

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-VI Examination-Nov/Dec-2011

Subject code: 160505**Date: 30/11/2011****Subject Name: Computer Aided Process Synthesis****Time: 10.30 am -1.00 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) Briefly explain safety issues and design approaches towards safe chemical plant. **07****(b)** Briefly describe the role of computers in product and process design. **07****Q.2 (a)** Briefly describe the reactor network design using attainable region. **07****(b)** Write a short note on marginal vapor rate method. **07****OR****(b)** Draw and explain algorithm for establishing distillation column pressure and condenser type. **07****Q.3 (a)** To separate five components into five single component products, calculate: **07**

- (i) Number of sequences of ordinary distillation columns.
- (ii) Number of sequences using three different separation methods.

(b) Write a short note on selection of equipment for separation operation. **07****OR****Q.3 (a)** Draw rough sketch of residue curve map for ternary homogeneous mixture of component A, B and C. Pure component boiling points for component A, B and C are 55 °C, 69 °C and 81 °C, respectively. There is no binary or ternary azeotrope. Show the stable node, unstable node and saddle point in residue curve map. **07****(b)** Explain sizing of vessel in batch plant with suitable example. Discuss the possibility of optimization for given example. **07****Q.4 (a)** Explain threshold approach temperature and optimum approach temperature. **07****(b)** Two cold streams C1 and C2 are to be heated and two hot streams H1 and H2 are to be cooled without phase change. Find out minimum utility targets using temperature interval method. Use $\Delta T_{\min} = 10^\circ\text{C}$. **07**

Stream	T^s (°C)	T^t (°C)	$m C_p \left(\frac{\text{kJ}}{\text{s } ^\circ\text{C}} \right)$
C1	120	235	2
C2	180	240	4
H1	260	160	3
H2	250	130	1.5

OR

- Q.4 (a)** What is pinch point? Explain its importance in heat exchanger network synthesis giving step wise procedure to design heat exchanger network using pinch approach. **07**
- (b)** Using above stream data given in Q.4 (b) involving four streams, create linear programming problem to determine the minimum hot and cold utilities for a heat exchanger network. **07**

- Q.5 (a)** Explain the concept of multi effect distillation as possibility of energy integration. **07**
- (b)** Explain the cycle time and transfer policies (zero - wait, unlimited intermediate storage and no - intermediate storage). With example show how transfer policy affects the cycle time. **07**

OR

- Q.5 (a)** Differentiate heat engines and heat pumps with example of each. **07**
- (b)** A given batch plant produces one single product for which stage 1 requires 8 hours/batch; stage 2, 4 hours/batch and stage 3, 7 hours/batch. If zero - wait transfer is used, what is the cycle time? How many parallel units should be placed in each stage to reduce the cycle time to 4 hours? **07**
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