

GUJARAT TECHNOLOGICAL UNIVERSITY**Bachelor of Engineering - SEMESTER - IV EXAMINATION - SUMMER 2025****Subject Code: 3142607****Date: 17-05-2025****Subject Name: Rubber Rheology****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions**

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**

	Marks
Q.1 (a) Why viscosity measurement is important in rubber? Also mention it's unit?	03
(b) With schematic presentation, outline the term 'Laminar Flow' and Turbulent Flow respectively.	04
(c) Develop the stress-strain curve showing purely elastic behavior of different materials.	07
Q.2 (a) Define the term 'rheometry' and mention its purpose in rubber compound analysis.	03
(b) Describe the role of additives in modifying the rheological properties of rubber compounds.	04
(c) Develop momentum flux equation of fluid flowing in laminar flow through falling film.	07

OR

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|---|-----------|
| (c) Develop momentum flux equation of fluid flowing in laminar flow through circular tube. | 07 |
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- Q.3 (a)** What do you mean by 'Time Dependent fluid? Also give it's examples.
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| (b) Outline 'Eyring Powell Model' with necessary assumptions. | 04 |
| (c) For the polymer, the given data is available. Apparent rate of shear, $\dot{\gamma}_{w,a} = 5 S^{-1}$ | 07 |

Hydro static Pressure, M Pa	13.79	34.48	68.95	137.90	172.38
Shear Stress, K Pa	6.90	9.65	14.48	44.82	60.68

Calculate and plot the apparent viscosity and hydro static pressure.

OR

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| (a) What do you mean by 'Time-Independent fluid? Also give it's examples. | 03 |
| (b) Outline 'Ellis Model' with necessary assumptions. | 04 |
| (c) The zero shear viscosity of polymer at five different temperatures has been calculated using Carreau model. These values are given below. | 07 |

Temperature(°C)	150	170	190	210	230
η_0 Pa.s	11842	8471	5327	4507	3239

Identify the glass transition temperature using the WLF equation.

- Q.4** (a) State the equation used to calculate the 'Mooney Viscosity' along with its notations. **03**
- (b) Summarize the 'Brook Field Viscometer' with its principle, construction and working. **04**
- (c) List the different factors affecting the viscosity of rubber and polymeric materials. Describe any two. **07**

OR

- (a) Define the given terms: (i) Mooney Scorch (ii) Intrinsic viscosity (iii) Specific Viscosity **03**
- (b) Summarize the 'Ostwald Viscometer' with its principle, construction and working **04**
- (c) Identify rheometer designed to measure the properties of rubber and polymeric compounds before during and after cure. Also describe in detail about its mechanism, construction and working. **07**

- Q.5** (a) Define the given terms: (i) Vorticity Tensor (ii) Elongational Flow **03**
- (b) Identify shear flow rheometers and also give their applications. **04**
- (c) Explain in detail about the difference between compression flow instruments and Shear flow instruments in analyzing rubber compounds. **07**

OR

- (a) What do you mean by Stress Tensor? **03**
- (b) List the major components of Sandwich Rheometer along with its function and working. **04**

- (c) Explain influence of shear flow boundary conditions and slippage on rheology of rubber compound.
