

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
B.E SEM-V Examination-Nov/Dec.-2011

Subject code: 152604**Date: 29/11/2011****Subject Name: Rheology of Rubber****Time: 02.30 pm-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** (a) Explain and Derive Newton's Law of Viscosity. **05**
 (b) Answer the following **09**
- (i) Define the terms: Rheology and Viscoelastic fluids.
 - (ii) Write about the types of time independent Non Newtonian fluids.
 - (iii) List various rheological models for polymers. Write any one.
- Q.2** (a) Derive the equation of maximum velocity for flow through circular tube. **07**
 (b) The data on shear stress shear rate obtained with Capillary viscometer, for thermoplastic polyester melt is given below: **07**

Shear rate ($-du/dr$), s^{-1}	Temperature, $^{\circ}C$			
	Shear stress, $\tau \times 10^{-4}$, Pa			
	170	180	190	200
3.06	42	26	22.5	13.5
6.12	76	50	40.0	25.0
12.23	142	100	71.0	50.0
30.60	300	220	157.0	120.0
61.17	528	385	284.0	225.0
122.34	840	650	483.0	415.0
305.85	1700	1300	970.0	830.0
611.70	2500	1950	1625.0	1450.0
1223.40	3500	2890	2415.0	2000.0
3058.50	4680	4270	3630.0	3250.0

Characterize the fluid behaviour.

OR

- (b) Discuss Compression Plastimeters. **07**
- Q.3** Derive Buckingham Equation. [Hint: Capillary viscometer, Bingham plastic fluid] **14**
- OR**
- Q.3** Derive the expression for viscosity of Newtonian fluid and Power law fluid. placed in Cup & Bob Viscometer. **14**

- Q.4 (a)** From the data given in Q. 2 (b), calculate and plot viscosity as function of temperature. **07**
(b) Write a note on rheology of two roll mill for Newtonian fluid with symmetric roll rotation. **07**

OR

- Q.4 (a)** Explain different regions of stress strain curve for unvulcanized rubber compound. **07**
(b) Discuss the rheology of extrusion. **07**
- Q.5 (a)** Write the flow principles based on which rheometers for polymer melts and solutions have been developed. **04**
(b) Write a short note on falling sphere viscometer and plunger viscometer. **10**

OR

- Q.5 (a)** Give the design and viscosity measurement technique polymer melt in cone and plate viscometer. **06**
(b) Discuss Retardation phenomena. **08**
