Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (New) EXAMINATION – WINTER 2015

Subject Code:2142606 **Date:28/12/2015**

Subject Name: Viscoelasticity of Elastomers

Time: 02:30pm to 05:00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q. 1 Answer the following. (14)

- **(i) Define the term: (i) Elasticity (ii) Bulk Modulus.**
- **(ii) Give the difference between Viscosity and Apparent Viscosity.**
- **(iii) Write about the Deborah number.**
- **(iv) What do you mean by Linear Viscoelastic behaviour?**
- **(v) List the molecular requirements of Elastomers.**
- **(vi) Write about Boltzmann's constant.**
- **(vii) Differentiate Pseudoplastic and Dilatant fluid behaviour with the help of stress strain curve.**

Q. 2 (a) Explain about the Newtonian fluids in detail. (07)

Q. 2 (b) An unknown polymer melt shear stress rate of shear data is given below. (07)

Shear stress(τ, N/m^2)	2.5	5.2	7.4	17	33	59
Shear rate (-du/dr, s^{-1})	0.75	2	3.1	13.5	33.9	67.7

(a) Characterise the Fluid behaviour. And

(b) Plot the graph shear stress vs shear rate and find out the viscosity of polymer melt.

OR

(b) A wood bar 6 m long and with rectangular cross section of 5 cm X 2.5 cm supports a mass of 200 kg. How much is the wood bar stretched? (Young's modulus of Wood bar is 1.0 X 10^{10} N/m^2). (07)

Q. 3 (a) Discuss in detail about Young's modulus. (07)

(b) Discuss the time independent Non Newtonian fluid with suitable example. (07)

OR

Q. 3 (a) A wire has 0.70mm in diameter and 2.0m long was stretched 1.6mm by a load of 20N. Find young's modulus for wire. (07)

(b) Derive the relationship between Viscosity and Energy dissipated. (07)

Q. 4 (a) Calculate the Tg of Butadiene–Styrene copolymer which containing 10 vol% of Styrene. (07)

(b) Short note on: "Viscoelastic Fluids". (07)

…..P.T.O……

OR

Q. 4	**(a)**	**A Voigt element has parameters $E = 10^8$ N/m^2 and $\eta = 5 \times 10^{10}$ N · s/m^2. Sketch the creep curve for this element if the imposed constant stress is 10^8 N/m^2.**	**(07)**
	(b)	**How chain flexibility and Plasticizer affect the glass transition temperature? Explain in detail.**	**(07)**
Q. 5	**(a)**	**Describe in detail about general mechanical models for an Amorphous Polymer.**	**(07)**
	(b)	**Explain the Maxwell model and derive the derivation for creep test.**	**(07)**

OR

Q. 5	**(a)**	**Discuss the Stress Relaxation phenomena.**	**(07)**
	(b)	**Explain the Voigt model in detail.**	**(07)**

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