

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI • EXAMINATION – WINTER • 2014****Subject Code: 160405****Date: 03/12/2014****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.

- Q.1 (a)** Differentiate between dry-bulb temperature, wet bulb temperature and dew point. Also derive the relation for wet-bulb depression using concepts of film theory and wet-bulb temperature. **07**
- (b)** An air water vapour mixture has a dry bulb temperature of 55°C & Dew point temp. of 40°C at 1 atm total pressure. Using psychometric chart, determine : **07**
- 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.

- Q.2 (a)** With special reference to Frenundlich adsorption isotherm, explain adsorption of solute from dilute liquid solutions in detail. **07**
- (b)** Write a short note on : **07**
- 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 graphs. Also, apply Frenundlich equation to the same. **07**
- Q.3 (a)** 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**
- (b)** Explain positive deviations from ideality and minimum boiling mixture azeotropes. **07**

OR

- Q.3 (a)** A Continuous column, having rectifying section and stripping section is designed 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: **12**

x	0.10	0.30	0.50	0.70	0.90
y	0.195	0.585	0.690	0.840	0.950

x and y are mole fractions of n-heptane.

- (b)** Explain significance of Reflux ratio. **02**

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| Q.4 | (a) | Explain Swenson walker crystallizer with neat sketch. | 07 |
| | (b) | Derive the equation for q-line. Also, draw the feed line on equilibrium diagram for various values of q. | 07 |
| OR | | | |
| Q.4 | (a) | Explain Azeotropic Distillation with neat diagram. | 07 |
| | (b) | Explain Hysteresis curve in drying operation. | 07 |
| Q.5 | | Explain construction, working, advantages & disadvantages of spray drier. | 14 |
| OR | | | |
| Q.5 | (a) | Explain concept of freeze drying and its applications in biotechnology. | 07 |
| | (b) | Explain rate of drying curve for both constant rate period and falling rate period. | 07 |

