Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – III • EXAMINATION – SUMMER • 2013

Subject code: 731602 **Date: 15-05-2013**

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)** Discuss advantages and disadvantages of vacuum distillation over atmospheric distillation. **07**

(b) Discuss Heuristics for designing separation processes. **07**

Q.2 **(a)** Explain superstructure concept and its implementation for optimization of reactor network synthesis. **07**

(b) Explain Marginal Vapour flows and show how it will be for predicting the best sequence of distillation columns. **07**

OR

(b) We have a mixture of five alcohols labeled as A, B, C, D and E with flows in the feed of 1, 0.5, 1, 7 and 10 mol/s respectively, for a total of 19.5 mol/s and relative volatilities are 4.3, 4, 3, 2, and 1 respectively. The information about marginal vapor flows estimated for non-key species are as under: **07**

	A	B	C	D	E
A/B	--	--	2.6	6.5	3.2
B/C	5.3	--	--	9.3	4.0
C/D	2.4	1.3	--	--	6.7
D/E	1.5	0.8	2.0	--	--

Find the best distillation based separation sequence.

Q.3 **(a)** Explain Geometrical concept for Attainable Regions for reaction mechanism of your choice excluding van de Vusse reaction. **07**

(b) Discuss the criteria of selection of falling film absorber and Venturi scrubber as absorption equipments. **07**

OR

Q.3 **(a)** Discuss the Tridiagonal Metrix method for the multi component distillation. **10**

(b) Discuss the significance of the use of sealing strip in multicomponent condenser. **04**

Q.4 Discuss Thiele Geddes method for multicomponent distillation . **14**

OR

Q-4 A saturated liquid, consisting of phenol and cresols with some xylenols, is fractioned to give a top product of 95.3 mole% phenol. Metacresol is heavy key and phenol is light key components. Total condenser is used. **14**

The composition of the top product and of the phenols in the bottoms are given.

(a) Complete the material balance over the column for a feed rate of 100 kmol/h.

(b) Calculate the minimum reflux ratio by Underwood's method.

(c) For $\boldsymbol{R = 3R_m}$, calculate the composition of vapour entering to the top most tray by Lewis–Matheson method.

Distillation Column Data and Relatie Volatilities values are given in following Table.

Component	a_{av}	Feed, mole %	Top product, mole %	Bottom product, mole %
Phenol	1.98	35	95.30	5.24
o – Cresol	1.59	15	4.55	?
m – Cresol	1.00	30	0.15	?
Xylenols	0.59	20	–	?
		100	100.00	

Q.5 (a) Discuss the step wise procedure for the process design of absorption tower involving chemical reaction. **14**

OR

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

i Calculation of shell side heat transfer coefficient by Bell's method

ii Advantages of horizontal position over vertical position

iii Selection of operating pressure in distillation column

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