Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- VIth SEMESTER–EXAMINATION – MAY- 2012

Subject code: 160505 **Date: 19/05/2012**

Subject Name: Computer Aided Process Synthesis

Time: 10:30 am – 01:30 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)** Show steps in Product and Process design in Chemical Engineering **04**

(b) Briefly explain safety considerations and design approaches towards safe chemical plant. **05**

(c) Briefly explain the concept of Attainable region for reactor network design. **05**

Q.2 **(a)** Explain Heat Exchanger Network Synthesis (HENS) giving an example. **06**

(b) What is Pinch point for HENS? Explain the terms Minimum approach temperature, Optimum approach temperature and Threshold approach temperature for HENS. **08**

OR

(b) For the Heat Exchanger Network Synthesis (HENS) problem following stream information is available: **08**

Stream	T in ºK	Tout ºK	FCp kW/ºK
Liquid, H1	430	340	15
Liquid, C1	310	395	7
Vapor, C2	370	460	32

Draw Composite Curve and find out minimum utility targets and pinch point for ΔT_{min} = 20 ºK.

Q.3 **(a)** Two cold streams, C1 and C2 are to be heated and two hot streams H1 and H2 are to be cooled without phase change. Their conditions and properties are as follows: **07**

	FCp (kW/ºC)	tin (ºC)	tout (ºC)
H1	3	260	160
H2	1.5	250	130
C1	2	120	235
C2	3	180	250

Calculate the smallest possible amounts of heating and cooling utilities for the above network. Use ΔT_{min} = 10 ºC.

(b) Design a Heat Exchanger Network using the above data of question Q.3 (a). **07**

OR

Q.3 **(a)** Discuss effect of operating pressure on TQ diagram for distillation column and explain the concept of multi-effect distillation as possibility of energy integration. **07**

(b) Explain the concepts of Heat Engine and Heat pump. Discuss scope of heat and power integration in chemical process plant using it. **07**

Q.4 **(a)** What do you mean by direct sequence and indirect sequence? Show all possible sequences of ordinary distillation columns to separate four components ABCD into four single component products A, B, C and D. **07**

Draw all sequences clearly showing direct and indirect sequence.

(b) Discuss criteria for selection of separation method **07**

OR

Q.4 **(a)** Explain algorithm for establishing distillation column pressure and condenser type. **07**

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

Q.5 **(a)** Discuss sizing of vessels in batch plan with example. **06**

(b) Given the processing times for three products A, B, C, determine makespan and cycle time for manufacturing two batches of A, one of B and one of C in AABC and BAAC sequence using (a) Zero wait policy (b) No intermediate storage policy (c) Unlimited intermediate storage policy. **08**

	Processing Times(hr)		
	Stage 1	Stage 2	Stage 3
A	5	4	3
B	3	1	3
C	4	3	2
	Zero cleanup times		

OR

Q.5 **(a)** Explain how parallel units and intermediate storage supports optimum utilization of resources for batch plant with fermentation separation system. **06**

(b) Explain terms cycle time and make span for single product and multiproduct batch plants. Discuss effect of transfer policies and overlapping / non-overlapping of operations on them with example showing gantt charts. **08**

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