Estd. 1962
"A++" Accredited by
NAAC (2021)
With CGPA 3.52

SHIVAJI UNIVERSITY, KOLHAPUR - 416004,
MAHARASHTRA
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शिवाजी विद्यापीठ, कोल्हापूर -४१६००४,महाराष्ट्र
दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१—२६०९०९४
०२३१—२६०९४८७

Ref.No.SU/BOS/Science/481 **Date: 05/08/2025.**

To,

The Principal,
All Concerned Affiliated Colleges/Institutions
Shivaji University, Kolhapur.

Subject: Regarding revised syllabi of B.Sc. Part-III (Sem.V & VI) degree programme under the Faculty of Science and Technology as per NEP-2020 (1.0)

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi, nature of question paper of B.Sc. Part-III (Sem.V & VI) degree programme under the Faculty of Science and Technology as per NEP-2020 (1.0).

B.Sc. Part-III (Sem. V & VI) as per NEP-2020 (1.0)	
1.	Drug Chemistry

This syllabus, nature of question and equivalence shall be implemented from the academic year 2025-2026 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020@suk(Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2025 & March/April 2026. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours Faithfully,

Dy Registrar
Dr. S. M. Kubal

Encl: As above

for Information and necessary action

Copy to:

1	Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations and Evaluation	7	I.T.Cell /Computer Centre
3	Chairman, Respective Board of Studies	8	Eligibility Section
4	B.Sc.-M.Sc. Exam Section	9	Affiliation Section (T.1) (T.2)
5	Internal Quality Assurance Cell (IQAC Cell)	10	P.G. Seminar Section

Shivaji University, Kolhapur

Accredited By NAAC with 'A^{++}' Grade

Syllabus for

Bachelor of Science Part-III

Drug Chemistry (NEP-1.0)

To be implemented from

June, 2025 onwards

INTRODUCTION

This syllabus is prepared for Third year undergraduate students to encourage them to study drug chemistry and excel for the academic and industrial exposure simultaneously. As per the UGC norms and industry requirement content of the syllabus have been framed. The depth of the syllabi is compatible to the syllabi of other universities, at the same time is not rigid for the students at third year of their graduation. The units in the syllabus are well defined with scope and the number of lectures. The references are mentioned with relevance.

GENERAL OBJECTIVES OF THE COURSE:

1. To introduce drug chemistry which includes detail study of drug will help them to enhance their interdisciplinary approach with vigour.
2. To understand the fundamentals, principles, concepts and recent developments in the subject area.
3. To create a skilled workforce to match the requirements of the society.
4. To develop scientific attitude is the major objective so as to make the students open minded, and curious.
5. To develop laboratory skills through practical work and equipment's along with the collection and interpretation of scientific data to contribute to science.

PROGRAM OBJECTIVES AND OUTCOMES

PROGRAME OBJECTIVES:

Students gain a deep knowledge regarding natural products drug resources, analytical skills along with excipients, chemistry involved in SAR (Structure Activity Relationship) in drug development process, commonly used drugs for various therapeutic areas, Drug development process, toxicity and impurity profile.

PROGRAM SPECIFIC OUTCOMES:

1. Able to apply the knowledge gained during the course of the program from biochemistry, drug analysis, medicinal chemistry and environmental studies.
2. Able to communicate easily and confidently
3. Able to perform multitask in the fields including pharmaceuticals and research.
4. The students will graduate with proficiency in the subject of drug chemistry. 5. The students will be eligible to continue higher studies in their subject.

B. Sc. Part - III (NEP- 1.0) SEMESTER-V
Drug Chemistry Paper No.– IX
(Drug Design and Early Development)

(Theory Credits: 02, 30 hours.)

Expected Learning Outcomes:

Name of the topic	Expected Learning Outcome
1. Novel Drug Discovery	- Understand drug discovery stages - Identify targets & leads - Use modern tools
2. Drug Design	- Learn drug design principles - Use computational methods - Understand ADME impact
3. Preclinical Trialsm in Drug Development	- Know in vitro/in vivo models - Understand safety/toxicity tests - Meet regulations
4. Clinical Trials in Drug Development	- Know phases I–IV - Understand ethics & consent - Learn trial design & analysis
5. Drug registration process	- Learn approval steps - Understand regulatory bodies - Know CTD & surveillance

Unit-1. Novel Drug Discovery **[8]**

1.1 Disease
1.2 Biological target
1.3 Binding sites of the drug candidate
1.4 Structural designing of the pharmacophore
1.5 Synthesis
1.6 in-vitro study, in-vivo study
1.7 PK study and PD study

Unit-2. Drug Design **[6]**

2.1 Screening and types of the screening
2.2 Lead candidate identification and its modification for generating SAR with the help homologation
2.3 Chain branching
2.4 Ring chain transformation
2.5 Bio-isomerism

Unit-3. Preclinical Trials in Drug Development **[6]**

3.1 In-vitro study and in-vivo study
3.2 DMPK, toxicity
3.3 Drug metabolite study
3.4 stability, formulation and solubility

Unit 4_: Clinical trials in Drug Development **[6]**

4.1 Phase I
4.2 Phase II
4.3 Phase III
4.4 Phase IV
4.5 IND Filling
4.6 process of FDA Approval

Unit 5_: Drug Registration Process **[4]**

5.1 Drug registration process in Us
5.2 Europe
5.3 Japan
5.4 India

References:

1. Medicinal chemistry by Graham L. Patrick's, Oxford publications.
2. Drug design and discovery by Richard Silverman
3. Medicinal Chemistry by Foye, Oxford publications.
4. Textbook of Organic Medicinal and Pharmaceutical Chemistry by Lippincott, Williams and Wilkins.

B. Sc. Part III (NEP 1. 0) SEMESTER-V

Drug Chemistry Paper No. X

(Reaction Mechanisms reagents & Name Reactions)

(Theory Credits: 02, 30 hours.)

Expected Learning Outcomes:

Name of the Topic	Expected Learning Outcomes
1. Basics of Chemical Reactions	- Understand reaction types - Identify reactants & products - Know reaction mechanisms
2. Necleophilic and Electrophilic Substitution Reaction	. - Differentiate between nucleophilic & electrophilic rea - Understand SN1, SN2, E1, E2
3.Synthetic Reagents and Applications	- Learn common reagents - Understand their roles in synthesis - Apply in organic reactions
4.Name Reactions	- Recognize key name reactions - Understand their mechanisms - Apply in synthesis planning

Unit 1. Basics of Chemical Reactions [6]

1.1Types of organic reactions addition, substitution, elimination
1.2 electronic movement in organic reactions
1.3 fission of a covalent bond
1.4 concepts of electrophiles and nucleophiles
1.5 factors affecting on chemical reactions
1.6 order of reactivity
1.7 acidity and basicity.

Unit 2 Nucleophilic and Electrophilic Substitution Reactions [4]

2.1 SN^1 reaction
2.2 SN^2 reaction
2.3 SN^i reaction
2.4 Aliphatic electrophilic substitution
2.5 Aromatic electrophilic substitution
2.6 Aliphatic nucleophilic substitution
2.7 Aromatic nucleophilic substitution.

Unit 3 Synthetic Reagents and Applications [8]

Preparation and Applications of following reagents.
3.1 Lithium aluminum hydride $LiAlH_4$
3.2 Osmium tetroxide (OsO_4)
3.3 Dicyclohexyl Carbodiimide (DCC)
3.4 Raney Nickel
3.5 2,3 - Dichloro - 5,6 - dicyano –1,4-benzoquinone (DDQ)
3.6 Polyphosphoric acid (PPA)
3.7 Diazomethane
3.8 Ceric ammonium nitrate (CAN)
3.9 N-Bromosuccinamide (NBS)
3.10 Selenium dioxide (SeO_2)
3.11 Sodium borohydride ($NaBH_4$)

Unit 4 Name Reactions

Statement, General Reaction, Mechanism and Synthetic applications [12]

4.1 Diels-Alder reaction
4.2 Oppenauer Oxidation
4.3 Meerwein – Pondorff- Verley reduction
4.4 Schmidt rearrangement
4.5 Hofmann rearrangement
4.6 Wittig reaction
4.7 Wagner-Meerwein rearrangement
4.8 Favorskii rearrangement
4.9 Michael reaction
4.10 Dieckmann's reaction or condensation
4.11 Benzil- Benzilic acid rearrangement
4.12 Benzidine rearrangement.

Reference Books

1. March's Advanced Organic Chemistry, Michael B. Smith and Jerry March, 6th, Wiley India, 2013.
2. Organic Chemistry Vol. 1 and 2 by I. L. Finar, Wiley publications.
3. A textbook of Organic Chemistry, Arun Bahl and B.S. Bahl., S. Chand.
4. Organic Chemistry, J. Clayden, N. Greeves, S. Waren and P. Wothers, Oxford Press.
5. Organic chemistry by P. S. Kalsi.

Reaction mechanism, reagents by S. N. Sanyal

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B. Sc. Part III (NEP 1. 0) SEMESTER-V

Drug Chemistry Paper No. XI (Natural Products)

(Theory Credits: 02, 30 hours.)

Expected learning Outcomes:

Name of the Topics	Expected Learning Outcome
1 Introduction To Natural Compounds	- Understand types & sources - Know biological importance - Classify natural compounds
2. Terpenoids	- Learn structure & classification - Identify natural sources - Understand uses
3. Steroids	- Understand basic structure - Learn biological roles - Know medicinal applications
4. Vitamins	- Classify water & fat-soluble vitamins - Understand functions & deficiencies
5. Lipids	- Know types & functions - Understand metabolic roles - Identify biological sources

Unit 1. Introduction to natural Compounds **[5]**

1.1 Introduction to natural products history Pharmaceutical applications,

1.2 Natural products as leads for new Pharmaceuticals eg. CNS, Anticancer, Cardiovascular, Antimalerial, antibiotics.

1.3 Alkaloid: Occurrence, Isolation, Classification, Properties, General methods for structure determination,synthesis of nicotine, morphine, codeine, berberine and its applications.

Unit 2. Terpenoids **[7]**

2.1 Occurrence,
2.2 Classification,
2.3 Extraction,
2.4 General Characteristics,
2.5 Isoprene rule,
2.6 synthesis of Citral, menthol, camphor and its applications.

Unit 3. Steroids **[5]**

3.1 Introduction,
3.2 Occurrence,
3.3 Classification,
3.4 Biological Significance and Biosynthesis,
3.5 Mevalonate pathway: oestrone, cortisol, testosterone, progesterone.

Unit 4. Vitamins **[5]**

4.1 Overview on Vitamin A, B, C, D, E and K.
4.2 Synthesis of vitamin B and C.

Unit 5. Lipids **[8]**

5.1 Introduction,
5.2 Classification,
5.3 Properties and biological importance.
5.4 Fatty acids Nomenclature and Structures,
5.5 Lipids in cell membrane Cholesterol and steroids,
Hormones- structure and functions.

Reference Books:

1. Steroids in laboratory and clinical practice, John William Honour, Elsvier Publications, 2023.
2. Anabolics steroids, Matthew R. Rhea, Pero J Marin, Mark D. Peterson, Jaffery L. Alexander; 2008.
3. Textbook of Biochemistry, U. Satyanarayana
4. The Vitamins fundamental aspects in nutritional and health. Gerald Combs, Jr., James McClung, 5th edition, Dec. 2015.
5. A fragrant introduction to terpenoids chemistry, 1st edition 2003, Charles S. Sell, RSC.
6. Terpenoids Chemistry, Biochemistry, Medicinal effects and Ethno-pharmacology, Bimal Krishna Banik, Bishwa Mohan Sahoo, Abhishek Tiwari 2022, CRC press.

Pharmaceutical Chemistry of Natural Products, by V. Algarsamy, Elsevier.

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B. Sc. Part III (NEP 1. 0) SEMESTER-V

Drug Chemistry Paper No. XII

(Industrial Pharmacy)

(Theory Credits: 02, 30 hours.)

EXPECTED LEARNING OUTCOMES:

Name of the topic	Expected Learning Outcome
1. **Tablets and Liquid Orals**	. - Understand formulation steps - Know evaluation tests - Learn advantages & limitations
2. **Capsules**	- Differentiate hard & soft capsules - Understand filling techniques - Learn storage needs
3. **Parenteral Products**	- Understand aseptic techniques - Know formulation requirements - Learn quality control
4. **Cosmetics**	- Learn formulation of basic cosmetics - Understand regulatory & safety aspects
5. **Sterile formulations & Immunological Products**	. - Understand sterilization methods - Know vaccine & serum types - Learn handling & storage

Unit I - Tablets and Liquid Orals [6]

1.1 Introduction, ideal characteristics of tablets,
1.2 Classification of tablets, excipients,
1.3 Formulation of tablets, granulation methods,
1.4 Compression and processing problems, equipment's and tablet tooling,
1.5 Tablet coating: types of coating, coating material formulation of coating compositions methods of coating equipment employed and defects in coating.
1.6 Quality control tests: in process and finished product tests.
1.7 **Liquid orals:** formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging evaluation of liquid orals official in pharmacopoeia.

Unit –II Capsules [6]

A) **Hard gelatin capsules:**

2.1 Introduction,

2.2 Production of hard gelatin capsule shells.

2.3 Size of capsules Filling,

2.4 Finishing and special techniques of formulation of hard gelatin capsule,

2.5 Manufacturing defects, in process and final products quality control tests for capsules.

B) **Soft gelatin capsules:**

2.6 Nature of shell and capsule contain,

2.7 Size of capsule importance of base adsorption and minimum/gm factors production in process and final product quality control tests.

2.8 Packaging, storage and stability testing of soft gelatin capsules and their applications.

Unit –III Parenteral Products **[6]**

3.1 Definition, types, advantages and limitations.

3.2 Preformulation factors and essential requirements,

3.3 Vehicles, additives, importance of isotonicity, Production procedure, production facilities and controls, aseptic processing, Formulation of injections, sterile powders, Large volume parenteral and Lyophilized products

Unit –IV Cosmetics **[6]**

4.1 Introduction,

4.2 types, its formulation and preparation of the following cosmetics: Lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and Sunscreens.

Unit V - Sterile formulations & Immunological Products [6]

5.1 Injectable,
5.2 Eye drops, eye ointments
5.3 Immunological Products: Sera, Vaccines, Toxoids and their manufacturing methods.

References:

1. Pharmaceutical dosage forms-tablets, volume 1, 2,
3 by H. A. Liberman, Leon Lachman and J.B. Schwartz.
2. Pharmaceutical dosage forms-parental medications, volume 1&2, by H. A. Liberman and Leon Lachman.
3. Pharmaceutics-science of the dosage forms-design by M.E. Aulton, Churchil livingstone

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B. Sc. Part III (NEP 1. 0) SEMESTER-VI

Drug Chemistry Paper No. XIII

(Therapeutic areas and its Drugs)

(Theory Credits: 02, 30 hours.)

EXPECTED LEARNING OUTCOME:

Name of the topic	Expected Learning Outcome
1 **Central Nervous system Drugs**	- Understand drug action on CNS - Learn classes like analgesics, sedatives, anticonvulsants
2. **Cardiovascular Drugs**	- Know types like antihypertensives, antianginals - Understand their mechanisms & uses
3. **- Drugs for respiratory system**	- Learn bronchodilators, antihistamines - Understand treatment of asthma & related disorders
4 **Anti-Neoplastic and Anti-HIV Drugs**	- Understand chemotherapy principles - Learn antiviral mechanisms - Know side effects & safety

Unit –I Central Nervous system Drugs [8]

1.1 Introduction to Central Nervous system,
1.2 Pharmacological actions, Concept of sedation, hypnosis, anesthesia,
1.3 Phenobarbitone(Barbiturates),
1.4 Phenytoin (Hydantoins),
1.5 Trimethadione (Oxazolidinediones),
1.6 Piracetam (Pyranones),
1.7 Midazolam,
1.8 Alprazolam (Benzodiazepines),
1.9 Methylphenidate, (Piperidines),
1.10 Chlorpromazine (Phenothiazines),
1.11 Fluoxetine (phenyl propyl amines),
1.12 Synthesis of Trimethadione;
1.13 Methylphenidate; Phenytoin.
Mode of action of Barbiturates as sedatives and hypnotics

Unit II - Cardiovascular Drugs **[6]**

2.1 Introduction to Cardiovascular system,
2.2 Diseases of Cardiovascular system,
2.3 Classification based on pharmacological actions, 2.4 Cardio tonic,
2.5 Antiarrythmic agents,
2.6 Enalapril, (alpha amino acids),
2.7 Isosorbide dinitrate(Nitrates),
2.8 Atenolol (Aryloxy propanol amines),
2.9 Nifedipine (pyridines),
2.10 Chlorthiazide (Thiazides),
Mode of action of Atenolol

Unit III- Drugs for respiratory system **[8]**

3.1 Respiratory system anatomy and working mechanism, 3.2 Disease of respiratory system,
3.3 General idea of Expectorants; Mucolytes;
3.4 Bronchodilators; Decongestants and Antitussives, \
3.5 Bromohexine(phenyl methyl amines),
3.6 Salbutamol,
3.7 Pseudo-epuedrine (Phenyl eth amines) ,
3.8 Oxymetazoline(Imidazolines) , Codeine Phosphate(Opiates),
Synthesis of Salbutamol

Unit IV- Anti-Neoplastic and Anti-HIV Drugs **[8]**

Anti-Neoplastic Drugs
4.1 Malignancy; Causes of cancer, brief idea of Immuno Stimulants, Immuno supressants,
4.2 Lomoustine (Nitrosoureas),
4.3 Fluorouracil (Pyrimidines),
4.4 Estrogen(steroidal hormones),
4.5 Mitomycin C (Antibiotics),
4.6 Vincristine; vinblatine; Vindesine (Vica alkaloids- no structures)
4.7 Cisplatin
4.8 Synthesis of 5 fluorouracil from urea.
4.9 Anti HIV Drugs Idea of HIV pathogenicity; 4.8 Symptoms of AIDS AZT,
4.10 Lamivudinr, Stavidine (Pyrimidines),
DDI (Purines).

Reference Books: (Use recent editions)

1. Human Anatomy and Physiology by Dr. N.Murugesh Sathya Publishers 2021
2. Cardiac Drugs by Kanu Chatterjee, Eric J Topol Jaypee Publisher 2015
3. The pharmacological basis of therapeutics by Goodman and Gilmans
4. Textbook of medical physiology arthurc, guyton and John E. Hall Miamisburg U.S.A

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B.Sc. Part III (NEP 1. 0) SEMESTER-VI

Drug Chemistry Paper No. XIV

(Heterocyclic Drugs)

(Theory Credits: 02, 30 hours.)

Expected learning Outcomes:

Name of the Topic	Expected Learning Outcome
1. **Heterocyclic Chemistry**	- Understand importance of heterocycles - Learn basic structures & classification
2. **Five & Six Membered Heterocyclic Compounds**	- Study synthesis & properties - Know examples like furan, pyridine, pyrrole
3 **Condensed Heterocyclic Compounds**	- Understand fused ring systems - Learn synthesis and medicinal relevance
4. **Bridged and Spiro heterocycles**	- Identify unique structures - Understand synthesis methods

Unit I - Heterocyclic Chemistry [6]

1.1 Introduction,
1.2 Classification of heterocyclic compounds,
1.3 Aliphatic heterocyclic compounds,
1.4 Aromatic heterocyclic compounds and 3-6 membered heterocyclic compounds condensed or fused hetero cyclic compounds,

Applications of heterocyclic compounds.

Unit II - Five & Six Membered Heterocyclic Compounds [8]

2.1 Drugs with 5 &6 membered heterocyclic compounds with one and two hetero atoms (03 each),
2.2 Synthesis,
2.3 Mode of action and its applications/uses.

Unit III - Condensed Heterocyclic Compounds [8]

3.1 Drugs with condensed five membered heterocycles,
3.2 Synthesis and applications of Benzoxazole,
3.3 Benzthiazole,
3.4 Benzimidazole,
3.5 Condensed six membered heterocycles synthesis

Applications of Benzofuran, Indole and Quinoline

Unit IV- Bridged and Spiro heterocycles [8]

Synthesis and applications of (06) bridged heterocyclic drugs:
4.1 Zoipidem,
4.2 Necopidem,
4.3 Aldpiodem,
4.4 Minodronic acid,
4.5 Cephalexin and quinine.

spiro hetrocycles- (5)

Reference Books:

1. Heterocyclic Chemistry by R. K. Bansal.
2. Heterocyclic Chemistry by T. Gilchrist.
3. The essence of Heterocyclic chemistry by A. R. Parikh, Hansa Parikh, Rajan Khunt.
4. Heterocyclic Chemistry by R. R. Gupta, M. Kumar, V. Gupta, Springer publications.

Principles of modern Heterocyclic Chemistry by A. Paquette.

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B.Sc. Part III (NEP 1. 0) SEMESTER-VI

Drug Chemistry Paper No. XV

(Herbal Drug technology)

(Theory Credits: 02, 30 hours.)

EXPECTED LEARNING OUTCOMES:

Name of the Topics	Expected Learning Outcome
1 **Herbs as raw materials**	- Identify sources & types of herbs - Understand selection, cultivation & collection
2 **Nutraceuticals**	- Understand definition & categories - Learn health benefits and applications
3. **Herbal Cosmetics**	- Know common herbal ingredients - Understand formulation & safety aspects
4. Evaluation of Drugs	- Learn methods for quality control - Understand authentication & standardization
5. **General Introduction to Herbal Industry**	- Know industry structure & scope - Understand regulatory and market trends

Unit –I Herbs as raw materials **[6]**

1.1 Definition of herb,
1.2 Herbal medicine,
1.3 Herbal medicinal product,
1.4 Herbal drug preparation,
1.5 Source of Herbs, Selection, identification and authentication of herbal materials,
1.6 Processing of herbal raw material
1.7 Biodynamic Agriculture Good agricultural practices in cultivation of medicinal plants including Organic farming.
Pest and Pest management in medicinal plants: Bio pesticides/ Bio insecticides

Unit –II Nutraceuticals **[6]**

2.1 General aspects, Market, growth, scope and types of products available in the market.
2.2 Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases,

Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.

2.3 Study of following herbs as health food: *Alfa alfa*, Chicory, Ginger, Fenugreek, Garlic, Honey, Alma, Ginseng, Ashwagandha, Spirulina

2.4 Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng,
Garlic, Pepper & Ephedra

Unit –III Herbal Cosmetics [6]

3.1 Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colors, perfumes, protective agents, bleaching agents, antioxidants in products such as skincare, hair care and oral hygiene products.

3.2 **Herbal excipients**: Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

3.3 Herbal formulations: Conventional herbal formulations
like syrups, mixtures and tablets and Novel dosage forms like phytosomes

Unit IV - Evaluation of Drugs [6]

4.1 WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.

Patenting and Regulatory requirements of natural products:

4.2 a) Definition of the terms: Patent, IPR, Farmers right, Breeder‘s right, Bio prospecting and Bio piracy

4.3 b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

Unit –V General Introduction to Herbal Industry [6]

5.1 Herbal drugs industry: Present scope and future prospects.

5.2 A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

5.3 Schedule T– Good Manufacturing Practice of Indian systems of medicine Components of GMP (Schedule –T) and its objectives Infrastructural requirements, working space, storage area, machinery and equipment's, standard

operating procedures, health and hygiene, documentation and records.

Reference Books:

1. Textbook of pharmacognocy by Trease & Evans.
2. Pharmacognocy & phytochemistry by V. D. Rangari
3. Pharmacopeial standards for ayurvedic formulations (Council of research in Indian medicine and homeopathy

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B.Sc. Part III (NEP 1. 0) SEMESTER-VI

Drug Chemistry Paper No. XVI

(Industrial Chemistry)

(Theory Credits: 02, 30 hours.)

Expected learning Outcomes:

Name of the topic	Expected Learning Outcome
1. **Small scale Industries**	- Understand definition & scope - Learn setup process and challenges
2. **Entrepreneurship Development and Management**	- Develop entrepreneurial skills - Learn planning, financing & managing a business
3. **Sugar Industry**	- Know manufacturing steps - Understand by-products & quality control
4. **Manufacture of Industrial Heavy Chemicals**	- Learn production processes - Understand safety and environmental considerations
5 **Electroplating**	- Understand principles & methods - Learn industrial applications and safety measures

Unit –I Small scale Industries [6]

1.1 Introduction and aspects of small scale industries,
1.2 safety matches,
1.3 Agarbatties,
1.4 Naphthalene balls,
1.5 Wax candles,
1.6 Shoe polishes,
1.7 Gum paste,
1.8 Writing and fountain pain ink,
1.9 Plaster of Paris,
1.10 Silicon carbide crucibles,
How to remove stains

Unit –II Entrepreneurship Development and Management [6]

2.1 Entrepreneurship, Concept/Meaning,
2.2 Need , Competencies/qualities of an entrepreneur,
2.3 Entrepreneurial Support System, District Industry Centers (DICs) Commercial Banks State Financial Corporations,
2.4 Small Industries Service Institutes (SISIs),
2.5 Small Industries Development Bank of India (SIDBI),
2.6 National Bank for Agriculture and Rural Development (NABARD),
National Small Industries Corporation (NSIC) and other relevant institutions/ organizations at State level

Unit –III- Sugar Industry [6]

3.1 Introduction Manufacture of cane sugar in India :
3.2 Extraction of juice,
3.3 Clarification,
3.4 Concentration,
3.5 Crystallization, centrifugation and other details of industrial process By products of sugar industry Manufacture of Ethyl Alcohol from Molasses.
3.6 Introduction,
3.7 Preparation of wash,
Fermentation and Distillation.

Unit –IV Manufacture of Industrial Heavy Chemicals [6]

Introduction,
4.1 Manufacture of Ammonia by Haber's process; (NH3): i] Physico - chemical principles, ii] Plant and process.
4.2 Manufacture of Sulphuric acid by Contact process; (H2 SO4): i] Physico - chemical principles, ii] Plant and process.
4.3 Manufacture of Nitric acid by Ostwald's (Ammonia oxidation process) ;(HNO3): i] Physico - chemical principles, ii] Plant and process.
Manufacture of Sodium carbonate (Washing soda) by Solvay process. (Na_2CO_3): i] Physico - chemical principles, ii] Plant and process.

Unit –V Electroplating **[6]**

5.1 Electrolysis,
5.2 Faraday's laws,
5.3 Cathode current efficiency; Basic principles of electroplating, Ceaning of articles; Electroplating of Nickel and Chromium; Anodizing.

References:

1. Industrial Chemistry - B. K. Sharma
2. Chemical Process industries- Shreve & Brink
3. Industrial Chemistry- Kent
4. Industrial Chemistry- Rogers
5. Industrial Chemistry- R. K. Das

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Laboratory Course (Practicals)

N. B. (i) Use of Digital/Analytical/Chainometric/Single pan balance is allowed.

(ii) Use of Scientific calculator is allowed.

(iii) Use of Chart/Text book/Hand book of practical is allowed.

(iv) There will be a project having weightage of 15 marks.

Project should be in the following areas but focused on applications of Chemistry.

a) Society oriented

b) Daily use

c) Industry based

d) Analysis based

The project will be assessed by all the three examiners with equal weightage at the time of practical examinations. The project may be completed individually or by a group of students not exceeding number three. One copy of the project should be submitted at the time of examination. After assessment this copy will remain in the department.

SECTION A **PRACTICALS FOR-**
DRUG DESIGN AND EARLY DEVELOPMENT& REACTION MECHANISMS RESGENTS &NAME REACTIONS

Course Objectives: Student will be able to:

1. Draw chemical structure and check its physico-chemical properties.
2. Collect and compile data for drug from history to market.
3. Calculate Saponification value of oils.
4. Estimate amount of unsaturation in the given sample.

EXPERIMENTS-

1. Structure drawing with the help chem-draw and calculation of Physico-chemical properties. (TPSA, C logP, Mol. Wt., Hydrogen bond donor, hydrogen bond acceptors etc.) And add comment whether compounds follow the Lipinski rule.
2. Project: Detailed information of any one drug and its presentation.
3. Diels Alder reaction between furan and maleic anhydride.
4. Benzil Benzillic acid rearrangement.
5. Aldol condensation reaction (dibenzal propane).
6. Electrophilic aromatic substitution reaction, Bromination of acetanilide by KBr and CAN.
7. Preparation of derivatives: 2, 4-DNP, Osazone, Oxime.
8. Estimation of acid and ester by hydrolysis method.
9. Saponification of oil.
10. Estimation of unsaturation by bromate bromide

Note- Any other relevant practical may be added

Course Outcomes: After completion of the course student should be able to:

1. Estimate acid and ester by hydrolysis method
2. Calculate saponification value of oil
3. Prepare derivatives
4. Synthesize different compounds and develop skills in synthesis, workup and product isolation

SECTION B PRACTICALS FOR-

NATURAL PRODUCTS & INDUSTRIAL PHARMACY

Course Objectives: Student will be able to:

1. Understand the extraction process of natural products from plant sources.
2. Learn Preparation of shampoo.
3. Know the synthesis of vitamin B.
4. Learn to prepare balms.

EXPERIMENTS-

1. Vitamin B synthesis (1)
2. Extraction of nicotine from Tobacco.
3. Determination of total contents of alkaloids.
4. Shampoo
5. Lipsticks
6. Balm
7. Cold Creams
8. Vanishing Creams
9. Tooth paste

Note- Any other relevant practical may be added.

Course Outcomes: After completion of the course student should be able to

1. Extract natural products from plant sources.
2. Determine total contain of alkaloids
3. Prepare toothpaste
4. Synthesize vitamin.

SECTION C PRACTICALS FOR-

Preparation of intermediates

1. 1,3 Pyrazole
2. 1,3 Oxazole
3. Synthesis of Barbiturates
4. Preparation of Dihydro pyrimidine
5. Preparation of Triphenyl imidazole
6. Synthesis of Sulpha drugs
7. Preparation of Paracetamol
8. Synthesis of five membered heterocyclic ring containing drug.(02)
9. Synthesis of Quinolone from aniline (Skraup synthesis)
10. Estimation of an aspirin.

Note- Any other relevant practical may be added.

SECTION D PRACTICALS FOR-

1. Determination of Aldehyde content in herb.
2. Determination of alcohol content of Asava and Arista.
3. Preparation of herbal face pack.
4. Preparation of herbal Hair care products. (2)
5. Determination of Phenol contents in herbs.
6. Estimation of sucrose
7. Preparation of Aloe Vera gel.
8. Estimation of Oxalic acid from cane sugar.
9. Methyl orange, Aniline yellow dye preparation.

pH – metry:

10. To determine the dissociation constant of monobasic acid (Acetic acid).
11. To determine the pH values of various mixtures of sodium acetate and acetic acid in aqueous solutions and hence find out the dissociation constant of the acid.

Note- Any other relevant practical may be added.

Nature of Practical Examination

1) The practical examination will be of 200 marks.
2) The duration of practical examination will be of three days - six and half hour per day.
3) Questions related to the practical exercise/project report/industrial visit carried out by the student should be asked in viva.
4) Use of scientific calculator is allowed.
5) S.I. units should be used wherever possible.
6) Use of Chart / Hand book / Text book of practical is allowed.
7) A student is expected to submit a journal certified by the Head of the Department.
8) A student not be permitted to appear at the practical examination unless he/she produces a certified journal. If the journal is lost, the student should produce a certificate from the Head of the Department stating that he/she has satisfactory completed the practical work but his / her journal is lost. In this case he/she will be given Zero mark for journal.
9) Use of Digital / Analytical / Chainometric / Single pan balance is allowed.
10) A student should submit one copy of project at the time of examination.
    Each examiner should asses the project work for Five marks and sign the same. If any student will not submit project work, he/she will be given Zero mark for the project.
11) The distribution of marks for practical examination will be as follows:

A) Section A **50 marks :**

i) Experiments

ii) Viva 05 marks

iii) Journal 05 marks

B) Section B **50 marks:**

i) Experiments

ii) Viva 05 marks

iii)Journal 05 marks

C) Section C **45 marks:**

i) Experiments

ii) Viva 05 marks

iii)Journal 05 marks

D) Section D **40 marks:**

i) Experiments

ii) Viva 05 marks

iii)Journal 05 marks

E) Project

15 marks

Total:- **200 marks**

List of Laboratory Equipments

Apparatus & Equipments

1. Digital balance with 1 mg accuracy
2. Conductometer
3. Potentiometer
4. pH Meter
5. Polarimeter
6. Colorimeter
7. Thermostat
8. Electric Oven
9. Suction Pump
10. Crucible Heater
11. IR Lamp
12. Magnetic stirrer
13. Buckner funnel
14. Water bath / Thermostat.
15. Platinum electrode
16. Glass electrode
17. Silver, Zinc, Copper electrodes
18. Conductivity cell
19. Distilled water plant.
20. Refractometer
21. Freeze
22. Deep Freeze
23. H_2S Apparatus
24. Muffle Furnace
25. Magnetic Stirrer

Glassware & Porcelain ware:

1. Burette (25/50 ml)
2. Micro burette (10 ml)
3. Pipette (5 ml,10 ml,25ml)
4. Graduated Pipette (1/2/5/10 ml)
5. Conical flask(100 ml, 250 ml)

6. Beakers (100 ml, 250 ml, 500 ml)
7. Volumetric flask (25ml,50 ml,100 ml, 250 ml)
8. Gooch Crucible / Sintered glass Crucible
9. Silica Crucible
10. Watch glass
11. Glass tubing
12. Glass Funnel (3")
13. Gas jar
14. Glass rod
15. Test Tubes (12 x100, 5x5x8)
16. Evaporating dish
17. TLC Unit
18. Measuring cylinder
19. Thile's tubes
20. Fusion Tube
21. Capillary tube
22. Stopper bottle
23. Thermometer ($1/10^{o}$, 360^{o})
24. Water condenser
25. Distillation flask (100 ml/ 250 ml)
26. Titration tiles.
27. Asbestos sheet.
28. Desiccators
29. Clay pipe triangle

Iron & Wooden ware:

1. Burners
2. Tripod stand
3. Iron stand
4. wire gauze
5. Burette stand
6. Test tube stand
7. Pair of tongs
8. Test tube holder

9. Spatula

10. Copper foil

Chemicals: All the chemicals required for experiments are mentioned in the syllabus.

Others:

1. Filter papers (Kalpi)

2. Whatman Filter paper No. 1, 40, 41 and 42.

Lab Safety Precautions / Measures in Chemistry Laboratory:

Part-I: Personal Precautions-

1. All personnel must wear safety Goggles at all times.

2. Must wear the Lab. Aprons / Lab jacket and proper shoes.

3. Except in emergency, an over-hurried activity is forbidden.

4. Fume cupboard must be used whenever necessary.

5. Eating, Drinking and Smoking in the laboratories strictly forbidden.

Part-II: Use of safety and Emergency Equipments –

1. First aid kits.

2. Sand Bucket.

3. Fire extinguishers (dry chemical and carbon dioxide extinguisher).

4. Chemical storage cabinet with proper ventilation.

5. Material safety data sheets

6. Management of local exhaust system and fume hoods.

7. Sign in register if using instruments.

B.Sc. III (NEP 1.0)

Revised Syllabus from June 2025 onwards

Semester V & VI Nature of theory Question paper

Total Marks 40

N.B. The question paper should cover the entire syllabus. Marks allotted to questions should be in proportion to the lectures allotted to respective units.

Papers Semester V: IX, X, XI, XII.
Papers Semester VI: XIII, XIV, XV, XVI

Q.1 Choose the correct alternative and rewrite the sentence again **8**

1)

2)

3)

4)

5)

6)

7)

8)

Q.2. Attempt any TWO of the following (Out of Three) **16**

1)
2)
3)

Q.3. Answer any FOUR of the following (Out of Six) **16**

1)
2)
3)
4)
5)
6)
