

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2024****Subject Code:3162313****Date:17-05-2024****Subject Name:Kinetics and Rheology of Plastics****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) Explain working of batch reactor along with advantages and limitations.	03
	(b) Explain Maxwell Model for viscoelasticity.	04
	(c) Explain working of Continuous stirred tank reactor (CSTR) along with its advantages and limitations.	07
Q.2	(a) Give Difference between Elementary and non elementary reactions.	03
	(b) Discuss kinetics studies of cationic polymerization.	04
	(c) Explain about (1) Fluidized bed reactor and (2) Fixed bed reactor.	07
	OR	
	(c) Explain kinetics studies of free radical polymerization.	07
Q.3	(a) Explain working of Semi-batch reactor along with advantages and limitations.	03
	(b) State and discuss about Williams–Landel–Ferry (WLF) Equation.	04
	(c) Explain Capillary Rheometer with neat diagram.	07
	OR	
Q.3	(a) The rate constants of a certain reaction are 1.6×10^{-3} & $1.625 \times 10^{-2} \text{ (s)}^{-1}$ at 10°C & 30°C . Calculate the activation energy.	03
	(b) Describe the Weissenberg effect in molten polymers with neat diagram.	04
	(c) Describe the theory based on the concepts of free volume.	07
Q.4	(a) Discuss in brief about Hooks model and Newton Model.	03
	(b) Discuss working of Torque Rheometer with diagram.	04
	(c) Define Rheology. Give classification of Non-Newtonian fluid and Explain each with suitable example.	07
	OR	
Q.4	(a) Explain the Power law for viscoelastic materials.	03
	(b) Explain die swell and melt fracture effect in polymer melt flow.	04
	(c) Discuss kinetics of free radical copolymerization.	07
Q.5	(a) Discuss the effect of molecular weight, molecular weight distribution and chain branching on viscosity.	03
	(b) Discuss kinetics studies of anionic polymerization.	04
	(c) Define Activation energy. Describe temperature dependency from Arrhenius law.	07
	OR	
Q.5	(a) Define: Rheology, Reactivity ratio and Kinetic chain length	03

- (b) The following are data for polymerisation of styrene in benzene at 60°C with benzoyl peroxide as the initiator. If the spontaneous decomposition rate of benzoyl peroxide is $3.2 \times 10^{-6} \text{ mol}^3/\text{mol sec}^{-1}$. Calculate of rate of propagation for free radical polymerisation. $[M]=3.34 \times 10^3 \text{ mol/m}^3$, $[I] = 4.0 \text{ mol/m}^3$, $f = 1$, $k_p^2/k_t = 0.95 \times 10^{-6} \text{ m}^3/\text{mol sec}$. **04**
- (c) Explain Burger model for Viscoelastic materials. **07**
