## GUJARAT TECHNOLOGICAL UNIVERSITY **BE - SEMESTER-VI • EXAMINATION - WINTER • 2014**

Subject Code: 160405 Subject Name: Principles of Process Engineering-III Time:02:30 pm - 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.
- Differentiate between dry-bulb temperature, wet bulb temperature and dew **Q.1** 07 (a) point. Also derive the relation for wet-bulb depression using concepts of film theory and wet-bulb temperature.
  - An air water vapour mixture has a dry bulb temperature of 55° C & Dew point **(b)** 07 temp. of  $40^{\circ}$  C at 1 atm total pressure. Using psychometric chart, determine :
    - i) Absolute humidity
    - ii) Saturation humidity
    - iii) Wet -bulb temperature
    - iv) Percentage humidity
    - v) Relative humidity
    - vi) Humid volume

Also indicate above quantities on chart.

- With special reference to Frenundlich adsorption isotherm, explain adsorption of Q.2 **(a)** 07 solute from dilute liquid solutions in detail.
  - **(b)** Write a short note on :
    - i) Adsorption hysteresis
    - ii) Heat of adsorption
    - ii) Adsorption from concentrated liquid solutions

## OR

- **(b)** Explain single-stage adsorption operation with the help of neat diagram and 07 graphs. Also, apply Frenundlich equation to the same.
- A feed solution contains 100 moles of Benzene- Toluene mixture having 70 mol % Q.3 **(a)** 07 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.
  - Explain positive deviations from ideality and minimum boiling mixture **(b)** 07 azeotropes.

## OR

A Continuous column, having rectifying section and stripping section is designed Q.3 12 **(a)** to separate 50 mol % n-heptane with the distillate product containing 98 mol % heptanes and the water product containing 98 mol % n-octane. The feed is at its boiling point and tower operates at 1 atmosphere pressure. Calculate minimum reflux ratio, minimum number of theoretical plates, If a reflux ratio is 1.5 times minimum reflux is to be used, How many theoretical plates will be required. Equilibrium data are as follows:

Х	0.10	0.30	0.50	0.70	0.90
у	0.195	0.585	0.690	0.840	0.950

x and y are mole fractions of n-heptane.

Explain significance of Reflux ratio. **(b)** 

## Date: 03/12/2014

07

(a)	Explain Swenson walker crystallizer with neat sketch.	
<b>(b)</b>	Derive the equation for q-line. Also, draw the feed line on equilibrium diagram	
	for various values of q.	
	OR	
<b>(a)</b>	Explain Azeotropic Distillation with neat diagram.	07
<b>(b</b> )	Explain Hysteresis curve in drying operation.	07
	Explain construction, working, advantages & disadvantages of spray drier.	14
	OR	
<b>(a)</b>	Explain concept of freeze drying and its applications in biotechnology.	07
<b>(b)</b>	Explain rate of drying curve for both constant rate period and falling rate period.	07
	<ul> <li>(a)</li> <li>(b)</li> <li>(a)</li> <li>(b)</li> </ul>	<ul> <li>(a) Explain Swenson walker crystallizer with neat sketch.</li> <li>(b) Derive the equation for q-line. Also, draw the feed line on equilibrium diagram for various values of q.</li> <li>OR</li> <li>(a) Explain Azeotropic Distillation with neat diagram.</li> <li>(b) Explain Hysteresis curve in drying operation.</li> <li>Explain construction, working, advantages &amp; disadvantages of spray drier.</li> <li>OR</li> <li>(a) Explain concept of freeze drying and its applications in biotechnology.</li> <li>(b) Explain rate of drying curve for both constant rate period and falling rate period.</li> </ul>

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