

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – III • EXAMINATION – WINTER 2012****Subject code: 731602****Date: 26/12/2012****Subject Name: Computer Aided Product and Process Design****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) Explain Geometrical concept for Attainable Regions with example and discuss its importance in reactor design. **07**
- (b) Define cycle time for design and scheduling of batch plant. Discuss effect of transfer policies on cycle with Gant chart. **07**

- Q.2** (a) Synthesize a process to separate a 70 mole% mixture of n-butanol and water. Is there a second readily apparent process or not? Explain. How does it compare to the process for a 15% feed? **07**
- (b) Explain Marginal Vapour flows and show how it will be useful for predicting the best sequence of distillation columns. **07**

OR

- (b) Explain superstructure concept and its implementation for optimization of reactor network synthesis. **07**
- Q.3** (a) You are to separate the following relatively ideally behaving mixture of A, B and C. The feed is at its bubble point of 345.8 K at 1 bar. Feed contains 50 kmol/hr A, 100 kmol/hr B and 30 kmol/hr C. The Antoine constants for A are 11.1, 3000, -70, for B are 10.2, 2800, -70, and for C are 10,3000, -70; where T is in K and pressure is in bar. Which sequence is better, direct or indirect? Why? **07**
- (b) Discuss the criteria of selection of Tray tower and Falling film scrubber as absorption equipments. **07**

OR

- Q.3** (a) Write a generalize MILP model for synthesizing distillation sequences for any mixture of n components that is to be separated into pure components. **07**
- (b) Discuss the Tridiagonal Metrix method for the multi component distillation. **07**

- Q.4** Discuss Theile-Geddes method for multicomponent distillation . **14**

OR

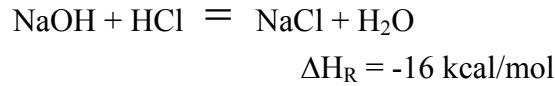
- Q.4** Discuss Lewis-Mathason method for multicomponent distillation . **14**

Q.5

Packed tower type scrubber is required for the following duty.

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- (i) Feed gas : 80 kg/h HCl + 240 kg/h air
- (ii) Solvent : 10% NaOH solution
- (iii) Specific heat of solvent : 0.9 kcal/(kg.°C)
- (iii) Concentration of Cl₂ in exit gas : 40 ppm
- (iv) Chemical Reactions :



Calculate :

- (a) Amount of solvent required. Tower diameter required for this scrubber is 0.4 m.
- (b) Calculate the number of overall gas phase transfer unit.
- (c) Calculate the height of packing required. Mass transfer coefficient, $k_{Ga}=150 \text{ kmol}/(\text{m}^3 \cdot \text{h})$.
Atomic mass of Na:23, O:16, H:1, Cl:35.5

OR

Q.5

Write short notes on any two of following.

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- i** PROS and CONS of vacuum distillation.
- ii** Advantages of horizontal position over vertical position and significance of 'Inverted U-Seal' in design of multicomponent condenser
- iii** Key components
