Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV (NEW) EXAMINATION – SUMMER 2015

Subject code: 2142606 **Date:30/05/2015**
Subject Name: Viscoelasticity of Elastomers
Time: 10.30am-01.00pm **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 "Rheopectic fluid".
(ii). What do mean by Hookean Elasticity?
(iii). Write the observation from the phase states of substance and their comparison with the states of aggregates.
(iv). Write about the Hook's law.
(v). "Deborah number is related to material response time" Justify the statement.
(vi). Define the given term: (1) Plasticity (2) Flow
(vii). Give the difference between the young modulus and bulk modulus.

Q. 2 (a) The following shear stress – shear rate data were obtained for an aqueous polymer solution at 25 ^{0}C. (08)

τ X 10^{-4} N/m^2	(-du/dr) s^{-1}
10.0	0.1
19.6	1.0
31.0	2.0
49.0	4.0
92.0	8.0
164.0	15.0
210.0	20.0
700.0	70.0
1005.0	100.0

Plot (i) Viscosity vs Shear rate & (ii) Viscosity vs shear stress. Also identify the fluid behavior.

Q. 2 (b) "Viscosity of fluids directly gives a measure of capacity of fluids to dissipate energy" Justify the statement. (06)

OR

(b) Discuss in detail about Time dependent Non Newtonian fluid with suitable example. (06)

……P.T.O…….

Q. 3	**(a)**	**Give the detail analysis of Voigt – Kelvin model.**	**(07)**
	(b)	**Write the classification for measurement of viscosity. Explain rotational viscometer in detail.**	**(07)**
		OR	
Q. 3	**(a)**	**List the mechanical models for Viscoelasticity. Explain any one in detail.**	**(07)**
	(b)	**Answer the following.**	
	(i)	**Write the molecular requirements of Elastomer.**	**(04)**
	(ii)	**Explain the ideal Elastomer.**	**(03)**
Q. 4	**(a)**	**Describe the transitions and associated properties with respect to glass transition temperature.**	**(07)**
	(b)	**Estimate Tg and Tm of a polystyrene sample containing 20 volume % toluene, when Toluene behaves as a plasticizer for polystyrene.**	**(07)**
		OR	
Q. 4	**(a)**	**Explain the concept of various transitions of states associated with low molecular weight compounds and polymeric materials with schematic representation.**	**(07)**
	(b)	**List the factors affecting glass transition temperature (Tg). Explain any two in detail.**	**(07)**
Q. 5	**(a)**	**Explain the creep response of Four parameter model.**	**(07)**
	(b)	**Discuss the superposition principle with linear Viscoelasticity.**	**(07)**
		OR	
Q. 5	**(a)**	**The constants for a four-parameter model are $E_1 = 5\times10^8$ N/m^2, $\eta_2 = 5\times10^{10}$ N.s/m^2 , $E_3 = 10^8$ N/m^2, and $\eta_3 = 5\times10^8$ N.s/m^2** **For creep and creep recovery experiments calculate:** **(i). The instantaneous elastic strain** **(ii). The recoverable retarded elastic strain** **(iii). The permanent set** **Assume that the creep experiment lasted for 200 s and that the imposed stress is 10^8 N/m^2.**	**(07)**
	(b)	**Explain the relaxation and retardation spectra with respect to Maxwell model.**	**(07)**

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