Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – SUMMER • 2015

Subject Code: 152604 **Date: 07/05/2015**

Subject Name: Rheology of Rubber

Time: 02.30pm-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 Rheology. Which was the first rheological relationship?

(ii) Write the difference between Long range and Short range molecular motion.

(iii) Write the important properties of viscoelastic material with suitable example.

(iv) Write the Buckingham equation.

(v) Explain the types of Rotational Viscometers.

(vi) What do you mean by Uniaxial and Biaxial Elongational viscosity?

(vii) Explain the Griffith Extrusion Plastometer.

Q. 2 (a) Give the classification of fluids based on fluid behavior under the applied stress. **(07)**

Q. 2 (b) Derive the Volumetric flow rate for a viscometer pipe whose length is larger than the diameter. **(07)**

OR

(b) Answer the following.

(i) Describe the methods which are recommended for various viscosity ranges. **(05)**

(ii) Write the importance of Reynolds number. **(02)**

Q. 3 (a) Explain the Maxwell and voight model for Viscoelastisity. **(07)**

(b) Answer the following.

(i) Write the boundary conditions for the velocity distribution in laminar flow. **(03)**

(ii) The Process oil has a kinematic viscosity of $3X\ 10^{-4}\ m^2sec^{-1}$ and a density of $0.85X10^3 kg\ m^{-3}$. What should the mass rate of flow of this film down a vertical wall be in order to have a film thickness of 3 mm? ($g = 9.8\ m\ sec^{-2}$) **(04)**

OR

Q. 3 (a) Discuss in detail about Relaxation and Retardation in terms of viscoelastisity of polymeric material. **(07)**

(b) Derive the equation of momentum flux and the velocity distribution for steady, incompressible flow in an annulus. **(07)**

Q. 4 Derive the expression foe viscosity of Newtonian fluid and power law fluid placed in Rotational viscometer. **(14)**

OR

Q. 4 (a) Explain the effect of temperature on the Rheology of Elastomer. **(07)**

(b) List the types of Elongational flow instruments. Explain any one in detail. **(07)**

Q. 5 (a) Short note on "Sandwich Rheometer" **(07)**

(b) Discuss in detail about the Flow behavior of unvulcanized rubber compounds. **(07)**

OR

Q. 5 Write the accepted test methods to determine the Plasicity of rubber compounds. Explain the Shearing Disc viscometer in detail. **(14)**

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