GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 151301   **Date: 08/05/2017**

Subject Name: Elements of Chemical 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.**

Q.1	**(a)**	Discuss effects of concentration and temperature on the rate of reaction using Arrhenius Equation.	**07**
	(b)	Describe a method to find the rate constant and order of reaction from the power law type rate equations.	**07**
Q.2	**(a)**	Differentiate between elementary and non-elementary reactions.	**07**
	(b)	Define: (i) Homogeneous Reaction, (ii) Heterogeneous Reaction.	**07**
		OR	
	(b)	Give the classification of types of reactions.	**07**
Q.3	**(a)**	Differentiate between plug flow reactor and mix flow reactor.	**07**
	(b)	Write performance equation of Batch, CSTR and Plug flow reactor, explain each variable used in the equations.	**07**
		OR	
Q.3	**(a)**	Discuss the types of ideal reactors.	**07**
	(b)	The reaction A $\rightarrow$ B is carried in a batch reactor. The initial concentration is C_{A0} = 2.0 mol/litre. The conversion is 90%. Find the time required if the reaction is, (i) First order reaction, k = 0.01 s^{-1}, (ii) Second order reaction, k = 0.01 L $mol^{-1}s^{-1}$.	**07**

Q.4	**(a)**	In a catalytic decomposition of hydrogen peroxide the concentration changes with time following first order kinetics as follows:	**07**

Time, hr	0	10	20	30
Concentration, mol/litre	25.4	13.4	7.08	3.81

Determine the rate constant with correct unit.

	(b)	State the difference between step input and pulse input for RTD measurement.	**07**
		OR	
Q.4	**(a)**	Explain the relationship between F and E curves.	**07**
	(b)	The decomposition of NO_2 follows a second order rate equation. The reaction is $2NO_2 \rightarrow 2NO + O_2$. Data at different temperatures are as follows:	**07**

T (^{0}C)	319	330	354	378.5	383
k (cm^3/gmol - sec)	522	755	1700	4020	5030

Calculate the activation energy.

Q.5	**(a)**	Explain transition state theory.	**07**
	(b)	Draw a neat sketch of plug flow reactors in parallel with proper explanation.	**07**
		OR	
Q.5	**(a)**	Explain: i) Space time, ii) Space velocity	**07**
	(b)	Write a short note on temperature dependency from thermodynamics.	**07**

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