

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III(NEW) EXAMINATION – SUMMER 2023

Subject Code:3132606

Date:24-07-2023

Subject Name:Numerical methods & Viscoelastic models of Elastomers

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.

- Q.1 (a) What do you mean by Elasticity? **03**
(b) State the Hook's law with suitable example. **04**
(c) Discuss the Bulk modulus and Young modulus in detail. **07**

- Q.2 (a) Derive the equation for the entropy generated force in polymer chain. **03**
(b) Define the term Viscosity & Write it's Nomenclature. **04**
(c) List out the different viscometers and explain any one in detail. **07**

OR

- (c) Explain the "Theory of Viscosity". **07**
Q.3 (a) State the Newton's law of viscosity with its derivation. **03**
(b) Give the comparison of Time dependent & Time independent non Newtonian fluid. **04**
(c) Write a short note on "Viscoelastic fluids." **07**

OR

- Q.3 (a) What is the difference between Thixotropic and Rheopectic fluid? **03**
(b) List out the classification of fluids and explain any one in brief. **04**
(c) Explain the Pseudoplastic, Dilatant and Bingham plastic fluids in detail. **07**

- Q.4 (a) Give the disadvantages of Maxwell model. **03**
(b) Derive the stress relaxation experiment equation for Maxwell Model. **04**
(c) Discuss the Four parameter model in detail. **07**

OR

- Q.4 (a) Derive the creep experiment equation for Voight model. **03**
(b) Explain a brief note on Deborah number. **04**
(c) A polystyrene sample of $0.02/m^2$ cross-sectional area is subjected to a creep load of 10^5 N. The load is removed after 30 s. Assuming that the Maxwell element accurately describes the behavior of polystyrene and that viscosity is 5×10^{10} P, while Young's modulus is 5×10^5 psi, calculates: (i) The compliance (ii) The deformation recovered on the removal of the dead load (iii) The permanent

- Q.5 (a) What is the Tg of polystyrene of $M_n = 3000$? Where $K = 2 \times 10^5$. **03**
(b) List out the factors affecting Glass transition temperature. **04**
(c) How chain flexibility and Plasticizer and pendent group affect the glass transition temperature? Explain in detail. **07**

OR

- Q.5** (a) Why polyethylene have (-120°C T_g) glass transition temperature? **03**
- (b) Toluene behaves as a plasticizer for polystyrene. Estimate T_g of a polystyrene sample containing 20 vol% toluene. **04**
- (c) Describe the transitions and associated properties with respect to glass transition temperature. **07**
