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 ofpolymerization. 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 condensationpolymers. **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 GPCmethods

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

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

Properties and uses of Specialty polymers- Composites, Conducting polymers and Biomedicalpolymers.

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

UNIT- III: **[15 Hours]**

Photochemistry: Introduction to photochemistry. Determiation 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^{th} Ed., - Atkins (ELBS) 1995.
8. Photochemistry-Gurdeep Raj, Goel Publishing House, 2^{nd} Edition, 1991.
9. Photochemistry, Carol E Wayne & Richard P. Wayne, Oxford Univ Press, , 1996

AC S 504: ORGANOMETALLIC CHEMISTRY

COURSE OUTCOME:

- The students will learn Historical development of Organometallic compounds, Classification,
- Nomenclature, Transition metal to carbon multiple bonded compounds, Transition metal-carbon pi complexes,
- Catalysis by organometallic compounds, Homogeneous catalysis by organometallics, Hydrocarbonylation of olefins,
- Ziegler-Natta catalyst and Water Gas Shift reactions in this course.

UNIT- I: **[12 Hours]**

Historical development- classification and nomenclature, bond energies and stability. 16- and 18-electron rules. Transition metal alkyls and aryls- types, routes of synthesis, stability and decomposition pathways,. Nucleophilic and electrophilic cleavage of metal-carbon sigma bonded compounds. Alkane activation.

Transition metal to carbon multiple-bonded compounds- carbenes, carbynes, synthesis, nature of bond, agostic interactions, structural characteristics and reactivity. Transition metal hydrides – synthetic routes, properties, structure and reactivity, synthetic applications.

UNIT-II: **[12 hours]**

Transition metal-carbon pi complexes: Preparative methods, nature of bonding, structural features of olefinic, acetylenic, allylic, butadiene, cyclobutadiene, η^5-cyclopentadienyl, η^6-benzene and other arenes, cycloheptatriene and cyclooctatetraene complexes. Important reactions relating to nucleophilic and electrophilic attack on ligands. Fluxional isomerism in olefin, allyl, dienyl and cyclopentadienyl complexes. Carbene complexes and metallacycles, arene complexes. Isolobal concept.

UNIT- III: **[12 hours]**

Catalysis by organometallic compounds: oxidative addition, insertion, deinsertion and reductive elimination reactions. Homogeneous catalysis by organometallics- hydrogenation, hydrosilation, hydrocyanation and isomerization of olefins, immobilisation of homogeneous hydrogenation catalysts, Hydrocarbonylation of olefins (oxo reaction–cobalt and rhodium