

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

### BE - SEMESTER-VII(NEW) EXAMINATION – SUMMER 2019

**Subject Code:2170507**
**Date:18/05/2019**
**Subject Name:Computer Aided Process Synthesis**
**Time:02:30 PM TO 05:00 PM**
**Total Marks: 70**
**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**MARKS**

- Q.1** (a) What is pinch point? Explain its importance to design heat exchanger network using pinch design approach. **03**
- (b) Explain role of GCC in design of HEN. **04**
- (c) Explain the concept of threshold approach temperature and optimum approach temperature. **07**

- Q.2** (a) Discuss heuristics for selection of separation methods. **03**
- (b) With suitable example explain the concept of breaking heat loops to reduce number of heat exchangers in HEN. **04**
- (c) Explain positioning of heat engines and heat pumps relative to pinch. **07**

**OR**

- (c) Design HEN, with minimum numbers of heat exchangers that satisfy  $\Delta T_{\min} = 10^{\circ}\text{C}$  and hot utility MER targets of 300 kW, for three streams on hot side of the pinch. **07**

Stream	$T_{\text{in}} (^{\circ}\text{C})$	$T_{\text{out}} (^{\circ}\text{C})$	FCp (kW/ $^{\circ}\text{C}$ )
C1	90	190	10
H1	200	100	5
H2	150	100	4

- Q.3** (a) Discuss vapour recompression with respect to heat integrated distillation column. **03**
- (b) Briefly describe design approaches toward safe chemical plants. **04**
- (c) A mixture of four alcohols labeled as A, B, C, and D with flows in the feed of 1.05, 0.5, 1.2 and 7 mol/s respectively, for a total 9.75 mol/s and relative volatiles are 3.4, 2.5, 2 and 1 respectively. The information about marginal vapor flows estimated for non-key species are as under, Find the best distillation based separation sequence. Calculate number of possible sequence to separate four components and Draw direct and indirect sequences for same. **07**

	A	B	C	D
A/B	--	--	2.53	3.59
B/C	3.11	--	--	5.6
C/D	1.88	1.25	--	--

**OR**

- Q.3** (a) Explain separation sequencing for Solid-Fluid systems. **03**
- (b) Discuss the ethics of chemical engineer. **04**

- (c) Use the marginal vapor rate (MV) method to determine a sequence for the separation of alcohol mixture. Give rank to various sequences. Calculate no. of possible sequence for five components. **07**

Sep.	MV	Sep.	MV	Sep.	MV	Sep.	MV	Sep.	MV
A/BCDE	12.3	ABC/DE	10.4	B/CDE	13.2	BCD/E	2.8	A/B	0
AB/CD	14	C/DE	6.7	B/CD	9.5	A/BC	2.6	B/C	0
AB/CDE	18.3	ABCD/E	4.3	BC/DE	8.2	A/BCD	9.1	C/D	0
ABC/D	3.6	CD/E	2.1	BC/D	1.3	AB/C	5.5	D/E	0

- Q.4** (a) Discuss the residue curve map. **03**  
 (b) Differentiate Flow shop plant and Job shop plant. **04**  
 (c) Explain the step wise procedure for construction of attainable region. **07**

**OR**

- Q.4** (a) List the environmental factors to be considered in process design. **03**  
 (b) Explain the concept of reboiler flashing and vapor recompression in distillation configuration. **04**  
 (c) List out various methods to calculate MER targets. Explain any one in detail with suitable example. **07**

- Q.5** (a) Define with example : Cycle time, Make span, Flow shop plant. **03**  
 (b) Explain transshipment model for stream matching. **04**  
 (c) Explain algorithm for establishing distillation column pressure and condenser type. **07**

**OR**

- Q.5** (a) Discuss role of computers in Process Design. **03**  
 (b) Discuss on types of plants in multiple product batch plants. **04**  
 (c) Discuss reactor designs used for handling large adiabatic changes in temperature. **07**

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