

6th Semester		Polymer Rheology	L-T-P 3-0-0	3 Credits
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MODULE I**(6 Hours)****Fundamentals of Rheology**

Introduction and basic concept of rheology; viscosity and types of viscosity; classification of fluids – ideal and real, Newtonian and non-Newtonian, compressible and noncompressible fluids; power law model; shear stress; shear strain; shear rate; true strain; true strain rate; shear modulus; bulk modulus; zero shear viscosity; dependence of viscosity with temperature, shear stress, shear rate fluid through channel.

MODULE II**(10 Hours)****Visco-elastic behaviour and Mechanical Models**

Viscoelastic behaviour of polymers – stress relaxation, shear thinning, normal stresses in shear flow, creep, hyperelastic deformation, irrecoverable deformation; Mechanical models – stress strain response of spring and dashpot; viscoelastic models – Maxwell model, Kelvin–Voigt model; response to creep and stress relaxation; dynamic mechanical properties – complex modulus, dynamic modulus, loss modulus; Boltzman principle; time temperature super position principle – WLF equation.

MODULE III**(8 Hours)****Measurements of rheological properties**

Measurements of rheological properties – sliding plate rheometer, cone and plate rheometer, parallel plate rheometer, capillary rheometers, extensional rheometer, bubble inflation rheometers, compressional rheometer.

MODULE IV**(12 Hours)****Rheology of polymers in processing**

Viscoelasticity in amorphous and semi crystalline states; effect of rate of strain, temperature and time on viscoelastic behaviour of polymeric materials; viscoelasticity of polymer melts and flow analysis during – injection moulding, extrusion process – die swell and melt fracture, blow moulding and thermoforming – melt strength, biaxial stretching.

MODULE V**(4 Hours)****RHEOLOGY OF FILLED POLYMERS**

Rheological behaviour of suspensions – dilute and concentrated suspensions of spheres and fibres; effect of orientation of fibres on rheology.

Books:

1. B. R. Gupta, *Applied Rheology in Polymer Processing*, Asian Books, Thailand (2005).
2. Tim Osswald and Natalie Rudolph, *Polymer Rheology: Fundamentals and Applications*, Hanser Publishers, Munich (2015).
3. Christopher W. Macosko, *Rheology: Principles, Measurements and Applications*, Wiley-VCH, New York (1993).
4. H. A. Barnes, J. F. Hutton and K. Walters, *An Introduction to Rheology*, Elsevier, Netherlands (1993).