Karmaveer Bhaurao Patil University, Satara

Syllabus for

M. Sc. II (Chemistry)

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2024-2025

Department of Chemistry

Revised Syllabus of IInd 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 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)
c) 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
c) 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
e) Acridine Dyes: Acriflavine

vii)Quinone Dyes:
a) Naphthaquinone: Naphthazarin
b) 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 ashetc.)

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 able to understand chemical constitution of different dyes.
2) After completion of the course student will 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 Techology 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 Viley,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 Intermdiates, 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 polyster
   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 Safranine 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

v) 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 dying 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*

Department of Chemistry

Revised Syllabus of II Year Advanced Diploma Courses (PG)

Physico–Chemical Analysis.

Preamble:

Chemical testing and analysis is vital to understand the quality and composition of chemical substances and materials that are used in products, industrial processes and manufacturing. This advanced diploma is designed to impart knowledge and skills that is career and community oriented. This programme is designed to develop a practical "hands on training" in fertilizers, biochemical & food, and pharma analysis. Th

e programme incorporates the specialized knowledge and skills required to implement the fundamental principles regarding analysis of commercial samples.

Program Objectives of the Course:

The objectives of the course are to provide

1. Theoretical as well as practical knowledge of analysis of different samples
2. Skills required for accurate qualitative analysis
3. Knowledge regarding synthesis of drug and its analysis
4. Information regarding test and assay of raw materials

Program Outcomes:

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

1. Perform processes of sampling, analysis of samples for specific component in soil, fertilizer etc.
2. Demonstrate competency in the use of standard techniques of food, blood & urine analysis
3. demonstrate skills necessary for practice of a Pharmacy viz. able to synthesize, purify, identify and analyze medicinal agents, able to formulate, store, dispense.
4. Synthesize and analysis of the drug-molecules

I Year Advanced Diploma Programme

1. Title: **Physico-chemical analysis**
2. Year of Implementation: 2020

3. Duration: One Year
4. Pattern: Semester
5. Medium of Instruction: English
6. Contact hours: 7 hours/week
7. Structure of Course:

Syllabus Structure (PG)

Year	Semester	Course No.	Course Code	Contact Hours	Credits (1Credit=15 H)	Total Marks
1	I	CT I	ADCAT 101	30	2	75
		CL I	ADCAL101	60	2	150
	II	CT II	ADCAT 202	30	2	75
		CL II	ADCA L202	60	2	150
	Annual	CP I	ADCAP101	60	2	150
			Total	**240**	**10**	**600**
2	III	CT III	ADCAT 303	30	2	75
		CL III	ADCAL303	60	2	150
	IV	CT IV	ADCAT 404	30	2	75
		CL IV	ADCAL404	60	2	150
	Annual	CP II	ADCAP202	60	2	150
			Industrial and or Incubation and or Research and or Field Training	60	2	-
			Total	**270**	**12**	**600**
			Total	**510**	**22**	**1200**

AD: Advanced Diploma, *: Departmental Code

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

Total No. of Papers: 10 (Theory: 04, Practical: 04, Project: 02) Theory and Practical: Semester**,** Project: Annual

Semester III

ADCAT 303: Pharmaceutical analysis-I

(Contact Hrs: 30 Credits: 2)

Learning Objectives:

The objectives are to provide students with the knowledge and necessary skills

1) to carry out quality assurance of pharmaceuticals and related products
2) for the quality control of pharmaceuticals and related products
3) to carry out basic research in pharmaceutical analysis

Unit-I **15**

a) Sources of Impurities in Pharmaceutical Raw Materials and Finished Products:

Raw materials, Method of manufacture, Contamination-atmospheric, particulate, cross contamination, microbiological, process errors, Packing errors, chemical instability, container contamination (in brief) physical changes, temperature effects. General manufacturing processes.

b) Stability Studies, Shelf-Life Fixation for Formulated Products

Unit-II **15**

Test and assay of raw materials and finished products:

a) Biological Assays: Introduction, Precision of biological assays in brief, (estimation of errors is excluded) Biological assay of insulin, Tetanus antitoxin, Determination of proteolytic activity, Determination of ABO group and Rh group, Photometric haemoglo binometry, Haemolysins?

b) Chemical Tests and Assays: Limit test, characteristics of limit tests, specificity sensitivity, control of personal errors, Loss on drying (NaCl), loss on ignition (ZnO),limit test for lead, arsenic, chloride and sulphate, moisture determination of moisture by KFR titration method and assay of steroids. steroids (IP)

c) Analysis of vegetable drugs: Sampling, foreign organic matter, ash values and water soluble ash (ginger) Acid insoluble ash, sulphated ash.

d) Microbiological tests and assays: Microbiological assay of antibiotics, (std. preparations and units of activity, test organisms and inoculum, Apparatus, Method -Cylinder or cup plate method and two level factorial assays.

e) Physical tests and assays: Disintegration tests for (tablets, capsules, pessaries and suppositories Dissolution test stablets and capsules.

Learning Outcomes:

After completion of the course student will able to

1. Know the sources of impurities, manufacturing processes and stability study.
2. Familiar with test & assay of raw materials

Reference Books:

1. Practical Pharmaceutical chemistry third edition volume 1. By A.H.Beckett &J.B.Stenlake
2. Pharmacoepia of India Volume I and II.
3. Remington‘s Pharmaceutical sciences.
4. Forensic pharmacy by B.S Kuchekar, A.M Khadatare (NiraliPrakashan)
5. Practical pharmaceutical analysis by Ashitosh Kaur
6. Analytical problems of drug substances and Exp by Florey
7. The theory and practice of Ind pharmacy Leon lachmann,Herbert Liebermann and Joseph L.Karnic 3rd edition By Varghese Publication House, Hind Rajasthan Building Dadar Mumbai –14

ADCAL 303: **(Practical):**

(Contact Hrs: 60 Credits: 02)

Learning Objectives:

To expert students in

1. Preparation of various pharmaceutical buffers
2. Use of various techniques for qualitative & quantitative analysis
3. Skill & logic in impurities identification by limit test

List of Practicals

1 Preparation of pharmaceutical buffers (5)

2 Identification of impurities by limit test

i) Iron,

ii) Chloride,

iii) Sulphate,

iv) Arsenic,

v) Lead

3 Qualitative & Quantitative analysis by analytical techniques
i) HPLC,
ii) GC,
iii) UV,
iv) IR etc

Learning Outcomes:
Students will be able to
1. identify impurities in sample by analytical techniques
2. identify impurities in sample by limit test

Reference Books:

1. A.H. Beckett and J.B. Stenlake, Practical pharmaceutical chemistry, Part-I. The Athtone press, University of London, London.
2. P. Gundu Rao, Inorganic Pharmaceutical Chemistry; Vallabh Prakashan, Delhi.
3. Advanced Inorganic Chemistry by Satya Prakash, G.D. Tuli
4. Jolly-Modern Inorganic Chemistry
5. Pharmaceutical Inorganic Chemistry Textbook by Alagarsamy.
6. L.M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Oxford University Press, London; Indian Pharmacopoeia 1996, 2006.
8. J.H Block, E. Roche, T.O Soine and C.O. Wilson, Inorganic Medical and Pharmaceutical Chemistry Lea & Febiger Philadelphia PA.
9. Principle of Instrument analysis by A. Skoog
10. Pharmaceutical Inorganic Chemistry by S. Chand, R.D. Madan, Anita Madan
11. Pharmaceutical Inorganic Chemistry by Soma Shekar Rao
12. Reviews in Analytical Chemistry Volume 33: Issue 2, 2014, Prajesh Prajapati and Yadvendra K. Agrawal Quantatitive chemical analysis by D. Harris
13. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals by Pulok Mukherjee; Analysis and impurity identification in pharmaceuticals.

Semester IV

ADCAT 404: Pharmaceutical analysis-II

(Contact Hrs: 30 Credits: 2)

Learning Objectives:
The objective is to provide
1. understanding of the key stages in drug discovery, development.
2. theoretical and practical skills through classroom, laboratories and project

Unit I: Introduction` [15]
Introduction, source of drug, difference between drug and medicine, dangerous drugs, narcotics, classification of drugs, Fundamentals of Drug Action, Introduction to drug discovery and design, role of Pharmacology in drug discovery, impurities / contaminants in pharmaceutical raw materials /chemical and drug, role of pre-formulation in drug discovery, Role of preformulation in drug development

Unit II: [15]
Drug Analysis

Drug screening using instrumental techniques like gas chromatography, HPLC, MS etc., assay of drugs. Characterization and analysis of some of the following drug-molecules;

1. Local anesthetics: Procaine Hydrochloride
2. Sedative-Hypnotics: Phenobarbital
3. Antianxiety agents: Diazepam
4. Anticonvulsants: Phenytoin
5. Antipsychotic agents: Chlorpromazine
6. Central intraneural blocking agents: Levodopa
7. Antidepressant agents: Imipramine hydrochloride
8. Central nervous system stimulants: Fenfluramine hydrochloride
9. Opioid Analgesics and Antitussives: Morphine sulphate, Codeine phosphate
10. Diuretic agents: Hydrochlorothiazide
11. Antihistamines- Antiallergic agents: Meyperamine maleate, Cyclizine hydrochloride
12. Nonsteroidal anti-inflammatory drugs: Ibuprofen, Paracetamol
13. Drugs that affect the cardiac functions: Isosorbide dinitrate, Digitoxin
14. Adrenergic agents: Ephedrine, Adrenaline
15. Antihypertensive agents: Propanolol hydrochloride
16. Chollnergic agents: Pilocarpine nitrate, Neostigmine bromide
17. Barbiturates: Phenobarbital, Cyclobarbitone calcium

Learning Outcomes:

After completion of the course student will able to.

1) understand the concepts of Impurity profiling.
2) gain appropriate knowledge about appropriate analytical skills required for the analysis of impurities in the bulk drugs and various formulations.

Reference Books:

1. Textbook of Pharmaceutical Drug Analysis (PB 2019) by Ahmad M. Z.
2. Pharmaceutical Drug Analysis by Kar, Ashutosh
3. Standard Methods of Chemical Analysis vol I and II (6th ed) by F.J.Welcher.
4. Practical Pharmaceutical Chemistry by Beckett.
5. P.D.Sethi, Quantitative analysis of drugs in pharmaceutical formulations, Unique publisher, New Delhi.
6. S.N.Pandeya, A Text Book of Medicinal Chemistry Vol.I and Vol.II, S.G. Publisher, Varanasi.
7. Alka L.Gupta, Analytical chemistry, Pragati prakashan, Merut.
8. Principle of Drug action-Goldstein
9. Introduction to medicinal Chemistry, III Edn. Patrick (2001) Oxford

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

Learning Objectives:

The Objectives of the practical are to expert students in

1 synthesis and purification of various drugs

2 isolation, separation and interpretation various groups of chemical constituents of Pharmaceutical significance

List of Practicals

1) Determination of amount of vit-B2 in the medicinal tablet fluorometrically.
2) Estimation of vit.C by 2,6 dichloro-indophenol method.
3) Analysis of Vitamin C in juices
4) Estimation of sulphadizine
5) Synthesis of Methyl salicylate
6) Synthesis of Paracetamol
7) Synthesize of Benzocaine
8) Synthesis of Phenytoin.
9) Synthesis of Barbituric acid
10) Interpretation of a few spectra
11) Isolation, separation, purification of various groups of chemical constituents of Pharmaceutical significance (Isolation of cumin oil from cumin, Hesperidin from Orange Peel)

Any other suitable experiments may be added

Learning Outcomes:

After completion of the unit, Student is able to

1) synthesize different drugs
2) perform isolation and purification of chemical constituents of Pharmaceutical significance

Reference Books:

1) Willard H.H. and Merrit L. Jr and Dean J.A., Instrumental methods of analysis Van Nostrand Renhold, New York.
2) Obonson J.W.R. Undergraduate Instrumental Analysis, Marcel Dekker Inc, New York, 1970
3) Sim, Medicinal Plant Alkaloids & Glycosides Furniss B A, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London
4) Pharmacopoeia of India, Ministry of Health, Govt. of India.
5) Singh Harkishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6) O.P. Agarwal, "Chemistry of Organic Natural Product" Vol. I & II
7) Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
8) Ghosh, MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta

ADCP202 (Project):
(Contact Hrs. 60, Credits: 2)

BOS Sub committee

1. Dr. S. B. Kamble (Chairman)
2. Mr. P. M. Gaikwad

Expert committee:

1. Dr. Ashok Ravalekar, Sr.Manager, Sun Pharmaceutical Industries Ltd, Mumbai
2. Dr. B. B. Shingate, Asso. Professor, BAMU, Aurangabad