Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VIITH EXAMINATION – SUMMER 2015

Subject Code: 173601 **Date: 12/05/2015**

Subject Name: Basics of Catalysis

Time: 02.30PM-05.00PM **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)** Classify chemical reactions and discuss with example. **07**

(b) What are different methods for kinetic data analysis? Explain any one. **07**

Q.2 **(a)** For the reaction A→ R , second order kinetics and C_{A0} = 1 mol/lit, we get 50% conversion after one hour in a batch reactor. What will be the conversion and concentration of A after one hour if C_{A0} = 10 mol/lit. **07**

(b) Show that the decomposition of N_2O_5 at 340 K is a first order reaction. Calculate the value of the rate constant. **07**

Time , min	0	1	2	3	4
C_{N2O5} , mol/l	0.16	0.113	0.08	0.056	0.04

OR

(b) What do you understand by half life of a reaction? Derive an expression of half life for nth order reaction. **07**

Q.3 **(a)** Discuss mechanism of solid catalyzed reactions. **07**

(b) Derive an expression for the effectiveness factor of a rectangular slab (flat plate) of porous catalyst. (Assume edges are sealed so that diffusion occurs in one direction only). **07**

OR

Q.3 **(a)** Discuss method of preparing Catalysts. **07**

(b) For kinetics of fluid-solid catalyzed reaction, write about “Adsorption isotherm”. **07**

Q.4 **(a)** Derive a performance equation for Mixed flow reactor (MFR) containing solid catalyst with neat and clean diagram and shows how it’s different from simple performance equation **07**

(b) What do you mean by inhibitor? Explain competitive and non competitive inhibition. **07**

OR

Q.4 **(a)** Enzyme E catalyzes the transformation of reactant A to product R as follows: **07**

$$A \xrightarrow{E} R$$

$$-rA = \frac{200\, C_A C_{E0}}{1+0.5\, C_A} \quad \frac{mol}{lit*min}$$

if we introduce enzyme (C_{E0} =0.001 mol/lit) and reactant (CA_0= 10 mol/lit) into a batch reactor a let the reaction proceed. Find the time required for the concentration of reactant to drop to 0.025 mol/lit. Note that the concentration of enzyme remains unchanged during the reaction.

(b) Explain Temperature-Time Trajectories. **07**

Q.5 **(a)** Differentiate the fixed bed and fluidized bed reactor with figure. **07**

(b) A reaction $2\,HI(g) \rightarrow H_2(g) + I_2(g)$ is studied over a range of temperatures. The results obtained are tabulated below: **07**

Temperature, K	**633**	**666**	**697**	**715**	**781**
Rate constant k,[lit/mol.s]	**1.7×10^{-5}**	**1.07×10^{-4}**	**5.01×10^{-4}**	**1.05×10^{-3}**	**1.51×10^{-3}**

Find out the value of activation energy graphically using the given data

OR

(a) Write a short note on heat effects encountered in fluid- solid catalyzed reaction **07**

(b) Define activation energy of a reaction and explain the Arrhenius law **07**

****