

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- VII EXAMINATION-SUMMER 2023****Subject Code: 3173518****Date: 26/06/2023****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) Distinguish between molecularity and order of a reaction.	03
	(b) Discuss about temperature dependence on the rate of reaction based on Arrhenius law.	04
	(c) Discuss the first law of thermodynamics for a flow process with a schematic diagram.	07
Q.2	(a) Differentiate between instantaneous and overall fractional yield of a reaction.	03
	(b) Derive the integrated form of rate expression for an n^{th} order reaction.	04
	(c) The pyrolysis of ethane proceeds with an activation energy of 75000 cal. How much faster is the decomposition at 650 °C than at 500 °C?	07
	OR	
	(c) The rate of reaction triples on doubling the concentration of the reactant. Determine the order of the reaction.	07
Q.3	(a) Discuss the difference between open, closed and isolated systems with examples.	03
	(b) Discuss differential method of analysis of rate data.	04
	(c) Drive the performance equation of PFR with suitable assumptions.	07
	OR	
Q.3	(a) Differentiate between irreversible and reversible processes.	03
	(b) Consider a feed with $C_{A0} = 100$ moles, $C_{B0} = 200$ moles and $C_{i0} = 100$ moles enters a steady flow reactor in which isothermal gas phase reaction $A + 3B \rightarrow 6R$ takes place. Determine C_B , X_B , X_A at exit of reactor if C_A at exit is 40 moles.	04
	(c) Discuss the analysis of total pressure data obtained in a constant volume system and establish the relation used to calculate the partial pressure of gaseous component in reaction mixture.	07
Q.4	(a) Define (a) Space time and (b) Space velocity	03
	(b) Discuss how compressibility factor can be used in the estimation of fugacity coefficient.	04
	(c) For a zero-order reaction $A \rightarrow R$, 90% conversion is obtained in 80 minutes. If the initial concentration is 1.1 kmol/m^3 . Determine: (a) rate of reaction (b) time for attaining 95% conversion (c) conversion after 45 minutes.	07
	OR	
Q.4	(a) What do you mean by batch reactor? How is it different from variable volume batch reactor?	03
	(b) Define fugacity and explain how it can be applied in estimating the behavior of real gases.	04

	(c)	The concentrations of a compound undergoing a chemical change are 5.72, 3.23 and 1.96 at times of 0, 20 and 50 min from start of reaction. Determine the order of the reaction.	07
Q.5	(a)	Differentiate between ideal and non-ideal solutions.	03
	(b)	State the Maxwell relations.	04
	(c)	Discuss the classifications of various thermodynamic processes.	07
OR			
Q.5	(a)	Define (a) Entropy and (b) Chemical potential.	03
	(b)	Explain isobaric, isochoric, isothermal and adiabatic processes with P-V diagrams.	04
	(c)	Discuss the effect of pressure and temperature on fugacity.	07