

Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering - SEMESTER - IV EXAMINATION - WINTER 2025

Subject Code: 3142607

Date: 20-11-2025

Subject Name: Rubber Rheology

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. Simple and non-programmable scientific calculators are allowed.**

	Marks
Q.1 (a) Define the term 'Rheology'. Also give practical significance of rheological measurement related to rubber and rubbery materials.	03
(b) Compare velocity profiles of Newtonian and non-Newtonian fluids respectively in laminar flow.	04
(c) With schematic diagram, explain the difference in behavior of ideal elastic solids, viscous liquids, and viscoelastic materials.	07
Q.2 (a) Give the relationship between shear stress and velocity gradient for a Newtonian fluid.	03
(b) Justify the given statement with suitable example: Rubber shows non-Newtonian behavior under varying shear rates.	04
(c) With schematic diagram, explain the Mooney Viscosity Test graph with its important features.	07
OR	
(c) With schematic diagram, explain the Oscillating Disc Rheometer Test graph with its important features.	07
Q.3 (a) What do you mean by laminar flow? Mention the characteristics of laminar flow.	03
(b) Compare the flow behavior of Power Law model fluid and Eyring model fluid.	04
(c) Develop momentum flux equation of fluid flowing in laminar flow through falling film.	07
OR	
(a) What do you mean by turbulent flow? Mention the characteristics of turbulent flow.	03
(b) Analyze the practical significance of the Eyring-Powell model in rubber flow operations.	04
(c) Develop momentum flux equation of fluid flowing in laminar flow through circular tube.	07
Q.4 (a) Brief out the use of 'cup and bob viscometer'.	03

- (b)** Differentiate elongational flow instruments and shear flow instruments with examples. **04**
- (c)** Explain influence of the given parameters on rheology of rubber: (i)Temperature **07**
(ii)Pressure(iii)Molecular Weight

OR

- (a)** Brief out the use of sandwich rheometer. **03**
- (b)** Compare the design and application of biconical rheometer and plunger viscometer. **04**
- (c)** Explain influence of the given parameters on viscoelastic behavior of rubber: (i) **07**
polymer structure (ii)chain entanglement(iii)chain motion

- Q.5**
- (a)** Brief out the term ‘Stress Tensor’. **03**
 - (b)** Identify different shear flow rheometers. Also give their applications. **04**
 - (c)** Explain how the shear flow boundary conditions and slippage influence the rheology **07**
of rubber compounds.

OR

- (a)** State continuity equation when the polymer melts and elastomers are incompressible **03**
and density is constant.
- (b)** Analyze uniaxial extensional elongational flow instrument. Also write a short note on **04**
it.
- (c)** Mention different rheological instrument used for quality control in rubber industries. **07**
Explain any one in detail.
