

# **DEPARTMENT OF CHEMISTRY**

# **M.Sc. APPLIED CHEMISTRY**

# AC H 503: POLYMERS AND PHOTOCHEMISTRY

# **COURSE OUTCOME:**

- This consists of two units of polymer chemistry and one unit of photochemistry topics. In the first two units, students get knowledge on highly useful materials, namely polymers.
- It deals with types, techniques of preparation and characterization of polymer materials. The applications of these materials in daily life, engineering and biomedical field have been emphasized.
- The students are exposed to the methods of polymer waste management which is essential to minimize plastic pollution
- Students learn various physical chemistry aspects of electronic spectroscopy and examples for different category of photochemical reactions.

### UNIT-I:

# [15 Hours]

**Terminology and basic concepts:** Monomers, Functionality, repeat units, degree of polymerization. General structure and naming of polymers.

**Classification** based on various considerations-source, preparation methods, thermal behavior, chain structure etc. Homopolymers and copolymers, Linear, branched and network polymers. **Techniques of polymerization**: Techniques of preparation of addition and condensation polymers. **Kinetics of polymerization**: Kinetics of addition and condensation polymerization. Kinetics of copolymerization, reactivity ratio and composition of copolymers.

Expressions for average molecular weighs. Molecular weight distribution and Polydispersity. **Determination of molecular weight:** Osmometry, viscometry, ultracentrifugation and GPC methods

#### UNIT-II:

### [15 Hours]

**Stereochemistry of polymers**: Geometric and optical isomerism in polymers. Structure, properties and preparation of stereoregular polymers.

Thermal Characterization: Glass Transition and melting-correlation with structure- Factors

affecting Tg and Tm. Techniques of thermal characterization: DSC, DTA, DTG and TGA techniques.

**Structural features, properties and uses of commercial polymers:** Vinylic and acrylic polymers, polyesters, polyamides, polyurethanes, polycarbonates, phenolic and amino resins, and regenerated cellulose.

**Properties and uses of Specialty polymers-** Composites, Conducting polymers and Biomedical polymers.

Polymer processing Techniques - Compounding- role of additives. Casting, moulding and spinning techniques. Plastic waste management techniques.

### UNIT-III:

# [15 Hours]

**Photochemistry**: Introduction to photochemistry. Determination of quantum yield-Actinometry. Frank-Condon principle and its implications in predicting shapes of absorption and emission spectra. Effect of solute solvent interactions on electronic spectra-spectral shifts. Physicochemical properties of electronically excited molecules-excited state dipole moments, acidity constants. Flash photolysis technique.

Photophysical pathways- Jablonski diagram, Radiative and Radiationless transitions, selection rules. Photochemical kinetics of unimolecular and bimolecular processes. Quenching-collisions in the gas phase and in solution (Stern-Volmer equation). Photoisomerization, photo Fries rearrangement and Norrish type cleavage reactions with specific examples.

### **REFERENCES:-**

- 1. Text book of Polymers- F.W. Billmeyer (Wiley)
- 2. Contemporary Polymer Chemistry-H.R. Allcock and F.W. Lampe (Prentice Hall).
- 3. Polymer Science and Technology-J.R. Frird (Prentice Hall).
- 4. Polymer Science: V.R. Gowariker, N.V. Viswanathan & T. Sreedhar.
- 5. Principles of Polymer Science- P. Bahadur and N. V. Sastry (Narosa Publishers)
- 6. Fundamentals of Photochemistry Rohatgi and Mukherje (New Age Bangalore), 2000.
- 7. Physical Chemistry, 5<sup>th</sup> Ed., Atkins (ELBS) 1995.
- 8. Photochemistry-Gurdeep Raj, Goel Publishing House, 2<sup>nd</sup> Edition, 1991.
- 9. Photochemistry, Carol E Wayne & Richard P. Wayne, Oxford Univ Press, 1996