Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(NEW) EXAMINATION – SUMMER 2019

Subject Code:2173612 **Date:18/05/2019**

Subject Name:Fundamentals of Reaction Engineering

Time:02:30 PM TO 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	Differentiate order and molecularity of a reaction.	**03**
	(b)	What are the different ways in which rate of reaction is defined for a homogeneous system?	**04**
	(c)	Explain about various theories predicting temperature dependency for rate of a chemical reaction.	**07**
Q.2	**(a)**	On doubling the concentration of reactant rate of reaction triples. Estimate order of reaction	**03**
	(b)	What is a constant volume batch reactor	**04**
	(c)	Describe differential method of data analysis.	**07**
		OR	
	(c)	At 500 K the rate of a bimolecular react ion is ten times the rate at 400 K. Find the activation energy of this react ion using Arrhenius law and Collision theory.	**07**
Q.3	**(a)**	What is half life? Derive integrated form of rate expression for rate constant interms of half life time for first order reactions.	**03**
	(b)	Decomposition of a gas is of second order when initial concentration of gas is 5×10^{-4}mol/l, it is decomposed 40% in 50 min. Calculate the value of rate constant.	**04**
	(c)	Derive integrated form of rate expression for second order reaction of form $2A \rightarrow$ products, where total volume of reaction system varies linearly with conversion.	**07**
		OR	
Q.3	**(a)**	Differentiate Space time, holding time and residence time.	**03**
	(b)	In case of first order reaction, show that time required for 75% conversion is double the time required for 50% conversion.	**04**
	(c)	Derive the performance equation of a steady state plug flow reactor.	**07**
Q.4	**(a)**	Mention the physical significance to Damkohler number.	**03**
	(b)	Consider a gaseous feed $C_A = 100$, $C_{B0} = 200$ enters an isothermal flow reactor. For $X_A = 0.8$, find C_A, C_B and X_B	**04**
	(c)	A homogeneous second order liquid phase reaction is carried out in a mixed flow reactor. What will be conversion if this reactor is replaced by another mixed flow reactor having volume 6 times that of original reactor all else remain unchanged.	**07**
		OR	
Q.4	**(a)**	How selectivity is defined for systems batch and flow systems?	**03**
	(b)	Discuss regarding qualitative product distribution for reactions in parallel.	**04**
	(c)	How performance of mixed flow reactors and plug flow reactors can be generalized for a n^{th} order reactions?	**07**
Q.5	**(a)**	Define standard heat of reaction and combustion.	**03**
	(b)	What is equilibrium conversion? How is it related to equilibrium constant and temperature for case of a first order reversible reaction?	**04**

	(c)	For reversible first order aqueous reaction, A↔R, starting with pure A, kinetic experiments in a batch reactor gives 58.1 % conversion in 1 min at 65 °C and 60 % conversion in 10.1 min at 25 °C. Find the rate expression for this reaction.	**07**

OR

Q.5	**(a)**	Mention the essential properties of a catalyst and its classification.	**03**
	(b)	Discuss the effect of modifiers and promoters on the activity of catalyst	**04**
	(c)	Derive a rate law for decomposition of cumene from benzene and propylene, considering desorption of benzene as rate limiting from the surface of catalyst.	**07**

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