4. POLYMER ENGINEERING AND RHEOLOGY

Module I (8 hours)

State of Aggregation and phase states of matter Molecular motion in Polymers Transition relaxation processes in Polymers. Glass Transition, Theories to determine the glass transition i.e. Dilatometry, Heart capacity, measurement, Thermo mechanical Analysis. Effect of Tg on molecular mass, kinetic chain flexibility and chemical constituent, Importance of Tg and Tm, concept of HDT. **Module II (10 hours)**

Introduction and Basic concept of Rheology, classification of fluids, Newtonian and non-Newtonian fluids. Shear stress, shear strain and shear rate, shear modulus, bulk modulus zero shear viscosity. Dependence of viscosity with temp, shear stress, shear rate fluid through channel, characteristic parameter during shear deformation. Theories of viscosities of dilute (De-bye Bueche theory) and conc. Solutions (Grassley's entanglement theory), (Entanglement concern)

Module III (9 hours)

Methods to determine shear viscosity by capillary Rheometer, cone and plate viscometer, Cup and bob viscometer, Measurement of normal stresses. Rheology of dilute and concentrated suspensions, Rheometer, Bubble inflation rheometer, compressional rheometers, stress relaxation instruments. Torque rheometers, rotational & sliding surface rheometers and their use in determining processability.

Effect of Rheology during Injection, moulding Extrusion: Film extrusion, sheet Extrusion and Blow mouldings of polymers.

Module IV (8 hours)

Viscoelastic behavior of Polymer solution and melts stress-strain curves for Polymers, creep of Polymeric materials, elastic deformation, and irrecoverable flow deformation. Rubber like deformation, Time-temp superposition (WLF Equation) Models of viscoelastity such as Maxwell and Kelvin model their study on creep modulus and stress relaxation.

Text and Reference Books:

1. The flow of high polymers, S.Middleman John Wiley & Sons, George St. 1968.

2. Rheomerty K. Walters, Chapman & Hall London 1975.

3. Rheology of Polymers: G.V. Vinogradov& A. Ya. Malkin Mir, Pub. MOSCOW 1980.

4. J. J. Alkonis & W. J. Macknight-Introduction to polymer elasticity-Willey interscience New York-1982.

5. Viscoelasticity of Polymers D.D. Ferry III Edn. John Willey & Sons New York 1981.

6. Physical Chemistry of Polymers-Tager

7. Polymer Science & Tech. of Plastics and rubbers, D. Ghosh.

8. Melt Rheology and its role in plastic processing: Dealy

9. Flow properties of polymers melt by J.A. Brydson.

10. Cogswell, F.N. Polymer melt rheolgoy, George Goodwin Ltd. & P.R. London- John Wiley & Sons.

11. Polymer Science , V. R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, New Age International Publishers, 4th Edition