ARSD College, University of Delhi

Lesson Plan

Course Name : B.Sc. (Hons) Chemistry						
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
VI	DSE-3	DSE: Polymer Chemistry	2	0	0	2
Teacher/Instructor(s)		Dr. Anjali Verma				
Session		2022-23				

Course Objective:

- This paper provides an insight on history and introduction of polymers.
- Also, students will learn different techniques for synthesis of various polymers.
- Emphasis is being laid to introduce students to need and applications of polymers.

Course Learning Outcomes:

- 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) and their determination
- Know about solid and solution properties of polymers
- Learn properties and applications of various useful polymers in our daily life.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1.	Introduction and history of polymeric materials Functionality and its importance	1-2	History and classification of Polymers
		3-4	Nomenclature of Polymers
		5-6	Molecular Forces and Chemical Bonding & texture
		7-8	Criteria of polymer formation and classification of polymerization processes

		9-10	Functionality, extent of reaction & degree of polymerization & their relationship
		11-12	Discussion on bifunctional and polyfunctional systems, discussion on queries
2.	Kinetics of Polymerization	13-14	Mechanism of step growth polymerization and kinetics
		15-16	Mechanism of chain growth polymerization (free radical, cationic and anionic) and kinetics
		17-18	Mechanism and kinetics of co-polymerization, Polymerization techniques
3.	Glass Transition Temperature Crystallization and crystallinity	19-20	Glass transition temperature and its determination
		21-22	Free Volume theory & WLF theory
		23-24	Factors Affecting glass transition temperature
		25-26	Crystallization and crystallinity: Determination of crystalline melting point and degree of crystallinity,
		27-28	Morphology of crystalline polymers, Factors affecting crystalline melting point.
		29-30	Discussion on queries and previous year question papers

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment • Quiz • Class Test • Attendance • Assignment		25
2.	End Semester Examination	3 hr	75

Details of the Course		
Unit	**Contents**	**Contact Hours**
I	**Introduction and history of polymeric materials:** History of polymeric materials, Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers **Functionality and its importance:** Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerizationBifunctional systems, Polyfunctional systems	12
II	**Kinetics of Polymerization** Mechanism of step growth polymerization, kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic), Mechanism and kinetics of copolymerization, polymerization techniques	08

III	**Glass transition temperature** (Tg) and determination of Tg, Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg). **Crystallization and crystallinity**: Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point. Nature and structure of polymers-Structure Property relationships	14
IV	**Determination of molecular weight** of polymers (Mn, Mw, etc.) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index **Polymer Solution** Criteria for polymer solubility and Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy and free energy change of mixing of polymers solutions. **Polymer Degradation** Thermal, oxidative, hydrolytic and photodegradation	16
V	**Properties of Polymers** (Physical, thermal, Flow & Mechanical Properties) Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, 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, Novolac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers: polyacetylene, polyaniline, poly(p-phenylene sulphide, polypyrrole, polythiophene	10
	Total	**60**

Suggested Books:

Sl. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
1.	Carraher,C. E. Jr. Seymour's Polymer Chemistry, Marcel Dekker, Inc	2013
2.	Odian, G., Principles of Polymerization, John Wiley	2004
3.	Billmeyer, F.W., Text Book of Polymer Science, John Wiley	1984
4.	Ghosh, P., Polymer Science & Technology, Tata Mcgraw-Hill	2001
5.	Gowariker, V. R., Viswanathan, N. V., & Sreedhar, J. Polymer science. New Age International.	1986

Mode of Evaluation:	Internal Assessment / End Semester Exam