

Elective Paper II (Group C)

Polymers:

- I. Basics** **10 hrs.**
Importance of polymers. Basic concepts: Monomers repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Step Growth Polymerization: Theory of reactivity of large monomeric molecules, ring formation vs. chain formation. Polymerization: Chain Reaction, Free radical, Cationic, Anionic and living polymers. Co-ordination and co-polymerization. Polymerization conditions and polymer reactions.
- II. Polymer Characterization** **14 hrs.**
Polydispersion-average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular weights. Light scattering, osmotic, ultracentrifugation viscosity and end group analysis methods. Analysis and testing of polymers; chemical analysis, IR and NMR of polymers. X-ray diffraction study. Microscopy. Thermal analysis and physical testing hardness, tensile strength. Fatigue, impact, Tear resistance and abrasion resistance.
- III. Structure and Properties** **12 hrs.**
Morphology and order in crystalline polymer- configurations of polymer chains. Crystal structures of polymers. Morphology of crystalline polymers, strain-induced morphology, crystallization and melting. Polymer structure and property relationship. Melting point T_m , effect of chain flexibility and other steric factors. Entropy and heat of fusion. The glass transition temperature, T_g -Relationship between T_m and T_g . General ideas about elastomers, plastics and fibres.
- IV. Polymer Processing** **12 hrs.**
Elastomers, Plastics and fibres: Compounding and vulcanization of elastomers. Processing techniques: Calendering, die casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing and fibre spinning.
- V. Some Commercial and Speciality Polymers** **12 hrs.**
Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins silicone and PTFE polymers. Speciality polymers: Fire retarding polymers and electrically conducting polymers. Biomedical polymers – contact lens, dental, artificial heart, kidney, skin and blood cells – polymers.

Books Suggested

1. Textbook of Polymer Science, F.W.Billmeyer Jr. Wiley.
2. Polymer Science, V.R.Gowariker, N.V.Viswanathan and J.Sreedhar, Wiley-Estern.
3. Functional Monomers and Polymers, K.Takemoto, Y.Inaki and R.M.Ottanbrite.
4. Contemporary Polymer Chemistry, H.R. Alcock and F.W.Lambe, Prentice Hall.
5. Physics and Chemistry of Polymers, J.M.G.Cowie, Blackie Academic and Professional.