

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2023****Subject Code:3173518****Date:08-12-2023****Subject Name: Basics of Reaction Engineering and Thermodynamics****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 is meant by activation energy? How is it related to energy released from a reaction?	03
	(b) What are the main differences between order and molecularity of a reaction?	04
	(c) With suitable examples mention the various classification of reactions.	07
Q.2	(a) Differentiate Arrhenius theory from Collision theory in describing about the rate of a reaction.	03
	(b) How half life method can be used to interpret the kinetics of reaction?	04
	(c) Determine the value of first order rate constant for disappearance of A in the gas phase reaction $2A \rightarrow P$ if on holding the pressure constant the volume of reaction mixture starting with 80% mole A and 20 mole % Inerts decreases by 20% in 3 minutes.	07
	OR	
	(c) At 500 K the rate of a bimolecular reaction is ten times as that at 400 K. Find the activation energy for this reaction from Arrhenius law.	07
Q.3	(a) Mention the difference between space time, space time and holding time for continuous reactors.	03
	(b) For a gaseous feed having $C_{A0} = 100$, $C_{B0} = 200$ enters a isothermal flow reactor having $X_A = 0.8$. Find C_A , C_B , and X_B	04
	(c) Discuss in detail how analysis of total pressure data analysis can be carried out in Constant volume system.	07
	OR	
Q.3	(a) Mention about the advantages and disadvantages of batch reactor.	03
	(b) Liquid A decomposes by second order kinetics and in a batch reactor 50% of A is converted in 5 minutes. How long will it take to reach 75% conversion?	04
	(c) Derive the performance equation of PFR from first principles.	07
Q.4	(a) How Selectivity is different from fractional yield considering quantitative product distribution?	03
	(b) Specify the differences between reversible and irreversible process.	04
	(c) Prove that for N - CSTR's connected in series the performance of overall system will approach to that of PFR.	07
	OR	
Q.4	(a) Mention the assumptions involved in derivation of Clausius Clapeyron equation with its relevant applications.	03
	(b) Prove that for a system violating Kelvin Plank statement of Second law of thermodynamics, it will violate Clausius statement.	04
	(c) With suitable sketches mention the various process involved in a Carnot cycle.	07

- Q.5** (a) Discuss the various applications of thermodynamic diagrams. **03**
 (b) Specify the differences between Gibb's Free Energy and Helmholtz Free energy. **04**
 (c) Establish the following Maxwells correlation. **07**
1. $\left[\frac{\partial T}{\partial V}\right]_S = -\left[\frac{\partial P}{\partial S}\right]_V$
 2. $\left[\frac{\partial T}{\partial S}\right]_P = \left[\frac{\partial V}{\partial P}\right]_S$

OR

- Q.5** (a) How fugacity can be used to estimate the behavior of a real gas? **03**
 (b) What is meant by Partial molar Properties? Discuss any one of them with a suitable example. **04**
 (c) What is meant by Fugacity coefficient? How it can be estimated from compressibility factor? **07**