

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2022****Subject Code:3163612****Date:03/06/2022****Subject Name:Fundamentals of 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.
4. Simple and non-programmable scientific calculators are allowed.

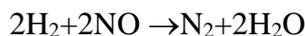
MARKS

- Q.1**
- (a) What are the different methods for testing kinetic mode? Explain one method. **03**
- (b) Write and explain material and energy balance equation with chemical reaction. **04**
- (c) Derive the design equation of the ideal batch reactor. **07**

- Q.2**
- (a) Differentiate between elementary and non-elementary reactions **03**
- (b) Explain the size comparison of single ideal CSTR with PFR and mention the different parameter affecting the sizes of the reactor. **04**
- (c) Define ideal reactors. Explain the importance of reactor design with broad classification of reactor types. **07**

OR

- (c) Find the overall order of the irreversible reaction **07**



From the following constant volume data using equimolar amount of hydrogen and nitric oxide.

Total Press., mm Hg	200	240	280	320	360
Half-life, Sec	265	186	115	104	67

- Q.3**
- (a) Explain in detail free radicals reaction mechanism. **03**
- (b) Continuous stream of gaseous enters a vessel at temperature $T_0=400$ K, $P_0=4$ atm, reacts there and leaves at $T=300$ K, $P=3$ atm and $C_{A0}=100$, $C_{B0}=200$, $A+B \rightarrow 2R$ find X_A , X_B . **04**
- (c) What are the different ideal reactors? Derive the performance equation of Ideal Plug flow reactor (PFR). **07**

OR

- Q.3**
- (a) Define and Explain single and multiple reactions. **03**
- (b) Define recycle ration. Derive the performance equation of recycle reactor. **04**
- (c) Find the conversion after 1 hr. in a batch reactor for $A \rightarrow R$, $-r_A=3C_A^{0.5}$ mol/lit-hr and $C_{A0}=1$ mol/l. **07**
- Q.4**
- (a) Differentiate between rate of reaction and order of the reactions. **03**
- (b) Derive the rate expression for first order irreversible reaction. **04**

- (c) Explain the temperature dependency term in the rate equation using thermodynamics and collision theory. **07**
- OR**
- Q.4** (a) Write short notes on Activation Energy **03**
- (b) What is instantaneous yield and over all fractional yield of the reaction. **04**
- (c) Derive the performance equation of steady state Mixed Flow Reactor for the first order reaction with change in density case. **07**
- Q.5** (a) Define and Explain Molecularity and order of reaction **03**
- (b) Derive the performance equation of Ideal Mixed Flow Reactor (MFR). **04**
- (c) The activation energy of a chemical reaction is 17982 cal/mol in the absence of a catalyst, and 11980 cal/mol with a catalyst. By how much times will the rate of the reaction will grow in the presence of catalyst, if a reaction proceeds at 25 °C **07**
- OR**
- Q.5** (a) Define and Explain Space time and Space Velocity **03**
- (b) Show that total volume required is minimum when two equal sizes CSTR is connected in series. **04**
- (c) Substance A reacts according to second-order kinetics. 95% conversion of A is achieved in a single flow reactor. We buy a second reactor identical to the first. For the same 95% conversion, by how much is the capacity increased if we operate these two Plug flow reactor in series. **07**
