Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(New) • EXAMINATION – WINTER 2016

Subject Code:2142606 **Date:21/11/2016**

Subject Name:Viscoelasticity 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.**

Q.1		Answer the following.	14
	1	Define the term elasticity.	
	2	Which fluids are showing the hysteresis?	
	3	Write the difference between the Storage Modulus and Loss Modulus.	
	4	Name the components to develop the stress.	
	5	Write the observation from the phase states of substance and their comparison with the states of aggregates.	
	6	What is the Dynamic Compliance?	
	7	Give the difference between the Real Modulus and Imaginary Modulus.	
	8	Write the Poiseuille's Law.	
	9	List the instrument to measure the shear viscosity.	
	10	What is the value of Poisson's ratio for rubber?	
	11	Give the importance of Compression and Tensile test.	
	12	What do mean by Hookean Elasticity?	
	13	Give the difference between the Young modulus and Bulk modulus.	
	14	Write about the Deborah number.	
Q.2	(a)	Describe about the Ideal Elastomer.	03
	(b)	Write a short note on "Hook's Law".	04
	(c)	Explain the creep response of Four parameter model.	07
		OR	
	(c)	"Viscosity of fluids directly gives a measure of capacity of fluids to dissipate energy" Justify the statement.	07
Q.3	(a)	A wire 0.7 mm in diameter and 2.0 m long was stretched by a load of 20 N. Find Young's modulus for the wire.	03
	(b)	A steel bar is 10mm diameter and 2 m long. It is stretched with a force of 20 kN and extends bt 0.2 mm. Calculate the stress and strain.	04
	(c)	The following shear stress – shear rate data were obtained for an aqueous polymer solution at 25 ^{0}C.	07

τ(pa)	81	130	210	390	600	900	1450
$\gamma(s^{-1})$	3.06	6.12	12.23	30.60	61.2	122.3	305.8

Plot the graph and find out the viscosity.

……P.T.O……

OR

Q.3	(a)	How the elastic fluids responses under creep test?	03

	(b)	Discuss about the Pseudoplastic fluid with example.	04
	(c)	Write the classification for measurement of viscosity. Explain rotational viscometer in detail.	07
Q.4	(a)	Describe about Linear Viscoelasticity.	03
	(b)	A bar of polypropylene is of length 200 mm and has a rectangular cross section of diameters 25 mm X 3 mm. It is subjected to a constant tensile load of 250 N acting along its length. 100 s after the load was applied the length is measured and is found to have increased by 0.5 mm. Determine the 100 s tensile creep compliance.	04
	(c)	Explain the Maxwell model and derive the derivation for creep test.	07
		OR	
Q.4	(a)	Write about the Creep Compliance and Relaxation Modulus.	03
	(b)	Discuss about the Superposition Principles.	04
	(c)	Explain the Voigt model in detail.	07
Q.5	(a)	Write the WLF equation with their importance.	03
	(b)	What is the Tg of Polybutadiene rubber? Take the value of Mn = 3000 and k= 2×10^5	04
	(c)	Describe the transitions and associated properties with respect to glass transition temperature.	07
		OR	
Q.5	(a)	Give the classification of time dependent fluid by giving graphical representation.	03
	(b)	List the molecular requirements of Elastomers.	04
	(c)	List out the factors affecting the Glass transition temperature. Explain any one in detail.	07

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