

DISCIPLINE SPECIFIC ELECTIVE COURSE CHEM-DSE 11: Chemistry of Polymers, Dyes and Natural Products

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		
Chem-DSE 11: Chemistry of Polymers, Dyes and Natural Products	04	02	-	02	Class XII with Science	

Learning Objectives

The Learning Objectives of this course are as follows:

- To understand the process of converting knowledge of chemistry into marketable products for commercial gain.
- To familiarize the basic nomenclature of polymers, dyes and natural products, classification and important terms.

Learning outcomes

By studying this course, students will be able to:

- Learn about the chemistry of natural and synthetic polymers including fabrics and rubbers.
- Understand the chemistry of biodegradable and conducting polymers and appreciate the need of biodegradable polymers with emphasis on basic principles.
- Comprehend the theory of colour and constitution as well as the chemistry of dyeing.
- Know applications of various types of dyes including those in foods and textiles.
- Understand the chemistry and applications of natural products like terpenoids and alkaloids.

Syllabus

UNIT-1: Polymers

(Hours: 12)

Introduction and classification based on origin, monomer units, thermal response, mode of formation, structure, application and tacticity; di-block, tri-block and amphiphilic polymers; Weight average molecular weight, number average molecular weight, glass transition

temperature (T_g) of polymers; Polymerisation Reactions-Addition and condensation. Mechanism of cationic, anionic and free radical addition polymerization; Ziegler-Natta polymerisation of alkenes.

Preparation and applications of: Plastics -thermosetting (phenol-formaldehyde, polyurethanes) and thermosoftening(PVC, polythene); Fabrics -natural (cellulose and synthetic derivatives of cellulose like rayon and viscose); synthetic (acrylic, polyamide, polyester); Rubbers-natural and synthetic: Buna-N, Buna-S, Neoprene, silicon rubber; Vulcanization; Polymer additives; Introduction to Specialty Polymers: electroluminescent (Organic light emitting diodes), conducting, biodegradable polymers and liquid crystals.

UNIT 2: Dyes

(Hours: 08)

Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing. Synthesis and applications of Azo dyes – Methyl orange, Congo red; Triphenyl methane dyes- Crystal violet; Phthalein Dyes – Phenolphthalein; Natural dyes –Structure elucidation and synthesis of Alizarin and Indigotin; Edible Dyes with examples.

Unit 3: Natural Product Chemistry- An Introduction to Terpenoids and Alkaloids

(Hours: 10)

Terpenes: Introduction, occurrence, classification, uses, isoprene and special isoprene rule; structure elucidation, synthesis and industrial application of citral.

Alkaloids: Introduction, occurrence, classification, uses, general structural features, general methods for structure elucidation including Hoffmann's exhaustive methylation and Emde's method. Structure elucidation, synthesis and physiological action of Nicotine.

Practicals:

-

Credits: 02

(Laboratory periods: 60)

1. Preparation of Starch-PVA Film.
2. Recycling of Plastic: Moulding of plastic or Cracking of plastic.
3. Preparation of Urea-formaldehyde resin.
4. Preparation of Methyl Orange.
 - (a) Dyeing of different fabrics (cotton, wool, silk) using Alizarin or any other dye.
 - (b) Preparation of azo dye on the surface of the fabric.
5. Qualitative test for identification of alkaloids (Dragendorff Reagent and Mayer's reagent test) and terpenoids (Salkowski test).
6. Preparation of Malachite Green.
7. Preparation of perichromic dye using p-amino Phenol and p-nitro benzaldehyde.

References:

Theory

1. Finar, I.L. (2008), **Organic Chemistry**, Volume 2, 5th Edition, Pearson Education
2. Saunders, K. J. (1988), **Organic Polymer Chemistry**, 2nd Edition Chapman & Hall, London
3. Campbell, Ian M., (2000), **Introduction to Synthetic Polymers**, 2nd Edition Oxford University Press, USA.
4. Bahadur, P. and Sastry, N.V. (2002) **Principles of Polymer Science** Narosa Publications, New Delhi
5. Patrick, G. **An Introduction to Medicinal Chemistry** (2013), 4th Edition, Oxford University Press.

6. Priscilla Abarca, Patricia Silva, Iriux Almodovar and Marcos Caroli Rezende* Quim. Nova, Vol. 37, No. 4, 745-747, 2014. <http://dx.doi.org/10.5935/0100-4042.20140120>

Practical:

1. Ashraf S.M., Ahmad S., Riaz U., **A Laboratory Manual of Polymers**, I. K. International Publishing House Pvt. Ltd., New Delh.
2. Hannaford FA J., Smith P. W. G. & Tatchell A. R.; **Vogel's Textbook of Practical Organic Chemistry** Fifth Edition, Longman Scientific and Technical.
3. Pasricha, S., Chaudhary, A. (2021), **Practical Organic Chemistry: Volume I**, I K International Publishing House Pvt. Ltd., New Delhi.

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