Hindi Vidya Prachar Samiti's

Ramniranjan Jhunjhunwala College

of Arts, Science & Commerce

(Empowered Autonomous College)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for the T.Y.B.Sc.

Program: B.Sc (Chemistry)

Program Code: RJSUCHE

(NEP 2020)

Level 5.5

(CBCS 2025-2026)

T.Y.B.Sc. CHEMISTRY SEMESTER V

Discipline Specific Elective -I (DSE-I)

Course Code	Unit	Topic Headings	Credits	Duration
RJDSECHE351	**Paper Title: Chemistry of Drugs and Dyes - I**			**60 hours**
	I & II	Chemistry of Drugs	**04**	30 hours
	III & IV	Chemistry of Dyes		30 hours

Discipline Specific Elective -II (DSE-II)

Course Code	Unit	Topic Headings	Credits	Duration
RJDSECHE352	**Paper Title: Polymer Chemistry -I**			**60 hours**
	I & II	Polymer Chemistry	**04**	30
	III & IV	Polymer Chemistry		30

T.Y.B.Sc. CHEMISTRY SEMESTER VI

Discipline Specific Elective -I (DSE-I)

Course Code	Unit	Topic Headings	Credits	Duration
RJDSECHE361	**Paper Title: Chemistry of Drugs and Dyes –II**			**60 hours**
	I & II	Chemistry of Drugs	**04**	30 hours
	III & IV	Chemistry of Dyes		30 hours

Discipline Specific Elective -II (DSE-II)

Course Code	Unit	Topic Headings	Credits	Duration
RJDSECHE362	**Paper Title: Chemistry- Polymer Chemistry- II**			**60 hours**
	I & II	Polymer Chemistry	**04**	30
	III & IV	Polymer Chemistry		30

SEM V SYLLABUS

DSE-THEORY

DSE-I

SEMESTER		**SEM – V**
TITLE OF THE SUBJECT / COURSE		**CHEMISTRY OF DRUGS AND DYES -I**
COURSE CODE		**RJDSECHE351**
CEDITS		**04**
DURATION		**60 Hrs.**

LEARNING OBJECTIVE	
1.	Understand what drugs are, how they are administered, and their effects on the body.
2.	Learn about different therapeutic drugs, including pain relievers, anti-inflammatory agents, and drugs for heart, diabetes, Parkinson's, and respiratory conditions.
3.	Explore the dye industry, the types of fibres used, and how dyes are classified and applied in dyeing.
4.	Understand how the chemical structure of dyes affects their color and properties.
5.	Learn the basic chemical processes used to create dyes and the intermediates involved in their production

COURSE OUTCOME NUMBER	**ON COMPLETION OF THE COURSE, STUDENT WILL BE ABLE TO:**	**PSO ADDRESSED**	**BLOOMS LEVEL**
CO1	Gain an understanding of drug types, administration routes, dosage forms, and pharmacodynamics.	PSO1, PSO2,	Remember, understand (L1,2)
CO2	learn about the therapeutic uses, mechanisms, and side effects of various drug classes for pain, inflammation, cardiovascular, and other diseases.	PSO1, PSO2, PSO3.	Remember, understand & Apply (L1,2,3)
CO3	Introduced to the dye industry, types of fibres, and the methods used to classify and apply dyes.	PSO-1, PSO-2, PSO-3	Remember, understand & Apply (L1,2,3)
CO4	Understand the relationship between the chemical structure of dyes and their color properties.	PSO-1, PSO-2	Remember, understand (L1,2)
CO5	Acquire knowledge of the chemical processes and intermediates involved in dye production.	PSO1, PSO2, PSO3	Remember, understand & Apply (L1,2,3)

T.Y.B.Sc.	**SEMESTER V THEORY**
COURSE CODE **RJDSECHE351** DSE-I CHEMISTRY OF DRUGS AND DYES-I	**COURSE OUTCOME:** ON SUCCESSFUL COMPLETION OF THIS COURSE, STUDENTS WILL BE ABLE TO: 1. Students will develop a basic understanding of drugs, including their types, administration methods, dosage forms, and how they interact with the body. 2. Students will gain knowledge about different therapeutic drugs, their mechanisms of action, and their clinical uses for pain, inflammation, cardiovascular, diabetes, and respiratory conditions. 3. Students will explore the dye industry, the types of fibres used in dyeing, and the methods of dye classification and application.

	4. Students will learn how the chemical structure of dyes affects their color, properties, and applications. 5. Students will understand the key chemical processes and intermediates involved in dye production and their significance in the dyeing process **LEARNING OUTCOME:** ON SUCCESSFUL COMPLETION OF THIS COURSE, STUDENTS WILL BE ABLE TO: 1. Identify different types of drugs, routes of administration, dosage forms, and understand pharmacodynamics. 2. Gain the ability to classify and explain the uses, actions, and side effects of various therapeutic drugs, including analgesics, antihistamines, and cardiovascular agents. 3. Understand the dye industry, types of fibres, and the methods used to classify and apply dyes. 4. Develop an understanding of how the chemical structure of dyes influences their color properties and performance. 5. Explain the chemical processes and intermediates involved in dye production and their role in dyeing applications

SEMESTER V (DSE – I)		**Hrs.**	**Cr.**
DSE -I: CHEMISTRY OF DRUGS AND DYES -I	**PAPER CODE: RJDSECHE351**	**60**	**04**
Unit No.	**Name of the topic**	**No. of Hrs.**	**Credits**
I	**1.1 General Introduction to Drugs (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: Pharmakon, Pharmacology, Pharmacophore, Prodrug, Half-life efficiency, LD50, ED50, GI50 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 Routes of Drug Administration and Dosage Forms (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 Pharmacodynamic agents**: A brief introduction of the following pharmacodynamic agents and the study with respect to their chemical structure, chemical class, therapeutic uses, and side effects. **1.3.1 CNS Drugs: (4L)**	**15**	**1**

	Classification based on pharmacological actions: CNS Depressants & CNS Stimulants. Concept of sedation and hypnosis, anesthesia. ● Phenytoin (Hydantoin) ● Trimethadione (Oxazolidinediones) **(Synthesis from acetone)** ● Alprazolam (Benzodiazepines) ● Levetiracetam (Pyrrolidines) ● Amphetamine (Phenethylamine) **(Asymmetric synthesis from phenyl acetic acid)** ● Chlorpromazine (Phenothiazines)		
II	**2.1 Analgesics, Antipyretics and Anti-inflammatory Drugs. (4L)** **2.1.1 Analgesics and Antipyretics** ● Morphine (Phenanthrene alkaloids) ● Tramadol (Cyclohexanols) **(Synthesis from salicylic acid)** ● Aspirin (Salicylates) ● Paracetamol (p-Amino phenols) **2.1.2 Anti-inflammatory Drugs** Mechanism of inflammation and various inflammatory conditions. ● Steroids: Prednisolone, Betamethasone ● Sodium Diclofenac, Aceclofenac (N- Aryl anthranilic acids) **(Synthesis from 2,6-dichlorodiphenyl amine)** **2.2 Antihistaminic Drugs (2L)** ● Diphenhydramine (Ethanol amines) ● Cetirizine (Piperazine) **(Synthesis from 4-Chlorobenzhydryl chloride).** ● Chlorpheniramine maleate (Ethyl amines). ● Pantoprazole (Benzimidazoles). **2.3 Cardiovascular drugs (3L)** Classification based on pharmacological action ● Isosorbide dinitrate (Nitrates) ● Valsartan (Amino acids) (structure not expected) ● Atenolol (Aryloxy propanol amines) **(Synthesis from 3-Hydroxy phenyl acetamide)** ● Amlodipine (Pyridines) ● Frusemide /Furosemide (Sulfamoyl benzoic acid) ● Rosuvastatin (Pyrimidine) **2.4 Antidiabetic Agents (2L)** General idea and types of diabetes; Insulin therapy ● Glibenclamide (Sulphonyl ureas) ● Metformin (Biguanides) ● Dapagliflozin (Pyranose) ● Pioglitazon (Thiazolidinediones)**(Synthesis from 2-(5-ethylpyridin-2-yl ethanol)** **2.5 Antiparkinsonian Drugs (2L)** Idea of Parkinson's disease. ● Procyclidine hydrochloride (Pyrrolidines) ● Ethopropazine hydrochloride (Phenothiiazines)	**15**	**1**

	● Levodopa (Amino acids) **(Synthesis from Vanillin)** **2.6 Drugs for Respiratory System (2L)** General idea of: Expectorants; Mucolytics; Bronchodilators; Decongestants; Antitussives. ● Ambroxol (Cyclohexanol) **(Synthesis from paracetamol)** ● Salbutamol (Phenyl ethyl amines) ● Oxymetazoline (Imidazolines) ● Codeine Phosphate (Opiates)		
III	**3.1 Introduction to the dye-stuff Industry (5L)** **3.1.1** Dyes Definition of dyes, requirements of a good dye i.e. Colour, Chromophore and Auxochrome, Solubility, Linearity, Coplanarity, Fastness, Substantivity, Economic viability. Definition of fastness and its properties and Mordants with examples Explanation of nomenclature or abbreviations of commercial dyes with at least one example 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. **3.1.2** Natural and Synthetic Dyes Natural Dyes: Definition and limitations of natural dyes. Examples and uses of natural dyes w.r.t Heena, Turmeric, Saffron, Indigo, Madder, Chlorophyll –names of the chief dyeing material/s in each natural dye [structures not expected], Synthetic dyes: Definition of synthetic dyes, primaries and intermediates. 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) **3.2 Substrates for Dyes: Types of fibers. (3L)** **3.2.1** Natural: cellulosic and proteinaceous fibres, examples-wool, silk and cotton structures and names of dyes applied on each of them. **3.2.2** Semi – synthetic: definition and examples [structures not expected] **3.2.3** Synthetic: Nylon, Polyesters and Polyamides structures & names of dyes applied on each of them **3.2.4** Blended fabrics: definition and examples [structures not expected] **3.2.5** Binding forces of dyes on substrate: ionic forces, covalent linkages, hydrogen bonding, Van der walls forces **3.3 Classification of dyes based on applications and dyeing methods (7L)** **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	**15**	**1**

	3.3.2 Classification of dyes based on applicability on substrates (examples with structures) (a) Acid Dyes- Orange II, (b) Basic Dyes-methyl violet, (c) Direct cotton Dyes- Benzofast Yellow 5GL. (d) Azoic Dyes – Diazo components; Fast yellow G, Fast orange R. Coupling components. 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, (i) Reactive Dyes- Cibacron Brilliant Red B, **3.3.3** Optical Brighteners: General idea, important characteristics of optical brighteners and their classes [Stilbene, Coumarin, Heterocyclic vinylene derivatives, Diarylpyrazolines, Naphthylamide derivatives] general structure of each class.		
IV	**4.1 Colour and Chemical Constitution of Dyes (4L)** **4.1.1** Absorption of visible light, Colour of wavelength absorbed, Complementary colour. **4.1.2** Relation between colour and chemical constitution. (i) Armstrong theory (quinonoid theory) and its limitations. (ii) Witt's Theory: Chromophore, Auxochrome, Bathochromic & Hypsochromic Shift, Hypochromic & Hyperchromic effect (iii) Valence Bond theory, comparative study and relation of colour in the following classes of compounds/dyes: Benzene, Nitrobenzene, Nitroanilines, Nitrophenols, Benzoquinones, Azo, Triphenyl methane, Anthraquinones. (iv) Molecular Orbital Theory. **4.2 Unit process and Dye Intermediates (3L)** **4.2.1** A brief idea of Unit Processes Introduction to primaries and intermediates Unit processes: definition and brief ideas of below unit processes: (a) Nitration (b) Sulphonation (c) Halogenation (d) Diazotization: (3 different methods& its importance) (e) Ammonolysis (f) Oxidation NB: Definition, Reagents, Examples of each unit processes mentioned above with reaction conditions (mechanism is not expected) **4.2.2 Preparation of the Following Intermediates(8L)** Benzene derivatives: Benzenesulphonic acid; 1,3-Benzenedisulphonic acid; sulphanilic acid; o-, m-, p-chloronitrobenzenes; o-, m-, p-nitroanilines; o-, m-, p-phenylene diamines; Naphthol ASG Naphthalene Derivative: Schaeffer acid; Tobias acid; Naphthionic acid; N.W. acid; cleve-6-acid; H-acid; Naphthol AS Anthracene Derivative: 1-Nitroanthraquinone; 1-Aminoanthraquinone Anthraquinone-2-sulphonic acid; Benzanthrone.	**15**	**1**

REFERENCES FOR UNIT I & II

1. Text book of organic medicinal & pharmaceutical chemistry. Wilson & Gisovolds, 11th Edition by John H Block, John M Beale Jr.
2. Medicinal chemistry. V.K. Ahluwalia and Madhu Chopra, CRC Press.
3. The organic chemistry of drug design & drug action. 2nd ed. By Richard B Silvermann, Academic Press.
4. Foye's principles of medicinal chemistry. 6th Edition, Edited by Davis William & Thomas Lemke, Indian edition by B I Publication Pvt Ltd, Lippmcolt Williams & Wilkins.
5. Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher. 4th edition.

REFERENCES 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. Chemistry of Synthetic Dyes, Vol I – IV, Venkatraman K., Academic Press 1972
5. The Chemistry of Synthetic Dyes and Pigments, Lubs H.A., Robert E Krieger Publishing Company, NY ,1995

DSE-II

SEMESTER		**SEM – V**
TITLE OF THE SUBJECT / COURSE		**POLYMER CHEMISTRY -I**
COURSE CODE		**RJDSECHE352**
CEDITS		**04**
DURATION		**60 Hrs.**

LEARNING OBJECTIVE	
1.	Understanding of the basic knowledge and classification polymers
2.	To Acquire a sound knowledge about the nomenclature and classification of polymer
3.	To understand the techniques used for calculating and determining the molecular weight of a polymer
4.	To familiarize with various synthesis techniques of polymers
5.	To understand the stereochemistry for polymeric compounds

COURSE OUTCOME NUMBER	**ON COMPLETION OF THE COURSE, STUDENT WILL BE ABLE:**	**PSO ADDRESSED**	**BLOOMS LEVEL**
CO1	To understand the history and development of polymer chemistry	PSO1, PSO2, PSO3, PSO4.	remember, understand, apply and analyze (L1,2,3,4.)
CO2	To understand the peculiarities of polymer molecular weight and various determination techniques	PSO1, PSO2, PSO3.	remember, understand, apply (L1,2,3)
CO3	To understand and correlate the various techniques for determination of molecular weight of polymers	PSO-1, PSO-2, PSO-5	Understand (L2)
CO4	To compare and correlate various polymerization methods and techniques including advanced approaches	PSO-2, PSO-3	Apply (L3)
CO5	To understand in detail the mechanisms of the reactions that lead to the formation of polymers	PSO2, PSO3, PSO5.	Analyze (L4)
CO6	To familiarize with various types of polymers	PSO5, PSO6, PSO8.	Apply (L3)

T.Y.B.Sc.	**SEMESTER V THEORY**
COURSE CODE **RJDSECHE352** DSE-II POLYMER CHEMISTRY -I	**COURSE OUTCOME:** ON SUCCESSFUL COMPLETION OF THIS COURSE, STUDENTS WILL BE ABLE: 1. To understand the history and development of polymer chemistry 2. To understand the peculiarities of polymer molecular weight and various determination techniques 3. To understand and correlate the various techniques for determination of molecular weight of polymers 4. To compare and correlate various polymerization methods and techniques including advanced approaches

	5. To understand in detail the mechanisms of the reactions that lead to the formation of polymers 6. To familiarize with various types of polymers **LEARNING OUTCOME:** ON SUCCESSFUL COMPLETION OF THIS COURSE, STUDENTS WILL BE ABLE: 1. To understanding the basics knowledge and classification polymers 2. To Acquire a sound knowledge about the nomenclature and classification of polymer 3. To understand the techniques used for calculating and determining the molecular weight of a polymer 4. To familiarize with various synthesis techniques of polymers 5. To understand the stereochemistry of polymers

SEMESTER V (DSE – II)		**Hrs.**	**Cr.**
DSE -II: POLYMER CHEMISTRY -I	**PAPER CODE: RJDSECHE352**	**60**	**04**

Unit No.	**Name of the topic**	**No. of Hrs.**	**Credits**
I	**1.1. Introduction (5L)** Historical development and present status of polymer chemistry, micromolecule, macromolecule, monomer, oligomer, polymer, homopolymer, copolymer. **1.2. Nomenclature of polymers (3L)** names based on source, based on structure (IUPAC and Non-IUPAC), Trade names. **1.3 Classification of polymers (7L)** Classification based on source, structure, thermal response and physical properties.	**15**	**01**
II	**2.1. Molecular Weights of Polymers(10L)** Concept of average molecular weight - number average, weight average and viscosity average molecular weight, molecular weight distribution, theoretical considerations and empirical distribution model, degree of polymerization and molecular weight, influence of molecular weight on physical properties. **2.2. Techniques used for determination of molecular weights of polymer (5L)** Vapour phase osmometers, light scattering, viscometry and Gel permeation chromatography.	**15**	**01**
III	**3.1. Synthesis of Polymers (8L)** **Addition polymers:** Polyethylene, polypropylene, teflon, polystyrene, PVC and it's uses. **Condensation polymers:** Polyesters, polyamides, polyurethanes, polycarbonates, phenol formaldehyde resins and it's uses. **3.2. Free radical addition polymerization (7L)**	**15**	**01**

	Chain growth polymerization. Mechanism of chain growth polymerization. Initiation, propagation and termination. Types of free radical initiators (peroxo, azo and redox initiators). Initiator efficiency.		
IV	**4.1. Cationic, anionic and ring opening polymerization (8L)** Basic concepts of cationic and anionic methods of polymerization, distinguishing between radical and ionic polymerization. Kinetics of cationic and anionic polymerization. **4.2. Stereochemistry of polymers (7L)** Tacticity, Mechanism of stereochemical control of polymerization using Ziegler Natta catalysts.	**15**	**01**

REFERENCES FOR UNIT I & II

1. Principles of Polymer Chemistry, 2Nd Ed. A Ravve Kluwer Academic Publisher (2000) ISBN 0-306- 48368-7
2. Polymer Chemistry – An Introduction R. B. Seymour and C. E. Carraher, Jr. Marcel Dekker, Inc. New York
3. Introduction to Polymer Science and Technology an SPE Textbook H. S. Kaufman and J. J. Falcetta John- Wiley and Sons, New York

REFERENCES FOR UNIT III & IV)

1. Polymer Science a Text book, F. W. Billmayer, 3rd edition, John Wiley &Sons
2. Polymer Science, V. R. Gowariker, N. V. Viswanathan&J. Sreedhar, New Age International Publishers
3. Principles of Polymer Science, P. Bahadur&N. V. Sastry, Narrora Publishing House, 2nd Edition, New Delhi

SEM VI SYLLABUS

DSE-THEORY

DSE-I

SEMESTER		**SEM – VI**
TITLE OF THE SUBJECT / COURSE		**CHEMISTRY OF DRUGS AND DYES -II**
COURSE CODE		**RJDSECHE361**
CEDITS		**04**
DURATION		**60 Hrs.**

LEARNING OBJECTIVE	
1.	Know steps involved in drug discovery, design and development. Study different chemotherapeutic agents with their uses.
2.	Get acquainted with drug metabolism study.
3.	Understand the synthesis of different class of drug molecule.
4.	The different classes of Chemotherapeutic Agents.
5.	The preparation, uses and the side effects of certain drugs in the treatment of various diseases.
6.	The synthesis of an important drug intermediate for medicinal purpose.
7.	The development and importance of nanomaterial in medicinal chemistry.
8.	The classification of dyes based on chemical constitution, its synthesis and applications.

COURSE OUTCOME NUMBER	**ON COMPLETION OF THE COURSE, STUDENT WILL BE ABLE TO:**	**PSO ADDRESSED**	**BLOOMS LEVEL**
CO1	To study discovery of lead compounds, development of drug and structure modification to increase potency.	PSO1, PSO2, PSO3, PSO4.	Remember, Understand, Apply, Analyse. (L1,2,3,4)
CO2	To study drug metabolism studies.	PSO1, PSO2, PSO3, PSO4.	Remember, Understand, Apply, Analyse. (L1,2,3,4)
CO3	To study chemotherapeutic agents involves antibiotics, antivirals, antimalarials and anthelmintics and antifungal agents.	PSO-1, PSO-2, PSO-5	Remember, Understand. (L1,2)
CO4	Classify various chemotherapeutic agents with respect to chemical class, structure, uses and side effects.	PSO-1, PSO-2, PSO8	Understand (L2)
CO5	Classification of Dyes based on Chemical Constitution and Synthesis of some selected dyes.	PSO2, PSO3, PSO5.	Apply (L3)
CO6	Understand and explain the biomedical applications of dyes.	PSO1, PSO2, PSO5.	Analyse (L4)
CO7	Understand the role and importance of FDA and FSSAI.	PSO-1, PSO-2, PSO5.	Remember, Understand. (L1,2)
CO8	Understand and justify the application of pigments.	PSO-1, PSO-2, PSO5.	Remember, Understand. (L1,2)

T.Y.B.Sc.	**SEMESTER VI THEORY**
COURSE CODE **RJDSECHE361** DSE-I CHEMISTRY OF DRUGS AND DYES-II	**COURSE OUTCOME:** ON SUCCESSFUL COMPLETION OF THIS COURSE, STUDENTS WILL BE ABLE TO: 1. To study discovery of lead compounds, development of drug and structure modification to increase potency. 2. To study drug metabolism studies. 3. To study chemotherapeutic agents involves antibiotics, antivirals, antimalarials and anthelmintics and antifungal agents. 4. Classify various chemotherapeutic agents with respect to chemical class, structure, uses and side effects. 5. Classification of Dyes based on Chemical Constitution and Synthesis of some selected dyes. 6. Understand and explain the biomedical applications of dyes. 7. Understand the role and importance of FDA and FSSAI. 8. Understand and justify the application of pigments. **LEARNING OUTCOME:** ON SUCCESSFUL COMPLETION OF THIS COURSE, STUDENTS WILL BE ABLE TO: 1. Know steps involved in drug discovery, design and development. Study different chemotherapeutic agents with their uses. 2. Get acquainted with drug metabolism study. 3. Understand the synthesis of different class of drug molecule. 4. The different classes of Chemotherapeutic Agents. 5. The preparation, uses and the side effects of certain drugs in the treatment of various diseases. 6. The synthesis of an important drug intermediate for medicinal purpose. 7. The development and importance of nanomaterial in medicinal chemistry. 8. The classification of dyes based on chemical constitution, its synthesis and applications. 9. Syntheses of some representative dyes. 10. The awareness regarding the toxicity of dyes and their effect on human health and environment including remediation process. 11. know the biomedical applications of the dyes. 12. know the applications of dyes in food, cosmetics, paper and leather industries. 13. know the role of FDA and FSSAI in the dye regulations. 14. Understand the concept of pigment and its applications. 15. Understand the role of the Indian dye industry in the development and production of dyes.

SEMESTER VI (DSE – I)		Hrs.	Cr.
DSE -I: CHEMISTRY OF DRUGS AND DYES -II	**PAPER CODE: RJDSECHE361**	**60**	**04**

Unit No.	Name of the topic	No. of Hrs.	Credits
I	**1.1 Drug Discovery, Design and Development (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 Drug Metabolism (3L)** Introduction, Absorption, Distribution, Bio- transformation, Excretion. Different types of chemical transformation of drugs with specific examples. **1.3 Chemotherapeutic Agents. (6L)** 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 **Antibiotics and antivirals:** Definition, i. Amoxicillin (β- lactum antibiotics) ii. Cefpodoxime (Cephalosporins) iii. Doxycycline (Tetracyclines) iv. Levofloxacin (Quinolones) (**Synthesis from 2,3,4 – Trifluoro -1- nitrobenzene)** v. Aciclovir/Acyclovir (Purines) **1.3.2 Antimalarials:** Types of malaria; Symptoms; Pathological detection during window period (Life cycle of the parasites not to be discussed). i. Chloroquine (3-Amino quinolones) ii. Artemether (Benzodioxepins) **Following combination to be discussed:** Atremether-Lumefantrine (no structure) **1.3.2 Anthelmintics and Anti-Fungal agents** Drugs effective in the treatment of Nematodes and Cestodes infestations. i. Diethyl carbamazine (Piperazines) ii. Albendazole (Benzimidazoles) (**Synthesis from 2-Nitroaniline)** iii. Clotrimazole (Imidazole) iv. Fluconazole (Triazole) (**Synthesis from 1- Bromo – 2,4- difluorobenzene)**	**15**	**01**
II	**2.1 Antiamobic Drugs (1L)** Types of Amoebiasis. • Metronidazole, Ornidazole, Tinidazole (Imidazoles) Synthesis of Metronidazole from glyoxal by Debus-	**15**	**01**

Radziszewski imidazole synthesis route

Following combination therapy to be discussed:

Ciprofloxacin- Tinidazole.

2.2 Antitubercular and Antileprotic Drugs: (3L)

Types of Tuberculosis; Symptoms and diagnosis Of Tuberculosis

Types of Leprosy.

General idea of Antibiotics used in their treatment.

i. PAS (Amino salicylates)
ii. Isoniazid (Hydrazides)
iii. Pyrazinamide (Pyrazines)
iv. (+) Ethambutol (Aliphatic diamines) (**Synthesis from 1-Nitropropane)**
v. Dapsone (Sulphonamides) (**Synthesis from 4-Chloronitrobenzene)**
vi. Clofazimine (Phenazines)
vii. Bedaquiline (Quinoline)

Following combination therapy to be discussed:

i. Rifampin + Ethambutol + Pyrazinamid
ii. Rifampin + Isoniazid + Pyrazinamide

2.3 Anti – Neoplastic Drugs (2L)

Idea of malignancy; Causes of cancer

Brief idea of Immuno stimulants and Immuno depressants

i. **Lomoustine (Nitrosoureas)**
ii. Anastrozole (Triazoles) (**Synthesis from 3,5-bis (bromo methyl) toluene)**
iii. Cisplatin (Chloro platinum)
iv. Vincristine, Vinblastine, Vindesine (Vinca alkaloids) (structure not expected)

2.4 Anti-HIV Drugs (1L)

Idea of HIV pathogenicity, Symptoms of AIDS.

- AZT/Zidovudine, Lamivudine, DDI (Purines)

2.5 Drug Intermediates: (2L)

Synthesis and uses of:

i. 2,3,6-Triamino-6- hydroxy pyrimidine from Guanidine
ii. p-[2'-(5-Chloro-2-methoxy benzamido) ethyl]-benzenesulphonamide from Methyl-5-chloro-2-methoxybenzene
iii. 3-(p-Chlorophenyl)-3- hydroxypiperidine from 3-Chloroacetophenone
iv. p-Acetyl amino benzene sulphonyl chloride from Aniline
v. Epichlorohydrine from propene.

2.6 Nano particles in medicinal chemistry (4L)

Introduction; Carbon nano particles (structures) and Carbon nano tubes:

i. Functionalization for Pharmaceutical applications.
ii. Targeted drug delivery.
iii. In vaccine (Foot and mouth disease).
iv. Use in Bio-physical treatment.
v. Gold nano particles in treatment of: Cancer; Parkinson and Alzheimer.
vi. Silver nano particles: Antimicrobial activity.

2.7 Drugs and Environmental Aspects (2L)

	• Impact of Pharma-industry on environment • International regulation for human experimentation with reference to: "The Nuremberg Code" and "The Helsinki Declaration".		
III	**3. 3.1 Classification of Dyes based on Chemical Constitution and Synthesis of selected Dyes (12L)** (Synthesis of the dyes marked with * is expected) 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 **3.2 Health and Environmental Hazards of Synthetic Dyes and their Remediation Processes (3L)** 3.2.1 **Impact of the textile and leather dye Industry on the environment** with special emphasis on water pollution 3.2.2 **Health Hazards:** Toxicity of dyes w.r.t food colours. 3.2.3 **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.	**15**	**01**
IV	**4.4.1 Non-textile uses of dyes: (8L)** 4.1.1 **Biomedical uses of dyes** i. Dyes used in formulations (Tablets, capsules, syrups etc) Indigo carmine, Sunset yellow, Tartrazine	**15**	**01**

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

4.1.2 **Dyes used in food and cosmetics:**
i. Properties of dyes used in food and cosmetics
ii. Introduction to FDA and FSSAI
iii. Commonly used food colours and their limits

4.1.3 **Paper and leather dyes**
i. Structural features of paper and leather
ii. Dyes applicable to paper and leather

4.1.4 **Miscellaneous dyes**
i. Hair dyes
ii. Laser dyes
iii. Indicators
iv. Security inks
v. Coloured smokes and camouflage colours

4.2 Pigments (3L)
Introduction:
Definition of pigments, examples, properties of pigments, difference between dyes and pigments.
Definition of Lakes and Toners

4.3 Dyestuff Industry - Indian Perspective (4L)
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

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4. The organic chemistry of drug design & drug action. 2nd ed. By Richard B Silvermann, Academic Press.
5. The Organic Chemistry of Drug Synthesis. Lednicer and Mitsher, Wliey.
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7. The Chemistry of Synthetic Dyes and Pigments, Lubs H.A., Robert E Krieger Publishing Company, NY ,1995
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9. Foye's principles of medicinal chemistry. 6th Edition, Edited by Davis William & Thomas Lemke, Indian edition by B I Publication Pvt Ltd, Lippmcolt Williams & Wilkins.
10. Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher. 4th edition.
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13. The Art of Drug synthesis. Johnson and Li. Wiley, 2007.
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DSE-II

SEMESTER		**SEM – VI**
TITLE OF THE SUBJECT / COURSE		**POLYMER CHEMISTRY -II**
COURSE CODE		**RJDSECHE362**
CEDITS		**04**
DURATION		**60 Hrs.**

LEARNING OBJECTIVE	
1.	To impart basic concepts of natural rubber and synthetic rubber, also understand different manufacturing processes
2.	To Acquire a sound knowledge about biodegradable polymers and light emitting polymers
3.	To explain the principle, construction, working & application of thermal analysis techniques used for polymer characterization
4.	To explain the principle, construction, working & application of X – ray diffraction technique used for polymer characterization

COURSE OUTCOME NUMBER	**ON COMPLETION OF THE COURSE, STUDENT WILL BE ABLE:**	**PSO ADDRESSED**	**BLOOMS LEVEL**
CO1	To Acquire a fundamental knowledge in classification, structure, and properties of nature rubber, synthetic rubber, cellulose based polymers, rayon, and jute	PSO1, PSO2, PSO3, PSO4.	Remember, Understand, Apply, Analyse. (L1,2,3,4)
CO2	To impart basic concepts of biodegradable polymer and light emitting polymers	PSO1, PSO2, PSO3, PSO4.	Remember, Understand, Apply, Analyse. (L1,2,3,4)
CO3	To Acquire a basic knowledge about the working principle of various instruments used for characterization of polymers	PSO-1, PSO-2, PSO-5	Understand (L2)
CO4	To familiarize with the thermal techniques for polymer sample analysis	PSO-1, PSO-2, PSO8	Understand (L2)
CO5	To identify the potential applications of X-Ray diffraction technique and its applications for polymer sample analysis	PSO2, PSO3, PSO5.	Apply (L3)

T.Y.B.Sc.	**SEMESTER VI THEORY**
COURSE CODE **RJDSECHE362** DSE-II POLYMER CHEMISTRY -II	**COURSE OUTCOME:** ON SUCCESSFUL COMPLETION OF THIS COURSE, STUDENTS WILL BE ABLE: 1. To Acquire a fundamental knowledge in classification, structure, and properties of nature rubber, synthetic rubber, cellulose based polymers, rayon, and jute 2. To impart basic concepts of biodegradable polymer and light emitting polymers 3. To Acquire a basic knowledge about the working principle of various instruments used for characterization of polymers 4. To familiarize with the thermal techniques for polymer sample analysis

	5. To identify the potential applications of X-Ray diffraction technique and its applications for polymer sample analysis **LEARNING OUTCOME:** ON SUCCESSFUL COMPLETION OF THIS COURSE, STUDENTS WILL BE ABLE: 1. To impart basic concepts of natural rubber and synthetic rubber, also understand different manufacturing processes 2. To Acquire a sound knowledge about biodegradable polymers and light emitting polymers 3. To explain the principle, construction, working & application of thermal analysis techniques used for polymer characterization 4. To explain the principle, construction, working & application of X – ray diffraction technique used for polymer characterization

SEMESTER VI (DSE – II)		**Hrs.**	**Cr.**
DSE -II: POLYMER CHEMISTRY -II	**PAPER CODE: RJDSECHE362**	**60**	**04**

Unit No.	**Name of the topic**	**No. of Hrs.**	**Credits**
I	**1.1.Natural Polymers (8L)** Natural rubber, Structure and properties of natural rubber, cis and trans polyisoprene, cellulose, cellulose based polymers Cotton, Rayon, Nitrocellulose, and cellulose acetate, jute. **1.2. Synthetic Rubbers (7L)** Manufacture, general properties and applications of synthetic rubber, Polyisoprene, Polybutadiene, Butyl rubber, Neoprene rubber.	**15**	**01**
II	**2.1. Biodegradable polymers (8L)** Classification and uses. Polylactic acid structure, properties and use for packaging and medical purposes, mechanism of degradation. **2.2. Light Emitting Polymers (7L)** Introduction, Characteristics, Method of preparation and applications.	**15**	**01**
III	**3.1. Thermal Analysis of Polymers (15L)** Thermogravimetric analysis (TGA): Applications, purity, thermal stability, thermal degradation, Estimation of thermal stability from TGA curves, qualitative methods. Differential thermal analysis (DTA): Determination of physical transitions, melting thermograms, Glass transition. Differential Scanning Calorimetry (DSC)	**15**	**01**
IV	**4.1. X-Ray diffraction analysis of Polymers (15L)** Methods of production of x-rays, properties of x-rays, diffraction of x-rays, Bragg's Law, small angle scattering of x-ray by polymers, Crystalline and amorphous phase, Analysis of molecular structure of simple polymers by XRD, determination of crystallinity, factors affecting polymer crystallinity.	**15**	**01**

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1. Introduction to Synthetic Polymers I. M. Campbell 1st Ed., Oxford Press (1994)
2. An Introduction to Polymer Science H. G. Elias, 1st Edn. John Wiley (1997)
3. Polymers: Chemistry and Physics of Modern Materials J. M. G. Cowie, 2nd ed., Staaley Thornes Publ (1991)
4. Principles of Polymerization, G. Odian, John Wiley & Sons (1981)
5. Polymer Characterization, E. Schroder, G. Muller and K. F. Arndt, Hanser Publishers, Munich
6. Polymer Characterization: Physical Techniques, D. Campbell and J. R. White; Chapman & Hall, London (1989)