

Enrollment No./Seat No.:

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**Bachelor of Engineering - SEMESTER - III EXAMINATION - WINTER 2025**

**Subject Code: 3132606**

**Date: 31-12-2025**

**Subject Name: Numerical methods & Viscoelastic models of Elastomers**

**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.**

	<b>Marks</b>
<b>Q.1 (a)</b> State Hooke's Law and Define stress and strain.	<b>03</b>
<b>(b)</b> Describe the structure of an ideal rubber.	<b>04</b>
<b>(c)</b> Compare the creep and stress relaxation behaviors in detail.	<b>07</b>
<b>Q.2 (a)</b> Mention different types of non-Newtonian fluids.	<b>03</b>
<b>(b)</b> Discuss the difference between elastic and plastic deformation.	<b>04</b>
<b>(c)</b> Predict stress relaxation using four-parameter model equations.	<b>07</b>
<b>OR</b>	
<b>(c)</b> Explain the importance of Poisson's Ratio and Derive equations for relation between the different modulus.	<b>07</b>
<b>Q.3 (a)</b> A rubber specimen of 10 cm length is stretched to 12 cm under 50 N load. Calculate the strain and stress developed.	<b>03</b>
<b>(b)</b> List out the factors affecting viscosity.	<b>04</b>
<b>(c)</b> Assess the role of microstructure on non-Newtonian flow behavior.	<b>07</b>
<b>OR</b>	
<b>(a)</b> Calculate the Young's modulus of rubber if a tensile stress of 1.2 MPa produces a strain of 0.4.	<b>03</b>
<b>(b)</b> Give the concept of Auxetic materials with suitable examples and figures.	<b>04</b>
<b>(c)</b> Differentiate between Newtonian and non-Newtonian fluids in detail.	<b>07</b>
<b>Q.4 (a)</b> Write a brief note on Newton's model.	<b>03</b>
<b>(b)</b> Describe the glass transition phenomenon in elastomers.	<b>04</b>
<b>(c)</b> Elaborate in detail about "Superposition principle".	<b>07</b>
<b>OR</b>	
<b>(a)</b> Discuss viscosity theory in polymers.	<b>03</b>
<b>(b)</b> Interpret the relationship between molecular weight and T <sub>g</sub> .	<b>04</b>

- (c) Discuss the Maxwell model in detail. 07
- Q.5** (a) List the experimental methods used for measuring viscosity. 03
- (b) Describe the kinetic theory of rubber elasticity. 04
- (c) Discuss in detail about the transition and associated properties of glass transition temperature. 07

**OR**

- (a) Explain the importance of viscosity in elastomers. 03
- (b) Explain the concept of viscoelasticity. 04
- (c) List out the factors affecting glass transition temperature and explain it in detail with example. 07

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