

DISCIPLINE SPECIFIC ELECTIVE COURSE - 6 (DSE- 6): Polymers, Colloids, Surfaces and Interfaces

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, Colloids, Surfaces and Interfaces (DSE- 6)	04	03	--	01	Class 12 th with Physics, Chemistry	--

Learning Objectives

The objectives of this course are as follows:

- To give students a comprehensive coverage of important physical aspects of polymers chemistry, colloids, emulsions, surfaces and interfaces.
- to study the applications of these aspects.

Learning outcomes

By studying this course, the students will be able to:

- Explain the types of polymers, kinetics of polymerization and polymer properties.
- Understand and apply the concepts of properties of polymer solutions and their thermodynamics.
- Comprehend the basic concepts of surface chemistry specifically in relation to colloids.
- Have a thorough understanding of applications of colloids in various areas.

SYLLABUS OF DSE-6

UNIT 1: Introduction to polymers

(Hours: 6)

Recapitulation of basic concepts of polymers. Types of polymerizations and their mechanism and kinetics: Free radical, ionic, step-growth, coordination, copolymerization. Polymerization techniques: Bulk, solution, suspension, and emulsion.

UNIT 2: Polymer solution

(Hours: 9)

Polymer solution – solubility parameter, properties of dilute solutions and their criteria, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change. Flory Huggins theory.

UNIT 3: Introduction to Colloid Chemistry

(Hours: 9)

Recapitulation of basic concepts of Adsorption, Distinction among true solutions, colloids and suspensions, Components of Colloids, classification of colloids - lyophilic, lyophobic; Preparation methods and properties of lyophobic solutions, Hydrophile-lyophile balance (HLB), multi molecular, macromolecular and associated colloids (micelles formation), preparation and properties of colloids - Tyndall effect, Brownian movement, electrophoresis, dialysis, coagulation and flocculation; Charge on Colloidal particles and Electrical double layer concept, Suspensions and their characteristics, Emulsions and their characteristics.

UNIT 4: Surface chemistry in relation to colloids

(Hours: 12)

Surface film on liquid surface, surface potential, monomolecular films, Langmuir Blodgett layers. Emulsions, foams and aerosols; electrical aspects of surface chemistry; Surface of solids, solid-liquid interface, stability of dispersions, stabilization of suspensions

UNIT 5: Application of colloids

(Hours: 9)

Characterization of colloidal particles, Role of colloid chemistry in Nanotechnology (wet colloid chemical approach, “bottom up” fabrication of nanoparticles and nanostructured materials), applications of colloid chemistry in petroleum recovery, coating and painting, food, pharmaceuticals and cosmetic industry, medicinal chemistry (use in drug formulations), Sewage disposal, Purification of water, cleansing action of soap, Formation of Delta, Smoke precipitation, Photography, Artificial rain

Practical component

Practicals:

Credits: 01

(Laboratory periods:15 classes of 2 hours each)

1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA)/MethylAcrylate (MA).
2. Preparation of nylon 6,6
3. Determination of molecular weight of polyvinyl propylidene in water by viscometry.
4. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of head-to-head monomer linkages in the polymer.
5. Determination of molecular weight by end group analysis of polymethacrylic acid.
6. Estimation of the amount of HCHO in the given solution by sodium sulphite method.
7. Preparation of Colloidal Sols of following
 - A. Arsenic sulphide,

- B. Antimony sulphide
 - C. Ferric chloride
 - D. Aluminium hydroxide
8. To find out the precipitation values of arsenious sulphide sol by using monovalent, bivalent and trivalent cations.
 9. To determine the nature of charge on particle in given colloidal solution and their electrophoretic velocity and zeta potential.
 10. To prepare lyophilic sol of starch.

Essential/recommended readings

Theory:

1. Carraher, C. E. Jr. (2013), **Seymour's Polymer Chemistry**, Marcel Dekker, Inc.
2. Odian, G. (2004), **Principles of Polymerization**, John Wiley.
3. Billmeyer, F.W. (1984), **Text Book of Polymer Science**, John Wiley
4. Myers D., Surface, interfaces and colloids Principles and Applications, 2nd Edition, Wiley-VCH
5. V.R. Gowarikar (2010), **Polymer Science**, New Age International Publishers Ltd.

Practical:

1. Sperling, L.H. (2005), **Introduction to Physical Polymer Science**, John Wiley & Sons

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.