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

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

Ref.No.SU/BOS/Science/270 **Date: 03/05/2025**

To,

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

Subject: Regarding revised syllabi of B.Sc. Part-II (Sem.III & IV) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0)

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-II (Sem.III & IV) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

B.Sc.Part-II (Sem. III & IV) as per NEP-2020 (2.0)			
1.	Botany	8.	Geology
2.	Physics	9.	Zoology
3.	Statistics	10.	Chemistry
4.	Mathematics	11.	Electronics
5.	Microbiology	12.	Drug Chemistry
6.	Plant Protection	13.	Industrial Microbiology
7.	Astrophysics and Space Science	14.	Sugar Technology (Entire)

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,

By 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-II

(B. Sc. II)
Drug Chemistry (Major)

(NEP-2.0)
To be implemented from

June, 2025 onwards

SHIVAJI UNIVERSITY, KOLHAPUR
Revised Syllabus for the Bachelor of Science in Drug Chemistry (As per NEP- 2.0)
Applicable from the Academic Year 2025 –26

1. **Title**: B. Sc. II Drug Chemistry, Shivaji University, Kolhapur Revised Syllabus as per NEP– 2.0
2. **Faculty**: Faculty of Science and Technology.
3. **Year of Implementation**: From June 2025
4. **Objectives of a Bachelor of Science (B.Sc.) in Drug Chemistry Program include**:
    - To develop the content of the syllabus according to the UGC norms.
    - Develop problem-solving skills of students.
    - To inculcate fundamental principles of chemical sciences in students.
    - To establish the link between theory and laboratory practice by conducting laboratory experiments which help students to improve the understanding of the concepts.
    - To enhance student's sense of enthusiasm for chemistry and to involve them in an intellectually stimulating experience of learning in a supportive environment.
    - Gain practical experience by hands-on experience with instruments and develop laboratory skills.
    - Learn about advanced Chemistry and its applications for higher studies.
    - Learn to apply conceptual knowledge to practical work.
    - Learn to interpret chemical and physical phenomena through experimental evidence.
    - Learn to analyze and interpret data accurately through scientific reasoning and experimental hypothesis testing.

5. **Program Outcomes:**
    - **Understanding Drug Chemistry principles:**

    Graduates demonstrate a comprehensive understanding of organic chemistry, medicinal chemistry and related chemical principles, including drug synthesis, structure activity relationships and drug metabolism.

    - **Laboratory Skills and Experimental Design :**

    Students gain proficiency in various laboratory techniques, instrumental analysis, and experimental design, enabling them to perform chemical synthesis, analysis, and characterization of drug compounds.

- **Drug Discovery and Development:**

Graduates develop an understanding of the drug discovery process, including target identification, lead discovery, optimization, and preclinical and clinical development.

- **Data Analysis and Interpretation:**

Students learn to gather, analyze, and interpret data from chemical experiments, instrumental analysis, and computational simulations, drawing meaningful conclusions from their findings.

- **Problem-Solving and Critical Thinking:**

Graduates develop critical thinking and problem-solving skills, enabling them to approach complex challenges in drug chemistry and contribute to the development of new therapeutic agents.

- **Professional Ethics and Responsibilities:**

Students understand the ethical and professional responsibilities of a drug chemist, including data integrity, safety, and regulatory compliance.

- **Communication and Collaboration:**

Graduates develop effective communication skills, including the ability to present scientific findings, collaborate with multidisciplinary teams, and engage in professional networking.

- **Regulatory Awareness:**

Students gain an understanding of the regulatory environment governing drug development and approval, including FDA guidelines and other relevant regulations.

- **Entrepreneurial Skills:**

Graduates develop an understanding of business principles and entrepreneurial skills, including the ability to identify market opportunities, develop business plans, and manage resources.

6. PROGRAM SPECIFIC OUTCOMES:

PSO-1. Able to apply the knowledge gained during the course of the program from biochemistry.

PSO-2.drug analysis, medicinal chemistry and environmental studies.

PSO-3. Able to communicate easily and confidently

PSO-4. Able to perform multitask in the fields including pharmaceuticals and research.

PSO-5. The students will graduate with proficiency in the subject of drug chemistry.

PSO-6. The students will be eligible to continue higher studies in their subject.

PSO-7. Equipped to Understand and Assess Drug Safety and Efficacy

7. The B. Sc. II Course (Drug Chemistry) (Level 5.0) will be of **Two Semesters (Sem. III and Sem IV)**.
8. Pattern of Examination: The Examinations will be conducted **semester-wise for Theory and Practical.**
9. **Fee structure**: As per Shivaji University guidelines.
10. **Eligibility Criteria for Admission to B. Sc. Part II (Level 5.0)**:

i) The students passing or ATKT the B. Sc. Part-I (or Undergraduate Certificate in Science) shall be allowed to enter upon the B. Sc. Part-II (or Undergraduate Diploma in Science).

OR

ii) An Examination of any other Statutory University or an Examining Body recognized as equivalent there to.

OR

iii) Completed 3-years diploma course with subjects allied / related to the subject at B.Sc. Part I

OR

iv) Completed first year of B.E./B. Tech. with subjects allied / related to the subject at B.Sc. Part I

11. **Medium of Instruction**: English
12. **Structure of course:** Given in Framework Chart
13. **Scheme of Teaching and Examination:**

a. Each theory course paper constitute of 4-5 units require 30 hours of teaching lectures and there shall be two lectures per theory (2 Cr) course per week.

b. B. Sc. II Chemistry Course will be of 44 Credits (1100 marks) .

c. Examination of each **theory course** shall be of **50 marks** (40 university examination + 10 internal assessment). University examination of 40 marks (1.5 hours' duration) will be conducted at the end of each Semester. Internal assessment of 10 marks will be done before the semester examination during each semester.

d. Examination of practical course shall be of 50 marks per semester.

e. Pattern and Nature, marking scheme for theory and Practical Examination for Major Specific SEC and VSC courses are included in syllabus.

f. Question papers will be set in the view of the entire syllabus and preferably covering each unit of the syllabus. Weightage should be provided to each unit as per the hours allotted for teaching.

14. Standard of Passing: The standard of passing shall be as per the following table.

	Semester End Exam	Internal Assessment	Course Exam (Total)
Maximum Marks	40	10	50
Minimum Marks required for passing	14	4	18

i) There shall be a separate head of passing for semester end examination and internal examination.

ii) Minimum 18 marks out of 50 are required for passing of practical examination of each course.

iii) Passing criteria for Co-Curricular Activities (CC) and community Engagement Program (CEP) as per the University guidelines.

15. Nature of Question paper and scheme of marking:

Theory question paper: Maximum marks -40

Total No. of questions – 3

All questions are compulsory. Question No.1 is MCQ type (8 Marks). Question number 2 is long answer type question Carries 16 marks. Question number 3 is short answer type question carries 16 marks. (Nature of question paper is provided at the end of syllabus.)

Shivaji University, Kolhapur

Bachelor of Science

Credit Framework

B. Sc. II- Drug Chemistry (To be implemented from June 2025)

Level	Sem.	Subject-1 (Drug Chemistry)	Subject-2 (Drug Chemistry)	IDC/MDC/ OE/GE	VSC/SEC		AEC, VEC, IKS			OJT, FP, CEP, CC, RP			Total Credits	Degree/ Cum. Cr. MEME
		As Major	As Minor	OE (For Other Faculty)	VSC	SEC	AEC	VEC	IKS	CC	FP/ OJT	RP/ Dissert		
5.0	III	PCH-301 Paper-V Bio-Chemistry (2 Cr)	PCH-301 Paper-V Bio-Chemistry (2 Cr)	Will be selected from SUK basket	PRCHVSC-301 Vocational Skill Course Practical Paper-I (2 Cr) (Major specific)	Will be selected from SUK basket	AEC I (2 Cr) (English)	--	--	CC-I (2 Cr)	--	--	--	UG Diploma 88
		ACH-302 Paper-VI Analysis Techniques-I (2 Cr)	ACH-302 Paper-VI Analysis Techniques-I (2 Cr)											
		PRCH-303 Practical Paper-III (2 Cr)	PRCH-303 Practical Paper-III (2 Cr)											
	Credits	**4(T)+2(P) =6**	**4(T)+2(P) =6**	**2 (P) =2**	**2(P)=2**	**2(P)=2**	**2(T)=2**	**--**	**--**	**2**	**--**	**--**	**22**	
	IV	ICH-401 Paper-VII Elemental drug -I (2 Cr)	ICH-401 Paper-VII Elemental Chemistry-I (2 Cr)	Will be selected from SUK basket	--	Will be selected from SUK basket	AEC-II (2 Cr) (English)	VEC-II (2 Cr) (Environmental studies)	--	CHCEP-401 Community Engagement Programme in Chemistry (2 Cr)	--	--	--	
		OCH-402 Paper-VIII Bio-Instruments –I (2 Cr)	OCH-402 Paper-VIII Bio-Instruments –I (2 Cr)											
		PRCH-403 Practical Paper-IV (2 Cr)	PRCH-403 Practical Paper-IV (2 Cr)											
	Credits	**4(T)+2(P)=6**	**4(T)+2(P) =6**	**2 (P)=2**	**--**	**2(P)=2**	**2(T)=2**	**2(T)**	**--**	**2**	**--**	**--**	**22**	
Total Credits		**12**	**12**	**4**	**2**	**4**	**4**	**2**	**--**	**4**	**--**	**--**	**44**	
		Exit Option: Exit Option:4 credits NSQF/Internship/Skill courses												

Structure of B. Sc. II Drug Chemistry (Major)

Sr. No.	Semester	Course Code	Title of Paper
1	III		BDCT-301 Paper -V, Bio-Chemistry (2 credits, 30 Hours)
2			BDCT -302 Paper -VI, Analysis Techniques-I (2 credits, 30 Hours)
3			BDCP-303 Drug Chemistry Practical Paper-III (2 credits, 60 Hours)
4			PRDCVSC-301 Vocational Skill Course-Practical Paper-I (2 credits, 60 Hours)
6	IV		BDCT-401 Paper-VII, Elemental Drug Chemistry-I (2 credits, 30 Hours)
7			BDCT -402 Paper -VIII, Bio - Instruments-I (2 credits, 30 Hours)
8			BDCP-403 Drug Chemistry Practical Paper-IV (2 credits, 60 Hours)
9			DCCEP-401 Community Engagement Programme in Drug Chemistry (2 Credits, 60 Hours)

B.Sc. Part II (NEP-2.0) Semester– III

BDCT-301: Paper V (BIO- CHEMISTRY)

(Credits: 02, 30 hours)

Expected Course Outcomes:

Name of the Topics	Expected Course Outcomes
1. Carbohydrates and Metabolism	Students are expected to understand the structure, classification, and digestion of carbohydrates, as well as the various metabolic pathways involved in their breakdown and utilization, including glycolysis, the citric acid cycle, gluconeogenesis, and glycogen metabolism. They should also be able to explain the importance of these pathways and their role in energy production and other metabolic processes.
2. Lipids	Students should be able to describe lipids and their biological importance, classify them, and understand their roles in cell membranes, energy storage, and hormone production. Additionally, they should be able to discuss lipid digestion, mobilization, and metabolism, including beta-oxidation and ketone body formation.
3. Lipid Metabolism	Learning and understanding the basic functions of lipids, their digestion and absorption, the processes of fatty acid synthesis and breakdown (β-oxidation), and the role of ketone bodies and other related metabolic pathways. Additionally, understanding how lipids are involved in energy storage, signaling, and membrane structure is key.
4. Vitamins and Minerals	Understanding the role of various vitamins and minerals in the body ,their dietary sources , their specific functions in the body , potential health consequence of deficiencies or excesses , how to identify balanced dietary intake and the interaction between different vitamins and minerals with each other nutrients in the diet.

5. Enzymes	understand the role of enzymes as biological catalysts, learn about enzyme kinetics and mechanisms, and understand their regulation and applications in various fields. Students should be able to describe enzyme properties, explain their mechanisms, and understand their importance in biological systems.

Unit 1: Carbohydrates and Metabolism **(06 hours)**

Glycolysis- Pathway, energetics and significance.

1.1 Citric Acid Cycle- Pathway, energetics and significance

1.2 HMP shunt and its significance.

1.3 Glycogen metabolism pathways and glycogen storage diseases (GSD).

1.4 Gluconeogenesis- pathway and its significance.

Unit 2: Lipids **(06 hours)**

2.1 Definition and classification of lipids with two examples of each class, structure and functions of - i) Simple lipids - triglyceride and fatty acids.

ii) Compound lipids- Phospholipids lecithin , cephalin.

iii) Derived lipids - Steroids (Cholesterol)

2.2 Fatty acids- properties, classification, essential and non - essential fatty acids.

2.3 Lipids bilayer and fluid mosaic model of membrane.

Unit 3: Lipid Metabolism **(06 hours)**

3.1 Beta- Oxidation of fatty acid (Palmetic acid): activation of fatty acids

3.2 Carnitine transport system, Beta – oxidation cycle, significance, energetic.

3.3 Biosynthesis of fatty acids(palmetic acid) and significance.
3.4 Structure of fatty acids synthatase complex (Eukaryotes).

Unit 4: Vitamins and Minerals (06 hours)

4.1 Definition, Classification of minerals, source, structures, RDA value , coenzymes form. Biochemical function and deficiency symptoms of water soluble vitamins viz.

4.2 Vitamin C , Thiamine, Riboflavin , Niacin, Pyridoxine and fat soluble vitamins viz. Vitamin A, D, E , K.

4.3 Classification of minerals ; Sources, RDA value, cofactor form, biochemical functions and disease states of minerals

Unit 5: Enzymes (06 hours)

5.1 Definition, Explanation of terms- Holoenzyme Apoenzyme, Coenzyme, prosthetic group, cofactor.

5.2 Classification of enzymes into six classes with one example of each class EC number of enzymes.

5.3 Enzyme as a catalyst concept of the activation energy in enzyme-catalyzed reaction units of enzyme activity, specific activity, turnover number.

5.4 Enzyme specificity, types of specificity, the active site of the enzyme, and its features.

5.5 Theories of the mechanism of enzyme action lock, key and induced fit theory.

5.6 Factors affecting enzyme activity substrate concentration, pH, temperature.

Reference Books:

1. A.L. Lehniger, David L. Nelson & Cox. W. H. Freeman & company. Lehniger's Principles of Biochemistry, Fourth edition (2005) & Fifth edition (2008). (Unit I, II, III, IV)
2. Jermy M. Berg, John L. Tymoczko, LubertStryer, W.H. Freeman, Biochemistry-Sixth edition, 2006. (Unit I, II, III, IV)
3. Voet, Voet & Pratt, John Wiley & sons, Fundamentals of Biochemistry-Fifth edition, 2016.(Unit I, II, III, IV)
4. J. L. Jain, Nitin Jain & Sunjay Jain, Fundamental of Biochemistry- S. Chand Publishing, First Edition, 1979.(Unit I, II, III, IV)
5. U. Satyanarayan, Elsevier India, A Textbook of Biochemistry- Fifth edition, 2017. (Unit I, II, III, IV)
6. A. C. Deb, Fundamentals of Biochemistry, New Central Book Agency, Seventh edition, 2001.(Unit I, II, III, IV)
7. Dr. Jain J. L., (2016) Fundamentals of Biochemistry, 7th edition S. Chand & Company Ltd. New Delhi.
8. . Barar F. S., (2000) Essentials of Pharmacotherapeutics, S. Chand & Company Ltd. New Delhi
9. Gaud R. S. & Dr. Gupta G. D, (2007) Practical Pharmaceutics, CBS Publishers and Distributors, New Delhi.
10. Choudhary N. C. And Gurbani N. K., (2014) Pharmaceutical Chemistry. Vallabh Prakashan, Delhi
11. Jain N. K,(2009) Textbook of Professional Pharmacy, 5th Vallabh Prakash, Delhi

B. Sc. II Semester III, Paper VI
BDCT-302-Analysis Techniques
(Theory Credits:02, Lectures-30 hours)

Expected Course Outcomes:

Sr. No.	Name of Topic	Expected Course Outcomes
1	Conductometric and Potentiometric Titration	Understanding the basic principles of conductivity and potentiometry and how it relates to ion concentration , being able to set up and perform a conductometric titration, accurately identity the end point of a titration. Accurately identifying the equivalence point of a titration by potential changes
2	Nephelometry and Turbidimetry	Understanding the concepts and basic principles of Nephelometric and Turbidimetric analysis.
3	Complexometric Titration	Understanding the concepts and basic principles of Complexometry, Mechanism of complexation , identify the use of appropriate indicators.
4	Acid Base Titration	Understanding the concept of neutralization reactions, accurately calculating the concentration of an acid or base solution using titration data ,identifying the equivalent point, preparing standard solution.
5	Colorimetry and Spectrophotometry	Understanding , working and applications of optical methods as an analytical tool.

Unit I Conductometric and Potentiometric Titration [8 hours]

Conductometry- Introduction, Definition, Conductivity cell, measurement conductance by Wheatstone Bridge method, Conductometric Titration, applications.

Potentiometry- Electrochemical cell, conctruction and working of reference (Standard Hydrogen, silver chloride electrode and calomel electrode), and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.

Unit 2: Nephelometry and Turbidimetry (6 Hours)

2.1 Introduction, Principles and instrumentation of Nephelometric and Turbidimetric analysis

2.2 Difference between Nephelometric and Turbidimetric measurements.

2.3 Choice between Nephelometry and Turbidimetry.

2.4 Factors affecting nephelometry and Turbidimetric measurements.

2.5Quantative Applications.

2.6 Numerical Problems.

Unit 3: Complexometric Titration (6 Hours)

3.1 Introduction of complexometric titration

3.2 Classification

3.3 Metal ion Indicator

3.4 masking and demasking reagents

3.5 Estimation of Sodium benzoate and Ephedrine HCL

Unit 4: Acid- Base Titration (5 Hours)

4.1 Theories of acid base indicators

4.2 classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases

4.3 neutralization curves

Non aqueous titration: Solvents, acidimetry and alkalimetry
titration and estimation of Sodium benzoate and Ephedrine HCl.

Unit 5: Colorimetry and Spectrophotometry [5 hours]

5.1 Theory of colorimetry and spectrophotometry.

5.2 Lambert Beer's law, deviation from Beer's law.

5.3 Terms used in colorimetry and spectrophotometry.

5.4 Classification of methods of 'colour' measurement or comparison.

Reference Books:

1) A. H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2) A. I. Vogel, Text Book of Quantitative Inorganic analysis
3) P. Gundu Rao, Inorganic Pharmaceutical Chemistry (Unit III)
4) J. H. Kennedy, Analytical chemistry principles (unit I, II). M. Khopakar, Concepts in analytical chemistry
5) Bentley and Driver's Textbook of Pharmaceutical Chemistry (Unit IV)
6) A. I. Vogel's Textbook of Quantitative chemical analysis 3rd edition, (Unit II)
7) A. I. Vogel's Textbook of Quantitative chemical analysis 3rd edition, (Unit II)
8) Analytical Chemistry, H. Kaur, A Pragati Prakashan Meerut.
9) Analytical Chemistry, Alka Gupta, A Pragati Prakashan Meerut.
10) Instrumental Methods of Chemical Analysis – Chatwal & Anand.

B.Sc. II –Semester- III

BDCP-303 – Drug Chemistry Practical Paper -III

Credit: 02, 60 hours

A] Drug Chemistry:

Perform the following Experiments (Any 8)

1. Preparation of Cinnamic acid from benzaldehyde and malonic acid, determination of its pharmacodynamics properties.
2. Preparation of Anthraquinone from anthracene and determination of its pharmacodynamics properties.
3. Preparation of phthalimide from phthalic anhydride and determination of its pharmacodynamics properties.
4. Preparation of 7-hydroxy-4-methyl coumarin and determination of its pharmacodynamics properties.
5. Synthesis of paracetamol and determination of its pharmacodynamics properties
6. Synthesis of Aspirin and determination of its Pharmacodynamics properties.
7. Synthesis of Ibuprofen and determination of its pharmacodynamics properties
8. Determination of bioavailability and pharmacodynamics properties of the drug sample.
9. Synthesis and characterization of phenyl benzoate from phenol by acylation reaction.
10. Estimation of Fructose by Resorcinol.
11. Isolation of casein from milk.
12. Isolation of Pectin from Fruit

B) Drug Chemistry

Perform the following Experiments (Any 8)

1. Fertilizer analysis: To determine the percentage of nitrogen in the given sample of a nitrogenous fertilizer (ammonium sulphate).
2. Analysis of Synthetic /Commercial Sample: To estimate Magnesium from talcum powder.
3. Determination of alkali content from antacid tablet using HCl solution.
4. Estimation of Calcium from chalk: To estimate amount of calcium from the chalk by titrimetric method. (By redox titration using $KMnO_4$ solution)
5. Determination of total hardness of water using 0.01M EDTA solution. (Students should standardize the given EDTA solution by preparing 0.01M $CaCl_2$ solution. using $CaCO_3$ salt.)
6. Determination of Alkalinity of water titrimetrically using 0.02N H_2SO_4 using methyl orange and phenolphthalein indicator.
7. Estimation of acetone.
8. Estimation of Vitamin C from given tablet.
9. Estimation of Phenol by Bromination method

Reference Books:

1. Parikh D. M. (2018) Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
2. Beckett A. H. & Stenlake, J. B. (2000) Practical Pharmaceutical Chemistry Vol I & II 4th edition, Stahlone, Press of University of London.
3. Paye M. Barel A. O, Maibach H., (2001) Handbook of Cosmetic Science and Technology. 1" edition CRC Press.
4. Slørdal L, Spigset O. (2005) Basic pharmacokinetics--absorption Tidsskr Nor Laegeforen.
5. Starkey ES, Sammons HM. (2015) Practical pharmacokinetics: what do you really need to know? Arch Dis Child Educ Pract Ed
6. Practical Physical Chemistry : Gurtu (S. Chand) 2014.
7. Systematic Experimental Physical Chemistry : Rajbhoj, Chandekar

(Anjali Publication) 2016.

8. Advanced Practical Chemistry by J. Singh, L. D. S. Yadav, R. K. P. Singh, I. R. Siddiqui et.al, Pragati Prakashan.
9. Vogel's Text Book of Qualitative Inorganic Analysis by A. I. Vogel .3rd and 6th edition.
10. Practical Organic Chemistry by A. I. Vogel.
11. Hand Book of Organic Qualitative Analysis by H. T. Clarke.
12. Practical Organic Chemistry by F.G. Mann and B. C. Saunders. Low – priced Textbook. ELBS. Longman.

Note: Any other relevant Practical may added.

B. Sc. Part II Sem IV (NEP-2.0)

BDCT-401 Paper-VII Elemental Drug Chemistry

(Theory Credits: 02, 30 hours)

Expected Course Outcomes:

Name of the Topic	Expected Course Outcomes
1. Introduction to Drug Chemistry –I	Learning and understanding basic concepts About Drug Chemistry. Recollect the fundamentals concepts of medicinal chemistry.
2.Indian System of medicine and Homoeopathy	To acquire the knowledge about homothepathy and Understand the basic concepts in medicinal chemistry and also Introduce the different Indian system of Medicine.
3. Drug Absorption and Distribution	Learn the interrelationship among absorption distribution and metabolism of drugs .Elustrate drug Metabolism
4. Drug Metabolism	Describe the key mechanisms and enzymes involved in drug metabolism, understand how these processes affect drug efficacy and toxicity, explain the impact of genetic variations on drug metabolism and apply these knowledge to drug design and development by predicting potential metabolic liabilities of new drug candidates.

Unit-1: . Introduction to Drug Chemistry –I (6 Hours)

1.1 History, Drugs and medicinal chemist, Why should drugs work? Where do drugs work?

1.2 Cell structure, Drug targets at molecular level, intermolecular bonding forces, electrostatic bonds, Hydrogen bonds, Van der Waal's interaction, dipole-dipole and ion dipole interaction, Repulsive interactions, Role of water and hydrophobic interaction.

1.3 Drug targets ,Lipid as drug target, Carbohydrates a drug target, Protein and nucleic as a drug target.

Unit 2: Indian System of Medicine and Homoeopathy (6 Hours)

2.1 Introduction to Indian System of Medicine and Homoeopathy (ISH&M)- Ayurveda, Siddha (Classification), Unani

2.2 Homoeopathy and therapies such as Yoga and Naturopathy.

2 . 3 Ayurveda- Definition, Concept, classification
of Ayurvedic Drugs, diagnosis, treatment, Dietics in Ayurveda (2 examples)

2.4 Siddha- Definition, Concept, Basic Human Principals-Three humours, 5 Sheaths (Koshan), Ten Pranic Air (Vayus) (2 examples)

2.5 Unani – Definition, Concept, Principles of unani medicine (2 examples)
Homoeopathy –Defination, Concept, Homoeopathy in india, Benefits of homoeopathy (2 examples)

Unit- 3. : **Drug Absorption and Distribution**. **(10 Hours)**

3.1 **Absorption- i)** Mechanism of drug absorption through GIT

ii) factors influencing drug absorption through GIT

iii) absorption of drug through intra muscular routes.

3.2 Distribution- Tissue permeability of drugs , binding of drugs, apparents, volume of drug distribution, plasma and tissue protein binding of drugs ,factors affecting protein –drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs.

Unit-4. Drug Metabolism (8 Hours)

4.1. Drug metabolism and basic understanding metabolic pathways renal excretion of drugs

4.2. factors affecting renal excretion of drugs

4.3. renal clearance

4.4. Non renal routes of drug excretion of drugs

4.5. heterofermentative (pathways)

Reference Books:

1 .Graham L. Patrick's , An Introduction to Medicinal Chemistry (Unit I)

2. Dr. K. M. Nadkarni's, Indian Materia Medica, Bombay Popular Prakashan, (1982) (Volume-I Unit II)

3. Alka L Gupta, Medicinal Chemistry, Pragati Prakashan (2019) (page no 112, 113, 124-137 Unit IV)

4.V. K. Ahluwalia & Madhu Chopra, Medicinal chemistry, (page no 73-94 Unit IV)

5. N. K. Jain, Textbook of Professional Pharmacy, Vallabh Prakash, Delhi (Unit III & Unit IV)

6.B. N. Ladu, H. G. Mandel and E. L. Way, Fundamentals of Drug Metabolism and Disposition by William and Welkins Co. 428 E, Preston Street. Baltimore. (Unit III & Unit IV)

7.J. R. Robinson & V. Lee, Controlled Drug Delivery: Fundamentals & Applications, Marcel Dekker Inc., NY. (Unit III & Unit IV)

B. Sc. Part II Sem IV (NEP-2.0)

BDCT-402 Paper-VIII Bio-Instruments -I

(Theory Credits: 02, 30 hours)

Expected Course Outcomes:

Name of the topic	Expected Course Outcomes
1. Introduction to Bio-Instruments -I	To impart knowledge about the analytical techniques, mass spectroscopy , PH meter etc.
2. Centrifugation and its types.	Understanding the basic concepts, sedimentation coefficients, and types.
3. Basic Chromatographic Techniques.	Understanding the bssic concepts, types, principles and application of chromatographic techniques.
4. Advanced chromatographic techniques	Student will be capable of understanding the theory , principles, applications construction snd working of advanced chromatographic techniques.
5. Stereochemistry	Students will learn the basic knowledge of conformational analysis of some organic componds.

Unit 1: Introduction to Bio- Instruments -I [6 hours]

1.1 Concepts- Analytical techniques, analyte, method, procedure and protocol.

1.2 Principle construction, working and applications for analysis of biomolecules of following instruments.

a) pH meter,

b) Centrifuge (RCF, sedimentation concept),

1. different types of centrifuges.
2. Mass spectroscopy (Bainbridge mass spectrometer). Atomic absorption spectrometer(AAS)

Unit 2: Centrifugation and its Types [5 hours]

1.1 Basic principles.

2.2 .RCF, Sedimentation coefficient, Svedberg's constant,

2.3. Types of centrifuge: High speed and Ultracentrifuge,

2.4.Differential and density gradient centrifugation,

2.5 Application of preparative & analytical centrifuges

2.6 gradient centrifuge

Unit 3 Basic Chromatographic Techiniques [7 hours]

3.1 Introduction, Theory, Principle and applications of

A) Thin layer chromatography,

B) Paper chromatography

C) Column chromatography

D) Adsorption column chromatography

E) Size exclusion chromatography

F) Ion exchange chromatography

G) Affinity chromatography

Unit 4: Advanced Chromatografic Techniques [6 hours]

3.1 Theory, Principle of HPLC, construction and working of HPLC

3.2 Applications of HPLC

3.3 Theory, Principle of GLC construction and working of GLC,

3.4 Application of GLC

Unit 5: Stereochemistry **[6 hours]**

5.1 Conformational isomerism – Introduction.

5.2 Representation of conformations of ethane by using Saw- Horse, Fischer (dotted line wedge) and Newmann's projection formulae.

5.3 Conformations and conformational analysis of ethane and n-butane by Newmann's Projection formula with the help of energy profile diagrams.

5.4 Relative stability cycloalkanes - Baeyer's strain theory and Theory of strainless rings.

5.5 Conformations and stability of Cyclohexane

5.6 Conformation and stability of Methyl Cyclohexane.

Reference Books:

1. Stereochemistry Conformation & Mechanism, 9th Edition, By P. S. Kalasi, Publisher: New Age International, 2017.
2. Stereochemistry of Carbon Compounds by Eliel.
3. Stereochemistry of Organic Compounds by D. Nasipuri.
4. J. K. Nigel, Simpson's Solid phase extraction, Principles, techniques and applications (Unit II, Unit III)
5. C.V. S. Subrahmanyam, Physical pharmaceutics (Unit I, Unit II)
6. C.V. S Subrahmanyam et al., Pharmaceutical engineering principles and practices (unit IV)
7. S. M. Khopkar, Basic Concepts of Analytical Chemistry (Unit III)

B.Sc. II –Semester- IV

BDCP-403 – Drug Chemistry Practical Paper -IV - Credit: 02, 60 hours

A) :Section A - Preparations

1) !preparation of iodoform from acetone or ethyl alcohol.

2) Synthesis of p-cholorotoluene from p-toludine. (Sandmeyer Reaction)

3) To determine protein binding efficiency of ibuprofen.

4) Study of protein binding of ibuprofen by dynamic dilution method.

5) To formulate and evaluate transdermal patches of ibuprofen.

6) Prearation of Benzoic Acid.

7) Preparation of p-Nitroacetanilide.

8) Preparation of Benzamide.

9) Preparation of Dihydropyrimidione.

10) Estimation of Acetone.

SECTION B -Organic Chemistry:

Organic Qualitative Analysis: Identification of **Any Six** Organic Compounds with reactions including chemical type.

Acids – Succinic acid, Phthalic acid, Salicylic acid, Aspirin. (Any 2)

Phenols – Alpha-Naphthol, p-nitrophenol. (Any 1)

Bases – o - nitroaniline, p-nitroanilines, Diphenyl amine. (Any 1)

Neutrals – Urea, Acetanilide, Carbon tetrachloride, Bromobenzene, Methyl acetate, Nitrobenzene, Naphthalene, Anthracene, Ethyl methyl ketone. (Any 2)

Note: A systematic study of an organic substance involves reactions in the determination of elements and functional group.

3) Organic Preparations (Any two)

i) Preparation of p-nitro acetanilide from Acetanilide.

ii) Preparation of Acetanilide from Aniline using anhydrous $ZnCl_2$ and Zn dust.

iii) Preparation of Phthalimide from Phthalic anhydride.

Preparation of Benzoic acid from Benzamide

Reference Books:

1) Vogel's Quantitative Chemical Analysis, Pearson 2009.
2) Vogel's Textbook of Qualitative Inorganic Analysis by A. I. Vogel .3rd and 6th edition.
3) Vogel's Textbook of Quantitative Inorganic Chemistry by A. I. Vogel.
4) Physical Chemistry of Inorganic Qualitative Analysis by Kuricose & Rajaram.
5) Practical Manual in Water Analysis by Goyal & Trivedi.
6) Practical Organic Chemistry by A. I. Vogel.
7) Handbook of Organic Qualitative Analysis by H.T. Clarke.
8) A Laboratory HandBook of Organic Qualitative Analysis and Separation by V. S. Kulkarni. Dastane Ramchandra & Co.
9) Practical Organic Chemistry by F. G. Mann and B. C. Saunders. Low – priced Text Book. ELBS. Longman.
10) Advanced Practical Organic Chemistry by N. K. Vishnoi. Vikas Publishing House Private Limited.
11) Advanced Practical Chemistry by J. Singh, L. D. S. Yadav, R. K. P. Singh, I. R. Siddiqui et.al, Pragati Prakashan.

B.Sc. II Syllabus (NEP-2.0)
To be implemented from June 2025 onwards

Semester III & IV

Nature of Question paper

Total Marks 40 Time: 1.5 Hours

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

a)

b)

c)

d)

e)

f)

g)

h)

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

a)

b)

a)

Q.3. Answer any FOUR of the following (Out of SIX) 16 Marks

a)

b)

c)

d)

e)

f)

B.Sc. II Syllabus (NEP-2.0)
To be implemented from June 2025 onwards

Semester III & IV

Outline of Internal Assessment

Level	Semester	Activities Per Semester	Marks
5	III	Unit Test	10
	IV	Oral Examination/Group Discussion	10

B.Sc. II Syllabus (NEP-2.0)

To be implemented from June 2025 Onwards

Semester III and IV

Nature of Practical Exam

Semester-III Practical Paper-III (50 Marks)

Number of Days: 01

Experiment No-1 (20 Marks)

Experiment No. 2 (20 Marks)

Oral- 05 Marks

Journal- 05 Marks

Semester-IV Practical Paper-IV (50 Marks)

Number of Days: 01

Q.1 Major Experiment- 25 Marks

Q.2 Minor Experiment- 15 Marks

Q.3 Oral- 05 Marks

Q.4 Journal- 05 Marks

Shivaji University,

Kolhapur

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

Syllabus for

Bachelor of Science Part-II

(B. Sc. II)

Drug Chemistry

(Minor) (NEP-2.0)

To be implemented from

June, 2025 onwards

Structure of B. Sc. II Drug Chemistry (Minor)

Sr. No.	Semester	Course Code	Title of Paper
1	III		BDCT-301 Paper -V, Bio-Chemistry (2 credits, 30 Hours)
2			BDCT -302 Paper -VI, Analysis Techniques-I (2 credits, 30 Hours)
3			BDCP-303 Drug Chemistry Practical Paper-III (2 credits, 60 Hours)
4			PRDCVSC-301 Vocational Skill Course-Practical Paper-I (2 credits, 60 Hours)
6	IV		BDCT-401 Paper-VII, Elemental Drug Chemistry-I (2 credits, 30 Hours)
7			BDCT -402 Paper -VIII, Bio - Instruments-I (2 credits, 30 Hours)
8			BDCP-403 Drug Chemistry Practical Paper-IV (2 credits, 60 Hours)
9			DCCEP-401 Community Engagement Programme in Drug Chemistry (2 Credits, 60 Hours)

B.Sc. Part II (NEP-2.0) Semester– III

BDCT-301: Paper V (BIO- CHEMISTRY)

(Credits: 02, 30 hours)

Expected Course Outcomes:

Name of the Topics	Expected Course Outcomes
6. Carbohydrates and Metabolism	Students are expected to understand the structure, classification, and digestion of carbohydrates, as well as the various metabolic pathways involved in their breakdown and utilization, including glycolysis, the citric acid cycle, gluconeogenesis, and glycogen metabolism. They should also be able to explain the importance of these pathways and their role in energy production and other metabolic processes.
7. Lipids	Students should be able to describe lipids and their biological importance, classify them, and understand their roles in cell membranes, energy storage, and hormone production. Additionally, they should be able to discuss lipid digestion, mobilization, and metabolism, including beta-oxidation and ketone body formation.
8. Lipid Metabolism	Learning and understanding the basic functions of lipids, their digestion and absorption, the processes of fatty acid synthesis and breakdown (β-oxidation), and the role of ketone bodies and other related metabolic pathways. Additionally, understanding how lipids are involved in energy storage, signaling, and membrane structure is key.
9. Vitamins and Minerals	Understanding the role of various vitamins and minerals in the body ,their dietary sources , their specific functions in the body , potential health consequence of deficiencies or excesses , how to identify balanced dietary intake and the interaction between different vitamins and minerals with each other nutrients in the diet.

10.Enzymes	understand the role of enzymes as biological catalysts, learn about enzyme kinetics and mechanisms, and understand their regulation and applications in various fields. Students should be able to describe enzyme properties, explain their mechanisms, and understand their importance in biological systems.

Unit 1: Carbohydrates and Metabolism **(06 hours)**

Glycolysis- Pathway, energetics and significance.

1.5 Citric Acid Cycle- Pathway, energetics and significance

1.6 HMP shunt and its significance.

1.7 Glycogen metabolism pathways and glycogen storage diseases (GSD).

1.8 Gluconeogenesis- pathway and its significance.

Unit 2: Lipids **(06 hours)**

2.4 Definition and classification of lipids with two examples of each class, structure and functions of - i) Simple lipids - triglyceride and fatty acids.

iv) Compound lipids- Phospholipids lecithin , cephalin.

v) Derived lipids - Steroids (Cholesterol)

2.5 Fatty acids- properties, classification, essential and non - essential fatty acids.

2.6 Lipids bilayer and fluid mosaic model of membrane.

Unit 3: Lipid Metabolism **(06 hours)**

3.1 Beta- Oxidation of fatty acid (Palmetic acid): activation of fatty acids

3.2 Carnitine transport system, Beta – oxidation cycle, significance, energetic.

3.3 Biosynthesis of fatty acids(palmetic acid) and significance.
3.4 Structure of fatty acids synthatase complex (Eukaryotes).

Unit 4: Vitamins and Minerals (06 hours)

4.1 Definition, Classification of minerals, source, structures, RDA value , coenzymes form. Biochemical function and deficiency symptoms of water soluble vitamins viz.

4.2 Vitamin C , Thiamine, Riboflavin , Niacin, Pyridoxine and fat soluble vitamins viz. Vitamin A, D, E , K.

4.3 Classification of minerals ; Sources, RDA value, cofactor form, biochemical functions and disease states of minerals

Unit 5: Enzymes (06 hours)

5.1 Definition, Explanation of terms- Holoenzyme Apoenzyme, Coenzyme, prosthetic group, cofactor.

5.2 Classification of enzymes into six classes with one example of each class EC number of enzymes.

5.3 Enzyme as a catalyst concept of the activation energy in enzyme-catalyzed reaction units of enzyme activity, specific activity, turnover number.

5.4 Enzyme specificity, types of specificity, the active site of the enzyme, and its features.

5.5 Theories of the mechanism of enzyme action lock, key and induced fit theory.

5.6 Factors affecting enzyme activity substrate concentration, pH, temperature.

Reference Books:

1. A.L. Lehniger, David L. Nelson & Cox. W. H. Freeman & company. Lehniger's Principles of Biochemistry, Fourth edition (2005) & Fifth edition (2008). (Unit I, II, III, IV)
2. Jermy M. Berg, John L. Tymoczko, LubertStryer, W.H. Freeman, Biochemistry-Sixth edition, 2006. (Unit I, II, III, IV)
3. Voet, Voet & Pratt, John Wiley & sons, Fundamentals of Biochemistry-Fifth edition, 2016.(Unit I, II, III, IV)
4. J. L. Jain, Nitin Jain & Sunjay Jain, Fundamental of Biochemistry- S. Chand Publishing, First Edition, 1979.(Unit I, II, III, IV)
5. U. Satyanarayan, Elsevier India, A Textbook of Biochemistry- Fifth edition, 2017. (Unit I, II, III, IV)
6. A. C. Deb, Fundamentals of Biochemistry, New Central Book Agency, Seventh edition, 2001.(Unit I, II, III, IV)
7. Dr. Jain J. L., (2016) Fundamentals of Biochemistry, 7th edition S. Chand & Company Ltd. New Delhi.
8. . Barar F. S., (2000) Essentials of Pharmacotherapeutics, S. Chand & Company Ltd. New Delhi
9. Gaud R. S. & Dr. Gupta G. D, (2007) Practical Pharmaceutics, CBS Publishers and Distributors, New Delhi.
10. Choudhary N. C. And Gurbani N. K., (2014) Pharmaceutical Chemistry. Vallabh Prakashan, Delhi
11. Jain N. K,(2009) Textbook of Professional Pharmacy, 5th Vallabh Prakash, Delhi

B. Sc. II Semester III, Paper VI
BDCT-302-Analysis Techniques
(Theory Credits:02, Lectures-30 hours)

Expected Course Outcomes:

Sr. No.	Name of Topic	Expected Course Outcomes
1	Conductometric and Potentiometric Titration	Understanding the basic principles of conductivity and potentiometry and how it relates to ion concentration , being able to set up and perform a conductometric titration, accurately identity the end point of a titration. Accurately identifying the equivalence point of a titration by potential changes
2	Nephelometry and Turbidimetry	Understanding the concepts and basic principles of Nephelometric and Turbidimetric analysis.
3	Complexometric Titration	Understanding the concepts and basic principles of Complexometry, Mechanism of complexation , identify the use of appropriate indicators.
4	Acid Base Titration	Understanding the concept of neutralization reactions, accurately calculating the concentration of an acid or base solution using titration data ,identifying the equivalent point, preparing standard solution.
5	Colorimetry and Spectrophotometry	Understanding , working and applications of optical methods as an analytical tool.

Unit I Conductometric and Potentiometric Titration [8 hours]

Conductometry- Introduction, Definition, Conductivity cell, measurement conductance by Wheatstone Bridge method, Conductometric Titration, applications.

Potentiometry- Electrochemical cell, conctruction and working of reference (Standard Hydrogen, silver chloride electrode and calomel electrode), and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.

Unit 2: Nephelometry and Turbidimetry (6 Hours)

2.1 Introduction, Principles and instrumentation of Nephelometric and Turbidimetric analysis

2.2 Difference between Nephelometric and Turbidimetric measurements.

2.3 Choice between Nephelometry and Turbidimetry.

2.4 Factors affecting nephelometry and Turbidimetric measurements.

2.5Quantative Applications.

2.6 Numerical Problems.

Unit 3: Complexometric Titration (6 Hours)

3.1 Introduction of complexometric titration

3.2 Classification

3.3 Metal ion Indicator

3.4 masking and demasking reagents

3.5 Estimation of Sodium benzoate and Ephedrine HCL

Unit 4: Acid- Base Titration (5 Hours)

4.1 Theories of acid base indicators

4.2 classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases

4.3 neutralization curves

Non aqueous titration: Solvents, acidimetry and alkalimetry
titration and estimation of Sodium benzoate and Ephedrine HCl.

Unit 5: Colorimetry and Spectrophotometry [5 hours]

5.1 Theory of colorimetry and spectrophotometry.

5.2 Lambert Beer's law, deviation from Beer's law.

5.3 Terms used in colorimetry and spectrophotometry.

5.4 Classification of methods of 'colour' measurement or comparison.

Reference Books:

1 A. H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London

2. A. I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry (Unit III)
4. J. H. Kennedy, Analytical chemistry principles (unit I, II). M. Khopakar, Concepts in analytical chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry (Unit IV)
6. A. I. Vogel's Textbook of Quantitative chemical analysis 3rd edition, (Unit II)
7. A. I. Vogel's Textbook of Quantitative chemical analysis 3rd edition, (Unit II)
8. Analytical Chemistry, H. Kaur, A Pragati Prakashan Meerut.
9. Analytical Chemistry, Alka Gupta, A Pragati Prakashan Meerut.
10. Instrumental Methods of Chemical Analysis – Chatwal & Anand.

B.Sc. II –Semester- III

BDCP-303 – Drug Chemistry Practical Paper -III

Credit: 02, 60 hours

A] Drug Chemistry:

Perform the following Experiments (Any 8)

1. Preparation of Cinnamic acid from benzaldehyde and malonic acid, determination of its pharmacodynamics properties.
2. Preparation of Anthraquinone from anthracene and determination of its pharmacodynamics properties.
3. Preparation of phthalimide from phthalic anhydride and determination of its pharmacodynamics properties.
4. Preparation of 7-hydroxy-4-methyl coumarin and determination of its pharmacodynamics properties.
5. Synthesis of paracetamol and determination of its pharmacodynamics properties
6. Synthesis of Aspirin and determination of its Pharmacodynamics properties.
7. Synthesis of Ibuprofen and determination of its pharmacodynamics properties
8. Determination of bioavailability and pharmacodynamics properties of the drug sample.
9. Synthesis and characterization of phenyl benzoate from phenol by acylation reaction.
10. Estimation of Fructose by Resorcinol.
11. Isolation of casein from milk.
12. Isolation of Pectin from Fruit

C) Drug Chemistry

Perform the following Experiments (Any 8)

1. Fertilizer analysis: To determine the percentage of nitrogen in the given sample of a nitrogenous fertilizer (ammonium sulphate).
2. Analysis of Synthetic /Commercial Sample: To estimate Magnesium from talcum powder.
3. Determination of alkali content from antacid tablet using HCl solution.
4. Estimation of Calcium from chalk: To estimate amount of calcium from the chalk by titrimetric method. (By redox titration using $KMnO_4$ solution)
5. Determination of total hardness of water using 0.01M EDTA solution. (Students should standardize the given EDTA solution by preparing 0.01M $CaCl_2$ solution. using $CaCO_3$ salt.)
6. Determination of Alkalinity of water titrimetrically using 0.02N H_2SO_4 using methyl orange and phenolphthalein indicator.
7. Estimation of acetone.
8. Estimation of Vitamin C from given tablet.
9. Estimation of Phenol by Bromination method

Reference Books:

1. Parikh D. M. (2018) Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
2. Beckett A. H. & Stenlake, J. B. (2000) Practical Pharmaceutical Chemistry Vol I & II 4th edition, Stahlone, Press of University of London.
3. Paye M. Barel A. O, Maibach H., (2001) Handbook of Cosmetic Science and Technology. 1" edition CRC Press.
4. Slørdal L, Spigset O. (2005) Basic pharmacokinetics--absorption Tidsskr Nor Laegeforen.
5. Starkey ES, Sammons HM. (2015) Practical pharmacokinetics: what do you really need to know? Arch Dis Child Educ Pract Ed
6. Practical Physical Chemistry : Gurtu (S. Chand) 2014.
7. Systematic Experimental Physical Chemistry : Rajbhoj, Chandekar (Anjali Publication) 2016.

8. Advanced Practical Chemistry by J. Singh, L. D. S. Yadav, R. K. P. Singh, I. R. Siddiqui et.al, Pragati Prakashan.
9. Vogel's Text Book of Qualitative Inorganic Analysis by A. I. Vogel .3rd and 6th edition.
10. Practical Organic Chemistry by A. I. Vogel.
11. Hand Book of Organic Qualitative Analysis by H. T. Clarke.
12. Practical Organic Chemistry by F.G. Mann and B. C. Saunders. Low – priced Textbook. ELBS. Longman.

Note: Any other relevant Practical may added.

B. Sc. Part II Sem IV (NEP-2.0)

BDCT-401 Paper-VII Elemental Drug Chemistry

(Theory Credits: 02, 30 hours)

Expected Course Outcomes:

Name of the Topic	Expected Course Outcomes
1. Introduction to Drug Chemistry –I	Learning and understanding basic concepts About Drug Chemistry. Recollect the fundamentals concepts of medicinal chemistry.
2.Indian System of medicine and Homoeopathy	To acquire the knowledge about homothepathy and Understand the basic concepts in medicinal chemistry and also Introduce the different Indian system of Medicine.
3. Drug Absorption and Distribution	Learn the interrelationship among absorption distribution and metabolism of drugs .Elustrate drug Metabolism
4. Drug Metabolism	Describe the key mechanisms and enzymes involved in drug metabolism, understand how these processes affect drug efficacy and toxicity, explain the impact of genetic variations on drug metabolism and apply these knowledge to drug design and development by predicting potential metabolic liabilities of new drug candidates.

Unit-1: . Introduction to Drug Chemistry –I (6 Hours)

1.4 History, Drugs and medicinal chemist, Why should drugs work? Where do drugs work?

1.5 Cell structure, Drug targets at molecular level, intermolecular bonding forces, electrostatic bonds, Hydrogen bonds, Van der Waal's interaction, dipole-dipole and ion dipole interaction, Repulsive interactions, Role of water and hydrophobic interaction.

1.6 Drug targets ,Lipid as drug target, Carbohydrates a drug target, Protein and nucleic as a drug target.

Unit 2: Indian System of Medicine and Homoeopathy (6 Hours)

2.1 Introduction to Indian System of Medicine and Homoeopathy (ISH&M)- Ayurveda, Siddha (Classification), Unani

2.2 Homoeopathy and therapies such as Yoga and Naturopathy.

2 . 3 Ayurveda- Definition, Concept, classification
of Ayurvedic Drugs, diagnosis, treatment, Dietics in Ayurveda (2 examples)

2.4 Siddha- Definition, Concept, Basic Human Principals-Three humours, 5 Sheaths (Koshan), Ten Pranic Air (Vayus) (2 examples)

2.5 Unani – Definition, Concept, Principles of unani medicine (2 examples)
Homoeopathy –Defination, Concept, Homoeopathy in india, Benefits of homoeopathy (2 examples)

Unit- 3. : **Drug Absorption and Distribution**. **(10 Hours)**

3.2 **Absorption- i)** Mechanism of drug absorption through GIT

ii) factors influencing drug absorption through GIT

iii) absorption of drug through intra muscular routes.

3.2 Distribution- Tissue permeability of drugs , binding of drugs, apparents, volume of drug distribution, plasma and tissue protein binding of drugs ,factors affecting protein –drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs.

Unit-4. Drug Metabolism (8 Hours)

4.1 Drug metabolism and basic understanding metabolic pathways renal excretion of drugs

4.2 factors affecting renal excretion of drugs

4.3 renal clearance

4.4 Non renal routes of drug excretion of drugs

4.5 heterofermentative (pathways)

Reference Books:

2 .Graham L. Patrick's , An Introduction to Medicinal Chemistry (Unit I)

2. Dr. K. M. Nadkarni's, Indian Materia Medica, Bombay Popular Prakashan, (1982) (Volume-I Unit II)

3. Alka L Gupta, Medicinal Chemistry, Pragati Prakashan (2019) (page no 112, 113, 124-137 Unit IV)

4.V. K. Ahluwalia & Madhu Chopra, Medicinal chemistry, (page no 73-94 Unit IV)

5. N. K. Jain, Textbook of Professional Pharmacy, Vallabh Prakash, Delhi (Unit III & Unit IV)

6.B. N. Ladu, H. G. Mandel and E. L. Way, Fundamentals of Drug Metabolism and Disposition by William and Welkins Co. 428 E, Preston Street. Baltimore. (Unit III & Unit IV)

7.J. R. Robinson & V. Lee, Controlled Drug Delivery: Fundamentals & Applications, Marcel Dekker Inc., NY. (Unit III & Unit IV)

B. Sc. Part II Sem IV (NEP-2.0)

BDCT-402 Paper-VIII Bio-Instruments -I

(Theory Credits: 02, 30 hours)

Expected Course Outcomes:

Name of the topic	Expected Course Outcomes
1. Introduction to Bio-Instruments -I	To impart knowledge about the analytical techniques, mass spectroscopy , PH meter etc.
2. Centrifugation and its types.	Understanding the basic concepts, sedimentation coefficients, and types.
3. Basic Chromatographic Techniques.	Understanding the bssic concepts, types, principles and application of chromatographic techniques.
4. Advanced chromatographic techniques	Student will be capable of understanding the theory , principles, applications construction snd working of advanced chromatographic techniques.
5. Stereochemistry	Students will learn the basic knowledge of conformational analysis of some organic componds.

Unit 1: Introduction to Bio- Instruments -I [6 hours]

1.1 Concepts- Analytical techniques, analyte, method, procedure and protocol.

1.2 Principle construction, working and applications for analysis of biomolecules of following instruments.

c) pH meter,

d) Centrifuge (RCF, sedimentation concept),

1.3 different types of centrifuges.

1.4 Mass spectroscopy (Bainbridge mass spectrometer). Atomic absorption spectrometer(AAS)

Unit 2: Centrifugation and its Types [5 hours]

1.1 Basic principles.

2.2 .RCF, Sedimentation coefficient, Svedberg's constant,

2.3. Types of centrifuge: High speed and Ultracentrifuge,

2.4.Differential and density gradient centrifugation,

2.5 Application of preparative & analytical centrifuges

2.6 gradient centrifuge

Unit 3 Basic Chromatographic Techiniques [7 hours]

3.1 Introduction, Theory, Principle and applications of

A) Thin layer chromatography,

B) Paper chromatography

C) Column chromatography

D) Adsorption column chromatography

E) Size exclusion chromatography

F) Ion exchange chromatography

G) Affinity chromatography

Unit 4: Advanced Chromatografic Techniques [6 hours]

3.1 Theory, Principle of HPLC, construction and working of HPLC

3.2 Applications of HPLC

3.3 Theory, Principle of GLC construction and working of GLC,

3.4 Application of GLC

Unit 5: Stereochemistry **[6 hours]**

5.1 Conformational isomerism – Introduction.

5.2 Representation of conformations of ethane by using Saw- Horse, Fischer (dotted line wedge) and Newmann's projection formulae.

5.3 Conformations and conformational analysis of ethane and n-butane by Newmann's Projection formula with the help of energy profile diagrams.

5.4 Relative stability cycloalkanes - Baeyer's strain theory and Theory of strainless rings.

5.5 Conformations and stability of Cyclohexane

5.6 Conformation and stability of Methyl Cyclohexane.

Reference Books:

1. Stereochemistry Conformation & Mechanism, 9th Edition, By P. S. Kalasi, Publisher: New Age International, 2017.
2. Stereochemistry of Carbon Compounds by Eliel.
3. Stereochemistry of Organic Compounds by D. Nasipuri.
4. J. K. Nigel, Simpson's Solid phase extraction, Principles, techniques and applications (Unit II, Unit III)
5. C.V. S. Subrahmanyam, Physical pharmaceutics (Unit I, Unit II)
6. C.V. S Subrahmanyam et al., Pharmaceutical engineering principles and practices (unit IV)
7. S. M. Khopkar, Basic Concepts of Analytical Chemistry (Unit III)

B.Sc. II –Semester- IV

BDCP-403 – Drug Chemistry Practical Paper -IV - Credit: 02, 60 hours

B) :Section A - Preparations

1. !preparation of iodoform from acetone or ethyl alcohol.
2. Synthesis of p-cholorotoluene from p-toludine. (Sandmeyer Reaction)
3. To determine protein binding efficiency of ibuprofen.
4. Study of protein binding of ibuprofen by dynamic dilution method.
5. To formulate and evaluate transdermal patches of ibuprofen.
6. Prearation of Benzoic Acid.
7. Preparation of p-Nitroacetanilide.
8. Preparation of Benzamide.
9. Preparation of Dihydropyrimidione.
10. Estimation of Acetone.

SECTION B -Organic Chemistry:

Organic Qualitative Analysis: Identification of **Any Six** Organic Compounds with reactions including chemical type.

Acids – Succinic acid, Phthalic acid, Salicylic acid, Aspirin. (Any 2)

Phenols – Alpha-Naphthol, p-nitrophenol. (Any 1)

Bases – o - nitroaniline, p-nitroanilines, Diphenyl amine. (Any 1)

Neutrals – Urea, Acetanilide, Carbon tetrachloride, Bromobenzene, Methyl acetate, Nitrobenzene, Naphthalene, Anthracene, Ethyl methyl ketone. (Any 2)

Note: A systematic study of an organic substance involves reactions in the determination of elements and functional group.

4) Organic Preparations (Any two)

i) Preparation of p-nitro acetanilide from Acetanilide.

ii) Preparation of Acetanilide from Aniline using anhydrous $ZnCl_2$ and Zn dust.

iii) Preparation of Phthalimide from Phthalic anhydride.

Preparation of Benzoic acid from Benzamide

Reference Books:

1. Vogel's Quantitative Chemical Analysis, Pearson 2009.
2. Vogel's Textbook of Qualitative Inorganic Analysis by A. I. Vogel .3rd and 6th edition.
3. Vogel's Textbook of Quantitative Inorganic Chemistry by A. I. Vogel.
4. Physical Chemistry of Inorganic Qualitative Analysis by Kuricose & Rajaram.
5. Practical Manual in Water Analysis by Goyal & Trivedi.
6. Practical Organic Chemistry by A. I. Vogel.
7. Handbook of Organic Qualitative Analysis by H.T. Clarke.
8. A Laboratory HandBook of Organic Qualitative Analysis and Separation by V. S. Kulkarni. Dastane Ramchandra & Co.
9. Practical Organic Chemistry by F. G. Mann and B. C. Saunders. Low – priced Text Book. ELBS. Longman.
10. Advanced Practical Organic Chemistry by N. K. Vishnoi. Vikas Publishing House Private Limited.
11. Advanced Practical Chemistry by J. Singh, L. D. S. Yadav, R. K. P. Singh, I. R. Siddiqui et.al, Pragati Prakashan.

B.Sc. II Syllabus (NEP-2.0)
To be implemented from June 2025 onwards

Semester III & IV

Nature of Question paper

Total Marks 40 Time: 1.5 Hours

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

a)

b)

c)

d)

e)

f)

g)

h)

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

a)

b)

b)

Q.3. Answer any FOUR of the following (Out of SIX) 16 Marks

a)

b)

c)

d)

e)

f)

B.Sc. II Syllabus (NEP-2.0)
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Semester III & IV

Outline of Internal Assessment

Level	Semester	Activities Per Semester	Marks
5	III	Unit Test	10
	IV	Oral Examination/Group Discussion	10

B.Sc. II Syllabus (NEP-2.0)

To be implemented from June 2025 Onwards

Semester III and IV

Nature of Practical Exam

Semester-III Practical Paper-III (50 Marks)

Number of Days: 01

Experiment No-1 (20 Marks)

Experiment No. 2 (20 Marks)

Oral- 05 Marks

Journal- 05 Marks

Semester-IV Practical Paper-IV (50 Marks)

Number of Days: 01

Q.5 Major Experiment- 25 Marks

Q.6 Minor Experiment- 15 Marks

Q.7 Oral- 05 Marks

Q.8 Journal- 05 Marks

Shivaji University,

Kolhapur

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Syllabus for

Bachelor of Science Part-II

(B. Sc. II)

VOCATIONAL SKILL COURSE

IN

DRUG CHEMISTRY

(NEP-2.0)

To be implemented from

June 2025 onward

Structure of B.Sc. II Drug Chemistry (Major Specific)

Vocational Skill Course in Drug Chemistry (2 Credits)			
Semester	**Paper No.**	**Name of Course**	**Units**
III	**(Practical)-I**	**Skin and Hair Care products**	**Practical (2 Credits , 60 Hours)**

Credit 2	**B.Sc. II Drug Chemistry Sem III** **Practical Course: Skin and Hair Care Products** **BDCP-VSC**	No. of Hrs.60

Course Objectives: Students should be able to…

1. Gain proficiency in qualitative and quantitative analysis techniques for organic compounds.
2. Apply theoretical knowledge of organic chemistry principles in practical scenarios
3. Enhance critical thinking, problem-solving, and data interpretation skills through experimental design and analysis.
4. Understand the importance and relevance of organic chemistry in various scientific disciplines and real-world applications.

1.	To formulate and prepare an effective and marketable shampoo.	
2.	Advanced Formulation Techniques: Creating vibrant and safe hair dyes.	
3.	Nourish and Flourish: Crafting enriching hair oils for radianttresses.	
4.	To prepare conditioner for silky and shiny hairs.	
5.	Moisture Mastery: Formulating luxurious skin elixirs	
6.	Lotion Alchemy: Creating Indulgent Body Bliss	
7.	Almond Elegance: Artisanal face massage oil delight	

8.	Sun-Kissed Defense: Whipping up radiant sunscreen lotions.		
9.	Purity Unveiled: The art of skin cleanser creation		
10	Face Freshness Fusion: Crafting invigorating face wash marvels		
11.	To prepare a primer.		
12.	To prepare a tonner for the dry skin.		
13.	To prepare herbal mehendi for shiny hairs. (black & brown)		
14.	To prepare colour corrector for dark spots.		
15.	To prepare aloe-vera gel.		
16.	To prepare a hair serum.		
17.	To prepare a face scrub.		
18.	To prepare gulabjal.		
19.	To prepare vaselline.		
20.	To prepare herbal face mask.		
	Note: any other relevant practicals may be added.		

Course Outcomes: After completion of the experiments students will be able to…

1. Understand the principles of formulation, including the role of key ingredients.
2. Apply knowledge to select and combine ingredients that promote hydration, skin barrier function, and overall skin health.
3. Master the art and science of formulating cosmetic products, utilizing appropriate techniques for blending, emulsification, and stabilization.

4. Apply theoretical knowledge through hands-on experiences, gaining practical skills in the creation of hair conditioners, moisturizers, body lotions, face massage oils, sunscreen lotions, skin cleansers, and face washes.
5. Understand the principles of formulation, including the role of key ingredients.
6. Apply knowledge to select and combine ingredients that promote hydration, skin barrier function, and overall skin health.
7. Master the art and science of formulating cosmetic products, utilizing appropriate techniques for blending, emulsification, and stabilization.
8. Apply theoretical knowledge through hands-on experiences, gaining practical skills in the creation of hair conditioners, moisturizers, body lotions, face massage oils, sunscreen lotions, skin cleansers, and face washes.

References:

1. TAKAHASHI, Motoji. 2015 "Skin Care Products and the Skin." Journal of the Japan Society of Colour Material.
2. NISHIYAMA, Shoji, and Yoshimaru KUMANO. 1996 "Skin Care Products and the Skin."

Kuller, Joanne McManus. 1993 "Infant Skin Care Products."

References:

1. TAKAHASHI, Motoji. 2015 "Skin Care Products and the Skin." Journal of the Japan Society of Colour Material.
2. NISHIYAMA, Shoji, and Yoshimaru KUMANO. 1996 "Skin Care Products and the Skin."

Kuller, Joanne McManus. 1993 "Infant Skin Care Products."

4. Robbins CR. 2013 Chemical and Physical Behavior of Human Hair.

5. Madnani N, Khan K. 2013 Hair cosmetics. Indian J Dermatol Venereol Leprol

B.Sc. II Syllabus (NEP-2.0)

To be implemented from June 2025 onwards

VOCATIONAL SKILL COURSE

Semester III

Nature of Practical Exam

No. of Examination Days-01

Semester-III Practical Paper-I (50 Marks)

Q.1 Experiment- 20 Marks

Q.2 Experiment- 20 Marks

Q.3 Oral - 5 Marks

Q.4 Journal- 5 Marks

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Syllabus for

Bachelor of Science Part-II

(B. Sc. II)

COMMUNITY ENGAGEMENT PROGRAMME (CEP)

IN DRUG CHEMISTRY

(NEP-2.0)

To be implemented from

June 2025 onwards

Structure of B. Sc. II

Community Engagement Programmed in Drug Chemistry

Sr. No.	Semester	Course Code	Title of Paper
1	IV	**BSU0325CEP207D01**	CHCEP-401 Community Engagement Programme in Chemistry (2 credits, 60 Hours)

B. Sc. II, Semester IV		
BSU0325CEP207D01	**CHCEP-401 Community Engagement Programme in Drug Chemistry Paper-I**	**Credits:** 2 **Hours:** 60

INTRODUCTION:

New generation of students are increasingly unaware of local rural and peri-urban realities surrounding their HEIs, as rapid urbanization has been occurring in India. A large percentage of Indian population continues to live and work in rural and peri-urban areas of the country. While various schemes and programs of community service have been undertaken by HEIs, there is no singular provision of a well- designed community engagement course that provides opportunities for immersion in rural realities. Such a course will enable students to learn about challenges faced by vulnerable households and develop an understanding of local wisdom and lifestyle in a respectful manner

OBJECTIVES:

- To promote a respect for rural culture, lifestyle, and wisdom among students.
- To learn about the present status of agricultural and development initiatives.
- Identify and address the root causes of distress and poverty among vulnerable households.
- Improve learning outcomes by applying classroom knowledge to real-world situations.

To achieve the objectives of the socio-economic development of New India, HEIs can play an important role through active community engagement. This approach will also contribute to improve the quality of both teaching and research in HEIs in India. India is a signatory to the global commitment for achieving Sustainable Development Goals (SDGs) by 2030. Achieving these 17 SDG goals requires generating locally appropriate solutions. Community engagement should not be limited to a few social science disciplines alone. It should be practiced across all disciplines and faculties of HEIs. These can take the forms of enumerations, surveys, awareness camps and campaigns, training, learning manuals/films, maps, study reports, public hearings, policy briefs, cleanliness and hygiene teachings, legal aid clinics, etc. For example, students of chemistry can conduct water and soil testing in local areas and share the results with the local community. Students of science and engineering can undertake research in partnership

with the community on solid and liquid waste disposal Therefore, students are being encouraged to foster social responsibility and community engagement in their teaching and research.

LEARNING OUTCOMES:

After completing this course, students will be able to

1. Gain an understanding of rural life, Indian culture, and social realities.
2. Develop empathy and bonds of mutuality with the local community.
3. Appreciate the significant contributions of local communities to Indian society and economy.
4. Learn to Value local knowledge and wisdom.
5. Gain valuable skills such as communication, leadership, teamwork and problem solving etc.
6. Identify opportunities to contribute to the community's socioeconomic improvement.

Credits: Two credit Course; Students are expected to complete 60 hours of participation

COURSE STRUCTURE:

Sr.	Module Title	Module Content	Teaching/ Learning/ Methodology
1	Understanding CEP	Introduction, Guidelines, Necessities	Classroom discussions, Field visit. Survey, Individual / Group conference, Report submission & VIVA
2	Identification of the topic and area	Use of survey, Field visits, communication with society	
3	Organization of Activities	Organization of Hands on Training, Exhibitions, lectures, community conferences	
4	Project	Detailed report of the outcome of the works	

Note: Faculty can make addition in the list of activities as per domain content:

Recommended field-based activities (Tentative):

A community engagement program in chemistry generally aims to increase public understanding and appreciation of chemistry. It encourages engagement with scientific

knowledge. These programs can involve activities like open days, workshops, exhibitions, awareness lectures, conducting surveys and partnerships with local schools to provide hands-on chemistry experiences.

Types of Engagement:

1. Demonstrations and Workshops:

- Showcasing Chemistry through practical demonstrations and hands-on workshops

By making Chemistry more accessible and relatable, community engagement can help the public understand its role in everyday life. For example, visits to elementary schools with Chemistry experiments.

2. Open Days and Science Festivals, exhibitions:

- Hosting open days and organization of science festivals allows the community to interact with chemists and learn about their work in an informal setting.

3. **Educational Outreach to Schools:**

- Collaborating with local schools to offer chemistry programs or demonstrations can inspire students to consider a career in science. Exposing students to the excitement of Chemistry can encourage them to pursue careers in Chemistry.

4. Community-Based Research:

- Community-based research can help identify and address environmental or social problems that affect the community.
- Engaging with the community on projects related to Chemistry, such as soil testing, waste management, drinking water analysis, use of renewable sources of energy, Adverse effects of pesticides, disadvantages of plastic, microplastic, pollution due to industry effluents etc.

5. Surveys:

- Building solar powered village
- Energy use and fuel efficiency surveys
- Raising awareness about chemical hazards
- Assessing the impact of chemical pollution on human health and the environment.
- Gathering feedback on the effectiveness of waste management programs.
- Measuring public support for stricter chemical regulations and industry standards.
- Evaluating public awareness and attitudes towards pesticide use and regulations.

- Evaluating the societal benefits of new chemical technologies, such as renewable energy sources. etc.

6. **Any other activity addressing issues related to Chemistry can be added.**

IMPORTANT RULES AND REGULATIONS FOR CEP:

Concurrent Fieldwork:

1. Students must conduct comprehensive studies on various challenges that they face in their chosen field. Every work relevant to the subject matter should be compiled and documented.
2. Students should keep separate fieldwork diary or maintain journal in order to record their fieldwork experiences i.e. reading, e- contents, tasks, planning and work hours have to be recorded in the diary. Detailed work records report on students' fieldwork experiences and activities to be submitted and should be presented.
3. In addition to the principal curriculum, the students engage in a variety of community development related activities. They are encouraged to plan and carry out programs, processions, and events for social causes. These activities seek to enhance students' personal and professional skills as well as foster self-development.

Reference

1. Guidelines on "Fostering Social Responsibility & Community Engagement in Higher Education Institutions in India 2.0 (https://www.ugc.gov.in/publication/ebook)

2. Shivaji University Guidelines regarding CEP. (https://www.unishivaji.ac.in/uploads/syllabus/2024/JULY/BOS/23-July/All%20Bachelor%20Degree%20Programmes%20CEP%202024-25.pdf)

Shivaji University, Kolhapur

B.Sc. II Syllabus (NEP-2.0)

To be implemented from June 2025 onwards

Name of College

COMMUNITY ENGAGEMENT PROGRAMME (CEP)

IN DRUG CHEMISTRY

Diary

Name of Student:	**Roll No.**
Exam Seat No:	

Sr. No.	Date	Activity	Type of Activity	Time Duration	Sign of Student	Signature of Teacher
1						
2						
3						
4						

- Total 60 Hours participation is required.

Teacher in Charge **H.o.D.** **Principal**

Shivaji University, Kolhapur

B.Sc. II Syllabus (NEP-2.0)

Name of College

COMMUNITY ENGAGEMENT PROGRAMME (CEP)
IN DRUG CHEMISTRY

Format of Report

- Front Page
- Certificate
- Index
- Introduction
- Diary
- Surveys, Field Visits
- Activities- Detail Report
- Summary, Findings and Outcomes
- References

Shivaji University, Kolhapur

B.Sc. II Syllabus (NEP-2.0)

To be implemented from June 2025 onwards

Semester IV

Evaluation/Assessment Scheme

The assessment pattern is internal and external i.e. 40+10.

Particulars	**Marks**
Internal Continuous Assessment:	
1. Participation in concurrent field visits (40%)	
a) Diary Completion, Attendance	10
b) Surveys/Field Visits	10
2)Individual/group field project conference, report/journal submission (40%)	
a) Organization/Participation in activities	10
b) Project	10
Total	**40**
External Assessment: Presentation of project findings (VIVA) (20%)	
Oral Examination	**10**
Total (Internal (40) + External Assessment (10))	**50**

Note: Oral Examination will be conducted along with the Sem. IV Practical Examination.