

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2023****Subject Code:3162313****Date:06-07-2023****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 showing elongation vs. time and stress vs. strain graph.	04
	(c) Explain kinetics of free radical polymerization.	07
Q.2	(a) Define: Strain, Kinetic Chain Length and Rheology.	03
	(b) Explain working of Tubular (Plug flow) Reactor along with its advantages and limitations and application.	04
	(c) Give classification of Non-Newtonian fluid and Explain each with suitable example.	07
	OR	
	(c) Define Reactivity ratio. Explain Reactivity ratio and Copolymerization behavior.	07
Q.3	(a) Discuss the effect of molecular weight, molecular weight distribution and chain branching on viscosity.	03
	(b) The data for the bulk polymerization of styrene at 60°C with benzoyl peroxide as initiator $[M]=3.34 \times 10^3 \text{ mol/m}^3$, $[I] = 4.0 \text{ mol/m}^3$, $k_p^2/k_t = 0.95 \times 10^{-6} \text{ m}^3/\text{mol-sec}$, If the spontaneous decomposition of benzoyl peroxide is $3.2 \times 10^{-6} \text{ m}^3/\text{mol-s}^{-1}$. Calculate the rate of propagation (R_p).	04
	(c) Explain Burger model for Viscoelastic materials.	07
	OR	
Q.3	(a) At 1100 K n-nonane thermally cracks 20 times as rapidly as at 1000 K. Estimate the activation energy for this decomposition. $R=8.314 \text{ J/mol.K}$.	03
	(b) Describe the Weissenberg effect in molten polymers with neat diagram	04
	(c) Explain Capillary Rheometer with neat diagram..	07
Q.4	(a) Give equation for temperature dependency of reaction rate constant given by Arrhenius law, collision theory and Transition state theory.	03
	(b) Describe the free volume theory.	04
	(c) Explain Zener Model- A standard linear solid	07
	OR	
Q.4	(a) Explain the Power law for viscoelastic materials.	03
	(b) Discuss working of Torque Rheometer with diagram.	04
	(c) Explain working of (1) Fluidized bed reactor and (2) Fixed bed reactor.	07
Q.5	(a) Explain die swell and melt fracture effect in polymer melt flow.	03
	(b) Discuss kinetics studies of cationic polymerization	04
	(c) Define Activation energy. Describe temperature dependency from Arrhenius law.	07

OR

- Q.5 (a)** A linear amorphous polymer has a T_g of $+10\text{ }^{\circ}\text{C}$. At $28\text{ }^{\circ}\text{C}$, it has a melt viscosity of 4×10^8 poise. Calculate the viscosity of polymer at its T_g using WLF equation. **03**
- (b)** Derive WLF equation. **04**
- (c)** Define Chemical Kinetics. Give classification of chemical reactions with suitable examples. **07**
