

# University of Mumbai



No. AAMS\_UGS/ICC/2024-25/08

## CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology is invited to this office Circular No. UG/73 of 2018-19 dated 06<sup>th</sup> July, 2018 relating to the revised syllabus as per the (CBCS) for the Chemistry of T.Y.B.Sc. Physical Chemistry, Inorganic Chemistry, Organic Chemistry and Analytical Chemistry (Sem –V & VI) (3 and 6 units) including Applied Component Drugs and Dyes, Heavy Fine Chemicals and Petrochemicals.

They are hereby informed that the recommendations made by the **Board of Studies in Chemistry** at its meeting held on 11<sup>th</sup> May, 2024 and subsequently passed by the Board of Deans at its meeting held on 24<sup>th</sup> May, 2024 vide item No. 6.11 (R) have been accepted by the Academic Council at its meeting held on 24<sup>th</sup> May, 2024 vide item No. 6.11 (R) and that in accordance therewith, the **revised syllabus for T.Y.B.Sc. Applied Component (Drugs and Dyes) – Sem V & VI (CBCS)** has been brought into force with effect from the academic year 2024-25.

(The said circular is available on the University's website [www.mu.ac.in](http://www.mu.ac.in)).

MUMBAI – 400 032  
25<sup>th</sup> June, 2024

*Baliramh*  
(Prof. (Dr.) Baliram Gaikwad)  
I/c. REGISTRAR

To,

The Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology.

A.C/6.11 (R) /24/05/2024

Copy forwarded with Compliments for information to:-

- 1) The Dean, Faculty of Science & Technology,
- 2) The Chairman, Board of Studies **Chemistry**,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Director, Department of Information & Communication Technology,
- 6) The Co-ordinator, MKCL,
- 7) The Deputy Registrar, Admissions, Enrolment, Eligibility & Migration Department (AEM),
- 8) The Deputy Registrar, Result Unit,
- 9) The Deputy Registrar, College Affiliations Development Department (CAD)

**Copy to :-**

- 1. The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),**
- 2. The Deputy Registrar, College Affiliations & Development Department (CAD),**
- 3. The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
- 4. The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
- 5. The Deputy Registrar, Executive Authorities Section (EA),**
- 6. The Deputy Registrar, PRO, Fort, (Publication Section),**
- 7. The Deputy Registrar, (Special Cell),**
- 8. The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,**
- 9. The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**

**They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.**

- 1. P.A to Hon'ble Vice-Chancellor,**
- 2. P.A Pro-Vice-Chancellor,**
- 3. P.A to Registrar,**
- 4. All Deans of all Faculties,**
- 5. P.A to Finance & Account Officers, (F.& A.O),**
- 6. P.A to Director, Board of Examinations and Evaluation,**
- 7. P.A to Director, Innovation, Incubation and Linkages,**
- 8. P.A to Director, Board of Lifelong Learning and Extension (BLLE),**
- 9. The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,**
- 10. The Director of Board of Student Development,**
- 11. The Director, Department of Students Welfare (DSD),**
- 12. All Deputy Registrar, Examination House,**
- 13. The Deputy Registrars, Finance & Accounts Section,**
- 14. The Assistant Registrar, Administrative sub-Campus Thane,**
- 15. The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
- 16. The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
- 17. The Assistant Registrar, Constituent Colleges Unit,**
- 18. BUCTU,**
- 19. The Receptionist,**
- 20. The Telephone Operator,**
- 21. The Secretary MUASA**

**for information.**

# University of Mumbai



**Revised Syllabus for**

**T.Y.B.Sc.**

**Applied Component (Drugs and Dyes)**

**Semester – (Sem V and VI)**

**(Choice Based Credit System)**

**(With effect from the academic year 2024-25)**

# University of Mumbai



## Syllabus for Approval

O: _____	<b>Title of Course</b>	T.Y.B.Sc. Applied Component (Drugs and Dyes)
O: _____	<b>Eligibility</b>	As per University Ordinance
R: _____	<b>Passing Marks</b>	40%
<b>No. of years/Semesters:</b>		Three
<b>Level:</b>		UG
<b>Pattern:</b>		Semester
<b>Status:</b>		Revised
<b>To be implemented from Academic Year :</b>		From Academic Year: 2024-25

**Sign of the BOS  
Coordinator  
Dr. Sunil Patil  
BOS in Chemistry**

**Sign of the  
Offg. Associate Dean  
Dr. Madhav R. Rajwade  
Faculty of Science &  
Technology**

**Sign of the  
Offg. Dean  
Prof. Shivram S. Garje  
Faculty of Science &  
Technology**

# Preamble

## 1) Introduction

The B.Sc (Chemistry) program is meticulously structured to foster a deep understanding of chemical principles and their real-world applications. The curriculum is a blend of theoretical knowledge and hands-on experience, ensuring that students not only grasp the core concepts but also develop a passion for the subject. With a focus on continuous assessment through quizzes, class tests, and assignments, the program emphasizes the importance of a strong conceptual foundation. This approach is complemented by practical experiments, where theoretical knowledge is applied, enhancing the learning experience and preparing students to tackle the multifaceted challenges in the field of chemistry.

## 2) Aims and Objectives

The B.Sc (Chemistry) program is structured to equip students with a comprehensive understanding of chemical principles and their real-world applications. It aims to foster a deep appreciation for the subject, encouraging students to engage in critical thinking and problem-solving. By integrating theoretical knowledge with practical skills, the course prepares graduates for diverse careers in research, industry, education, and beyond, contributing to their holistic academic and professional growth.

## 3) Learning Outcomes

Building a robust foundation in Applied Component principles is indeed crucial for anyone aiming to excel in scientific disciplines. This solid grounding not only prepares one for the complexities of the field but also enhances adaptability to the dynamic nature of scientific research. As the field of chemistry continues to expand, professionals who embrace continuous learning and exhibit a strong sense of curiosity will likely be at the forefront of pioneering discoveries. Moreover, the versatility of chemistry as a discipline offers a plethora of career opportunities across various industries, ensuring that those with a passion for the subject can find their niche and contribute meaningfully to society.

## 4) Any other point (if any)

The program is meticulously designed to lay a solid foundation in the subject, equipping students with essential skills and knowledge. Through a blend of theoretical understanding and practical application, the curriculum aims to fortify the students' grasp of the basics, ensuring they are well-prepared for advanced study or professional application in the field. This foundational strength is crucial for their academic and career progression, providing a robust platform from which they can build expertise and specialization.

**T. Y. B. Sc. CHEMISTRY (6 UNITS)**

Choice Based Credit System (CBCS)

**To be implemented from the Academic year 2024-25****Applied Component: Drugs and Dyes****SEMESTER V**

<b>Course Code: USACDD501</b>	<b>Credits: 02</b>	<b>Lectures: 60</b>
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<b>Unit</b>	<b>Topic</b>		<b>No. of Lectures</b>	<b>Total No. of Lectures</b>
I	1.1)	General Introduction to Drugs	8L	15L
	1.2)	Routes of Drug Administration and Dosage Forms	3L	
	1.3)	Pharmacodynamic Agents Central Nervous System (CNS) Drugs	4L	
II	2.1.1)	Analgesics and Antipyretics	2L	15L
	2.1.2)	Anti-Inflammatory Drugs	2L	
	2.2)	Anti-histaminic Drugs	2L	
	2.3)	Cardiovascular Drugs	3L	
	2.4)	Anti-diabetic Agents	2L	
	2.5)	Anti-parkinsonism Drugs	2L	
	2.6)	Drugs for Respiratory System	2L	
III	3.1)	Introduction to Dyestuff Industry	5L	15L
	3.2)	Substrates of Dyes: Types Of Fibres	3L	
	3.3)	Classification of dyes based on Applications and Dyeing Methods	7L	
IV	4.1	Colour and Chemical Constitution of Dyes	4L	15L
	4.2	Unit Process and Dye Intermediates		
	4.2.1	A Brief idea of Unit Processes	3L	
	4.3.2	Dye Intermediates.	8L	



Unit		Topic	No. of Lectures
Unit I	1.1	<b>General Introduction to Drugs</b>	8L
		1.1.1 Definition of a drug, sources of drugs, requirements of an ideal drug, classification of drugs (based on therapeutic action),	
		1.1.2 Nomenclature of drugs: Generic name, Brand name, Systematic name	
		1.1.3 Definition of the following medicinal terms: Pharmacon, Pharmacology, Pharmacophore, Prodrug, Half – life efficiency, LD <sub>50</sub> , ED <sub>50</sub> , GI <sub>50</sub> Therapeutic Index.	
		1.1.4 Brief idea of the following terms: Receptors, Agonists, Antagonists, Drug-receptor interaction, Drug Potency, Bioavailability, Drug toxicity, Drug addiction, Spurious Drugs, Misbranded Drugs, Adulterated Drugs, Pharmacopoeia.	
	1.2	<b>Routes of Drug Administration and Dosage Forms</b>	3L
		1.2.1 Oral and Parenteral routes with advantages and disadvantages.	
		1.2.2 Formulations & combination formulation, Different dosage forms (including Patches & Adhesives, emphasis on sustained release formulations and enteric coated tablets).	
	1.3	<b>Pharmacodynamic agents:</b> A brief introduction of the following pharmacodynamic agents and the study with respect to their chemical structure, chemical class, therapeutic uses, and side effects.	4L
		1.3.1 <b>CNS Drugs:</b> Classification based on pharmacological actions: CNS Depressants & CNS Stimulants. Concept of sedation and hypnosis, anaesthesia. <ul style="list-style-type: none"> <li>• Phenytoin (Hydantoin)</li> <li>• Trimethadione (Oxazolidinedione) (<b>Synthesis from acetone</b>)</li> <li>• Alprazolam (Benzodiazepines)</li> <li>• Levetiracetam (Pyrrolidines)</li> <li>• Amphetamine (Phenethylamine) (<b>Asymmetric synthesis from phenyl acetic acid</b>)</li> </ul> Chlorpromazine (Phenothiazines)	
Unit II	2.1	<b>Analgesics, Antipyretics and Anti-inflammatory Drugs.</b>	4L
	2.1.1	<b>Analgesics and Antipyretics</b> <ul style="list-style-type: none"> <li>• Morphine (Phenanthrene alkaloids)</li> <li>• Tramadol (Cyclohexanols) (<b>Synthesis from salicylic acid</b>)</li> <li>• Aspirin (Salicylates)</li> </ul> Paracetamol (p-Amino phenols)	
	2.1.2	<b>Anti-inflammatory Drugs</b> Mechanism of inflammation and various inflammatory	

		<p>conditions.</p> <ul style="list-style-type: none"> <li>• Steroids: Prednisolone, Betamethasone</li> </ul> <p>Sodium Diclofenac, Aceclofenac (N-Aryl anthranilic acids) (<b>Synthesis from 2, 6-dichlorodiphenyl amine</b>)</p>	
	2.2	<p><b>Antihistaminic Drugs</b></p> <ul style="list-style-type: none"> <li>• Diphenhydramine (Ethanol amines)</li> <li>• Cetrizene (Piperazine) (<b>Synthesis from 4-Chlorobenzhydryl chloride</b>)</li> <li>• Chlorpheniramine maleate (Ethyl amines)</li> </ul> <p>Pantoprazole (Benzimidazoles)</p>	2L
	2.3	<p><b>Cardiovascular drugs</b></p> <p>Classification based on pharmacological action</p> <ul style="list-style-type: none"> <li>• Isosorbide dinitrate (Nitrates)</li> <li>• Valsartan (Amino acids) (structure not expected)</li> <li>• Atenolol (Aryloxy propanol amines) (<b>Synthesis from 3-Hydroxy phenyl acetamide</b>)</li> <li>• Amlodipine (Pyridines)</li> <li>• Frusemide /Furosemide (Sulfamoyl benzoic acid)</li> </ul> <p>Rosuvastatin (Pyrimidine)</p>	3L
	2.4	<p><b>Antidiabetic Agents</b></p> <p>General idea and types of diabetes; Insulin therapy</p> <ul style="list-style-type: none"> <li>• Glibenclamide (Sulphonyl ureas)</li> <li>• Metformin (Biguanides)</li> <li>• Dapagliflozin (Pyranose)</li> </ul> <p>Pioglitazone (Thiazolidinediones) (<b>Synthesis from 2-(5-ethylpyridin-2-yl) ethanol</b>)</p>	2L
	2.5	<p><b>Anti-Parkinsonism Drugs</b></p> <p>Idea of Parkinson's disease.</p> <ul style="list-style-type: none"> <li>• Procyclidine hydrochloride (Pyrrolidines)</li> <li>• Ethopropazine hydrochloride (Phenothiazines)</li> </ul> <p>Levodopa (Amino acids) (<b>Synthesis from Vanillin</b>)</p>	2L
	2.6	<p><b>Drugs for Respiratory System</b></p> <p>General idea of: Expectorants; Mucolytes; Bronchodilators; Decongestants; Antitussives</p> <ul style="list-style-type: none"> <li>• Ambroxol (Cyclohexanol) (<b>Synthesis from paracetamol</b>)</li> <li>• Salbutamol (Phenyl ethyl amines)</li> </ul> <p>Oxymetazoline (Imidazolines)</p>	2L
<b>UNIT III</b>			
	3.1	<p><b>Introduction to the dye-stuff Industry</b></p>	5L
	3.1.1	Dyes	
		<p>Definition of dyes, requirements of a good dye i.e. Colour, Chromophore and Auxochrome, Solubility, Linearity, Coplanarity, Fastness, Substantivity, Economic viability.</p> <p>Definition of fastness and its properties and Mordants with examples</p>	



		<p>Explanation of nomenclature or abbreviations of commercial dyes with at least one example.</p> <p>Suffixes – G, O, R, B, K, L, C, S, H, 6B, GK, 6GK, Naming of dyes by colour index (two examples) used in dye industries.</p>	
	3.1.2	<b>Natural and Synthetic Dyes</b>	
		<p>Natural Dyes: Definition and limitations of natural dyes. Examples and uses of natural dyes w.r.t Heena, Turmeric, Saffron, Indigo, Madder, Chlorophyll with names of the chief dyeing material/s in each natural dye. <b>[structures not expected],</b></p> <p>Synthetic dyes: Definition of synthetic dyes, primaries and intermediates.</p> <p>Important milestones in the development of synthetic dyes – Emphasis on Name of the Scientist, dyes and the year of the discovery is required. (structure is not expected)</p>	
	<b>3.2</b>	<b>Substrates for Dyes: Types of fibres</b>	<b>3L</b>
	3.2.1	Natural fibres: cellulosic and proteinaceous fibres, Structural features of wool, silk and cotton and names of dyes applied on each of them.	
	3.2.2	Semi-synthetic fibres: definition and examples [structures not expected]	
	3.2.3	Synthetic fibres: Nylon, Polyesters and Polyamides structures and names of dyes applied on each of them	
	3.2.4	Blended fabrics: definition and examples [structures not expected]	
	<b>3.3</b>	<b>Classification of dyes based on applications and dyeing methods</b>	<b>7L</b>
	3.3.1	Dyeing methods	
		Basic Operations involved in dyeing process: i. Preparation of fibres            ii. Preparation of dyebath iii. Application of dyes            iv. Finishing	
		Dyeing Method of Cotton Fibres: (i) Direct dyeing                      (ii) Vat dyeing (iii) Mordant dyeing                  (iv) Disperse dyeing	
	3.3.2	<b>Classification of dyes based on applicability on substrates (examples with structures)</b> (a) Acid Dyes- Orange II, (b) Basic Dyes-Methyl violet, (c) Direct cotton Dyes- Benzo fast Yellow 5GL (d) Azoic Dyes – Diazo components; Fast yellow G, Fast orange R.	

			<p><b>Coupling components.</b> Naphthol AS, Naphthol ASG          (e) Mordant Dyes- Eriochrome Black A, Alizarin.          (f) Vat Dyes- Indanthrene brown RRD,          (g) Sulphur Dyes- Sulphur Black T (no structure)          (h) Disperse Dyes- Celliton Fast brown 3R,          Reactive Dyes- Procion Brilliant HB</p>	
		3.3.3	<p><b>Optical Brighteners:</b> General idea, important characteristics of optical brighteners and their classes [Stilbene, Coumarin, Heterocyclic vinylene derivatives, Diaryl pyrazolines, Naphthylamide derivatives]          General structure of each class.</p>	
<b>UNIT IV</b>				
	<b>4.1</b>		<b>Colour and Chemical Constitution of Dyes</b>	<b>4L</b>
		4.1.1	Absorption of visible light, Colour of wavelength absorbed, Complementary colour.	
		4.1.2	Relation between colour and chemical constitution.	
			<p>(i) Armstrong theory (quinonoid theory) and its limitations.          (ii) Witt's Theory: Chromophore, Auxochrome, Bathochromic &amp; Hypsochromic Shift, Hypochromic &amp; Hyperchromic effect          (iii) Valence Bond theory, comparative study and relation of colour in the following classes of compounds/dyes: Benzene, Nitrobenzene, Nitroanilines, Nitrophenols, Benzoquinones, Triphenyl methane, Anthraquinones.          (iv) Molecular Orbital Theory. With reference to Ethylene; 1, 3- butadiene &amp; <math>\beta</math>-carotene.</p>	
	<b>4.2</b>		<b>Unit process and Dye Intermediates</b>	
		4.2.1	<b>A brief idea of Unit Processes</b>	<b>(3L)</b>
			Introduction to primaries and intermediates	
			<p>Unit processes: definition and brief ideas of following unit processes: (a) Nitration (b) Sulphonation (c) Halogenation (d) Diazotization: (Direct &amp; Reverse Method)          (e) Ammonolysis.          NB: Definition, Reagents, Examples of each unit processes mentioned above with reaction conditions (mechanism is not expected)</p>	
		4.2.2	<b>Preparation of the Following Intermediates</b>	<b>8L</b>
			<p><b>Benzene derivatives:</b> Benzene sulphonic acid; 1,3-Benzene disulphonic acid; Resorcinol; sulphanilic acid; o-, m-, p-chloronitrobenzenes;          o-, m-, p-nitroanilines; o-, m-, p-phenylene diamines;          Naphthol ASG</p>	
			<p><b>Naphthalene Derivative:</b> Schaeffer acid; Tobias acid; Naphthionic acid; N.W. acid; H-acid; Naphthol AS.</p>	
			<p><b>Anthracene Derivative:</b>          Anthraquinone; 1-Amino anthraquinone; Benzanthrone.</p>	

### Reference Books for Unit I & II

1. Foye's principles of medicinal chemistry. 6th Edition, Edited by Davis William & Thomas Lemke, Indian edition by B I Publication Pvt Ltd, Lippincott Williams & Wilkins.
2. Text book of organic medicinal & pharmaceutical chemistry. Wilson & Gisovolds, 11th Edition by John H Block, John M Beale Jr.
3. Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher. 4<sup>th</sup> edition.
4. Burger's Medicinal Chemistry, Drug Discovery and Development. Abraham and Rotella. Wiley
5. Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher. 4<sup>th</sup> edition.
6. Medicinal chemistry. V.K. Ahluwalia and Madhu Chopra, CRC Press.
7. Principle of medicinal chemistry. Vol 1 & 2 S. S. Kadam, K. R. Mahadik, K. G. Bothara
8. The Art of Drug synthesis. Johnson and Li. Wiley, 2007.
9. The organic chemistry of drug design & drug action. 2<sup>nd</sup> ed. By Richard B Silvermann, Academic Press.
10. The Organic Chemistry of Drug Synthesis. Lednicer and Mitscher, Wiley.
11. Synthetic organic Chemistry, Gurdeep R. Chatwal, Himalaya Publishing House, 2001

### For Unit III & IV

1. Chemistry of Synthetic Dyes, Vol I – VIII, Venkatraman K., Academic Press 1972
2. The Chemistry of Synthetic Dyes and Pigments, Lubs H.A., Robert E Krieger Publishing Company, NY, 1995
3. Chemistry of Dyes and Principles of Dyeing, Shenai V.A., Sevak Publications, 1973
4. Dyes: Overview, Shrikrishna D. Tupare, Lulu publications, 2021
5. Synthetic organic Chemistry, Gurdeep R. Chatwal, Himalaya Publishing House, 2001

## PRACTICALS

Course Code: USACDD5P1

Credits: 02

### Title of Experiments

1. Estimation of Ibuprofen (back titration method)
2. Estimation of Acid neutralizing capacity of a drug
3. Preparation of Aspirin from salicylic acid.
4. Preparation of Anthraquinone from Anthracene
5. Separation of components of natural pigments by paper chromatography (eg: chlorophyll)

**II] Project:** Preparation of Orange II dye (semi-microscale 1.0gms) and its use for dyeing different fabrics.

### Reference Books

1. Assay of Ibuprofen: Medicinal Practical
2. Practical Medicinal Chemistry, Jayaveera K.N.; Subramanyam S. & Reddy, Yogananda K., S. Chand Publishing 2008

**T. Y. B. Sc. CHEMISTRY (6 UNITS)**

Choice Based Credit System (CBCS)

To be implemented from the Academic year 2024-25

Applied Component: Drugs and Dyes

**SEMESTER VI**

<b>Course Code: USACDD601</b>	<b>Credits: 02</b>	<b>Lectures: 60</b>
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Unit	Topic		No. of Lectures	Total No. of Lectures
I	5.1)	Drug Discovery, Design and Development	6L	15L
	5.2)	Drug Metabolism	3L	
	5.3)	Chemotherapeutic Agents		
	5.3.1)	Antibiotics and antivirals	2L	
	5.3.2)	Antimalarials	2L	
	5.3.3)	Anthelmintics and antifungal	2L	
II	6.1)	Anti-amoebic Drugs	1L	15L
	6.2)	Antitubercular and antileprotic Drugs	3L	
	6.3)	Anti-Neoplastic Drugs	2L	
	6.4)	Anti-HIV Drugs	1L	
	6.5)	Vitamin Therapy	3L	
	6.6)	Nano particles in Medicinal Chemistry	3L	
	6.7)	Drugs and environmental Aspects	2L	
III	7.1)	Classification of dyes based on Chemical Constitution	4L	15L
	7.2)	Synthesis of selected dyes	7L	
	7.3)	Health and environmental Hazards of Synthetic Dyes and their Remediation Process	4L	
IV	8.1)	Non -textiles Uses of Dyes	8L	15L
	8.2)	Pigments	5L	
	8.3)	Dyestuff Industry -Indian Perspective	2L	

Unit		Topic	No. of Lectures	
Unit I	1.1	<b>Drug Discovery, Design and Development</b>	(6L)	
		1.1.1	Discovery of a Lead compound: Screening, drug metabolism studies and clinical observation, Lipinski's rule of 5	
		1.1.2	Medicinal properties of compounds from Natural Sources: Anti-infective and anticancer properties of Turmeric (Curcumin)	
		1.1.3	Development of drug: The Pharmacophore identification, modification of structure or functional group, Structure activity relationship (Sulphonamides).	
		1.1.4	Structure modification to increase potency: Homologation, Chain branching and Extension of the structure.	
		1.1.5	Computer assisted drug design.	
	1.2		<b>Drug Metabolism:</b>	3L
			Introduction, Absorption, Distribution, Bio- transformation, Excretion Different types of chemical transformation of drugs with specific examples.	
	1.3		<b>Chemotherapeutic Agents:</b>	
			Study of the following chemotherapeutic agents with respect to their chemical structure, chemical class, therapeutic uses, side effects and introduction to MDR wherever applicable	
		1.3.1	<b>Antibiotics and antivirals:</b> Definition, <ul style="list-style-type: none"> <li>• Amoxicillin (<math>\beta</math>-lactum antibiotics)</li> <li>• Cefpodoxime (Cephalosporins)</li> <li>• Doxycycline (Tetracyclines)</li> <li>• Levofloxacin (Quinolones)</li> </ul> <b>(Synthesis from 2, 3, 4 -Trifluoro -1- nitrobenzene)</b> Aciclovir/Acylovir (Purines)	2L
	1.3.2	<b>Antimalarials:</b> Types of malaria; Symptoms; Pathological detection during window period (Life cycle of the parasites not to be discussed) <ul style="list-style-type: none"> <li>• Chloroquine (3-Amino quinolones)</li> <li>• Artemether (Benzodioxepins)</li> </ul> <b>Following combination to be discussed:</b> Atremether-Lumefantrine (no structure)	2L	
	1.3.3	<b>Anthelmintics and Anti-Fungal agents</b> Drugs effective in the treatment of Nematodes and Cestodes infestations. <ul style="list-style-type: none"> <li>• Diethyl carbamazine (Piperazines)</li> <li>• Albendazole (Benzimidazoles)</li> </ul> <b>(Synthesis from 2- Nitroaniline)</b>	2L	



		<ul style="list-style-type: none"> <li>• Clotrimazole (Imidazole)</li> <li>• Fluconazole (Triazole)</li> </ul> <p><b>(Synthesis from 1- Bromo – 2, 4- di-fluorobenzene)</b></p>	
<b>Unit II</b>			
	<b>2.1</b>	<p><b>Antiamoebic Drugs</b> Types of Amoebiasis</p> <ul style="list-style-type: none"> <li>• Metronidazole, Ornidazole, Tinidazole (Imidazole)</li> </ul> <p><b>(Synthesis of Metronidazole from glyoxal By Debus- Radziszewski imidazole synthesis route)</b></p>	<b>1L</b>
	<b>2.2</b>	<p><b>Antitubercular and Antileprotic Drugs</b> Types of Tuberculosis; Symptoms and diagnosis of Tuberculosis. Types of Leprosy. General idea of Antibiotics used in their treatment.</p> <ul style="list-style-type: none"> <li>• PAS (Amino salicylates)</li> <li>• Isoniazide (Hydrazides)</li> <li>• Pyrazinamide (Pyrazines)</li> <li>• (+) Ethambutol (Aliphatic diamines)</li> </ul> <p><b>(Synthesis from 1- Nitropropane)</b></p> <ul style="list-style-type: none"> <li>• Dapsone (Sulphonamides)</li> </ul> <p><b>(Synthesis from 4- Chloronitrobenzene)</b></p> <ul style="list-style-type: none"> <li>• Clofazimine (Phenazines)</li> <li>• Bedaquiline (Quinoline)</li> </ul> <p><b>Following combination therapy to be discussed:</b></p> <p>(i) Rifampin + Ethambutol + Pyrazinamide Rifampin + Isoniazide + Pyrazinamide</p>	<b>3L</b>
	<b>2.3</b>	<p><b>Anti-Neoplastic Drugs</b> Idea of malignancy; Causes of cancer Brief idea of Immuno Stimulants &amp; Immuno depressants</p> <ul style="list-style-type: none"> <li>• Lomoustine (Nitrosoureas)</li> <li>• Anastrozole (Triazoles)</li> </ul> <p><b>(Synthesis from 3, 5-bis (bromo methyl) toluene)</b></p> <ul style="list-style-type: none"> <li>• Cisplatin (Chloro Platinum)</li> </ul> <p>Vincristine, Vinblastine, Vindesine) (Vinca alkaloids) (structure not expected)</p>	<b>2L</b>
	<b>2.4</b>	<p><b>Anti-HIV Drugs</b> Idea of HIV pathogenicity, Symptoms of AIDS AZT/Zidovudine, Lamivudine, DDI (Purines)</p>	<b>1L</b>
	<b>2.5</b>	<p><b>Vitamin Therapy</b> Therapeutic uses and Hypervitaminosis with respect to water Insoluble Vitamins (A, D, E, &amp; K) and water-soluble Vitamins (B<sub>12</sub> and C)</p>	<b>3L</b>

	2.6		<b>Nano particles in Medicinal Chemistry</b> Introduction; Carbon nano particles (structures) and Carbon nano tubes: <ul style="list-style-type: none"> <li>• Functionalization for Pharmaceutical applications</li> <li>• Targeted drug delivery</li> <li>• In vaccine (Foot and mouth disease)</li> <li>• Use in Bio-physical treatment.</li> </ul> Gold nano particles in treatment of: Cancer; Parkinsonism; Alzheimer. Silver nano particles: Antimicrobial activity.	3L
	2.7		<b>Drugs and Environmental Aspects</b> <ul style="list-style-type: none"> <li>• Impact of Pharma-industry on environment,</li> <li>• International regulation for human</li> </ul> Experimentation with reference to: “The Nuremberg Code” and “The Helsinki Declaration”.	2L
<b>UNIT III</b>	<b>3</b>			
		3.1	<b>Classification of Dyes based on Chemical Constitution</b>	4L
			<b>i) Nitro dyes:</b> Naphthol Yellow S, <b>ii) Nitroso dyes:</b> Gambine Y , <b>iii) Azo dye:</b> Mono azo dyes: Orange IV, Eriochrome Black T; Dis azo dyes: Congo red; Tris azo dyes: Direct Deep Black EW <b>iv) Diphenyl methane Dyes:</b> Auramine O <b>v) Triphenyl methane dyes:</b> diamino Derivatives: Acid Magenta; Tri amino Derivatives: Malachite Green; Phenolic Derivatives: Rosolic Acid <b>vi) Heterocyclic dyes</b> <ol style="list-style-type: none"> <li>Thiazine dyes: Methylene Blue</li> <li>Azine dyes: Safranin T</li> <li>Xanthene Dyes: Eosin</li> <li>Oxazine Dyes: Capri Blue</li> <li>Acridine Dyes: Acriflavine</li> </ol>	
			<b>vii) Quinone Dyes:</b> <ol style="list-style-type: none"> <li>Naphthaquinone: Naphthazarin</li> <li>Anthraquinone Dyes: Indanthrene Blue</li> </ol>	
			<b>viii) Indigoid Dyes:</b> Indigo	
			<b>ix) Phthalocyanine Dyes:</b> Monastral Fast Blue B	
		3.2	<b>Synthesis of Selected Dyes</b> Synthesis of the following dyes <ol style="list-style-type: none"> <li>Orange IV from sulphanilic acid</li> <li>Eriochrome Black T from <math>\beta</math>- naphthol</li> <li>Congo red, from Nitrobenzene</li> <li>Direct deep black from benzidine</li> <li>Auramine O from benzaldehyde</li> </ol>	7L

			vi) Malachite Green, vii) Safranin T from o-toluidine viii) Indanthrene Blue from anthraquinone ix) Indigo from aniline & mono chloro acetic acid	
		<b>3.3</b>	<b>Health and Environmental Hazards of Synthetic Dyes and their Remediation Processes</b>	<b>4L</b>
		<b>3.3.1</b>	<b>Impact of the textile and leather dye Industry on the environment</b> with special emphasis on water pollution	
		<b>3.3.2</b>	<b>Health Hazards:</b> Toxicity of dyes w.r.t food colours.	
		<b>3.3.3</b>	<b>Effluent Treatment Strategies:</b> 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  <b>Chemical Remediation:</b> Oxidation Processes (chlorination),Coagulation-flocculation Precipitation	
<b>UNIT IV</b>	<b>4.1</b>		<b>Non-textile uses of dyes:</b>	<b>(8L)</b>
		<b>4.1.1</b>	<b>Biomedical uses of dyes</b> 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	
		<b>4.1.2</b>	<b>Dyes used in food and cosmetics:</b> a) Properties of dyes used in food and cosmetics b) Introduction to FDA and FSSAI Commonly used food colours and their limits	
		<b>4.1.3</b>	<b>Paper and leather dyes</b> Structural features of paper and leather Dyes applicable to paper and leather	
		<b>4.1.4</b>	<b>Miscellaneous dyes</b> i) Hair dyes	

		ii) Laser dyes iii) Indicators iv) Security inks v) Coloured smokes and camouflage colours	
	<b>4.2</b>	<b>Pigments</b>	<b>5L</b>
		Introduction, Definition of pigments with examples, Properties of pigments, Difference between dyes and pigments, Definition of Lakes and Toners, Requirement of Pigments, Types of Pigments, Extraction method of Pigments.	
	<b>4.3</b>	<b>Dyestuff Industry - Indian Perspective</b>	<b>2L</b>
		4.3.1 Growth and development of the Indian Dyestuff Industry	
		4.3.2 Strengths, Weaknesses, Opportunities and Challenges of the Dyestuff industry in India	
		4.3.3 Make in India - Future Prospects of the Dye Industry	

## Reference Books

### Unit V & VI

1. Foye's principles of medicinal chemistry. 6th Edition, Edited by Davis William & Thomas Lemke, Indian edition by B I Publication Pvt Ltd, Lippincott Williams & Wilkins.
2. Text book of organic medicinal & pharmaceutical chemistry. Wilson & Gisovolds, 11th Edition by John H Block, John M Beale Jr.
3. Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher. 4<sup>th</sup> edition.
4. Burger's Medicinal Chemistry, Drug Discovery & Development. Abraham & Rotella. Wiley
5. Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher. 4<sup>th</sup> edition.
6. Medicinal chemistry. V.K. Ahluwalia and Madhu Chopra, CRC Press.
7. Principle of medicinal chemistry. Vol 1 & 2 S. S. Kadam, K. R. Mahadik, K. G. Bothara
8. The Art of Drug synthesis. Johnson and Li. Wiley, 2007.
9. The organic chemistry of drug design & drug action. 2<sup>nd</sup> ed. By Richard B Silvermann, Academic Press.
10. The Organic Chemistry of Drug Synthesis. Lednicer and Mitsner, Wiley.
11. Text book of drug design and discovery. Povl-Krog-Sgaard-Larsen, Tommy Liljefors and ULF Madsen, 3rd Edition Taylor & Francis.
12. Bio-applications of nanoparticles. Edited by Warren C.W. Chan, Springer Publication.
13. Nanoparticle and technology for drug delivery (Drugs and pharmaceutical sciences). Ram B. Gupta & Uday B. Kompella Pub. Informa Healthcare.
14. Nano forms of carbon and its applications. Edited by Maheshwar Sharon and Madhuri Sharon. Monad Nanotech Pvt. Ltd.
15. Environmental Chemistry. A. K. De
16. Text Book on Law and Medicine. Chokhani and Ghormade. 2<sup>nd</sup> Edition. Hind Law House, Pune.
17. Essentials of Medical Pharmacology. K D Tripathi, Jaypee Brothers Medical publishers Pvt. Ltd. Practical organic chemistry, Vogel.
18. Synthetic organic Chemistry, Gurdeep R. Chatwal, Himalaya Publishing House, 2001
19. Organic Medicinal and Pharmaceutical Chemistry 12<sup>th</sup> Edition, John M. Beale, Jr. John H.

Block. Lippincott Williams and Wilkins Publication.

**(For units Unit VII & VIII)**

1. Chemistry of Synthetic Dyes, Vol I – IV, Venkatraman K., Academic Press 1972
2. The Chemistry of Synthetic Dyes and Pigments, Lubs H.A., Robert E Krieger Publishing Company, NY ,1995
3. Chemistry of Dyes and Principles of Dyeing, Shenai V.A., Sevak Publications, 1973
4. Environmental Studies, Joseph Benny, Tata McGraw Hill Education, 2005
5. Fundamental Concepts of Environmental Chemistry, Sodhi. G. S., Alpha Science International, 2009
6. Planning Commission, Niti Aayog, FSSAI and FDA websites
7. Green Chemistry for Dyes Removal from Waste Water- Research Trends and Applications, Ed. Sharma S.K., Wiley, 2015
8. Environmental Pollution- Monitoring and Control, Khopkar S.M., New Age International (P) Ltd, New Delhi, 1982.
9. Dyes: Overview, Shrikrishna D. Tupare, Lulu publications, 2021
10. Synthetic organic Chemistry, Gurdeep R. Chatwal, Himalaya Publishing House, 2001



**Practicals**

**SEMESTER VI**

**(Drugs and Dyes)**

**COURSE CODE: USACDD6P1**

**CREDITS: 02**

**[I]**

**(A) Synthesis**

1. O-Methylation of  $\beta$ -naphthol.
2. Preparation of Paracetamol from p-aminophenol.
3. Preparation of Fluorescein
4. TLC of a mixture of dyes (safranin-T, Indigo carmine, methylene blue)

**(B)** Preparation of monograph of any one drug from syllabus by I.P. method.

**OR**

**[I] CASE STUDY**

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## Evaluation Pattern for Semesters V and VI

### Semester End Theory Examination

<b>Internal Continuous Assessment: 25% (25 Marks)</b>	<b>Semester End Examination: 75% (75 Marks)</b>	<b>Duration for End Semester Examination</b>
<b>Continuous Evaluation through:</b> Quizzes, Class Tests, Presentations, Projects, Role Plays, Creative Writings, Assignments, etc.	As per following pattern	2 hrs 30 minutes

### Pattern for Semester End Examination (75 Marks):

1. Duration - This examination shall be of **Two hours and 30 minutes** duration.
2. Theory question paper pattern:
  - a. There shall be **05** questions each of **15 marks**.
  - b. All questions shall be compulsory with internal choice within the questions.

Question	Option	Marks	Based on Units
Q.1	Subjective questions 3 out of 5	15	Unit I
Q.2	Subjective questions 3 out of 5	15	Unit II
Q.3	Subjective questions 3 out of 5	15	Unit III
Q.4	Subjective questions 3 out of 5	15	Unit IV
Q.5	A. True or False (Any Five out of Eight)	05	All Units
	B. Fill in the Blank with correct alternative. (MCQs with Four Options) (Any Five out of Eight)	05	
	C. Match the following (Any Five out of Eight)	05	
Total		<b>75</b>	--

## Practical

1. Total Marks for Practical Examination is 100 Marks.
2. Every student shall perform **two experiments** (If there are two major parts in the curriculum of applied component then assign one experiment from Component I for first session and another experiment from Component II for second session).
3. Each experiment shall carry 50 Marks.
4. Scheme of Examination:
  - a. Experiment : 40 Marks
  - b. Journal : 05 Marks
  - c. Viva-Voce : 05 Marks

**Total : 50 Marks**

## Practical Book/Journal:

The students are required to perform 75% of the Practical for the journal to be duly certified. The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

**Sign of the BOS  
Coordinator  
Dr. Sunil Patil  
BOS in Chemistry**

**Sign of the  
Offg. Associate Dean  
Dr. Madhav R. Rajwade  
Faculty of Science &  
Technology**

**Sign of the  
Offg. Dean  
Prof. Shivram S. Garje  
Faculty of Science &  
Technology**