Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER V • EXAMINATION – WINTER - 2012

Subject code: 152604 Date: 16-01-2013

Subject Name: Rheology of Rubber

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.**
4. **All notations used have conventional meaning.**

Q.1 Answer the following **14**

(i) Write Newton's law of Viscosity.
(ii) What is meant by Viscoelastic material?
(iii) Write Ellis model.
(iv) Define kinematic viscosity and derive its unit.
(v) Explain the test for determination of PRI.
(vi) Give the advantage of rotation plastimeter over compression plastimeter.
(vii) Write in brief about working of Extrusion plastimeter.

Q.2 **(a)** Draw the stress strain curve of different kind of materials. Explain the curve of rubber-like material. **07**

(b) Derive the equation of maximum velocity for flow through an annulus. **07**

OR

(b) Derive the expression for velocity distribution of Newtonian fluid flowing through an extruder. **07**

Q.3 **(a)** Derive the mathematical expression for determining viscosity of Newtonian fluid in capillary viscometer. **10**

(b) Draw the table showing different viscometers and their viscosity range. **04**

OR

Q.3 Derive the relation between angular velocity of cup and torque on the bob for a Power law fluid placed in Cup & Bob Viscometer. **14**

Q.4 **(a)** For an unknown polymer melt shear stress- shear rate data is given below. Apply power law model to this data and calculate the constants. **10**

$\tau \times 10^{-4} N/m^2$	$(-du/dr)\ s^{-1}$
2.5	0.75
5.2	2.0
7.4	3.1
17.0	13.5
33.0	33.9
59.0	67.7
200.0	338.7
490.0	1354.8
780.0	3387.0
1120.0	5000.0
1550.0	7000.0

(b) Discuss the rheology of internal mixers. **04**

OR

Q.4 **(a)** Discuss the effect of temperature and pressure on viscosity of polymer melts. **08**

(b) Write a note on stress relaxation phenomena. **06**

Q.5 **(a)** Explain Maxwell and Voight model for Viscoelasticity. **08**

(b) Describe coaxial cylinder viscometer with axial motion. **06**

OR

Q.5 **(a)** Write a note on penetrometers, orifice and indentation viscometer. **06**

(b) Discuss Retardation phenomena. **08**

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