

# SEMESTER VII

## 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		
Dyes: Preparation and properties (DSC-7)	04	02	--	02	Class 12 <sup>th</sup> with Physics, Chemistry	--

### Course Objectives:

The paper imparts basic knowledge of dyes, properties of dyes and mode of action. This paper is designed in such a way that it will enrich students with the knowledge of various types of dyes, their preparations and applications. The paper has been drafted to impart the theoretical and practical knowledge of dyes with the view of their industrial applications.

### Learning Outcomes:

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

- Establish an appreciation of the role of dyes in industrial applications.
- Gain sound knowledge of various types of dyes.
- Get skilled in the scientific method of planning, developing, conducting, reviewing and reporting experiments.
- Get skilled concepts of dyes which will help them to explore new innovative areas of research.

### Unit I

Hours: 6

Definition of dyes and pigments. Historical development of dyes – from natural to synthetic. The concept of color and constitution (chromophore-auxochrome theory, resonance and molecular orbital theory).

### Unit II

Hours: 10

Classification of dyes: based on origin (natural/synthetic), chemical structure, and application. Important dye classes: azo, anthraquinone, indigoid, triphenylmethane, phthalocyanine, sulphur based dyes, vat, reactive, disperse, and mordant dyes. Mechanisms of dye synthesis (emphasis on azo coupling). Basic structure-property relationships.

### Unit III

Hours: 6

Methods of dyeing (batch, continuous, and semi-continuous processes). Dyeing of different fibres: cotton, wool, silk, polyester, nylon. fastness properties (light, wash, rub) and testing. Textile printing techniques.

### Unit IV

Hours: 8

Impact of dyes on the environment and human health. Treatment of dye effluents – physical, chemical, and biological methods.

Natural dyes – sources, extraction, and limitations. Advances in eco-friendly synthetic dyes. Enzymatic dyeing, waterless dyeing technologies (e.g., supercritical CO<sub>2</sub>). Case studies from Indian traditional practices (e.g., indigo dyeing, Kalamkari).

## Practical

(Credits: 2, Laboratory periods: 60)

1. Synthesis of Methyl Orange (e.g., Azo Dye)
2. Synthesis of Malachite Green (Triphenylmethane dye).
3. Dyeing of Cotton using Reactive Dye
4. Dyeing of Wool/Silk using Acid Dye
5. Dyeing (Mordant) of Cotton with Natural Dye (e.g., Turmeric, Henna, Madder) Using alum, ferrous sulfate, or tannins as mordants.
6. Testing of Color Fastness to Washing (ISO Method)
7. Testing Color Fastness to Rubbing
8. Determination of pH of dyed fabrics and dye baths
9. Decolorization of Dye Effluent Using Adsorption (Activated Charcoal / Natural Clays)
10. Extraction of Natural Dye from Plant Sources (Onion Peels, Marigold, Beetroot) and Application on Cotton or Paper

## References (Theory):

1. "Chemistry of Synthetic Dyes" – K. Venkataraman
2. "Textile Dyeing" – Peter Hauser
3. "Handbook of Natural Colorants" – Thomas Bechtold & Rita Mussak
4. Relevant UGC & BIS guidelines

### References (Practical):

1. Shore, J. (1995). Colorants and Auxiliaries: Volume 2: Auxiliaries. Society of Dyers and Colourists.
2. Broadbent, A. D. (2001). Basic Principles of Textile Coloration. Society of Dyers and Colourists.[
3. Trotman, E. R. (1984). Dyeing and Chemical Technology of Textile Fibres. Charles Griffin & Company.
- 4 Vogel's Textbook of Organic Chemistry.

### Assessment Methods:

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

### Keywords:

Dyes, Natural and Synthetic dyes, Classification of dyes, Structure-properties relationship of dyes, Application of dyes, Environmental aspects of dyes.

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

Course Code	Name of the course	Credits T- Theory Credits P- Practical Credits
Chemistry DSE-1	Main Group Clusters - Basics and Applications	T=2 P=2
Chemistry DSE-2	Advanced Coordination Chemistry	T=2 P=2
Chemistry DSE-5	Fundamentals of Natural Products	T=2 P=2
Chemistry DSE-6	Fundamentals of Medicinal Chemistry	T=2 P=2
Chemistry DSE-9	Advanced Molecular Spectroscopy and Applications	T=2 P=2
Chemistry DSE-10	Interfaces, Macromolecules and Biophysical Chemistry	T=2 P=2
Chemistry DSE-11	Mathematical Methods in Chemistry	T=2 P=2

**\*The Discipline Specific Elective (DSE's) papers have been taken from the syllabus of B Sc (H) Chemistry**