Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- VII EXAMINATION-SUMMER 2023

Subject Code: 3170507 Date: 21/06/2023

Subject Name: Computer Aided Process Synthesis

Time: 10:30 AM TO 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.**
4. **Simple and non-programmable scientific calculators are allowed.**

Marks

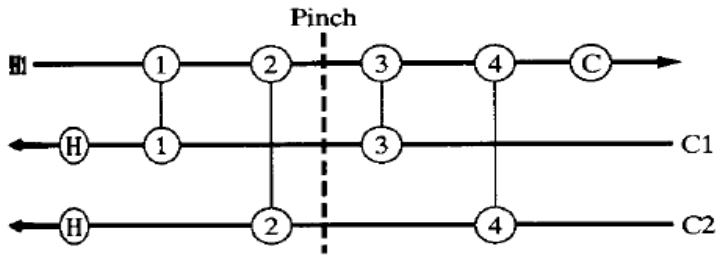
Q.1 **(a)** Describe threshold approach temperature. **03**

(b) Explain positioning of distillation towers between hot and cold composite curves. **04**

(c) Design a heat exchanger network for following data. Take ΔT_{min} = 15 K, Minimum hot utility = 9.5 KW, Minimum cold utility = 12 KW, Cold pinch temperature = 413 K **07**

Stream	T^S K	T^t K	mC_P KW/K
H1	473	353	0.25
H2	523	313	0.15
C1	413	503	0.3
C2	293	453	0.2

Q.2 **(a)** Decide minimum no. of heat exchanges required for following network and find loops. **03**



(b) Explain Grand Composite Curve for selection of the best utility resources while designing HENs. **04**

(c) Decide the minimum utility target for following stream data : Take ΔT min=10 K **07**

stream	Tin (K)	Tout (K)	mCp (KW/K)
H1	463	293	2.5
H2	413	323	20
C1	363	443	20
C2	303	393	5

OR

(c) Decide the minimum utility target for following stream data : Take ΔT min=15 K **07**

stream	Tin (K)	Tout (K)	mCp (KW/K)
H1	463	293	2.5
H2	413	323	20
C1	363	443	20
C2	303	393	5

03

Q.3 **(a)** Sketch the residue curve map for following data :

Component	Boiling point, K
A	329.2
B	337.7
C	334.2
Binary azeotrope(A+B)	328.7
Binary azeotrope(A+C)	337.4
Binary azeotrope(B+C)	326.4
Ternary azeotrope	330.5

04

(b) List the environmental factors to be considered in process design.

(c) Show the all possible sequences for separation of mixture containing five components. **07**

OR

Q.3 **(a)** Sketch the residue curve map for following data : **03**

Component	Boiling point, K
A	351.5
B	373
C	383.6
Binary azeotrope(A+B)	351.2
Binary azeotrope(B+C)	357
Binary azeotrope(A+C)	349.7
Ternary azeotrope	347.4

04

(b) List the statements of Engineering Ethics.

(c) Show the all possible sequences for separation of mixture containing four components and describe marginal vapor rate method for determining the best sequence. **07**

Q.4 **(a)** Explain conditions for most economical operation of distillation column. **03**

(b) Compare LSF and LSR in distillation. **04**

(c) Explain 4 step procedures for construction of attainable region. **07**

OR

Q.4 **(a)** Explain Heuristics for determining favorable sequences of ordinary distillation column. **03**

(b) Compare vapor recompression and reboiler flashing in heat integration of distillation column. **04**

(c) Explain reactor network design using attainable region for van de Vusse kinetics. **07**

Q.5 **(a)** Construct three alternatives for the placement of heat engines. **03**

(b) Compare various transfer policies. **04**

(c) Develop Gantt charts for overlapping and non-overlapping operation and solve for cycle time and makespan for following data : **07**

Stage	Processing time (hr)
1	4

2	1
3	2
4	1

OR

Q.5 **(a)** Construct three alternatives for the placement of heat pumps. **03**

(b) Compare flowshop plant and jobshop plant. **04**

(c) Develop Gantt charts for following data and solve for cycle time and makespan for single product campaigns (AAABBB) and mixed product campaigns (ABABAB) considering ZW transfer policy. **07**

product	Stage 1	Stage 2
A	5	2
B	2	4