Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022

Subject Code:3160506 Date:03/06/2022

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)**	Explain elementary reaction with example.	**03**
	(b)	Give difference between molecularity and order of reaction.	**04**
	(c)	Discuss the temperature dependence term from Arrhenius Law.	**07**
Q.2	**(a)**	What is activation energy? Explain the importance of activation energy in chemical reaction.	**03**
	(b)	Develop an expression that facilitates calculation of units of rate constant for any order. Give the unit of rate constant for first, second and third order reaction.	**04**
	(c)	Show that the time required for 99% conversion is double the time required for 90% conversion for first order irreversible, unimolecular reaction.	**07**
		OR	
	(c)	The first order reversible liquid reaction A↔R, C_{AO} = 0.5 mol/liter, C_{RO} = 0 ,takes place in a batch reactor. After 9 minutes, conversion of A is 30% while equilibrium conversion is 70%. Devise the rate equation for this reaction.	**07**
Q.3	**(a)**	What is bio-chemical reaction? Explain with example.	**03**
	(b)	Explain the procedure to determine the best system for a given conversion when two CSTR of different sizes are connected in series.	**04**
	(c)	Define and write about the advantages and disadvantages of Ideal batch reactor and also give industrial application of the same	**07**
		OR	
Q.3	**(a)**	Explain autocatalytic reaction with example.	**03**
	(b)	Discuss the stepwise procedure for differential method of analysis	**04**
	(c)	Define and write about the advantages and disadvantages of Ideal plug flow reactor and also give industrial application of the same	**07**
Q.4	**(a)**	Give detail classification of chemical reaction.	**03**
	(b)	Discuss the working of PFR in series and parallel connection.	**04**
	(c)	The rate equation of a chemical reaction is given as $-r_A = C_A^n$. On doubling the concentration of reactant, the rate of reaction triples. Find the reaction order.	**07**
		OR	

Q.4	**(a)**	Discuss the working of equal size CSTR in series.	**03**
	(b)	Give criteria for best arrangement of a set of ideal reactors.	**04**
	(c)	Derive equation for complete conversion for adiabatic operation.	**07**
Q.5	**(a)**	Sketch and explain RTD curves for Ideal Plug Flow Reactor and Ideal Mixed flow Reactor.	**03**
	(b)	Discuss the non-ideal flow patterns which may exist in Reactor and reactor deviates from ideal flow reactor.	**04**
	(c)	Derive the performance equation of Recycle reactor.	**07**
		OR	
Q.5	**(a)**	What is equilibrium conversion? Discuss	**03**
	(b)	What is effect of temperature and pressure on equilibrium conversion from thermodynamics?	**04**
	(c)	Dispersed non coalescing droplets [Cao = 2 mol/liter] react as per the reaction A→R with rate equation $-r_A = k\,C_A^2$, k=0.5 lit/(mol.min) as they pass through the contactor. Find the average concentration of A remaining in the droplets leaving the contactor. (Use E=0.50 for 1<t<3)	**07**

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