

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2024****Subject Code:3142607****Date:01-07-2024****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.
4. Simple and non-programmable scientific calculators are allowed.

- | | Marks |
|---|--------------|
| Q.1 (a) Define the given terms: (i) Finite Strain (ii)Lagrangian Strain (iii)Hencky Strain | 03 |
| (b) Illustrate how differently change in area of rubber test specimen takes place when true stress is applied on it? | 04 |
| (c) With suitable block diagram, give detail classification of classification material on the basis of it's rheological behavior. | 07 |
| Q.2 (a) Define the given terms: (i) Stress Tensor (ii) Vorticity Tensor(iii)Ideal Fluid | 03 |
| (b) With schematic graph and suitable example, outline the behavior of time dependent newtonian fluid. | 04 |
| (c) With suitable assumptions and by following the boundary conditions derive the momentum flux distribution equation and maximum velocity equation respectively for flow of falling film. | 07 |
| OR | |
| (c) With suitable assumptions and by following the boundary conditions derive the momentum flux distribution equation and maximum velocity equation respectively for flow through circular tube. | 07 |
| Q.3 (a) State 'Ostwald-De Waele Model' with necessary notations. | 03 |
| (b) With schematic graph and suitable example, outline the behavior of time independent viscous fluid. | 04 |
| (c) A certain polymeric material gave the following rheological data. From the rheograph, categorize the material rheologically. | 07 |

Shear Rate, $\dot{\gamma}$ (S^{-1})	150	450	750	1050	1450	1850	2050
Shear Stress, τ (Pa)	120000	580000	1220000	2200000	35000000	5600000	7120000

OR

- | | |
|---|-----------|
| Q.3 (a) State 'Eyring Prandalt Model' with necessary notations. | 03 |
| (b) With schematic graph and suitable example, outline the behavior of time dependent viscous fluid. | 04 |

- (c) A certain polymeric material gave the following rheological data. From the rheograph, categorize the material rheologically

Shear Rate, $\dot{\gamma}$ (S^{-1})	50	100	240	800	1200	1800	2200
Shear Stress, τ (KPa)	480	540	800	1670	2320	3240	3910

- Q.4** (a) Write the significance of rheology in field of rubber. **03**
 (b) Write a brief note on Rotational viscometer. **04**
 (c) Discuss the effects of pressure and temperature on rubber rheology. **07**

OR

- Q.4** (a) Give the limitations of Sandwich viscometer. **03**
 (b) "Molecular weight affects the viscosity of Polymer" justify the statement. **04**
 (c) Derive the Continuity Equation. **07**

- Q.5** (a) Give the importance of Viscoelastic fluids. **03**
 (b) Describe about the Uniaxial and Biaxial Elongational Flow. **04**
 (c) Discuss in detail about Shearing Disc (Mooney) Rheometer. **07**

OR

- Q.5** (a) List out the different applications of Mooney viscometer. **03**
 (b) Draw the schematic representation of Rheograph. **04**
 (c) Discuss in detail about Moving Die Rheometer (MDR). **07**
