Seat No.: _____ Enrolment No._____

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. **14**

(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 Cl_2 in exit gas : 40 ppm
(iv) Chemical Reactions :

$$NaOH + HCl = NaCl + H_2O$$
$$\Delta H_R = -16 \text{ kcal/mol}$$

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 kmol/(m³.h).
Atomic mass of Na:23, O:16, H:1, Cl:35.5

OR

Q.5 **Write short notes on any two of following.** 14

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

****