Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII EXAMINATION – SUMMER 2016

Subject Code:183502 **Date:05/05/2016**

Subject Name:Chemical Kinetics & Reaction Engineering

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.**

Q.1	**(a)**	An irreversible series reaction A →B is taking place in a constant volume batch reactor with rate expression $-r_A = kC_A^2$. Derive an expression to determine kinetics of this reaction.	**07**
	(b)	Explain Arhenious theory of temperature dependency along with activation energy and temperature sensitivity of reaction.	**07**
Q.2	**(a)**		
	1)	Liquid A decomposed by first-order kinetics, and in a batch reactor 50 % of A is converted in a 5-min run. How much longer it take to reach 75 % conversion?	**05**
	2)	Define molecularity and order of reaction.	**02**
	(b)	Explain reaction of shifting orders. Derive expression to determine its kinetics.	**07**
		OR	
	(b)	Explain Autocatalytic reactions. Derive expression to determine its kinetics.	**07**
Q.3	**(a)**	Write short note on classification of chemical reactions useful in reactor design.	**07**
	(b)	Explain variable volume reactor. Derive its expression to find kinetics for first order reaction.	**07**
		OR	
Q.3	**(a)**	Define reaction rate. Give various forms of rate equation.	**07**
	(b)	Gaseous reactant A decomposes as follows:	**07**

$$A \rightarrow 3R \qquad -r_A = (0.6\ \text{min}^{-1})\ C_A$$

Find the conversion of A in a 50% A–50% inert feed (υ_0 = 180 liter/min, C_{A0} = 300 milimol/liter) to a 1 m^3 mixed flow reactor.

Q.4	**(a)**	Write down steps for differential method of analysis and compare it with integral method of analysis.	**07**
	(b)	Consider a feed C_{A0} = 100, C_{B0} = 200, C_{i0}= 100 to a steady-flow reactor. The isothermal gas-phase reaction is A+3B → 6R. If C_A = 40 at the reactor exit, what is C_B, X_A, and X_B there?	**07**
		OR	
Q.4	**(a)**	What do you understand by instantaneous fractional yield and overall fractional yield of a product? Explain different contacting patterns for different concentration of reactant for non-continuous operations.	**07**
	(b)	Explain half life method to determine kinetics of reaction.	**07**
Q.5	**(a)**	Define ideal reactors. Explain the importance of reactor design with broad classification of reactor types.	**07**
	(b)	Write a short note on optimum temperature progression.	**07**
		OR	

Q.5	**(a)**	Starting from the first principles, obtain a design equation for Plug flow reactor.	**07**
	(b)	Write a short note on “Determination of Surface area for catalysts”.	**07**

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