



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

SHIVAJI UNIVERSITY, KOLHAPUR - 416 004,
MAHARASHTRA

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शिवाजी विद्यापीठ, कोल्हापूर - ४१६ ००४, महाराष्ट्र

दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दूरध्वनी ०२३१-२६०९०९३/९४



SU/BOS/Science/498

Date: 10/07/2023

To,

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

The Head/Co-ordinator/Director
All Concerned Department (Science)
Shivaji University, Kolhapur.

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

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 revised syllabi, nature of question paper and equivalence of B.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

B.Sc.-II (Sem. III & IV) as per NEP-2020			
1.	Computer Science (Opt)	8.	Food Technology & Management (Entire)
2.	Computer Science (Entire)	9.	Biochemistry
3.	Animation (Entire)	10.	Biotechnology (Optional/Vocational)
4.	Information Technology (Entire)	11.	Biotechnology (Entire)
5.	Food Science and Technology (Entire)	12.	Environmental Science (Entire)
6.	Food Science	13.	Pollution
7.	Food Science and Quality Control (Entire)		

This syllabus, nature of question and equivalence shall be implemented from the academic year 2023-2024 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2023 & March/April 2024. 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,

Dy Registrar
Dr. S. M. Kubal

Copy to:

1	The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section
2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education

SHIVAJI UNIVERSITY, KOLHAPUR.



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Revised Syllabus For

B. Sc. II Biochemistry

(Faculty of Science & Technology)

Paper –V, VI - (Semester- III)

and

Paper -VII, VIII - (Semester- IV)

(NEP-2020) CBCS Syllabus to be implemented from June, 2023 onwards

ii) Structure of B.Sc. Programme (Semester III & IV)

SEMESTER-III (Duration-6 Months)																
Sr. No.	Course (Subject) Title	TEACHING SCHEME					EXAMINATION SCHEME									
		THEORY			PRACTICAL		THEORY				PRACTICAL					
		Credits	No. of lecture	Hours	Credits	No. of lecture	Hours	Internal		University			Hours	Max Mark	Min Mark	
						Max Mark	Min Mark	Hours	Max Marks	Total	Min Mark	Hours	Max Mark	Min Mark		
1	DSC-C	2	3	2.4				10	4	2	40					
2	DSC-C	2	3	2.4	4	8	6.4	10	4	2	40	80	28			
3	DSC-C	2	3	2.4				10	4	2	40					
4	DSC-C	2	3	2.4	4	8	6.4	10	4	2	40	80	28			
5	DSC-C	2	3	2.4				10	4	2	40					
6	DSC-C	2	3	2.4	4	8	6.4	10	4	2	40	80	28			
7	AECC-C	4	4	3.2	---	---	---	---	---	---	---	---	---			
8	SEC-III	Any one from pool of courses			2	---	---	---	---	---	---	---	---	2	50	18
	TOTAL	16	22	17.6	14	24	19.2	60			240	350	---		50	

PRACTICAL EXAMINATION IS ANNUAL

SEMESTER-IV(Duration-6Months)

Sr. No.	Course (Subject) Title	TEACHING SCHEME						EXAMINATION SCHEME								
		THEORY			PRACTICAL			THEORY				PRACTICAL				
		Credits	No. of lecture	Hours	Credits	No. of lecture	Hours	Internal Max Marks	Internal Min Marks	University		Hours	Max Marks	Min Marks		
1	DSC-D	2	3	2.4	4	6.4	8	10	4	2	40	80	28	As per BOS Guide-lines	100	35
2	DSC-D	2	3	2.4				10	4	2	40					
3	DSC-D	2	3	2.4				10	4	2	40					
4	DSC-D	2	3	2.4	4	6.4	8	10	4	2	40					
5	DSC-D	2	3	2.4				10	4	2	40					
6	DSC-D	2	3	2.4	4	6.4	8	10	4	2	40					
7	AECC-C AECC-D	---	---	---	---	---	---	---	---	3	70	100	25			
										Project	30		10			
8	SEC-IV	Any one from pool of courses			2	---	---							2	50	18
	TOTAL	12	18	14.4	14	19.2	24					400	---		350	
		28	40	32	28	38.4	48					750	--	---		
<ul style="list-style-type: none"> Student contact hours per week: 36.8 Hours (Min.) 							<ul style="list-style-type: none"> Total Marks for B.Sc.-II (Including EVS) 1100 									
<ul style="list-style-type: none"> Theory and Practical Lectures :48 Minutes Each 							<ul style="list-style-type: none"> Total Credits for B.Sc.-II (Semester III & IV): 56 									
<ul style="list-style-type: none"> DSC: -Discipline Specific Core Course: Select any 3subject pairs, relevant to those opted at B. Sc. I, from DSC C1 to DSC C38 and / or DSC IC39 to DSC IC50 and DSC D1 to DSC D38 and/or DSC ID39 to DSC ID50. 																
<ul style="list-style-type: none"> AECC- Ability Enhancement Compulsory Course (C): Environmental Studies: EVS Theory and AECC-D EVS Project (Theory:70 & Project:30 marks) 																
<ul style="list-style-type: none"> <i>There shall be separate passing for internal and University theory as well as practical / project examinations.</i> 																
<ul style="list-style-type: none"> <i>Practical Examination shall be conducted annually for 100 Marks per course (subject) and minimum 35 marks are required for passing.</i> 																
<ul style="list-style-type: none"> <i>Except Environmental Studies, there shall be combined passing for two theory papers of 40 marks each. i. e. minimum. 28 marks are required for passing out of 80.</i> <i>Minimum 4 marks are required for passing out of 10 for Internal Examination of each paper.</i> <i>Examination of SEC shall be either theory or practical depending upon type of SEC.</i> 																

Ordinance and Regulations: (As applicable to Degree Course)

A] Shivaji University, Kolhapur

Revised syllabus for Bachelor of Science

1. TITLE: Subject-Biochemistry

Optional under the Faculty of Science

2. YEAR OF IMPLEMENTATION:- Revised Syllabi (As per NEP 2020) will be implemented from June 2023 onwards.

3. PREAMBLE:-

[**Note:** - The Board of Studies should briefly mention foundation, core and applied components of the course/paper. The student should get into the prime objectives and expected level of study with required outcome in terms of basic and advance knowledge at examination level.]

4. GENERAL OBJECTIVES OF THE COURSE:

(As applicable to the Degree concerned) Objectives:-

1. Demonstrate knowledge and understanding of the molecular machinery of living cells.
2. Demonstrate knowledge and understanding of the principles that govern the structures of macromolecules .
3. Demonstrate knowledge and understanding of the principles and basic mechanisms of metabolism.
4. Use basic laboratory skills and apparatus to obtain reproducible data from biochemical experiments;
5. Implement experimental protocols, and adapt them to plan and carry out simple investigations;
6. analyse, interpret, and participate in reporting to their peers on the results of their laboratory experiments;
7. participate in and report orally on team work investigations of problem-based assignments;
8. build on their knowledge and understanding in tackling more advanced and specialized courses, and more widely to pursue independent, self-directed and critical learning.

5. DURATION

The course shall be a fulltime course.

6. PATTERN:-

Pattern of examination will be semester.

7. FEE STRUCTURE:-

As per Government / University rules

1. Refer brochure and prospectus of concern affiliated college/institute to Shivaji University, Kolhapur.
2. Other fee will be applicable as per rules and norms of Shivaji University, Kolhapur.

8. ELIGIBILITY FOR ADMISSION:

As per guidelines obtained from Shivaji University, Kolhapur by following rules and regarding reservations by Govt. of Maharashtra

9. MEDIUM OF INSTRUCTION:

The medium of instruction shall be in English.

10. STRUCTURE OF THE COURSE - B. Sc. II Biochemistry

SECOND YEAR (SEMESTER III / IV) (NO. OF PAPERS 4)

Sr. No.	Subjects/Papers	Theory	Internal	Total Marks
1.	Paper-V	40	10	50
2.	Paper-VI	40	10	50
3.	Paper-VII	40	10	50
4.	Paper-VIII	40	10	50
	Practical-I			50
	Practical-II			50
Total				300

11. SCHEME OF TEACHING AND EXAMINATION:-

[The scheme of teaching and examination should be given as applicable to the course/paper concerned.]

SECOND YEAR- SEMESTER–III/IV: Biochemistry (Optional)

Scheme of Teaching and Examination

Sr. No.	Subject/Paper	Teaching Scheme (Hrs/Week)				Examination Scheme (Marks)		
		L	T	P	Total	Theory	Term Work	Total
Semester-III								
1	Paper-V	03	-	-	03	40	10	50
2	Paper-VI	03	-	-	03	40	10	50
Semester-IV								
3	Paper-VII	03	-	-	03	40	10	50
4	Paper-VIII	03	-	-	03	40	10	50
	Practical- I (annual)	-	-	04	04	-	-	50
	Practical- II (annual)	-	-	04	04	-	-	50
	Total	06	-	08	14	-	-	300

12. SCHEME OF EXAMINATION:-

- The examination shall be conducted at the end of each term for semester pattern.
- The theory paper shall carry 40 marks.
- The evaluation of the performance of the students in theory papers shall be on the basis of Semester Examination of 40 marks.
- The internal evaluation for each paper shall carry 10 marks. (Semester III: Group activity and Semester IV: Case study/Oral examination)
- Question paper will be set in the view of the /in accordance with the entire syllabus and preferably covering each unit of syllabi.

13. STANDARD OF PASSING:-

As prescribed under rules and regulation for each degree.

14. NATURE OF THEORY QUESTION PAPER AND SCHEME OF MARKING:

- Q. 1. Multiple choices questions (8-questions) --- 8 Marks
- Q. 2. Attempt **any two** of the following (out of three).
(Essay type / Broad answer questions)---- 16 Marks
- Q. 3. Write short notes (**any four**) (out of six). 16 Marks

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

(Introduced from June 2023 onwards)

Old Syllabus (Semester pattern)		Revised Syllabus (Semester pattern)		
Paper No.	Title of Old Paper	Semester No.	Paper No.	Title of New Paper
V	Metabolism of Carbohydrates	Semester-III	V	Metabolism of Carbohydrates and Lipids.
VI	Metabolism of Amino acids and Nutrition		VI	Metabolism of Amino acids and Nutrition
VII	Gene organization, Replication and Repair	Semester-IV	VII	Gene organization, Replication and Repair
VIII	Biochemical Techniques		VIII	Biochemical Techniques

16. SPECIAL INSTRUCTIONS, IF ANY

SEMESTER-III

Biochemistry Paper V: DSC C : Metabolism of Carbohydrates and Lipids.
CREDITS: 2, LECTURE PERIOD: 3 PER WEEK LECTURE HOURS: 3
PER WEEK, MARKS: 50

UNIT	SUBUNIT	TOPIC	LECTURE PERIOD
1.	Metabolism of Carbohydrates		15
	A. Glycolysis and TCA cycle:	Glycolysis - a universal pathway, reactions and energetics of glycolysis, Anaerobic glycolysis for ethanol production and its energetic Oxidation of pyruvate to acetyl CoA, PDH complex. Citric acid cycle, amphibolic role, glyoxalate pathway,	08
	B. Carbohydrate metabolism:	Synthesis of glucose from non-carbohydrate sources, pentose phosphate pathway and its importance. Glycogenesis and glycogenolysis	07
		1.6	
2.	METABOLISM OF LIPIDS		15
	A. Fatty acid oxidation:	Digestion, mobilisation and transport of cholesterol and triacylglycerols, fatty acid transport to mitochondria, β oxidation offatty acid, ω oxidation, ketone bodies metabolism, ketoacidosis.	09
	B. Fatty acid synthesis:	Fatty acid synthase complex. Biosynthesis fattyacids and energetic	06

SEMESTER-III
BIOCHEMISTRY Paper VI: DSC C : METABOLISM OF AMINO ACIDS AND NUTRITION
CREDITS: 2, LECTURE PERIOD: 3 PER WEEK LECTURE
HOURS: 3 PER WEEK, MARKS: 50

UNIT	SUBUNIT	TOPIC	LECTURE PERIOD
1.	A. Amino Acid Metabolism:		15
	Amino acid metabolism:	General reactions of amino acid metabolism i) Transamination ii) Deamination iii) Decarboxylation Urea cycle, Inborn errors of amino acid metabolism viz i) PKU ii) Alkaptonurea iii) tyronosis	08
	B. Nutrition:	Nutrition, food, nutrient definition Balanced diet- Source, requirement Nutritional aspects of carbohydrates, proteins and lipids. Brief account of Vitamines and Minerals in the diet.	07
2.			15
	A. Calorimetry	Calorific value of food stuffs and its measurements (Bomb calorimeter), Respiratory quotient, BMR and its measurement; (Douglass bag method) Factor affecting BMR and its significance	06
	B. Biological Oxidation	High energy compounds and their significance viz ATP, PEP, 1,3-DPG. Mitochondrial respiratory chain, components and carriers of ETC, Inhibitors of ETC. Mechanism of oxidative phosphorylation (Chemiosmotic hypothesis)	09

SEMESTER-IV
Biochemistry Paper VII:
DSC D: GENE ORGANIZATION, REPLICATION AND REPAIR
Biochemistry CREDITS: 2, LECTURE PERIOD: 3 PER WEEK
LECTURE HOURS: 3 PER WEEK, MARKS: 50

Module	Sub-Module	Topics	Lecture Period
1			15
	A. Replication & Transcription:	Introduction to central dogma process. Mechanism of prokaryotic replication. Mechanism of prokaryotic transcription.	07
	B. Translation :	Mechanism of prokaryotic translation. Genetic code Regulation of gene expression with Operon concept (<i>E.coli</i> Operon model)	08
2			15
	A. Chromosome and packing of DNA :	Chromosome structure Gene- gene number, gene cluster and pseudogene. Polytene and Lampbrush chromosome. Role of Histone proteins, Packing of DNA, supercoiled DNA, nucleosome.	07
	B. Mutations	Types of mutations - transition, transversion, frame shift mutations, mutations induced by chemicals, radiation, transposable elements, Repair of DNA damage - direct repair, base excision repair, nucleotide excision repair, and recombination repair, Ames test.	08

SEMESTER-IV
Biochemistry Paper VIII: DSC D: Biochemical Techniques
CREDITS: 2, LECTURE PERIOD: 3 PER WEEK
LECTURE HOURS: 3 PER WEEK, MARKS: 50

Module	Sub-Module	Topics	Lecture Period
1			15
	A. Absorption spectroscopy:	Beer Lambert's Law its mathematical derivation. meaning of the terms- transmittance, absorbance, molar and specific absorbance. Limitations of Beer Lambert's law. Construction, working and application of Colorimeter and Spectrophotometer. Advantages of spectrophotometer over colorimeter Absorption spectra of proteins, nucleic acids, cytochrome and NAD ⁺ .	08
	B. Enzyme immobilization:	Introduction, Definition, types and techniques of immobilization- Adsorption on carriers, Covalent binding, intermolecular crosslinking, gel entrapment. Industrial applications of Immobilization	07
2			15
	A. Chromatography	Introduction, definition and classification. Principle, technique and applications of Paper and Thin layer chromatography. (Discussion should include selection of adsorbent and types of adsorbents, preparation of plates, column packing, sample application and mechanism of separation. Important application and advantages) Introduction, definition, principle, technique and applications of Ion exchange and Gel permeation chromatography. (Discussion should include selection of matrix, column packing, sample application, mechanism of separation. Important application and advantages)	09
	B. Electrophoresis:	Definition of the terms electrophoresis - electrophoretic mobility, Factors affecting electrophoretic mobility. Principle, technique and applications of paper and starch gel electrophoresis. (Discussion should include preparation of gel plates, sample application, mechanism of separation , development of plates, applications and Advantages of method)	06

Practical - I

A. Colorimetric estimations:

1. Estimation of inorganic phosphate by Fiske-Subbarow method. (1)
2. Estimation of glucose from blood, Folin-Wu or o-Toluidine method. (1)
3. Estimation of RNA by Bial's orcinol method. (1)
4. Estimation of creatinine in urine. (1)
5. Estimation of urea from blood by DAM method.(1)

B. Isolations:

1. Extraction of lecithin from egg yolk.(1)
2. Isolation of DNA (1)

C. Problems on Bioinformatics:

1. Problems on DNA - RNA sequence (2)
2. Genetic code (2)
3. Bioinformatics experiment To determine three dimensional structure of proteins by visualizing software - RasMol. (2)
4. Browsing and understanding NCBI Web page, Introduction to literature database-PubMed. (1)

Practical - II

A. Enzyme Study:

1. Estimation of diastase (amylase) activity (1)
2. Quantitative Estimation of amylase activity. (2)
3. Immobilization of baker's yeast cells by gel entrapment for invertase activity.(2)

B. Volumetric Estimations:

1. Estimation of total chlorides in urine by Volhard's method (1)
2. Determination of saponification value of oil. (1)
3. Determination of iodine number of oil. (1)

C. Qualitative Analysis:

1. Detection of normal and abnormal constituents of urine. (2)
2. Determination of blood groups.(1)
3. Qualitative analysis of saturated and unsaturated lipids. (2)

D. Demonstration Experiments:

1. Separation of indicators/ proteins by gel electrophoresis. (1)
2. Separation of amino acids by paper electrophoresis. (1)

PRACTICALS IN BIOCHEMISTRY

Study Tour:

There shall be a study tour for not more than four days to visit industries and institutions of biochemical importance. One teacher will accompany a batch of 16 students. As per university rules T.A. and D.A. should be paid to the teacher.

List of the Laboratory Equipments :

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

Reference Books for Theory & Practical :

1. Practical Biochemistry-David Plummer (Tata McGraw Hill)
2. Biochemical Methods- Sadashivam and Manikam
3. Introductory Practical Biochemistry-Sawhney S.K. and RandhirSingh (Narosa publication).
4. Hawk's Physiological Chemistry-Oser
5. Viva and Practical Biochemistry-Dr. A. C. Deb (New central Book Limited).
6. Introduction to Practical Biochemistry - P. D. Boyer (Wiley International).
7. Biochemistry-Lubertstryer
8. Introduction to Bioinformatics-T.K.Attwood & D.J.Parry- Smith
9. Cell and Molecular Biology-P.K.Gupta
10. Biophysical Chemistry – Nath, Nath &Upadhya

Course Outcomes:

Paper V:

After successful completion of the course, the students will be able

1. Demonstrate the metabolic processes through which the energy is produce, utilized.
2. Describe what happens: - when lipids are metabolized.
3. Illustrate the metabolism of carbohydrates through various anabolic and catabolic pathways like glycolysis, Kreb's cycle, Glycogen metabolism, glucuronic acid cycle etc.
4. Describe the physiology of Digestion in mammals.

Paper VI:

After successful completion of the course, the students will be able

1. Learn how amino acids and proteins are metabolized, emphasizing the role of few intermediates of their metabolism,
2. monitoring the deficiency and abundance disorders of amino acid metabolisms and the role of enzymes.
3. To learn glycemic index, balanced diet and RDA.
4. Understand the concept of BMR and its measurements and biological oxidation.

Paper VII:

After successful completion of the course, the students will be able

1. Understand the central dogma and process of gene expression and replication in prokaryotes and its regulation.
2. To learn the genetic code.
3. Understand the genome organization in chromosome and types of chromosomes.
4. To learn basic concepts of mutations, DNA damage and repair.

Paper VIII:

After successful completion of the course, the students will be able

1. Understanding the principles of Electrophoresis, Spectrophotometry and their applications in biological investigations/experiments.
2. Understanding the applications of centrifugation and chromatography in biological investigations.
3. The students will obtain hands-on training in basic separation techniques in biochemistry like chromatography.
4. To learn basic concepts of enzyme immobilizations.