Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2024

Subject Code:3170507 Date:19-11-2024

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)**	Briefly explain safety considerations and design approaches towards safe chemical plants.	**03**
	(b)	Explain the node and saddle point in the residue curve map.	**04**
	(c)	Explain Vapor Recompression, Reboiler Flashing, and Heat Pumping as an energy-saving alternative for distillation along with their limitations.	**07**
Q.2	**(a)**	Briefly describe the role of computer programs useful in product and process design.	**03**
	(b)	Explain reactor design for complex configurations .	**04**
	(c)	Write a short note on threshold and optimum approach temperatures for heat exchanger networks.	**07**
		OR	
	(c)	What is the pinch design approach for minimizing utility requirements?	**07**
Q.3	**(a)**	Discuss in detail the phase separation of the reactor effluent.	**03**
	(b)	List the steps involved in product and process design in algorithmic form.	**04**
	(c)	Could you provide detailed instructions on how to split streams on both sides of the pinch to ensure compliance with MER criteria?	**07**
		OR	
Q.3	**(a)**	Write a short note on environmental factors in process design.	**03**
	(b)	List the statements of engineering ethics.	**04**
	(c)	Apply the TI method and find the MER target for the following data and Design HEN for the hot side of the pinch. Take ΔT min = 10 ^oC	**07**

Stream	T^s ^oC	T^t ^oC	C (kW/^oC)
H1	180	60	3
H2	150	30	1
C1	30	135	2
C2	80	140	5

Q.4	**(a)**	Explain in detail common industrial separation methods.	**03**
	(b)	Explain multi-effect distillation.	**04**
	(c)	We have a mixture of four alcohols labeled as A, B, C, and D with flows in the feed of 1, 1, 3, and 5 mol/sec, respectively, for a total of 10 mol/sec and relative volatilities. The information about marginal vapour flows estimated for non-key species is as under. Find the best distillation-based separation sequence.	**07**

	A	B	C	D
A/B			26	30
B/C	150			50
C/D	80	100		

OR

Q.4 **(a)** Explain marginal vapor flows and show how it will be useful for predicting the best sequence of distillation columns. **03**

(b) Explain the positioning of heat engines relative to pinch. **04**

(c) Discuss the heuristics for determining the favorable sequence of distillation operation. **07**

Q.5 **(a)** Define: 1. Zero-Wait (ZW), 2. NO Intermediate storage (NIS) policy, 3. Unlimited Intermediate storage (UIS) policy **03**

(b) Differentiate Flowshop & Jobshop Plant **04**

(c) 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**

OR

Q.5 **(a)** Write the Thomson and King formula. **03**

(b) Compare overlapping and non-overlapping operations. **04**

(c) The processing times data for these products A and B are shown in the table. Determine with a Gantt Chart the makespan and cycle time for manufacturing one batch of A and B for the following cases: No intermediate storage (NIS) and Unlimited intermediate storage (UIS). **07**

Processing Times (hr)			
	Stage 1	**Stage 2**	**Stage 3**
A	6	4	3
B	3	2	2
Zero Cleanup Times			

****