

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 used 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 fractionated to give a top product of 95.3 mole% phenol. Metacresol is heavy key and phenol is light key components. Total condenser is used. 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 $R = 3R_m$, calculate the composition of vapour entering to the top most tray by Lewis–Matheson method.

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

Component	α_{av}	Feed, mole %	Top product, mole %	Bottom product, mole %
Phenol	1.98	35	95.30	5.24
<i>o</i> – Cresol	1.59	15	4.55	?
<i>m</i> – 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
