

## DISCIPLINE SPECIFIC ELECTIVE COURSE – 8 (DSE-8): Applied Organic Chemistry

### 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		
Applied Organic Chemistry (DSE-8)	04	03	--	01	Class 12 <sup>th</sup> with Physics, Chemistry	--

### Learning Objectives

The objectives of this course are as follows:

- To make students aware of the importance of organic compounds in daily life.
- To familiarize students with the chemistry and uses of dyes, polymers, terpenoids, alkaloids, steroids and pharmaceutical compounds and their direct or indirect effect on human life and health

### Learning outcomes

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

- Discuss and demonstrate the chemistry and uses of commercially important and naturally occurring compounds like dyes, polymers, terpenoids, alkaloids, steroids and pharmaceuticals.
- Appreciate the chemistry of biodegradable and conducting polymers and their importance to human life and society.
- Comprehend the chemistry of dyeing and dyes. Explain why some dyes are better than others. Describe the applications of various types of dyes including those in foods and textiles.
- Comprehend the synthetic routes and mode of action of some selected pharmaceutical compounds
- Use the knowledge gained to solve real world problems

## SYLLABUS OF DSE-8

### Unit 1: Dyes

(Hours: 7)

Nomenclature of commercial dyes with at least one example. Suffixes - G, O, R, B, 6B, L, S; colour index and colour index number. Classification of dyes based on structure and application; Chemistry of dyeing.

Synthesis and applications of the following types of dyes: Azo dyes - Methyl orange, Congo red; Triphenyl methane dyes-Malachite green, Rosaniline and Crystal violet; Phthalein Dyes - Phenolphthalein; Natural dyes - Structure elucidation and synthesis of Alizarin and Indigotin; Edible Dyes (natural and synthetic) with examples and effect of synthetic food colours on health.

### Unit 2: 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 3: Natural Product Chemistry- An Introduction to Terpenoids, Alkaloids and Steroids (Hours: 12)

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.

Steroids: Introduction, occurrence, structure, Diel's hydrocarbon, nomenclature of steroid hydrocarbons, structure and biological functions of the following steroids- Cholesterol, Sex Hormones (Estrogen, androgen and progesterone), Adrenocortical hormones (Cortisone and cortisol) and Ergosterol (antirachitic effect).

#### Unit 4: Pharmaceutical Compounds

(Hours:14)

Introduction, classification; Synthesis, uses, mode of action and side effects of the following drugs:

Antipyretics -Paracetamol; Analgesics- Ibuprofen; Antimalarials - Chloroquine; Antitubercular drugs - Isoniazid.

An elementary treatment of Antibiotics and detailed study of chloramphenicol including mode of action. Structure and medicinal uses of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

#### Practical component

**Practical:**

**Credits: 01**

**(Laboratory periods:15 classes of 2 hours each)**

**(At least five experiments to be performed)**

1. Synthesis of urea formaldehyde resin and test the solubility.
2. Preparation of Starch-PVA Film.
3. Preparation of Methyl orange.
4. Separation of a mixture of dyes by Thin Layer Chromatography (TLC).
5. Isolation and estimation of the content of aspirin in a commercial tablet.
6. Synthesis of 4-methyl-7-hydroxycoumarin by condensation of resorcinol with ethyl acetoacetate.
7. Synthesis of 3,5-dimethyl pyrazole by condensation of acetylacetone and hydrazine.
8. Synthesis of benzimidazole.
9. Synthesis of 2,3-diphenylquinoxaline.
10. Synthesis of paracetamol

#### Essential/recommended readings

##### Theory:

1. Finar, I.L. Fifth Edition **Organic Chemistry**, Volume 2, Pearson Education, 2008.
2. Saunders, K. J., (1988), **Organic Polymer Chemistry**, Second Edition Chapman & Hall, London.
3. Campbell, Ian M., (2000), **Introduction to Synthetic Polymers**, Second Edition, Oxford University Press, USA.
4. Bahadur, P. and Sastry, N.V. (2002) **Principles of Polymer Science** Narosa, New Delhi
5. Patrick, G. **An Introduction to Medicinal Chemistry** (2013), Fourth Edition, Oxford University Press.
6. Beale J.M. Block J., (2010) **Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry**, Twelfth Edition, Lippincott Williams and Wilkins.
7. Alagarsamy, V. (2010), **Textbook of Medicinal Chemistry**, Volume II, Second Edition, Reed Elsevier India Private Limited.

### Practical:

1. Sciam, A.J. **TLC of mixture of dyes**; *J. Chem. Educ.*, **1985**, 62(4), 361.  
<https://pubs.acs.org/doi/10.1021/ed062p361>.
2. McKone, H.T.; Nelson, G.J. **Separation, and identification of some FD &C dyes by TLC. An undergraduate laboratory experiment**, *J. Chem. Educ.*, **1976**, 53(11), 722.  
DOI: 10.1021/ed053p722.

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