SHIVAJI UNIVERSITY, KOLHAPUR
416 004, MAHARASHTRA
PHONE : EPABX – 2609000, BOS Section – 0231-2609094, 2609487
Web : www.unishivaji.ac.in Email: bos@unishivaji.ac.in
शिवाजी विद्यापीठ, कोल्हापूर ४१६ ००४, महाराष्ट्र
दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४, २६०९४८७
वेबसाईट : www.unishivaji.ac.in ईमेल : bos@unishivaji.ac.in

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

SU/BOS/Sci & Tech/ 580 **Date: 20 /09/2025**

To,

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

Subject: Regarding Minor Changes in syllabus of B.Sc. Part –II (Sem. III & IV) as per NEP – 2020 (2.0) degree programme under the Faculty of Science and Technology.

Ref: No. SU/BOS/Science/271 & 274 Date: 03/05/2025 Letter.
SU/BOS/Science/499 Date: 18/08/2025 Letter.

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 Minor Changes in syllabi, Nature of Question paper and equivalence of B.Sc. Part-II (Sem III &IV) as per NEP 2020 (2.0) degree programme under the Faculty of Science and Technology.

B.Sc. Part-II (Sem. III & IV) as per NEP-2020 (2.0)	
1.	B.Sc.Part II Biochemistry
2	B.Sc.Part II Biotechnology (Entire)
3	B. Sc. Part II Environmental Science (Entire)

This Syllabus, nature of question and equivalence shall be implemented from the academic year **2025-26** onwards. A soft copy containing the syllabus is attached herewith and it is 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,

(Dr. S. M. Kubal)
Dy. Registrar

Copy to:

1	I/c Dean, Faculty of Science & Technology	7	Appointment Section A & B
2	Director, Board of Examinations & Evaluation	8	Affiliation Section (T.1) (T.2)
3	The Chairpersan, Respective Board of Studies	9	P.G.Admission Section,
4	B.Sc. Exam Section	10	Computer Centre / IT Cell
5	Eligibility Section	11	Internal Quality Assorance Cell (IQAC)
6	P.G Seminar Section		

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दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४, २६०९४८७
वेबसाईट : www.unishivaji.ac.in ईमेल : bos@unishivaji.ac.in

Ref. No./SU/BOS/Humanities/285 Date : 18/05/2024

To,

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

The Head,
All University Department,
Shivaji University, Kolhapur.

Subject : Regarding B. A., B. Com., B. Sc. Structure as per NEP-2020 (2.0)
Ref. : उच्च व तंत्र शिक्षण विभाग,मंत्रालय, मुंबई यांचे संदर्भ क.एनइपी–2022 / विशि–3 शिकाना दि.13 मार्च 2024 चे पत्र.

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 revised B. A., B. Com., B. Sc. Structure as per NEP-2020 (2.0), which is enclosed herewith.

This revised Structure will be implemented from the academic year 2024-25.

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

Thanking you,

Yours faithfully

Encl : As above

(Dr. S. M. Kubal)
Dy. Registrar

Copy to, For Information and necessary action.

The Dean, All Faculty.	P. G. Seminar Section.
The Chairman, Respectice, BOS	P. G. Admission Section.
Director, Board of Examinations & Evaluation	Affiliation Section (T. 1 & T 2)
Appointment Section A & B	Computer Center/I. T. Cell.
Internal Quality Assorance Cell	B. A. Exam Section
Centre for Distance Education	B. Com. Exam Section
Eligibility Section.	B. Sc. Exam Section

Shivaji University, Kolhapur

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Accredited By NAAC with 'A' Grade

Syllabus for Bachelor of Science Part – II (Sem III & IV)

BIOCHEMISTRY

(To be implemented from August, 2025-26 onwards as per NEP 2020)

Shivaji University, Kolhapur

Revised Syllabus for Bachelor of Science Part – II: Biochemistry

1. TITLE: Biochemistry

2. YEAR OF IMPLEMENTATION: - Revised Syllabus will be implemented from June, 2025 onwards.

3. PREAMBLE:

This syllabus is framed to give sound knowledge with understanding of biochemistry to undergraduate students at first year of three years of B.Sc. degree course.

Students learn biochemistry as a separate subject from B.Sc. I. The goal of the syllabus is to make the study of biochemistry popular, interesting, and encouraging to the students for higher studies including research.

The new and updated syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields.

The units of the syllabus are well defined, taking into consideration the level and capacity of students.

4. GENERAL OBJECTIVES OF THE COURSE/ PAPER:

1) To make the students knowledgeable with respect to the subject and its practicable applicability.
2) To promote understanding of basic and advanced concepts in Biochemistry.
3) To expose the students to various emerging areas of Biochemistry.
4) To prepare students for further studies, helping in their bright career in the subject.
5) To expose the students to different processes used in industries and in research field.
6) To prepare the students to accept the challenges in life sciences.
7) To develop skills required in various industries, research labs and in the field of human health.

5. Program Specific Outcomes:

- Understand basics of Biochemistry.
- Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learnt in the classroom.
- Develop the ability to apply the knowledge acquired in classroom and laboratories to specific problems in theoretical and experimental Biochemistry.
- Identify the area of interest in the academic research and development.
- Perform job in various fields like food, pharmaceutical, agriculture, health care, public services and business etc.
- Be an entrepreneur with precision, analytical mind, innovative thinking, and clarity of thought, expression, and systematic approach.

6. DURATION

• The course shall be a full-time course.

7. PATTERN: -

Pattern of Examination will be Semester

EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF PAPERS- (FOR REVISED SYLLABUS)

Sr.No.	Title of Old paper	Title of New paper
1	Paper V DSC- **Metabolism of Carbohydrates and Lipids**	Paper V DSC-V **Enzymology**
2	Paper VI DSC- **Metabolism of Amino acids and Nutrition**	Paper VI DSC- VI **Bioenergetics and Metabolism**
3	Paper VII DSC **Gene Organization, Replication and Repair**	Paper VII DSC-VII: - **Molecular Biology-I**
4	PAPER VIII DSC **Biochemical Techniques**	PAPER VIII DSC- VIII **Biochemical Techniques 2**

SHIVAJI UNIVERSITY,KOLHAPUR

NEP-2020 (2.0): Credit Framework for UG(B. Sc.) Programme under Faculty of Science and Technology

SEM (Level)	COURSES			OE	VSC/SEC	AEC/VEC/IKS	OJT/FP/CEP /CC/RP	Total Credits	Degree/Cum. Cr. MEME
	Course-1	**Course-2**	**Course-3**						
SEMI (4.5)	DSC-I(2) DSC-II (2) DSC P-I(2)	DSC-I(2) DSC-II (2) DSC P-I(2)	DSC-I(2) DSC-II (2) DSC P-I(2)	OE-1(2) (T/P)		IKS-I(2)		22	**UG Certificate 44**
SEMII (4.5)	DSC-III(2) DSC-IV (2) DSC P-II(2)	DSC-III(2) DSC-IV (2) DSC P-II(2)	DSC-III(2) DSC-IV (2) DSC P-II(2)	OE-2(2) (T/P)		VEC-I(2) (Democracy, Election and Constitution)		22	
Credits	**8(T)+4(P)=12**	**8(T)+4(P)=12**	**8(T)+4(P)=12**	**2+2=4 (T/P)**	**--**	**2+2=4**	**--**	**44**	**Exit Option:4 credits NSQF/Internship /Skill courses**
	MAJOR		**MINOR**						
SEMIII (5.0)	Major V(2) Major VI (2) Major P III (2)	--	Minor V(2) Minor VI (2) Minor P III(2)	OE-3(2) (T/P)	VSC I (2) (P) (Major specific) SEC I(2) (T/P)	AEC I(2) (English)	CC-I (2)	22	**UG Diploma 88**
SEMIV (5.0)	Major VII(2) Major VIII (2) Major P IV (2)	--	Minor VII(2) Minor VIII (2) Minor P IV (2)	OE-4(2) (T/P)	SEC-II(2) (T/P)	AEC-II(2) (English) VEC-II(2) (Environmental studies)	CEP-I(2)	**22**	
Credits	**8(T)+4(P)=12**		**8(T)+4(P)=12**	**2+2=4(T/P)**	**4(T/P)+2(P)=6**	**2+4=6**	**2+2=4**	**44**	**Exit Option:4 credits NSQF/Internship /Skill courses**
SEMV (5.5)	Major IX(2) Major X (2) Major P V (4)	Major I (ELEC)(2) Major P-I (ELEC) (2)	-	OE-5(2) (T/P)	VSC II (2) (Major specific)(P)	AEC III(2) (English)	**OJT (04)**	22	**UG Degree 132**
SEMVI (5.5)	Major XI(2) Major XII (2) Major P VI (4)	Major II (ELEC)(2) Major P-II(2) (ELEC)	-		VSC III (2) (Major specific) (P) SEC III(2) (T/P)	AEC IV(2) (English) IKS 2 (Major specific) (2)	**FP-(02)**	22	
Credits	**8(T)+8(P)=16**	**4(T)+4(P)=8**	**-**	**2(T/P)**	**2(T/P)+4(P)=6**	**4+2=6**	**4+2=6**	**44**	
Total Credits	**40+20=60**		**24**	**10**	**12**	**16**	**10**	**132**	**Exit Option**

SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. - II NEP Syllabus

B. Sc. Part – II Semester-III

Paper- V- DSC-V Enzymology

Objectives-

- To make students aware of fundamentals of Enzymology.
- To make Students aware of techniques of enzymology.
- To introduce vide areas in Enzymology.

Paper- V: -DSC- Enzymology		
	Credit – I	
	Introduction to enzymes **Nature of enzymes** - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes. Unit of enzyme activity – definition of IU, enzyme turn over number and nature of non-enzymatic and enzymatic catalysis. Specific activity. Enzyme specificity. Concept of active site, ES complex, specificity. **Features of enzyme catalysis** Factors affecting the rate of chemical reactions, collision theory, Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis.	15
	Credit- II	
	Characterization: Effect of enzyme concentration, substrate concentration, pH and temperature. Michaelis – Menten equation,Lineweaver – Burk(L-B) plot. **Mechanism of action of enzymes** General features - proximity and orientation, strain and distortion, acid base and covalent catalysis (chymotrypsin, lysozyme). Metal activated enzymes and metalloenzymes, transition state analogues. **Isoenzymes:Detection**, nature, importance. Lactate dehydrogenase as an example. Multi enzyme complex – Pyruvate dehydrogenase complex. – Composition, subunits, assembly, enzymatic reaction functions.RNA as an enzyme. (Ribozymes).Industrial and medical application of enzymes.	15

Learning Outcomes-

Students should be able to understand

- It provide fundamental knowledge on enzymes and their importance in biological reactions.
- Students will understand the difference between a chemical catalyst and biocatalyst

SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. - II NEP

B. Sc. Part – II Semester-III

Paper-VI-DSC-VI Bioenergetics and Metabolism

Objectives-

- This course introduces foundation of metabolism
- Student will learn metabolism and Bioenergetics.

Paper-VI: -DSC-VI BIOENERGETICS AND METABOLISM		
	Credit—I	
	Bioenergetics: Concepts of free energy, state functions, equilibrium constant. Coupled reactions, energy charge, ATP cycle, phosphorylation potential. Standard energy of hydrolysis of ATP, PEP, 1,3 BPG and thioesters. Redox reactions, standard redox potentials and Nernst equation. Universal electron carriers. **Basic design of metabolism** Autotrophs, heterotrophs, metabolic pathways, catabolism, anabolism, ATP as energy currency, reducing power of the cell**.** **Glycolysis, Gluconeogenesis, pentose phosphate pathway and Glycogen Metabolism** **Glycolysis** - a universal pathway, reactions of glycolysis, fermentation, fates of pyruvate, feeder pathways for glycolysis, galactosemia. Synthesis of glucose from non-carbohydrate sources,pentose phosphate pathway and its importance. Glycogenesis and glycogenolysis, regulation of glycogen metabolism, glycogen storage diseases. **Citric acid cycle** Production of acetyl CoA, reactions of citric acid cycle, anaplerotic reactions, amphibolic role, regulation of citric acid cycle, glyoxalate pathway, coordinated regulation of glyoxalate and citric acid pathways.	15
	Credit—II	
	Biological oxidation: Ultra structure of mitochondrion, electron transport chain. Electron transport complexes Complex I, II, III and IV. Uncouplers and inhibitors of respiration (Rotenone, antimycin. cyanide and 2,4 DNP). Oxidative phosphorylation, P/O ratio. Formation of ATP-Outline of Mitchell's hypothesis. Substrate level phosphorylation with examples. **Metabolism of lipids:** Oxidation of fatty acids –β-oxidation of even number saturated fatty acids. Energetics of β-oxidation. Biosynthesis of even number saturated fatty acids. Ketone bodies formation. **Metabolism of amino acids:** General reaction of amino acid degradation – Transamination, deamination and decarboxylation. Ketogenic and glucogenic amino acids. Urea cycle and its significance.	15

Learning Outcomes-

Students should be able to understand

- Fundamentals of Bioenergetics.
- Significance of Biological oxidation.

- Metabolism of carbohydrates, Lipids and Amino acids.

Reference Books: -

1. Nelson, D.L. and Cox, M. M. (2009). Lehninger`s Principles of Biochemistry.
2. Biochemistry - Lubert stryer.
3. Text book of Biochemistry and Human Physiology - G .P. Talwar.
4. Harper's Review of Physiological Chemistry - H. A. Harper.
5. Fundamentals of Biochemistry - J. L.J ain.
6. Biochemistry - U. Satyanarayan.

SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. - II NEP Syllabus

B. Sc. Part – II Semester-III Practical syllabus

I) Biochemistry Practical Course-III

Sr No	Name of The Experiment
	Enzymology
1	Isolation of urease and demonstration of its activity
2	Isolation of acid phosphatase and demonstration of its activity
2	Determination of specific activity of salivary amylase by DNS
3	Influence of substrate concentration and pH on the rate of enzymatic reaction
4	Determination of optimum temperature of salivary amylase
Volumetric estimations:	
5.	Estimation of lactose in milk by Fehling's or Benedict's method. (1)
6.	Estimation of total chlorides in urine by Volhard's method (1)
7.	Estimation of vitamin-C in biological samples & tablet by 2, 6 dichlorophenol indophenol method. (1)
8.	Determination of saponification value of oil.

Practical outcome-

1. The students will get detailed and comprehensive knowledge on the various practical aspects of biochemical techniques.
2. The students will be able to analyze biochemically different biological samples.
3. Students will get practical knowledge regarding preparation of biochemically important buffers, estimating the biomolecules in each sample by using standard analytical techniques.

Books recommended for Practical

1) Stains and Staining procedures by Desai and Desai.
2) Introduction to Practical Biochemistry by D. Plummer, J Wiley and Sons.
3) Bacteriological techniques by F. J.Baker.
4) Introduction to Microbial techniques by Gunasekaran.
5) Biochemical methods by Sadashivan and D.Manickam.
6) Laboratory methods in Biochemistry by J.Jayaraman.

SHIVAJI UNIVERSITY, KOLHAPUR
B.Sc. Part – II (Minor) Biochemistry Syllabus
(Effective from June 2025)
B. Sc. Part –II Semester-III

Minor Paper V: Metabolism

Credits: 02

Objectives

- To introduce the basic concepts of metabolism.
- To study carbohydrate and lipid metabolism pathways and their regulation.

Unit I: Carbohydrate Metabolism

- Introduction to metabolism: catabolism and anabolism.
- Glycolysis: steps, energetics, and regulation.
- TCA cycle: steps and significance.
- Gluconeogenesis (overview).
- Glycogen metabolism: synthesis and breakdown.

Teaching hours: 15

Unit II: Lipid Metabolism

- β-oxidation of fatty acids: pathway and energetics.
- Biosynthesis of fatty acid (Palmitic acid).
- Structure of fatty acid synthetase complex (Eu).
- Synthesis and utilization of ketone bodies. **Teaching hours:** 15

Learning Outcomes

Students will be able to:

1. Explain the basic metabolic pathways of carbohydrates and lipids.
2. Interpret the significance and regulation of major pathways.

References

1. Lehninger Principles of Biochemistry – Nelson & Cox
2. Biochemistry – Lubert Stryer
3. Fundamentals of Biochemistry – Jain & Jain
4. Biochemistry – U. Satyanarayana

SHIVAJI UNIVERSITY, KOLHAPUR
B.Sc. Part – II (Minor) Biochemistry Syllabus
(Effective from June 2025)
B. Sc. Part –II Semester-III

Minor Paper VI: Enzymology and Basic Immunology

Credits: 02

Objectives

- To learn enzyme structure, classification, and mechanism of action.
- To understand the role of vitamins in enzymatic reactions.

Unit I: Enzymology

- Enzyme nomenclature and classification (IUBMB system).
- Active site of enzyme and its features.
- Factors affecting enzyme activity.
- Enzyme kinetics: Michaelis-Menten equation, Km and Vmax.
- Theories of enzyme action - Lock and key and induced fit theory
- Types of enzyme inhibition: competitive and non-competitive.
- Isoenzymes of LDH and its clinical importance.

Teaching hours: 15

Unit II: Enzyme Immobilization and Basic Immunology

- **Enzyme immobilization: -**
  - Definition, classification
  - Types – i) Adsorption, ii) covalent binding, iii) intermolecular cross linking,
  - iv) Entrapment (gel)
  - Industrial applications of immobilization.
- **Basic Immunology and Techniques**
  - Natural and acquired Immunology
  - T Cells and B Cells
  - Structure of IgG E. Antigen –antibody interaction
  - Phagocytosis by Macrophages
  - ELISA

Teaching hours: 15

Learning Outcomes

Students will be able to:

1. Explain enzyme classification, kinetics, and inhibition.
2. Describe the biochemical role and importance of vitamins.

References

1. Lehninger Principles of Biochemistry – Nelson & Cox
2. Biochemistry – Lubert Stryer
3. Biochemistry – U. Satyanarayana
4. Fundamentals of Biochemistry – Jain & Jain

SHIVAJI UNIVERSITY, KOLHAPUR.
B. Sc. – II NEP Syllabus with effect from June 2025
B. Sc. Part – II Semester-III
Practical syllabus
Minor Biochemistry Practical Course-III
(Credit: 02)

Sr No	Name of The Experiment
1.	Fundamentals of Biochemical analysis
2.	Demonstration of some lab equipment: - Colorimeter, Hot air oven, Incubator, Centrifuge, Water bath, Water distillation unit.
	Separation methods:
3.	Uptake of Na*- ions by cation exchange resin.
4.	Separation of sugars (e.g. glucose and fructose) using TLC
	Isolations:
5.	Isolation of albumin and globulin from egg.
6.	Isolation of DNA (onion or cauliflower)
	Colorimetric estimations:
7.	Estimation of creatinine from urine.
8.	Estimation of protein by Lowry's method.
9.	Estimation of urea by DAM method.
10.	Estimation of inorganic phosphate by Fiske-Subbarow method

Practical outcome-

On completion of this course, students will be able to:

1. Perform accurate colorimetric estimates of biomolecules using standard protocols.
2. Isolate and characterize biomolecules such as proteins, carbohydrates, and lipids from biological samples. The students will be able to analyze biochemically different biological samples.
3. Students will get practical knowledge regarding preparation of biochemically important buffers, estimating the biomolecules in each sample by using standard analytical techniques.

Books recommended for Practical

1) Stains and Staining procedures by Desai and Desai.
2) Introduction to Practical Biochemistry by D. Plummer, J Wiley and Sons.
3) Bacteriological techniques by F. J.Baker.
4) Introduction to Microbial Techniques by Gunasekaran.
5) Biochemical methods by Sadashivan and D.Manickam.
6) Laboratory methods in Biochemistry by J.Jayaraman.
7) Experimental Microbiology – Patel &Patel

SHIVAJI UNIVERSITY, KOLHAPUR.
B. Sc. – II NEP Syllabus with effect from June 2025
B. Sc. Part – II Semester-III

VSC – Dairy Technology (Practical)

Total Credits: 2

Total Laboratory Hours: 60
Aim of the course: To develop the skills in dairy technology
Objective: To impart knowledge of microbial and chemical quality of milk.

Sr.No	Topic	Hours
	Part I	
1.	Introduction to Quality Assurance in milk and milk products	3
2.	Measurement of titrable acidity of milk	3
3.	Grading of milk by dye reduction test	3
4.	Microbiological examination of raw milk by DMC	3
5.	Microbiological examination of raw milk by SPC	3
6.	Detection of faecal contamination of milk and milk products	3
7.	Adulteration in milk and milk products	3
8.	Detection of neutralizer in milk	3
9.	Detection of urea in milk	3
10.	Detection of thickening agent in milk	3
	Part II	
11.	Detection of preservative in milk	3
12.	Detection of neutralizer in milk	3
13.	Detection of adulterants in milk products	3
14.	Determination of efficiency of pasteurization	3
15.	Tests for detection of mastitic milk	3
16.	Determination of fat and SNF content in milk	3
17.	Determination of specific gravity of milk.	3
18.	Preparation of Lassi	3
19.	Preparation of flavoured milk	3
20.	Visit to milk product development centre	3

SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. - 2 NEP Syllabus with effect from June, 2025

B. Sc. Part – II Semester-III

SEC-I Basic Bio analytical Techniques

Practical –I:

TOTAL HOURS : 30 CREDITS : 2

Unit 1 Biochemical reagents and solutions **No. of Hours: 18**

Safety practices in the laboratory. Preparation and storage of solutions. Concepts of solution concentration and storing solutions. Quantitative transfer of liquids. Concept of a buffer, Henderson-Hasselbach equation, working of a pH meter.

Exercise

Preparation of a buffer of given pH and molarity.

Unit 2 Spectrophotometric techniques **No. of Hours : 6**

Principle and instrumentation of UV-visible and fluorescence spectroscopy.

Exercises

Determination of the absorption maxima and molar extinction coefficient (of a relevant organic molecule).

Measurement of fluorescence spectrum.

Determination of concentration of a protein solution by Lowry/BCA method.

Unit- 3 Introduction and importance of virtual labs in biochemistry **No. of Hours: 6**

SUGGESTED READINGS

1. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., Wiley Blackwell (West Sussex), ISBN:978-0-470-85602-4 / ISBN:978-0-470-85603-1.

2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2nd ed., Freifelder, D., W.H. Freeman and Company (New York), ISBN:0-7167-1315-2 / ISBN:0-7167-1444-2.

3. An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN

SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. - 2 NEP Syllabus with effect from June, 2025

B. Sc. Part – II Semester-III

OE Practical –III: Non-Infectious diseases-I

Objectives:

- Equip students with knowledge about preventive strategies for non-infectious diseases, focusing on lifestyle modifications, health promotion, and public health interventions.
- Explore the role of risk factors such as diet, physical inactivity, genetics, and environmental exposures in the development of non-infectious diseases.
- Understand diagnostic methods used in identifying non-infectious diseases, including medical imaging and laboratory tests.

OE-III (T) Non-Infectious diseases-I		
	Credit-I	
	Nutritional disorders Overview of major and minor nutrient components in the diet. Balanced diet and the concept of RDA. Nutrient deficiencies; Kwashiorkor and Marasmus, Scurvy, beri beri, pellagra and B12 deficiency, Xerophthalmia and Night blindness, Vitamin D deficiency, Vitamin K deficiency. Discuss with relation to biochemical basis for symptoms.	15
	Credit- II	
	Overview of diseases caused by bacteria Obesity and eating disorders like Anorexia nervosa and Bullemia. Diabetes mellitus A metabolic syndrome and the relationship with hypertension, obesity, hypothyroidism, and stress. Cardio vascular disorders and Atherosclerosis-defining the broad spectrum of ailments that fall in this category, understanding the factors that contribute to the syndrome, stages of disorder and the management of the condition. Irritable bowel syndrome-biochemistry behind the disorder and the influence of diet, stress, and environment on the condition.	15

Learning Outcomes-

Students should gain knowledge about

- to advocate for health promotion and disease prevention strategies, both at an individual and community level.
- Demonstrate an understanding of the social determinants of health and their impact on the development of non-infectious diseases.

SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. - II NEP Syllabus

B. Sc. Part – II Semester-IV

PAPER VII DSC-VII: Molecular Biology-I

Objectives-

- Students will gain an overview of the immune system including cells, organs and receptors
- Student will importance of antigen-antibody interaction in disease diagnosis.

Paper-VII DSC-VII: - Molecular Biology-I		
	Credit-I	
	Genes and genomic organization - Genome sequence and chromosome diversity, definition of a gene, organization of genes in viruses, bacteria, animals and plants. Nucleosome structure and packaging of DNA into higher order structures **Replication of DNA** The chemistry of DNA synthesis, DNA polymerase, the replication fork, origin of replication, enzymes and proteins in DNA replication, various modes of replication, stages of replication of E. coli chromosome. Mechanism of prokaryotic transcription	15
	Credit- II	
	Translation: Mechanism of prokaryotic translation Genetic code Regulation of gene expression, with operon concept (E.coli lac operon model) **Mutations:** Types of mutations - transition, transversion, frame shift mutations, mutations induced by chemicals, radiation, transposableelements, Repair of DNA damage - direct repair, base excision repair, nucleotide excision repair, and recombination repair Ames test.	15

Learning outcomes-

Students should gain knowledge about

- Basic concepts of foundation of Molecular Biology
- Application of Molecular Biology

SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. - II NEP Syllabus

B. Sc. Part –II Semester-IV

PAPER VIII DSC-VIII –Biochemical Techniques 2

Objectives-

- Students will acquire the skills necessary for accurate and precise measurements, sample preparation, and data analysis in a biochemical laboratory setting.
- Develop an understanding of fundamental laboratory techniques used in biochemistry, including spectrophotometry, chromatography, and electrophoresis.

PAPER VIII DSC-VIII– BIOCHEMICAL TECHNIQUES-2		
	Credit-I	
	Bioinformatics: - Introduction to bioinformatics, Databases, Information sources (NCBI, GDB, and MGD), Data retrieval tools (ENTREZ, OMIM and PubMed), Database similarity searching (BLAST), Applications of Bioinformatics. **Cell Homoginization and Centrifugation:** Principle of differential centrifugation. Types of Rotors, Ultra centrifuge – construction and applications in subcellular fractionation. **DNA sequencing** - DNA sequencing by Sanger's method, modifications based on Sanger's method. Automated DNA sequencing. Pyrosequencing.	15
	Credit- II	
	Radiochemistry: Natural and artificial radioactivity, characteristics of radioactive elements, units of radioactivity, disintegration constant, half-life, α, β and γ radiation. Detection of radioactivity by GM counter. Applications of radioisotopes – 3H, 14C, 131I, 60Co and 32P. Biological effects of radiations. Safety measure in handling radio isotopes. **ELISA** Enzyme immobilization: - A. Definition, classification B. Types – i) Adsorption, ii) covalent binding, iii) intermolecular cross linking, iv) Entrapment (gel) C. Industrial applications of immobilization.	15

Learning Outcomes-

Students should gain knowledge about

- Bioinformatics tools
- Basic components of biochemical techniques.
- Methods of Centrifugation and Immobilization.

Reference books: -

1. Nelson, D.L. and Cox, M. M. (2009). Lehninger`s Principles of Biochemistry
2. Biochemistry - Lubert Stryer.
3. Introduction to Chromatography theory and practice - Shrivastava.
4. Chromatography - B.K. Sharma.
5. Biophysical and biochemical technique: Nath and Upadhya
6. Fundamental of Biochemistry: A.C. Deb·
7. Textbook of Biochemistry: Jain & Jain

SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. - II NEP Syllabus

B. Sc. Part – II Semester-IV

Biochemistry Practical Course-IV

Colorimetric estimations:	
1.	Estimation of inorganic phosphate by Fiske-Subbarow method. (1)
2.	Estimation of creatinine in urine. (1)
3.	Estimation of glucose from blood, Folin-Wu or o-Toluidine method. (1)
4.	Estimation of RNA by Bial's orcinol method. (1)
5.	Estimation of urea from blood by DAM method.(1)
Qualitative Analysis	
6.	Determination of blood groups.
7.	Detection of normal and abnormal constituents of urine.
8.	Qualitative analysis of saturated and unsaturated lipids. (2)
	Isolations
9.	Amino acid Separation by 2-D Chromatography
10.	Isolation of DNA (1)
	Demonstration Experiments
11.	Bioinformatics experiment to determine three-dimensional structure of proteins by visualizing softwares- RasMol.

Practical outcome-

1. The students will get detailed and comprehensive knowledge on the various practical aspects of biochemical techniques.
2. The students will be able to analyze biochemically different biological samples.
3. Students will get practical knowledge regarding preparation of biochemically important buffers, estimating the biomolecules in each sample by using standard analytical techniques.

Books recommended for Practicals

1. Stains and Staining procedures by Desai and Desai.
2. Introduction to Practical Biochemistry by D. Plummer, J Wiley and Sons.
3. Bacteriological techniques by F. J.Baker.
4. Introduction to Microbial techniques by Gunasekaran.
5. Biochemical methods by Sadashivan and D.Manickam.
6. Laboratory methods in Biochemistry by J.Jayaraman.
7. Experimental Microbiology – Patel &Patel

List of the Laboratory equipment:

1. Colorimeter
2. pH meter
3. Electrophoresis apparatus
4. Computer with printer.
5. Water bath / Incubator
6. Mixer
7. Oven
8. Chemical balance / Single pan balance
9. Suction pump
10. Centrifuge machine
11. Heating mantle with magnetic stirrer
12. Soxhlet extraction apparatus.
13. Micropipettes
14. Glassware

- **OTHER FEATURES:**

(A) LIBRARY:

References and Text Books, Journals and Periodicals, Reference Books. – List Attached

(B) LABORATORY SAFETY EQUIPMENTS:

1) Fire extinguisher
2) First aid kit
3) Fumigation chamber
4) Stabilized power supply
5) Insulated wiring for electric supply.
6) Good valves & regulators for gas supply.
7) Operational manuals for instruments.
8) Emergency exits

SHIVAJI UNIVERSITY, KOLHAPUR
B.Sc. Part – II (Minor) Biochemistry Syllabus
(Effective from June 2025)
B. Sc. Part –II Semester-IV

Minor Paper VII: Molecular Biology

Credits: 02

Objectives

- To introduce the fundamentals of molecular biology.
- To understand the basic biochemical techniques used in molecular biology.

Unit I: Molecular Basis of Genetic Information

- Central dogma of molecular biology
- Watson Crick model of DNA.
- Structure, and functions of mRNA, rRNA and tRNA (yeast).
- DNA replication (overview)
- Introduction to chromosomes and chromatin structure (nucleosome model, histones, and DNA packaging in eukaryotes – brief)
- Basic concept of telomeres and telomerase in replication

Teaching hours: 15

Unit II:

- Transcription: definition and basic process.
- Translation: definition and basic process.
- Genetic code (features).
- Regulation of gene expression, with operon concept (E. coli lac operon model).
- Concept of mutation:
  - Types and molecular basis
  - Point mutations (silent, missense, nonsense)
  - Frameshift mutations (insertions and deletions)
  - Causes (spontaneous vs induced)

Teaching hours: 15

Learning Outcomes

Students will be able to:

1. Describe fundamental processes in molecular biology.
2. Understand the biochemical basis of protein digestion and catabolism.

References

1. Lehninger Principles of Biochemistry – Nelson & Cox
2. Biochemistry – Lubert Stryer
3. Fundamentals of Biochemistry – Jain & Jain
4. Biochemistry – U. Satyanarayana

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B.Sc. Part – II (Minor) Biochemistry Syllabus
(Effective from June 2025)
B. Sc. Part –II Semester-IV

Minor Paper VIII: Genetic & Biochemical Techniques

Credits: 02

Objectives

- To introduce the fundamentals of molecular biology.
- To understand the basic biochemical techniques used in molecular biology.

Unit I: Genetic Engineering

- Introduction to Tools and techniques in genetic engineering
- Enzymes a) Restriction endonucleases- introduction to class I, II and III, eg-
- a) EcoRI, Bam HI b) Reverse transcriptase, c) S1 nuclease, d) DNA ligases, e) Alkaline phosphatase
- Basic concept of gene cloning technique,
- Principal, working and applications of PCR.
- Blotting techniques-southern, northern, and western blotting and their application,
- Applications of genetic engineering.

Teaching hours: 15

Unit II: Biochemical Techniques

- Basic principles and applications of Electrophoresis:
  - Electrophoresis: agarose gel electrophoresis (overview)
  - Principle, technique and applications of Paper, PAGE and SDS –PAGE (overview)
  - Definition of the terms: electrophoresis, electrophoretic mobility
  - Factors affecting electrophoretic mobility.
- Colorimetry and spectrophotometry (overview and differences).
  - Beer Lambert's law, Limitations of Beer Lambert's law
  - Construction, working and applications of i) colorimeter ii) uv spectrophotometer
  - Advantages of spectrophotometer over colorimeter
  - Absorption spectra of proteins, nucleic acids, cytochrome and NAD+

Teaching hours: 15

Learning Outcomes

Students will be able to:
1. Describe fundamental processes in molecular biology.
2. Explain the basic principles of common biochemical techniques.

References

1. Lehninger Principles of Biochemistry – Nelson & Cox
2. Molecular Biology of the Gene – Watson
3. Biochemistry – Lubert Stryer
4. Biochemical Methods – Sadashivam and Manickam

SHIVAJI UNIVERSITY, KOLHAPUR.
B. Sc. - II NEP Syllabus with effect from June, 2025
B. Sc. Part – II Semester-IV
Minor Biochemistry Practical Course-IV
(Credit: 02)

	Volumetric Estimations
1.	Estimation of vitamin-C by 2, 6-dichloro phenol-indophenol method.
2.	Determination of saponification value of oil or fat
	Immobilization
3.	Gel entrapment method.
4.	Immobilization of Amylase (Agar-Agar Gel/ alginate)
5.	Problems on DNA - RNA sequence, Genetic code
	Qualitative Analysis
6.	Determination of blood groups
7.	Qualitative analysis of saturated and unsaturated lipids
8.	Detection of proteins – albumin, casein
	Enzyme Study
9.	Effect of pH on amylase activity.
10.	Effect of temperature on amylase activity.
	Demonstration Experiments Separation of indicators/ proteins by gel electrophoresis Separation of amino acids by paper electrophoresis

Practical outcome-

On completion of this course, students will be able to:

1. Perform **enzyme assays** to determine activity and study the effects of pH and temperature on enzymes.
2. Accurately conduct **volumetric estimations** for quantitative analysis of biomolecules.
3. Identify biomolecules through **qualitative analysis** using specific biochemical tests.
4. The students will get detailed and comprehensive knowledge on the various practical aspects of biochemical techniques.
5. The students will be able to analyze biochemically different biological samples.
6. Students will get practical knowledge regarding preparation of biochemically important buffers, estimating the biomolecules in each sample by using standard analytical techniques.

Books recommended for Practical's

1) Stains and Staining procedures by Desai and Desai.
2) Introduction to Practical Biochemistry by D. Plummer, J Wiley and Sons.
3) Bacteriological techniques by F. J.Baker.
4) Introduction to Microbial techniques by Gunasekaran.
5) Biochemical methods by Sadashivan and D.Manickam.
6) Laboratory methods in Biochemistry by J.Jayaraman.
7) Experimental Microbiology – Patel &Patel

SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. - 2 NEP Syllabus with effect from June, 2025

B. Sc. Part – II Semester-IV

SEC Practical –II:

PROTEIN PURIFICATION TECHNIQUES

TOTAL HOURS: 30

CREDITS: 2

Unit 1 Purification and characterization of a protein from a complex mixture (native or heterologously expressed) involving the following methods/techniques No. of Hours: 24

Exercises

Preparation of the sample.

Ion-exchange chromatography.

Gel filtration chromatography.

Affinity chromatography.

Electrophoresis.

Unit 2 Demonstration of High Performance Liquid Chromatography (HPLC) No. of Hours: 6

SUGGESTED READINGS

1. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., Wiley Blackwell (West Sussex), ISBN:978-0-470-85602-4 / ISBN:978-0-470-85603-1.

2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2nd ed., Freifelder, D., W.H. Freeman and Company (New York), ISBN:0-7167-1315-2 / ISBN:0-7167-1444-2.

3. An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10:

SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. - 2 NEP Syllabus with effect from June, 2025

B. Sc. Part – II Semester-IV

OE-IV (T) Non-Infectious diseases-II

Objectives-

- Develop a deep understanding of the etiology of non-infectious diseases, including genetic, environmental, and lifestyle factors.
- Understand non-infectious diseases e.g. Cancer and Diseases due to misfolded proteins

OE-IV (T) Non-Infectious diseases-II		
	Credit-I	
	Multifactorial complex disorders and Cancer Understanding the definition of multifactorial diseases. Polygenic diseases and the relationship of environmental factors and genetic makeup in the onset of diseases. Cancer: characteristics of a transformed cell, causes and stages of Cancer, molecular basis for neoplastic growth and metastasis, Proto-oncogenes and tumor suppressor genes; Cancer causing mutations; Tumor viruses; Biochemical analysis of cancer; Molecular approaches to cancer treatment. Disorders of mood : Schizophrenia, dementia and anxiety disorders. Polycystic ovarian syndrome, Parkinson's disease, ALS.	15
	Credit- II	
	Diseases due to misfolded proteins Introduction to protein folding and proteosome removal of misfolded proteins; etiology and molecular basis for Alzheimer's, Prion diseases, Huntington's Chorea, sickle cell anemia, Thalassemia.	15

Learning Outcomes-

Students should gain knowledge about

- The importance of interdisciplinary collaboration in managing and preventing non-infectious diseases
- The common diseases like Alzheimer's, Prion diseases, Huntington's Chorea, sickle cell anemia, Thalassemia.

Nature of Question Paper
for B.Sc. Part – I, II & III (40 + 10 Pattern) according to Revised Structure as Per NEP – 2020
to be implemented from academic year 2025-26

Maximum Marks: 40 **Duration: 2 hrs.**

Q. 1 Select the most correct alternate from the following **[8]**

i) to viii) MCQ one mark each with four options

A) B) C) D)

Q.2 Attempt any TWO of the following **[16]**

A)

B)

C)

Q. 3 Attempt any FOUR of the following **[16]**

a)

b)

c)

d)

e)

f)

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B.Sc. II Syllabus (NEP-2020)
To be implemented from June 2025 onwards Nature of Practical Examination
Total Marks 50

1. Practical examination will be conducted semester wise.
2. Practical examination will be conducted for one day per batch.
3. The examination will be conducted in two sessions per day and each session will be of three hours duration.
4. Every candidate should perform one experiment each from Group I and Group II.
5. At least eighty percent practical should be completed by the student.
6. The marks distribution for practical is as below
   Note:- At least 80% Practical should be covered in practical examination.

For Semester III

Sr. No.	Experiments	Marks
1	Enzymology	15
2	Enzymology	10
3	Volumetric Estimation	15
4	Viva-voce	05
5	Journal	05
	Marks	**50**

For Semester IV

Sr.No.	Experiments	Marks
1	Colorimetric estimation	15
2	Qualitative analysis	10
3	Isolations	15
4	Viva-voce	05
5	Journal	05
	Marks	**50**

Nature of Question Paper
for B.Sc. Part – I, II & III (40 + 10 Pattern) according to Revised Structure as Per NEP – 2020 to be implemented from academic year 2025-26

Maximum Marks: 40 **Duration: 2 hrs.**

Q. 1 Select the most correct alternate from the following **[8]**

i) to viii) MCQ one mark each with four options

A) B) C) D)

Q.2 Attempt any TWO of the following **[16]**

A)

B)

C)

Q. 3 Attempt any FOUR of the following **[16]**

a)

b)

c)

d)

e)

f)

---xxx---

B.Sc. II Syllabus (NEP-2020)
To be implemented from June 2025 onwards
Nature of Practical Examination
Total Marks 50

1. Practical examinations will be conducted semester wise.
2. Practical examinations will be conducted for one day per batch.
3. The examination will be conducted in two sessions per day, and each session will be three hours duration.
4. Every candidate should perform one experiment, each from Group I and Group II.
5. At least eighty percent practical should be completed by the student.
6. The marks distribution for practical is as below

Note: - At least 80% Practical should be covered in practical examination.

For Semester III

Sr.No.	Experiments	Marks
1	Colorimetric estimation	15
2	Isolation	10
3	Separation method	15
4	Journal	10
	Marks	**50**

For Semester IV

Sr.No.	Experiments	Marks
1	Volumetric estimation	15
2	Immobilization	10
3	Enzyme study	10
4	Genetic problems/Qualitative (anyone)	05
	Journal	10
	Marks	**50**