) Adsorption (3) Ion Exchange (4) Drying	04

(c) The temperature of air in a room is 40.2 °C and the total pressure is 101.325 kPa absolute. **07**
The air contains water vapor with a partial pressure of 3.74 kPa. The vapor pressure of
water at this temperature is 7.415 kPa. Calculate the humidity, the saturation humidity,
percentage humidity and the percentage relative humidity.

Q.4 **(a)** Explain Tray Dryers in brief. **03**
(b) Explain rate of drying curve with a diagram. **04**
(c) A batch of solid is to be dried from initial moisture of 25% to final moisture of **07**
6% under the conditions of constant and falling rate of drying. The initial weight
of wet solid is 160 kg, and the drying surface is 1 m^2/40 kg dry weight. Determine
the time of drying. Note: The equilibrium moisture to be considered is: x*= 0.05
kg moisture/ kg dry solid. Table 1:

x (kg moisture/ kg dry solid.)	0.333	0.20	0.18	0.16	0.14	0.12	0.10	0.09	0.08	0.07	0.064
N *10^3	0.300	0.300	0.266	0.239	0.208	0.180	0.150	0.097	0.070	0.043	0.025
1/N * 10^{-3}	3.33	3.33	3.76	4.18	4.80	5.55	6.67	10.3	14.3	23.3	40.0

OR

Q.4 **(a)** Explain Freeze Drying in brief. **03**
(b) Explain Rotary Dryers. **04**
(c) Derive the relation to determine the time needed for constant & falling rate period of **07**
the batch drying operations.

Q.5 **(a)** Compare adiabetic saturation theory and wet bulb temperature theory. **03**
(b) State various types of cooling towers and their arrangements. **04**
(c) Explain differential distillation and derive Rayleigh equation. **07**

OR

Q.5 **(a)** Explain the stages of Crystallization in brief. **03**
(b) Explain Swenson- Walker Crystallizer in brief. **04**
(c) Derive Fenske's equation for the minimum number of theoretical stages. **07**

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