GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2024

Subject Code:3160501   **Date:15-05-2024**
Subject Name:Mass Transfer Operations 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)	Define: 1) Absolute Humidity 2) Unbound Moisture 3) Humid Volume	03
	(b)	Generally, adsorption is preferable at low temperature and high pressure. True or false. Justify.	04
	(c)	Enlist various types of distillation in brief and explain azeotropic distillation in detail.	07

Q.2	(a)	Classify drying equipment in depth.	03
	(b)	Explain q line for distillation. Also derive equation for q-line.	04
	(c)	A fractional column separates a liquid mixture entering at 5000 kmol/h containing 50 mole % A and rest B into an overhead product of 95 mole % A and a bottom product of 96 % mole B. R = 2R$_{min}$ is used and feed enters at boiling point. Determine number of theoretical stages required and feed point location.	07

x	0.03	0.06	0.11	0.14	0.26	0.39	0.53	0.66	0.76	0.86	1
y	0.08	0.16	0.27	0.33	0.50	0.63	0.71	0.83	0.88	0.93	1

OR

	(c)	It is desired to separate a mixture of 50 % vapor and 50 % liquid in a plate type ditillation column. The feed contains 45 mole % A and top product has 96 mole % A whereas bottom product has 5 mole % A. Determine minimum reflux ratio and number of theoretical plates needed if reflux ratio is twice the minimum is used.	07

x	0	0.1	0.16	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
y	0	0.215	0.30	0.52	0.625	0.725	0.78	0.89	0.89	0.95	1

Q.3	(a)	Steam distillation takes place at reduced temperature. Justify. Also explain the reason behind the same.	03
	(b)	Classify cooling towers in detail.	04
	(c)	Explain principle and working of fluidized bed dryer with neat sketch.	07

OR

Q.3	(a)	Briefly explain steam distillation by stating proper example.	03
	(b)	Distillation tower can not be operated at minimum reflux or total reflux. Justify.	04
	(c)	Derive equation for retention time in continuous dryer at low temperature.	07

Q.4	(a)	Discuss about the different factors affecting drying operation.	03

(b) Explain equilibrium with reference to adsorption. State characteristics of adsorbent as well. **04**

(c) A woolen cloth is dried in hot air dryer from 100 % to 10 % moisture. If the equilibrium and critical moisture content is 6 % and 55 % respectively. Estimate the reduction in time needed to dry the solid to 16 % moisture instead of 10 % under the same conditions. (All the moisture contents are on dry basis) **07**
Also mention major applications of drying and resistances acting while drying.

OR

Q.4 **(a)** Define: 1) Relative humidity, 2) Humid heat, 3) Dew point **03**

(b) Explain principles of ion exchange in brief. Also list its applications. **04**

(c) Explain the theory of adiabatic saturation temperature and derive the equation for adiabatic saturation temperature. **07**

Q.5 **(a)** Brief about optimum reflux ratio. **03**

(b) Explain moisture movement mechanism within solid for drying. **04**

(c) Explain Freundlich equation. Derive the relation for two stage counter current adsorption using the Freundlich equation. **07**

OR

Q.5 **(a)** Brief about elution and chromatography. **03**

(b) Explain range and approach with reference to cooling tower. Also explain losses taking place in cooling tower. **04**

(c) In detail explain about Pressure Swing Adsorption. Also cite few industrial examples of the same. **07**

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