

GUJARAT TECHNOLOGICAL UNIVERSITY
B E Sem-VI Examination May 2011

Subject code: 160501

Subject Name: Mass Transfer Operations - II

Date: 16/05/2011

Time: 10.30 am – 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.

- Q.1** (a) Describe extractive distillation in detail. **07**
 (b) Explain the Flash vaporization in detail. **07**

- Q.2** (a) Discuss types of adsorption and nature of adsorbents in detail **07**
 (b) Discuss differential distillation in detail. Also, derive Rayleigh Equation for binary mixture. **07**

OR

- (b) Define quantity 'q'. Derive equation for q-line and discuss location of 'q' line for typical feed condition in brief.. **07**

- Q.3** 1000 kg moles/hr of an ethanol propanol mixture containing 65 moles per cent ethanol is to be separated in a continuous plate column operating at 1 atm total pressure. The desired terminal composition in units of mole fraction of ethanol are: $x_D=0.92$ and $x_w=0.07$ **14**
 The feed is a saturated vapor and total condenser is used. When reflux flow rate is four times the amount of top product, find the number of theoretical plates required for the separation.
 Relative volatility of ethanol propanol system may be taken as 2.20.

OR

- Q.3** (a) Describe adsorption hysteresis. Also, explain effect of temperature on adsorption. **07**
 (b) Discuss about Principles, techniques and applications of ion exchange in detail. **07**
- Q.4** (a) Write a note on Water cooling towers. **07**
 (b) Define adiabatic saturation curve and derive equation for the same. **07**

OR

- Q.4** A plant requires 15 kg/s of cooling water to flow through its distillation equipment condensers, thereby removing 270 W from the condensers. The water will leave the condensers at 45°C. It is planned to cool the water for reuse by contact with air in an induced draft cooling tower. The design conditions are as follows: entering air at 30°C dry bulb, 24°C wet bulb temperature, water to be cooled within 5 °C of the inlet air wet bulb temperature, i.e., to 29°C; an air/water vapor ratio of 1.5 times the minimum. Makeup water will come from a well at 10°C, hardness 500 ppm dissolved solids. The circulating water is not to contain more than 2000 ppm hardness. For the packing to be used $K_y a$ is expected to be 0.90 kg/m³ s ΔY, for a liquid rate at least 2.7 kg/m² s and a gas rate 2.0 kg/m² s. Compute the dimension of the packed section. **14**

The entering air humidity: 0.016 kg water vapor/ kg dry air

The entering air enthalpy: 72000 kJ/ kg dry air

Air enthalpy data:

Sr No	t_{L_s} °C	H'*(equilibrium curve) J/ kg
1	29	100 000
2	32.5	114 000
3	35	129 800
4	37.5	147 000
5	40	166 800
6	42.5	191 000
7	45	216 000

- Q.5** (a) Describe the rotary driers in detail. **07**
(b) Explain design and working of spray dryer with figure. Also discuss benefits of spray drying in brief. **07**

OR

- Q.5** (a) Describe rate of drying curve in detail. **07**
(b) Write a note on direct driers. **07**
