Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(NEW) • EXAMINATION – WINTER 2016

Subject Code:2170507 **Date:29/11/2016**

Subject Name:Computer Aided Process Synthesis

Time:10.30 AM to 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)** Two cold streams C_1 and C_2 are to be heated and two hot streams H_1 and H_2 are to be cooled without phase change. Their conditions and properties are as follows: **07**

Stream	Tin (ºC)	Tout (ºC)	FCp (kW/ºC)
H_1	260	160	3
H_2	200	100	1.5
C_1	120	235	2
C_2	180	300	3

Calculate the smallest possible amount of heating and cooling utilities for the above network using temperature interval method. Use ΔT_{min} = 20 ºC.

(b) Discuss the pinch design approach for minimum utility requirements. **07**

Q.2 **(a)** 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**

(b) What is stream splitting? Explain how stream splitting can help in getting better design alternatives. **07**

OR

(b) Draw the stream matching diagram abovepinch temperature by considering pinch temperature in hot stream 125^0C from the data given as follows. Assume $\Delta T_{min} = 13^0$C. **07**

Stream	Source,Ts (^{0}C)	Target,T_t (^{0}C)	MC_p (kW/^{0}C)
H1	175	45	10
H2	125	65	40
C1	20	155	20
C2	40	112	15

Q.3 **(a)** Write a short note on threshold approach temperature and optimum approach temperature for heat exchanger networks. **07**

(b) With a neat sketch explain heat pumping, vapour recompression and reboiler flashing. **07**

OR

Q.3 **(a)** Explain the concept of multi effect distillation as possibility of energy integration. **07**

(b) Explain reactor design for complex configurations. **07**

Q.4 **(a)** Write a short note on geometric concepts for reactor attainable region. **07**

(b) Show steps in product and process design in chemical engineering. **07**

OR

Q.4 **(a)** Briefly describe the role of computers in product and process design. **07**

(b) Discuss criteria for selection of separation methods. **07**

Q.5 **(a)** Discuss design of single product processing sequences. **07**

(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.

OR

Q.5 **(a)** Given the processing times for these products A, B, C, below. Determine with a Gantt Chart the make span and cycle time for manufacturing two batches of A, 1 of B and 1 of C for the following cases. **07**

i. Zero-Wait policy with sequence AABC.

ii. Same as i) but with no intermediate storage policy (NIC)

iii. Same as i) but with unlimited intermediate storage policy (UIS)

(Processing Times hr)			
	Stage 1	**Stage 2**	**Stage 3**
A	5	4	3
B	3	1	3
C	4	3	2
Zero Cleanup Times			

(b) Explain algorithm for establishing distillation column pressure and condenser type. **07**

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