Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2150403 **Date: 01/05/2017**

Subject Name: Basics 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		Short Questions	14
	1	Define selectivity.	
	2	Define space velocity.	
	3	Define space time.	
	4	Define molecularity.	
	5	Define yield.	
	6	A reaction has the stoichiometric equation A + 2B → 2R.What is the order of reaction?	
	7	Define autocatalytic reactions.	
	8	Rate of chemical reaction is independent of the concentration of reactants for ……order reaction.	
	9	If n is the order of reaction then unit of rate constant is……	
	10	Define Damkohler number.	
	11	Define multiple reactions.	
	12	Write performance equation of a CSTR.	
	13	Define equilibrium conversion.	
	14	What is the unit of frequency factor?	
Q.2	(a)	Show that for a first order irreversible reaction $\ln (1/(1 - X_A)) = kt$.	03
	(b)	Differentiate between elementary and non-elementary reactions.	04
	(c)	Classify chemical reactions and discuss the variables affecting the rate of reaction.	07
		OR	
	(c)	Write physical significance of activation energy. Also discuss temperature dependency of activation energy using Arrhenius theory.	07

Q.3	(a)	Define rate of reactions in different useful ways.	03
	(b)	Explain various ideal reactors with their characteristics.	04
	(c)	Derive the design equation of recycle reactor.	07

OR

Q.3	(a)	Mention in brief the steps to establish the mechanism of reaction of Non-elementary reactions.	03
	(b)	Differentiate between integral & differential method of analysis.	04
	(c)	Write a short note on optimum temperature progression.	07

Q.4	(a)	Write a brief note on variable volume batch reactor.	03
	(b)	In a batch reactor the conversion of a liquid reactant A is 70% in 13 minutes. Find the space time required to effect this conversion in a plug flow reactor and a mixed flow reactor. Assume first order kinetics.	04
	(c)	Derive the C_{Rmax} and t_{Rmax} for the first order reactions given below: $A \rightarrow R \rightarrow S$	07

OR

Q.4	(a)	On doubling the concentration of reactant, the rate of reaction triples. Find the reaction order.	03
	(b)	Explain half-life method for determination of kinetics of reactions.	04
	(c)	Derive the design equation for autocatalytic reactor.	07

Q.5	(a)	The half-life period for a certain first order reaction is 2.5×10^3 s. How long will it take 1/4 of the reactant to be behind?	03
	(b)	Find the conversion after 1 hour in a batch reactor for A $-r_A = 3C_A$, mol/lit.h, $C_{Ao} = 1$ mol/lit.	04
	(c)	Derive an equation for equal-size mixed flow reactors connected in series for first order reaction.	07

OR

Q.5	(a)	The rate constants of a certain reactions are 1.6×10^{-3} and 1.625×10^{-2} s^{-1} at 10°C and 30°C. Calculate the activation energy.	03
	(b)	Derive the performance equation of ideal plug flow reactor (PFR).	04
	(c)	Explain quantitative product distribution for mixed flow reactors for the reaction $A \rightarrow R \rightarrow S$.	07

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