Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER– III (New) EXAMINATION – WINTER 2019**

**Subject Code: 3132606 Date: 26/11/2019**

**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.**

| | | | Marks |
|---|---|---|---|
| **Q.1** | **(a)** | State the differences between Young modulus, Bulk modulus and Modulus of Rigidity. | **03** |
| | **(b)** | Give the concept of Auxetic materials with suitable examples and figures. | **04** |
| | **(c)** | Explain the importance of Poisson's Ratio and Derive equations for relation between the different modulus. | **07** |
| **Q.2** | **(a)** | A nylon string has a diameter of 2mm, pulled by a force of 100N. Determine the tensile stress. | **03** |
| | **(b)** | List out the factors affecting viscosity. | **04** |
| | **(c)** | Explain the viscosity theory with suitable example. | **07** |
| | | **OR** | |
| | **(c)** | Draw the schematic diagram of "Oswald Viscometer" and explain it in detail. | **07** |
| **Q.3** | **(a)** | Write a brief note on Newton's model. | **03** |
| | **(b)** | Derive the stress relaxation experiment equation for Voight model. | **04** |
| | **(c)** | Discuss in detail about the non Newtonian fluid. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Explain a brief note on Deborah number. | **03** |
| | **(b)** | Give the broad classification of polymeric material based on mechanical behavior. | **04** |
| | **(c)** | Explain in detail about time dependent fluids. | **07** |
| **Q.4** | **(a)** | How can you estimate the $T_g$ with the help of Bulk properties? | **03** |
| | **(b)** | List the required properties for Elastomers. | **04** |
| | **(c)** | Discuss in detail about the structure of an ideal rubber. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Show the dependence of shear rate on shear stress for Newtonian fluid with the help of diagram. | **03** |
| | **(b)** | Summarize the molecular requirements of elastomer. | **04** |
| | **(c)** | Derive the equation for force constant using entropy elasticity theory. | **07** |
| **Q.5** | **(a)** | Define the terms: (i) Glass transition temperature (ii) Flow temperature (iii) Melting point | **03** |
| | **(b)** | Classify the different types of motions exhibited within a polymeric material. | **04** |
| | **(c)** | Discuss about the nature of curve showing variation in specific volume versus temperature for polymeric substances. | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | Relate the Glass transition temperature and Melting point for symmetrical and unsymmetrical polymers respectively. | **03** |
| | **(b)** | Summarize the change of state with temperature in polymeric materials. | **04** |
| | **(c)** | Discuss in detail about the factors influencing the Glass transition temperature. | **07** |

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