

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-VI EXAMINATION – WINTER 2025****Subject Code:3162313****Date:17-11-2025****Subject Name:Kinetics and Rheology of Plastics****Time:02:30 PM TO 05:00 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

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|------------|---|-----------|
| Q.1 | (a) Define the terms: Rate of reaction, Molecularity and Order of reaction. | 03 |
| | (b) Write difference between Elementary and Non Elementary reactions. | 04 |
| | (c) Explain about the Pseudo plastic fluids, Dilatants fluids, and Bingham plastic fluid with suitable graph. | 07 |
| Q.2 | (a) Discuss about creep curve of typical plastics. | 03 |
| | (b) Discuss about Maxwell model. | 04 |
| | (c) Give classification of Non-Newtonian fluid and Explain each with suitable example. | 07 |
| | OR | |
| | (c) Define Chemical Kinetics. Give classification of chemical reactions with suitable examples. | 07 |
| Q.3 | (a) What is Weissenberg effect? | 03 |
| | (b) Explain the cone & plate viscometer. | 04 |
| | (c) Explain Capillary Rheometer with neat diagram. | 07 |
| | OR | |
| 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) Define Reactivity ratio. Explain Reactivity ratio and Copolymerization behavior. | 07 |
| Q.4 | (a) Give the Definition & importance of Rheology. | 03 |
| | (b) Discuss WLF equation. | 04 |
| | (c) With a neat sketch explain the Batch type Reactor. | 07 |
| | OR | |
| Q.4 | (a) Explain die swell and melt fracture effect in polymer melt flow. | 03 |
| | (b) Discuss: (i) Effect of Temperature on Polymer Viscosity (ii) Effect of Shear rate on viscosity | 04 |
| | (c) Explain working of Continuous stirred tank reactor (CSTR) along with its advantages and limitations. | 07 |

- Q.5** (a) Discuss about free volume concept. **03**
(b) Discuss about Kelvin & Voigt model. **04**
(c) Write a short note on the Burger Model. **07**
- OR**
- Q.5** (a) What is a Rheometer? List the types of Rheometers. **03**
(b) Explain Maxwell Model showing elongation vs. time and stress vs. strain graph. **04**
(c) Explain the Hooke's and Newton's model. **07**
