

## **Polymer Science and Engineering**

### **Module I**

Polymers, Polymerization, Degree of polymerization, Structural features, Thermoplastic and thermosetting polymers, Additives, Mechanical properties, Thermal properties. Strengthening mechanism, Fibres. Special purpose plastics.

Types of polymeric materials and their structures, Classification of polymerization reactions, Step growth and chain growth polymerization. Inter and intra molecular reactions. Kinetics and mechanism of polycondensation. Simple and hindered rotation and end-to-end distances, Molecular weight distribution. General theory of chain growth polymerization. Acceleration factors. Retarders, Inhibitors. Copolymerization and its mechanisms, Crystalline and amorphous polymers. Glass transition temperature melting point.

### **Module II**

Plastics, Rubbers and fibres of commercial importance, Plasticisers, fillers, Stabilisers, lubricants etc., Properties of major thermosetting resins, Thermoplastics, Elastomers and fibre forming polymers, Properties of polymers as measured by tensile test, Impact strength, Softening point, Heat distortion temperature, Melt flow index, Mouldability. General applications, High temperature polymers, Polymer blends, Ultrahigh modulus fibres, polymers for biomedical applications, Polymer foams, Flat films sheet and laminations, Liquid crystal polymers. Stress relaxation.

### **Module III**

Properties in Service Environments : Effects of vapours and solvents on polymeric materials. Oxidation and thermal degradation of polymers. Compatibility, solubility, permeability, radiation damage and chemical resistance of polymers.

### **Module IV**

Processing of polymers : Flow properties of polymers, Extrusion, Injection and blow moulding. Calendering, Vacuum and pressure forming and warm forging. Casting of fibres and filaments. Assembly by adhesion. Thermal and mechanical bonding. Control of properties like chain length, molecular weight distribution etc. Standard heat treatment procedures polymers.

### **Text Books**

- 1 Billmeyer Jr.; Fred W., Textbook of Polymer Science, Wiley- Interscience Publishers, New York (1962)
2. Fried; Joel R., Polymer Science and Technology, 2<sup>nd</sup> Edition, Prentice-Hall of India Pvt. Ltd., New Delhi (2003).

## Reference Books

3. Ebewele, Robert O., Polymer Science and Technology, CRC Press, Boca Raton (2000).
4. Fried; Joel R., Polymer Science and Technology, Prentice-Hall of India Pvt. Ltd., New Delhi (2000).
5. Ghosh; Premamoy, Polymer Science and Technology of Plastics and Rubbers, Tata McGraw- Hill Publishing Co. Ltd., New Delhi (1990).
6. Ghosh; Premamoy, Polymer Science and Technology-Plastics, Rubbers, Blends and Composites, 2<sup>nd</sup> Edition, Tata McGraw-Hill Publishing Co. Ltd., New Delhi (2002).
7. Kaufmann; H. S. and Falcetta; J. J., Introduction to Polymer Science and Technology, John Wiley and Sons, New York (1977).
8. Kumar; Anil and Gupta; Rakesh K., Fundamentals of Polymers, McGraw-Hill Inc.,(International Edition), New York (1998).
9. Kumar; Anil and Gupta; S. K., Fundamentals of Polymer Science and Engineering
10. A. B. Glanvill, "The Plastic Engineer's Data Book", The Machinery Pub