

Department of Chemistry
New Syllabus of II Year Advanced Diploma Program (PG)
Synthesis and processing of dye

Syllabus Structure

Year	Semester	Course No.	Course Code	Contact Hours	Credits (1Credit=15 H)	Total Marks	
2	III	CT III	ADCST 303	30	2	75	
		CL III	ADCSL303	60	2	150	
	IV	CT IV	ADCST 404	30	2	75	
		CL IV	ADCSL404	60	2	150	
	Annual	CP II	ADCSP 202	60	2	150	
	Industrial and or Incubation and or Research and or Field Training				60	2	-
	Total				300	12	600
Total				540	22	1200	

AD: Advanced Diploma, *: Departmental Code (C: Chemistry, MI: Microbiology, CSE: Computer Science (Entire), etc)

C: Course, T: Theory, L: Lab (Practical), P: Project

Total No. of Papers: 06 (Theory: 02, Practical: 02, Project: 01)

Theory and Practical: Semester, **Project: Annual**

Semester III

~~ADCST~~ **ADCST 303: Synthesis of selected dyes**
 (Contact Hrs: 30 Credits: 2)

Learning Objectives:

- 1) To understand and learn the chemical constitution of dyes.
- 2) To learn the environmental hazards of dyes.

Unit I: Classification of Dyes based on Chemical Constitution and Synthesis of Selected Dyes

[15]

i) **Nitro Dye:** Naphthol Yellow S

ii) **Nitroso Dye:** Gambine Y

iii) Azo dyes:

- a) Monoazo dyes: Orange IV (from sulphanilic acid) & Eriochrome Black T (from β - naphthol)
- b) Bisazo dyes: Congo Red (from nitrobenzene)

Trisazo Dye: Direct Deep Black EW (from benzidine)

iv) **Diphenylmethane dye:** Auramine O (from N,N-dimethyl aniline)

v) Triphenylmethane dye:

- a) Diamine series: Malachite Green (from benzaldehyde)
- b) Triamine series: Acid Magenta

Phenol series: Rosolic acid

vi) Heterocyclic Dyes:

- a) Thiazine dyes: Methylene Blue
- b) Azine dyes: Safranin T (from o-toluidine)
- c) Xanthene Dyes: Eosin (from phthalic anhydride)
- d) Oxazine Dyes: Capri Blue

Acridine Dyes: Acriflavine

vii) Quinone Dyes:

- a) Naphthaquinone: Naphthazarin

Anthraquinone Dyes: Indanthrene Blue (from anthraquinone)

viii) Indigoid Dyes: Indigo (from aniline + monochloroacetic acid)

ix) Phthalocyanine Dyes: Monastral Fast Blue B

Unit II: Health and Environmental Hazards of Synthetic Dyes and their Remediation Processes

[15]

Impact of the textile and leather dye Industry on the environment with special emphasis on water pollution

Health Hazards: Toxicity of dyes w.r.t food colours.

Effluent Treatment Strategies:

Brief introduction to effluent treatment plants (ETP)

Primary Remediation processes:(Physical Processes) Sedimentation, Aeration, Sorption (activated charcoal, fly ash etc.)

Secondary Remediation processes: Biological Remediation –Biosorption, bioremediation and biodegradation

Chemical Remediation: Oxidation Processes (chlorination), Coagulation-flocculation-Precipitation

Learning Outcomes:

- 1) After completion of the course student will be able to understand chemical constitution of different dyes.
- 2) After completion of the course student will be able to understand health hazards of synthetic dyes and their remediation process.

Reference Books:

1. Venkatraman K., Chemistry of Synthetic Dyes, Vol I – IV, Academic Press 1972.
2. Lubs H.A., Krieger Robert, The Chemistry of Synthetic Dyes and Pigments, Publishing Company, NY, 1995.
3. Shenai V.A., Chemistry of Dyes and Principles of Dyeing, Volume 2 of Technology of textile processing. Sevak Publications, 1973.
4. Cain, Thorpe and Linstend LUBS Chemistry of synthetic dyes and pigments, R.E. Krieger Publishing Company. Chemistry of dyes and intermediates, 1969.
5. J. Driffths, Development in the Chemistry and Technology of Organic Dyes, Society of Chemicals Industry, Blackwell Scientific Publications
6. K. Venkataraman, The chemistry of Synthetic Dyes, Academic Press, Vol. I-III.
7. K. Venkateraman, John Wiley, The analytical Chemistry of Synthetic Dyes, New York.
8. D.M. Nunn, The Dyeing of Synthetic polymers and acetate fibres, Dyers Company Publishing Trust.

9. H.A. Abrahert, Dyes and Their Intermediates, Pergaman Press.

ADCSL 303: (Practical):
(Contact Hrs: 60 Credits: 02)

Learning Objectives:

To make students expert in synthesis of various dyes.

List of Practical's (15)

1. Separation of components of natural pigments by chromatography
 2. Synthesis of Antharquinone dye
 3. Printing of cotton with different dyes and methods like Block printing/screen printing
 4. Shade matching of Wool with Acid dyes.
 5. Extraction of natural dyes from natural resource (*pomegranate*)
 6. Extraction of natural dyes from natural resource (*Berries*)
 7. Printing of acid dye on wool.
 8. Dyeing of disperse red dye on polyester
- Any suitable experiment may be added

Learning Outcomes:

After completion of the practical, students will be able to synthesize different dyes

Reference Books:

1. Hans Eduard Fierz-David And Blangey Louis, Fundamental Processes Of Dye Chemistry, Interscience Publishers, 1949.
2. Buxbaum G., Pfaff G., Industrial Inorganic Pigments 3rd edition, Wiley VCH, 2005.
3. Venkataraman K., Chemistry of Synthetic Dyes – Vol II, Academic Press, New York, 1952.
4. Zollinger H., Color Chemistry –Synthesis, Properties and Applications of Dyes and Pigments, 2nd edition, Weinheim – VCH, 1991.

Semester IV

ADCST 404: High-tech applications of dyes
(Contact Hrs: 30 Credits: 2)

Learning Objectives:

- 1) To understand non textile applications of dyes.
- 2) To aware students about the pigments.

Unit I: Non-textile applications of dyes:

[15]

Biomedical uses of dyes

- i) Dyes used in formulations (Tablets, capsules, syrups etc)
Indigo carmine, Sunset yellow, Tartrazine
- ii) Biological staining agents
Methylene blue, Crystal violet and Safranin T

- iii) DNA markers
Bromophenol blue, Orange G, Cresol red
- iv) Dyes as therapeutics Mercurochrome, Acriflavine, Crystal Violet, Prontosil

Dyes used in food and cosmetics:

- i) Properties of dyes used in food and cosmetics
- ii) Introduction to FDA and FSSAI

Commonly used food colours and their limits

Paper and leather dyes

- i) Structural features of paper and leather

Dyes applicable to paper and leather

Miscellaneous dyes

- i) Hair dyes
 - ii) Laser dyes
 - iii) Indicators
 - iv) Security inks
- iv) Coloured smokes and camouflage colours

Unit II: (A) Pigments**[15]**

Definition of pigments, classification, properties of pigments, Rightfit pigments, difference between dyes and pigments. Definition of Lakes and Toners

(B) Dye Industry - Indian Perspective

Growth and development of the Indian Dye Industry, Strengths, Weaknesses, Opportunities and Challenges of the Dye industry in India, Make in India - Future Prospects of the Dye Industry

Learning Outcomes:

After completion of the course student will able to understand

- uses of dyes in different areas.
- pigments and Indian perspective of dye industry.

Reference Books:

1. Venkatraman K., Chemistry of Synthetic Dyes, Vol I – IV, Academic Press 1972.
2. Lubs H.A., Krieger Robert, The Chemistry of Synthetic Dyes and Pigments, Publishing Company, NY , 1995.
3. Shenai V.A., Chemistry of Dyes and Principles of Dyeing, Volume 2 of Technology of textile processing. Sevak Publications,1973.
4. Joseph Benny, Environmental Studies, Tata McGraw Hill Education, 2005
5. Sodhi. G. S., Fundamental Concepts of Environmental Chemistry, Alpha Science International, 2009
6. Niti Aayog, Planning Commission, FSSAI and FDA websites
7. Sharma S.K., Green Chemistry for Dyes Removal from Waste Water- Research Trends and Applications, Ed. Wiley, 2015

8. Khopkar S.M., Environmental Pollution- Monitoring and Control, New Age International (P) Ltd, New Delhi, 1982

ADCSL 404: Practical
(Contact Hrs: 60 Credits: 02)

Learning Objectives:

To expert students in synthesis and application of various dyes.

List of Practical's (15)

1. Shade matching of Wool with Metal Complex dyes.
 2. Shade matching of Silk with Acid dyes.
 3. Shade matching of Silk with Metal Complex dyes.
 4. Dyeing of Cotton and Viscose with Reactive and Vat dyes
 5. Extraction of natural dyes from natural resource (*Orange peel*)
 6. Extraction of natural dyes from natural resource (*Flowers*)
 7. Preparation of Orange II dye and its use for dyeing different fabrics
- Any suitable experiment may be added

Learning Outcomes:

After completion of the practical, students will be able to synthesize different dyes

Reference Books:

1. Hans Eduard Fierz-David And Blangey Louis, Fundamental Processes Of Dye Chemistry, Interscience Publishers, 1949.
2. Buxbaum G., Pfaff G., Industrial Inorganic Pigments 3rd edition, Wiley VCH, 2005.
3. Venkataraman K., Chemistry of Synthetic Dyes – Vol II, Academic Press, New York, 1952.
4. Zollinger H., Color Chemistry –Synthesis, Properties and Applications of Dyes and Pigments, 2nd edition, Weinheim – VCH, 1991.

ADCSP 202: Project/ Research institute/ Industrial Visit/ Internship
(Contact Hrs. 60, Credits: 2)

Industrial and or Incubation and or Research and or Field Training
(Contact Hrs. 60, Credits: 2)

BOS Sub committee

1. Dr. S. B. Kamble (Chairman)
2. Dr. V. B. Ghanwat (Member)

Expert Committee

1. Dr. Sharad R Patil, *Assistant Professor, KVVP's SPDM Arts SBB & SHD comm., Shirpur*
2. Mr. Madhukar Avaghade, *Production Manager, Boisar, Tarapur*