SYLLABUS FOR INDUSTRIAL CHEMISTRY
Semester VII & VIII
Details of Discipline Specific Core and Elective (DSC &DSE) courses

Course Code	**Name of the course**	**Credits** **T- Theory Credits** **P- Practical Credits**
Industrial Chemistry DSC-7	Dyes: Preparation and properties	T=2 P=2
Industrial Chemistry DSC-8	Polymers and Plastics	T=2 P=2
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-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-5	Fundamentals of Natural Products	T=2 P=2
Chemistry DSE-6	Fundamentals of Medicinal Chemistry	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-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
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

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

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 12th with Physics, Chemistry**	**--**

CourseObjectives:

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 dyesin 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_2).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**

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 12th 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 ofpolymersin 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, ringopening polymerisation and kinetics and types.

Unit 2 **Hours: 6**

Industrial manufacturing of the monomers and their polymers: Polystyrene, Polyethene, 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 Recyclingof Plastic and biodegradability: Mechanism and limitations of thermal degradation and biodegradation.Importance of plastic recycling and different methods:.Mechanical recycling(sorting, shredding andreprocessing), 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 reportits physical

Properties (Thickness/ Strength) .

References (Theory):

1. Plastic Materials; by J. A. Brydson

2. Polymer Science; by V.R. Gowariker, N.V. Viswanathan, and JayadevSreedhar

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 ChemistryA 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