

## SEMESTER VIII

### CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Polymers and Plastics(DSC-8)	04	02	--	02	Class 12 <sup>th</sup> with Physics, Chemistry	--

#### Course Objectives:

The paper imparts basic knowledge of polymers and plastics their properties and applications. The paper is designed in such a way that it will enrich students with the knowledge of various types of polymers such as Thermoplastic, thermosetting and elastomers.

#### Learning Outcomes:

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

- Develop the use of polymers in industrial applications.
- Gain sound knowledge of various types of polymers.
- Design and use of scientific method of planning, developing, conducting, reviewing and reporting experiments.
- Get skilled concepts of industrial and environmental friendly polymers which will help them to explore new innovative areas of research.

#### Unit 1

**Hours: 10**

Introduction to polymers and their applications, Classifications: Natural and Synthetic polymers, Conducting polymer, Thermoplastics, Thermosets, and Elastomers, Structure property relationship, Polymer properties: molecular weight, mechanical, thermal, electrical, and optical. Basics of polymerisation reaction, condensation, addition, metathesis, ring opening polymerisation and kinetics and types.

#### Unit 2

**Hours: 6**

Industrial manufacturing of the monomers and their polymers: Polystyrene, Polyethylene, Polyacrylonitrile, Polymethylmethacrylate, Polybutadiene, Polycarbonates, Polyurethanes, Nylon(6:6 and 6:10), and Poly-sulphone.

**Unit 3****Hours: 8**

Polymer modification and Processing: Polymer additives: Fillers, Plasticiser, stabiliser, Blowing agent and Colorants. Compounding, compression moulding, injection moulding, extruder and calendar.

**Unit 4****Hours: 6**

Degradation and Recycling of Plastic and biodegradability: Mechanism and limitations of thermal degradation and biodegradation. Importance of plastic recycling and different methods: Mechanical recycling (sorting, shredding and reprocessing), Chemical Recycling, and biological recycling.

**Practical**

(Credits: 2, Laboratory periods: 60)

1. Preparation of Maleic Anhydride/ glyptal resin.
2. Preparation of Caprolactum.
3. Preparation of Polystyrene by bulk polymerisation..
4. Preparation of phenol formaldehyde and urea formaldehyde resins.
5. Preparation of hexamethylenediamine and Adipic acid.
6. Preparation of nylon 6,6.
7. Molecular weight determination of a polymer (nylon 6,6) by end group analysis.
8. Biodegradability of polymer by soil burial Test.
9. Preparation of a flexible film of polyvinyl alcohol by solvent casting and report its physical Properties (Thickness/ Strength) .

**References (Theory):**

1. Plastic Materials; by J. A. Brydson
2. Polymer Science; by V.R. Gowariker, N.V. Viswanathan, and Jayadev Sreedhar
3. Textbook of Polymer Science; by Fred W. Billmeyer Jr.
4. Principles of Polymerization by George Odian
5. Handbook of Plastic Processes; edited by Charles A. Harpe
6. Plastics and the Environment; by Anthony L. Andrady

### References (Practical):

1. Experiments in Polymer Science by D G Hundiwale, V D Athawale, U R Kapadi and V VGite.
2. Practical's in Polymer Science by Siddaramaiah, CBS Publisher.
3. Practical Polymer Analysis by T R Crompton, Springer
4. Experimental methods in polymer science: modern methods in polymer research and technology, Elsevier.
5. Handbook of polymer testing: physical methods by Brown R., CRC Press
6. Polymer Chemistry A practical approach by Fred-J-Davis, Oxford.

### Assessment Methods:

All examination and assessments methods shall be in line with the University of Delhi guidelines issued from time to time.

### Keywords:

Polymer, Thermoset polymers, Thermoplastic polymers, Polymer additives: Fillers, Plasticiser, stabiliser, metathesis, Polystyrene, Polyethene, Polyacrylonitrile, Polymethylmethacrylate, Polybutadiene, Polycarbonates, Polyurethanes, Nylon(6:6 and 6:10), Poly-sulphone.

### Details of Discipline Specific Elective (DSE) courses

Course Code	Name of the course	Credits T- Theory Credits P- Practical Credits
Chemistry DSE-3	Transition Metal Clusters-Introduction and Applications	T=2 P=2
Chemistry DSE-4	Advanced Analytical Techniques for Inorganic Compounds	T=2 P=2
Chemistry DSE-7	Advanced Stereochemistry	T=2 P=2
Chemistry DSE-8	Reactive Intermediates of Organic Chemistry	T=2 P=2
Chemistry DSE-12	Interfacial Electrochemistry	T=2 P=2
Chemistry DSE-13	Fundamentals of Solid-State and Materials Chemistry	T=2 P=2
Chemistry DSE-14	Fundamentals of Solid-State and Materials Chemistry	T=2 P=2