GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–VII EXAMINATION – WINTER 2025

Subject Code:3170507   **Date:13-11-2025**

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 effect of ΔT_{min} on utilities in heat exchanger network.	**03**
	(b)	Explain selection of operating pressure in distillation column.	**04**

(c) Decide the minimum utility target and pinch point using following stream data: Take ΔT_{min} = 15 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 exchangers required for following network and find any one loop.   **03**
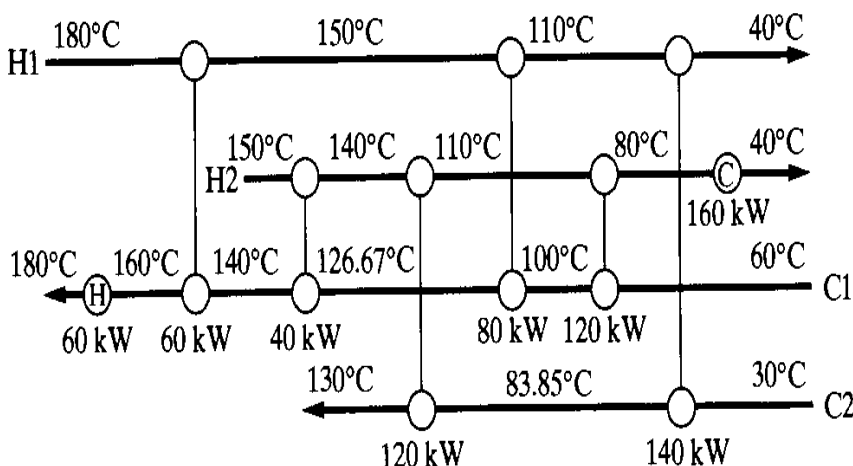
(b) Explain generalized rules for stream splitting on both sides of the pinch to satisfy MER requirements.   **04**

(c) Design a heat exchanger network for above pinch using following data. Take ΔT_{min} = 5 °C, Minimum hot utility =7.5 MW, Cold pinch temperature =140 °C   **07**

Stream	T^S °C	T^t °C	mC_P MW/°C
C1	20	180	0.2
H1	250	40	0.15
C2	140	230	0.3
H2	200	80	0.25

OR

(c) Design a heat exchanger network for below pinch using following data. Take $\Delta T_{min} = 5\ ^oC$, Minimum cold utility =10 MW, Cold pinch temperature =140 ^oC — **07**

Stream	$T^S\ ^oC$	$T^t\ ^oC$	mC_P MW/^oC
C1	20	180	0.2
H1	250	40	0.15
C2	140	230	0.3
H2	200	80	0.25

Q.3 **(a)** Calculate number of possible sequences of distillation columns for 6 numbers of products and show direct and indirect sequence. — **03**

(b) List statements of Engineering Ethics. — **04**

(c) Predict the best sequences using following vapor rate data : — **07**

Separation	Vapor rate, kmol/hr	Separation	Vapor rate, kmol/hr
A/B	1594	B/CD	921
A/BC	1757	AB/CD	1129
A/BCD	1934	C/D	2632
B/C	694	BC/D	3017
AB/C	925	ABC/D	3245

OR

Q.3 **(a)** Show any three complex and thermally coupled distillation columns for ternary system. — **03**

(b) List steps involved in Process Creation step during product and process design. — **04**

(c) Predict the best sequences using following vapor rate data : — **07**

Separation	Vapor rate, kmol/hr	Separation	Vapor rate, kmol/hr
A/B	70	B/CD	90
A/BC	130	AB/CD	120
A/BCD	100	C/D	220
B/C	100	BC/D	250
AB/C	140	ABC/D	240

Q.4 **(a)** Explain node and saddle point in residue curve map. — **03**

(b) Discuss heuristic for positioning of heat engine. — **04**

(c) Explain the construction of attainable region. — **07**

OR

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

(b) Discuss heuristic for positioning of heat pump. — **04**

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

Q.5 **(a)** Construct FS, LSF and LSR for multiple effect distillation columns. — **03**

(b) Discuss Overlapping operation and Non overlapping operation. — **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

OR

Q.5	**(a)**	Construct heat pumping, vapor recompression and reboiler flashing configuration in distillation column.	**03**
	(b)	Discuss Single product campaigns and Mixed product campaigns.	**04**
	(c)	Develop Gantt charts for following data and assuming zero cleanup time, determine the cycle time and makespan for zero wait policy and no intermediate storage policy for manufacturing of 2 batches of A, 1 of B and 1 of C.	**07**

Product	Processing time (hr)		
	Stage 1	Stage 2	Stage 3
A	5	4	3
B	3	1	3
C	4	3	2

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