**ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),**

**VISAKHAPATNAM**

**VII SEMESTER** **B.Sc. HONOURS CHEMISTRY** Time: 4Hrs/Week

**Code CH 7206(3)** **Revised Syllabus Under CBCS 2020-21** Marks: 100

**Polymer Chemistry**

**I.**

**Course Objective:** To enable students to understand the physical and chemical properties and functional importance of polymers along with the kinetics of polymerization reactions.

**Course Outcomes:**

**By the end of this course, students will be able to:**

- Know about history of polymeric materials and their classification
- Learn about different mechanisms of polymerization and polymerization techniques
- Evaluate kinetic chain length of polymers based on their mechanism
- Differentiate between polymers and copolymers
- Learn about different methods of finding out average molecular weight of polymers
- Differentiate between glass transition temperature (Tg) and crystalline melting point (Tm)
- Determine Tg and Tm
- Know about solid and solution properties of polymers
- Learn properties and applications of various useful polymers in our daily life.

**II. Syllabus:**

**Unit-1: History of polymeric materials and functionality and its importance**

**10 hours**

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers. Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bi-functional systems, Poly-functional systems.

**Unit-II: Kinetics of Polymerization** **12 hours**

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

**Unit-III: Determination of molecular weight of polymers and crystallinity**

**12 hours**

(*Mn*,*Mw*, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index. Determination ofcrystalline melting point and degree of crystallinity,Morphology of crystalline polymers, Factors affecting crystalline melting point.

**Unit-IV :Glass transition temperature (Tg) and Polymer Solution** **14 hours**

Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg). Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.

**Unit-V Properties of Polymers** **12 hours**

(Physical, thermal, Flow & Mechanical Properties).

Brief introduction to preparation, structure, properties and application of the following polymers: poly olefins, polystyrene and styrene copolymers, poly (vinyl chloride) and related polymers, poly (vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [poly acetylene, poly aniline, poly(pphenylene sulphide poly pyrrole, poly thiophene)].

**III. Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of relevantvideos and material.
3. Visits of abilities, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts.

**VI. Suggested Text Books:**

1. R.B. Seymour & C.E. Carraher: *Polymer Chemistry: An Introduction,* Marcel Dekker, Inc. New York, 1981.
2. G. Odian: *Principles of Polymerization*, 4th Ed. Wiley, 2004.
3. F.W. Billmeyer: *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971.
4. P. Ghosh: Polymer Science & Technology, Tata McGraw-Hill Education, 1991.
5. R.W. Lenz: *Organic Chemistry of Synthetic High Polymers.* Interscience Publishers, New York, 1967.

**V. References:**


1. Allcock, H.R.; ; Lampe, F. W.; Mark, J. E.(2003),Contemporary Polymer Chemistry, Prentice-Hall.
2. Fried, J.R. (2003), **Polymer** Science and Technology, Prentice-Hall