Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI EXAMINATION – SUMMER 2025

Subject Code:3160506 Date:22-05-2025

Subject Name: Chemical Reactions Engineering I

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)**	Define rate constant with its significance.	**03**
	(b)	Define rate of reaction considering unit volume, mass and surface of solid in fluid solid system.	**04**
	(c)	Derive performance equation for steady state plug flow reactor.	**07**
Q.2	**(a)**	Derive equation for a unimolecular type first order reaction for constant volume batch reactor using integral method.	**03**
	(b)	Give brief about shifting order reaction.	**04**
	(c)	Give detail classification of reactions with example.	**07**
		OR	
	(c)	For the decomposition A $\rightarrow$R, C_{A0} = 1 mol/liter, in a batch reactor conversion is 75% after 1 hour, and is just complete after 2 hours. Find a rate equation to represent this kinetics.	**07**
Q.3	**(a)**	Write in brief about variables affecting rate of reactions.	**03**
	(b)	Discuss about various types of nonideality exists in different reactors.	**04**
	(c)	Derive the equation for half life using overall order of irreversible reaction.	**07**
		OR	
Q.3	**(a)**	The concentration readings in Table represent a continuous response to a pulse input into a closed vessel which is to be used as a chemical reactor. Calculate the mean residence time of fluid in the vessel.	**03**

Time, t min	0	5	10	15	20	25	30	35
Tracer output conc. C pulse, gm /liter	0	3	5	5	4	2	1	0

	(b)	Discuss autocatalytic reaction with conversion-time and rate-concentration Curves.	**04**
	(c)	Discuss optimum temperature progression in detail.	**07**
Q.4	**(a)**	Discuss parallel reactions with examples.	**03**
	(b)	Milk is pasteurized if it is heated to 63^{O}C for 30 min, but if it is heated to 74°C it only needs 15 sec for the same result. Find the activation energy of this sterilization process.	**04**
	(c)	Derive performance equation for steady state ideal batch reactor.	**07**
		OR	
Q.4	**(a)**	Explain recycle ratio and the performance equation of recycle plug flow reactors.	**03**
	(b)	Show the graphical representation of energy balance equation for adiabatic operation.	**04**

	(c)	Explain tracer experiment with equations for pulse response in non-ideal flow reactor with equations and curves.	**07**
Q.5	**(a)**	Define: Conversion, yield, space time.	**03**
	(b)	Explain differential method of analysis to find rate of reaction.	**04**
	(c)	Discuss qualitative product distribution for irreversible first order reaction in series.	**07**

OR

Q.5	**(a)**	Explain selectivity with its equation.	**03**
	(b)	Discuss about different size of mixed flow reactors in series.	**04**
	(c)	Differentiate between contacting patterns in continuous flow operations and noncontinuous operations for various combination of high and low concentration of reactants for maximizing the desired product.	**07**

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