

Shree Warana Vibhag Shikshan Mandal's

**WARANA UNIVERSITY,
WARANANAGAR**

(A State Public University established under Section 3 (6) of MPUA, 2016)

॥ विद्या सर्वस्य भूषणम् ॥



Established: 2025

**Structure & Syllabus For
Bachelor of Science (B. Sc.)
Biochemistry**

UNDER

Faculty of Science & Technology

B. Sc. Part - II (Semester - III and IV)

**(As Per National Education Policy – 2020)
With Effect from Academic Year 2026-27 Onwards**

1. Year of Implementation: Revised Syllabus will be implemented from June 2026 onwards.

2. Preamble:

The National Education Policy 2020 for higher education aims to transform the existing higher education system in India. This policy emphasizes promoting interdisciplinary studies, introducing new subjects, and providing flexibility in courses and fresh opportunities for students. It aims to increase the Gross Enrolment Ratio (GER) in higher education, provide multiple entry and exit options, and allow students to choose courses according to their interests and aptitude. The policy envisions setting up of a National Research Foundation, a National Education Technology Forum, and setting up of more Higher Education Institutions in the country. The policy is aimed at creating a holistic and flexible education system that is adaptive to the needs of the 21st century.

The B.Sc. Biochemistry 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 students for higher studies including research.

3. Program Specific Outcomes (PSOs):

A candidate who wishes to graduate in B.Sc. (Biochemistry Course) needs to have acquired/developed following competencies:

1	PSO-1: - Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learnt in the classroom.
2	PSO-2: - Develop the ability to apply the knowledge acquired in classroom and laboratories to specific problems in theoretical and experimental Biochemistry.
3	PSO-3: - Identify the area of interest in the academic research and development.
4	PSO-4: - Perform job in various fields like food, pharmaceutical, agriculture, health care, public services and business etc.

3. Duration of the Program: The course shall be a full-time course.

4. Medium of Instruction: The medium of instruction shall be English.

5. Eligibility for Admission: The criterion for admission is as per the rules and regulations set from time to time by concerned departments, HEIs, university, government, and other relevant statutory authorities.

6. Scheme of Teaching and Examination Pattern (Theory/Practical/Internal):

The scheme of teaching and examination for a program of study as approved by the Academic Council / Board of Studies.

Each theory course is of 2 credits and require 30 hours of teaching. There shall be two lectures per theory course per week. Each practical course is of 2 credits and require 60 hours of teaching.

The pattern of examination will be Semester End Examination with Internal Assessment/Evaluation. Note: Separate passing is mandatory for both, Semester End Examination and Internal Assessment/ Evaluation.

7. Equivalence of the papers:

Two additional chances shall be provided for the repeater students of old three-year B.Sc. immediate after their Semester VI or VIII. After that the students concerned shall have to appear for the Examination as per this revised pattern. Equivalence of papers shall be provided as per revised syllabus for the pattern in accordance with NEP.

8. Programme Structure

WARANA UNIVERSITY, WARANANAGAR NEP-2020 (2.0): Credit Framework for UG (B. Sc. II) 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
	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

T : Theory

P: Practical

OE: Generic/Open Elective

VSC: Vocational Skill course

SEC: Skill Enhancement Courses

AEC: Ability Enhancement Course (English)

DSC: Discipline Specific Course

DSE: Discipline Specific Elective Course

VEC: Value Education Courses (Environmental
Science)

IKS: Indian Knowledge System

OJT: On Job Training

FP: Field Projects

CEP: Community Engagement Practice

CC: Co-Curricular Courses

RP: Research Project

IDC: Interdisciplinary Course

9. Standard of Passing and Determination of SGPA/CGPA, Grading and Declaration of Results:

The Standard of passing shall be 35%. For B. Sc. (all Semesters) the student shall have to score as per this standard of passing shown in the following table:

Maximum Marks	100	80	50	40	20	10
Minimum Marks required for passing	35	28	18	14	7	4

There shall be a separate head of passing in Theory and Internal Examination. However, ATKT rules shall be made applicable in respect of Theory courses (University examination) only. For Environmental Studies (Semester IV, Examination) the student shall have to score marks 13 marks out of 35 in theory course and 5 marks out of 15 for project work.

Gradation Chart:

Marks Obtained	Numerical Grade (Grade Point)		CGPA	Letter Grade
Absent	0 (zero)		-	-
0 – 34	0 to 4		0.0 – 4.99	F (Fail)
35 – 44	5		5.00 – 5.49	C
45 – 54	6		5.50 – 6.49	B
55 – 64	7		6.50 – 7.49	B+
65 – 74	8		7.50 – 8.49	A
75 – 84	9		8.50 – 9.49	A+
85 – 100	10		9.50 – 10.0	O (Outstanding)

Note:

1. Marks obtained ≥ 0.5 shall be rounded off to next higher digit.
2. The SGPA & CGPA shall be rounded off to 2 decimal points.

Calculation of SGPA & CGPA:

1.Semester Grade Point Average (SGPA)

$$SGPA = \frac{\sum(\text{Course credits} \times \text{Grade point obtained}) \text{ of a semester}}{\sum(\text{Course credits}) \text{ of a respective semester}}$$

2. Cumulative Grade Point Average (CGPA)

CGPA

$$= \frac{\sum(\text{Total credits of a semester} \times \text{SGPA of respective semester}) \text{ of all semester}}{\sum(\text{Total course credits}) \text{ of all semesters}}$$

10. Nature of Question Paper, Duration and Scheme of Marking:

- **Theory Examinations**

- Maximum Marks : 30
- Duration : 1 hr 30 min
- Nature of the Theory Examination Question Paper and Scheme of Marking

Question No.	Nature/Type of Question	Marks
1	Multiple Choice Questions (MCQs) (6 Questions)	6 Marks (1 Mark for Each Question)
2	Broad Answer/Descriptive Type Questions (Attempt Any 2 Out of 3)	12 Marks (6 Marks for Each Question)
3	Short Note Type Questions (Attempt Any 3 Out of 5)	12 Marks (4 Marks for Each Question)
	Total Marks	40

- **Practical Examinations**

The practical examination will be conducted on two consecutive days for six hours per day per batch.

Each candidate must produce a certificate from the Head of the Department in his/ her college, stating that he/she has completed in a satisfactory manner the practical course on lines laid down from time to time by Academic Council on the recommendations of Board of Studies and that the journal has been properly maintained. Every candidate must have recorded his/her observations in the laboratory journal and have written a report on each exercise performed. Every journal is to be checked and signed periodically by a member of teaching staff and certified by the Head of the Department at the end of the semester. Candidates must produce their journals at the time of practical examinations.

Candidates have to visit at least one place of microbiological interest (pharmaceutical / industry/dairy/research institute etc.) and submit the report of their visit.

Nature of the Practical Examination Question Paper and Distribution of Marks

- Semester III**

Question No.	Nature/Type of Question	Marks
1	Biochemical Estimations	10
2	Qualitative Detections	10
3	Biological Isolations	10
4	Spotting	10
5	Journal	10
Total Marks		50

- Semester IV**

Question No.	Nature/Type of Question	Marks
1	Biochemical Estimations	10
2	Qualitative Detections	10
3	Biological Isolations	10
4	Tour report	10
5	Journal	10
Total Marks		50

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**Structure and Syllabus in Accordance with
National Education Policy - 2020 (NEP 2.0)
with Multiple Entry and Multiple Exit**

Syllabus For

B.Sc. Part II

BIOCHEMISTRY

(MAJOR COURSE)

(Faculty of Science and Technology)

SEMESTER III AND IV

(To Be Implemented from Academic Year 2026-27)

B.Sc. Part II (NEP 2.0) Semester- III

COURSE- V: ENZYMOLOGY (MAJOR COURSE) [CREDITS - 02; LECTURES - 30 Hours; LEC/WEEK – 02]		
Learning Objectives 1. Understand classification and specificity of enzymes. 2. Discuss mechanism of enzyme action and enzyme kinetics. 3. Explain activation and deactivation of regulatory enzymes. 4. Explore different Industrial Applications of enzymes.		
Module I	Basic concepts in Enzymology	No. of hours: 15
• Definition and historical background of enzyme • Terminologies - intracellular enzymes, extracellular enzymes, holoenzymes, apoenzymes, prosthetic group, cofactor, coenzymes, isoenzymes, katal, international unit, turnover number and active site. • Nomenclature and classification (IUB) of enzymes • Factors affecting enzyme activity - effect of substrate concentration, enzyme concentration, product concentration, pH, temperature, activators, time, light and radiation. • Specificity of enzyme action - absolute specificity, group specificity, optical specificity and geometrical specificity. • Active site - definition and salient features of active site. Industrial applications of enzymes		
Module II	Enzyme Kinetics and Inhibition	No. of hours: 15
• Mechanism of enzyme action – lowering of activation energy, lock and key model, induced fit model. • MichaelisMenten Equation: derivation, K_m V_{max} • Transformation of Michaelis –Menten equation: Lineweaver-Burk plot, Eadie-Hofstee plot • Inhibition: Irreversible and reversible inhibition • Reversible inhibition- competitive, non-competitive and uncompetitive inhibition with examples. • Factors contributing to the catalytic efficiency of enzymes: proximity and orientation of the substrate, covalent catalysis, acid-base catalysis, factor of strain in enzyme catalysis		

COURSE VI: BIOENERGETICS AND METABOLISM

(MAJOR COURSE)

[CREDITS - 02; LECTURES - 30 hours; LEC/WEEK – 02]

Learning Objectives

1. Acquire the knowledge of various catabolic and anabolic reactions related to carbohydrate and amino acids.
2. To understand basic concepts of bioenergetics.
3. To learn the basics of metabolic regulations.
4. To apply basic knowledge of metabolic reactions to industrial applications.

Module I

BIOENERGETICS AND GLYCOBIOLOGY

No. of
hours: 15

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.

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.

Module II	BIOLOGICAL OXIDATION AND METABOLISM OF LIPIDS, AMINO ACIDS	No. of hours: 15
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.		

PRACTICAL COURSE III (MAJOR COURSE) [CREDITS -02, TOTAL HOURS- 60, PRACTICALS /WEEK - 04]		
Learning Objectives 1. Understand effect of various factors on enzyme activity. 2. Calculate K_m and V_{max}, immobilize enzymes/cells and explore its applications. 3. Isolate enzymes by methods like salt/solvent precipitation. 4. Estimate various clinically important components and understand their clinical significance		
Module I	1) Estimation of maltose by DNSA Method. 2) Determination of amylase activity. 3) Determination of specific activity of amylase enzyme. 4) Estimation of blood glucose by suitable method. 5) Estimation of hemoglobin and its significance. 6) Determination of effect of suitable inhibitor on amylase enzyme. 7) Determination of effect of temperature and pH on amylase enzyme.	No. of hours :30

Module II	1) Immobilization of suitable enzyme/ yeast cell 2) Isolation of amylase by salt precipitation method. 3) Isolation of enzyme by solvent precipitation method. 4) Qualitative determination amylase activity in precipitated sample. 5) Detection of abnormal constituents of urine: Sugar, protein, ketone bodies and bile and Pigments. 6) Estimation of serum cholesterol by colorimetric method	No. of hours :30
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B.Sc. Part II (NEP 2.0) Semester-IV

COURSE VII: MOLECULAR BIOLOGY (MAJOR COURSE) [CREDITS - 02; LECTURES - 30 hours; LEC/WEEK – 02]		
Learning Objectives: 1. Explain the organization of genes and genomes in prokaryotes and eukaryotes, including chromatin organization and nucleosome structure. 2. Describe the molecular mechanisms of DNA replication, transcription, and translation along with the role of enzymes and regulatory elements involved in gene expression. 3. Interpret post-transcriptional and post-translational modifications, genetic code characteristics, operon concept, and regulation of gene expression in prokaryotes. 4. Classify different types of mutations and evaluate mechanisms of DNA damage and repair, including mutagenicity testing such as the Ames test.		
Module I	Genome organization, Replication and Transcription	No. of hours: 15
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 Messelson–Stahl experiment of semiconservative DNA replication. DNA replication in prokaryotes: enzymes and proteins involved in replication. Transcription in prokaryotes: types of RNA polymerases. DNA elements in transcription: promoters, enhancers, silencers, transcription factors and inhibitors of transcription. Structure of mRNA in prokaryotes and eukaryotes. Post-transcriptional processing in eukaryotes: splicing, capping and polyadenylation. Codon, characteristics of genetic code and wobble hypothesis. Reverse transcription, transposons and retrotransposons.		
Module II	Translation and Mutation	No. of hours: 15

Translation: Mechanism of translation in prokaryotes: amino acid activation, initiation, elongation, and termination. Posttranslational modification in eukaryotes. Inhibition of protein synthesis by antibiotics. 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, transposable elements, Repair of DNA damage - direct repair, base excision repair, nucleotide excision repair, and recombination repair Ames test.

COURSE VIII: NANOBIO TECHNOLOGY

(MAJOR COURSE)

[CREDITS - 02; LECTURES - 30 hours; LEC/WEEK – 02]

Learning Objectives:

1. To understand the fundamental concepts, historical development, and significance of Nanobiotechnology along with different types of nanomaterials and their applications.
2. To study the synthesis, characterization, and properties of nanoparticles, nanofilms, nanovesicles, nanospheres, and nanocapsules used in biological systems.
3. To explore the role of nanoparticles in drug delivery, diagnostics, imaging, biosensor development, and cancer therapy.
4. To understand the applications of nanobiocatalysts and nanoscaffolds in catalysis, pharmaceutical production, and other biomedical applications.

Module I	Introduction to nanobiotechnology	No. of hours: 15
Introduction to Nanobiotechnology; Concepts, historical perspective; Different formats of nanomaterials and applications with example for specific cases; Cellular Nanostructures; Nanopores; Biomolecular motors; Bio-inspired Nanostructures, Synthesis and characterization of different nanomaterials.		
Module II	Nano Particles, Nano Films and Their Applications	No. of hours: 15

Nano Particles and Nanofilms

Nanoparticles for drug delivery, concepts, optimization of nanoparticle properties for suitability of administration through various routes of delivery, advantages, strategies for cellular internalization and long circulation, strategies for enhanced permeation through various anatomical barriers. Thin films; Colloidal nanostructures; Self Assembly, Nanovesicles; Nanospheres; Nanocapsules and their characterisation.

Applications of Nanoparticles

Nanoparticles for diagnostics and imaging (theranostics); concepts of smart stimuli responsive nanoparticles, implications in cancer therapy, nanodevices for biosensor development. Nanomaterials for catalysis, development and characterization of nanobiocatalysts, application of nanoscaffolds in sythesis, applications of nanobiocatalysis in the production of drugs and drug intermediates.

PRACTICAL COURSE IV (MAJOR COURSE) [CREDITS -02, TOTAL HOURS- 60, PRACTICALS /WEEK - 04]		
Learning Objectives: 1. To develop practical skills in the synthesis and characterization of nanoparticles using chemical and biological methods. 2. To understand techniques involved in biomolecule isolation, purification, and analysis including DNA, RNA, proteins, and enzymes. 3. To gain hands-on experience in analytical and separation techniques such as chromatography, spectroscopy, and agarose gel electrophoresis. 4. To understand the applications of nanobiotechnology and molecular biology techniques in drug delivery, diagnostics, and biomedical research.		
Module I	1) Synthesis of Nanoparticles by chemical method. 2) Synthesis of Nanoparticles by biological method. 3) Characterization of Nanoparticles. 4) Preparation of Alginate nanobeads for drug delivery. 5) Separation of Protein by Column chromatography. 6) Synthesis of Iron oxide nanoparticles by wet chemical method. 7) Synthesis of Gold Nanoparticles by biogenic methods. 8) Synthesis of Silver Nanoparticles by biogenic methods. 9) Isolation of enzymes involved in biosynthesis of nanomaterials. 10) FTIR spectroscopy analysis of given nanomaterial.	No. of hours: 30
Module II	1) Hydrolysis of DNA and separation of nucleotide bases by paper chromatography 2) Ultraviolet absorption spectrum of DNA and estimation of concentration by A260 method 3) Colorimetric estimation by DNA by diphenylamine (DPA) method 4) Isolation of microbial DNA 5) Isolation of plant and animal DNA 6) Agarose gel electrophoresis 7) Estimation of RNA by Orcinol method	No. of hours: 30

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Structure and Syllabus in Accordance with
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Syllabus For

B.Sc. Part II

SKILL ENHANCEMENT COURSE
IN BIOCHEMISTRY

(Faculty of Science and Technology)

SEMESTER III AND IV

(To Be Implemented from Academic Year 2026-27)

B.Sc. Part II (NEP 2.0) Semester-III

SKILL ENHANCEMENT COURSE-1 (SEC- 1):

Introduction to Artificial Intelligence-I

[CREDITS -02, TOTAL HOURS- 60, PRACTICALS /WEEK - 04]

Learning Objectives

1. To provide hands-on exposure to basic AI tools and applications.
2. To develop skills in scientific data handling and interpretation.
3. To familiarize students with AI-assisted scientific analysis.
4. To introduce simple machine learning activities without programming complexity.
5. To improve scientific problem-solving using AI platforms.

Practical No.	Title of Experiment
1	Introduction to Artificial Intelligence tools and applications.
2	Study of AI platforms such as ChatGPT, Google Gemini and Microsoft Copilot.
3	Exercise on prompt writing and effective communication with AI systems.
4	Identification and documentation of AI applications used in daily life.
5	Collection and organization of scientific datasets using spreadsheet software.
6	Preparation of graphical representations of data (bar graph, pie chart, line graph).
7	Demonstration of basic machine learning using Teachable Machine.
8	Image classification using AI tools.
9	Study of AI applications in Biological Sciences and Bioinformatics.
10	AI-assisted literature search using Google Scholar and PubMed.

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

SKILL ENHANCEMENT COURSE- 2 (SEC-2):

A.I APPLICATIONS IN BIOCHEMISTRY

[CREDITS -02, TOTAL HOURS- 60, PRACTICALS /WEEK - 04]

Learning Objectives

1. To introduce undergraduate students to basic applications of Artificial Intelligence in Biochemistry.
2. To develop practical skills in AI-assisted data collection, analysis, and interpretation in biochemistry experiments.
3. To familiarize students with simple AI tools useful in biochemical studies, fermentation analysis, and scientific documentation.
4. To integrate AI-based learning with routine microbiology laboratory practices suitable for rural and basic laboratories.

Practical No.	Title of Experiment
1	Introduction to Artificial Intelligence and its applications in Biochemistry.
2	Study of biological databases: NCBI, PubMed, Protein Data Bank
3	Retrieval of gene and protein information from biological databases.
4	Scientific literature search and AI-assisted summarization of biochemical research articles.
5	Study of nucleotide and protein sequence formats (FASTA format).
6	Sequence alignment using BLAST.
7	Multiple sequence alignment using Clustal Omega.
8	Comparative analysis of protein sequences and identification of conserved regions.
9	Identification of mutations from nucleotide or protein sequence data.
10	Basic phylogenetic analysis using sequence comparison tools.

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Syllabus For

B.Sc. Part II

BIOCHEMISTRY

(VOCATIONAL SKILL COURSE)

(Faculty of Science and Technology)

SEMESTER III AND IV

(To Be Implemented from Academic Year 2026-27)

**Structure and Syllabus in Accordance with
National Education Policy - 2020 (NEP 2.0)
with Multiple Entry and Multiple Exit**

Syllabus For

B.Sc. Part II

**VOCATIONAL SKILL COURSE
IN BIOCHEMISTRY**

(Faculty of Science and Technology)

SEMESTER III

(To Be Implemented from Academic Year 2026-27)

B.Sc. Part II (NEP 2.0) Semester-III

VOCATIONAL SKILL COURSE-1 (VSC- 1): MILK TESTING AND QUALITY CONTROL [CREDITS -02, TOTAL HOURS- 60, PRACTICALS /WEEK - 04]

Learning Objectives

1. To operate essential laboratory equipment used in milk testing and quality control
2. To perform accurate milk sampling, preservation, and physical analysis techniques
3. To apply the phosphatase test and other methods to ensure milk safety and pasteurization efficiency
4. To gain practical insights into industrial milk processing and quality assurance

Practical No.	Title of Experiment
1	Demonstration of laboratory equipment Incubator, Hot air oven, Water bath, Laminar air flow, Gerber's centrifuge
2	Milk sampling techniques and preservation of milk samples for different tests
3	Physical analysis of milk Organoleptic tests- Flavour, Colour, Taste
4	Chemical analysis of milk a) Measurement of pH of Milk and Milk Products b) Clot on Boiling c) Alcohol Test for Milk d) Inhibitor Test e) Acidity Test f) Detection of Adulterant- Soap, Common salt, SMP, Starch, Formalin, etc
5	Microbiological analysis of milk a) Dye Reduction Test – MBRT b) SPC for Milk c) Direct Microscopic Count d) Yeast or mold count e) Test for Coliforms
6	Phosphatase test

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**Structure and Syllabus in Accordance with
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with Multiple Entry and Multiple Exit**

Syllabus For

B.Sc. Part II

BIOCHEMISTRY

(OPEN ELECTIVE COURSE)

(Faculty of Science and Technology)

SEMESTER III AND IV

(To Be Implemented from Academic Year 2026-27)

**Structure and Syllabus in Accordance with
National Education Policy - 2020 (NEP 2.0)
with Multiple Entry and Multiple Exit**

Syllabus For

B.A. Part II /B. Com. Part II

OPEN ELECTIVE COURSE

IN BIOCHEMISTRY

SEMESTER III AND IV

(To Be Implemented from Academic Year 2026-27)

B. A. Part II / B. Com. Part II (NEP 2.0) Semester-III

OPEN ELECTIVE COURSE-3 (OE-3): Food

PURITY AND ADULTERATION

[CREDITS -02, TOTAL HOURS- 60, PRACTICALS

Learning Objectives

1. To develop practical skills for detecting adulterants in various food products.
2. To understand simple and effective methods for identifying food purity.
3. To promote awareness about food safety and consumer health.

Practical No.	Title of Experiment
1	Detection of detergent in milk.
2	Detection of starch in milk and milk products.
3	Detection of smashed potatoes and sweet potatoes and other starches in ghee/butter.
4	Detection of papaya seeds in black peppers.
5	Detection of artificial/synthetic colors in chilli powder.
6	Detection of cassia bark in cinnamon.
7	Detection of grass seeds colored with charcoal dust in cumin seeds.
8	Detection of lead chromate in turmeric whole.
9	Observation of the presence of microflora from soil
10	Observation of the presence of microflora on currency-coin

OPEN ELECTIVE COURSE-3 (OE-3):**शुद्धता आणि भेसळ****[CREDITS -02, TOTAL HOURS- 60, PRACTICALS /WEEK - 04]****शिकण्याची उशिष्टे**

1. विविध अन्नपदार्थांमधील भेसळ ओळखण्यासाठी आवश्यक प्रात्यक्षिक कौशल्य विकसित करणे.
2. अन्नाची शुद्धता तपासण्यासाठी सोप्या व प्रभावी पद्धती समजून घेणे.
3. अन्नसुरक्षा व ग्राहकांच्या आरोग्याविषयी जागरूकता निर्माण करणेसक्षमजीवांच्या िाढीला आळा घालण्यासाठी सच्छिता पद्धतींच्या प्रभाीतेचे मलूयांकि करणे.

अ. क्र.	प्रयोगाचे नाव
1	• दुधामधील डिटर्जंटची ओळख करणे.
2	• दूध व दुग्धजन्य पदार्थांमधील स्टार्चची ओळख करणे.
3	• तूप/लोणीमध्ये मिसळलेल्या बटाटा, रताळे व इतर स्टार्चयुक्त पदार्थांची ओळख करणे.
4	• काळी मिरीमध्ये पपईच्या बियांची भेसळ ओळख करणे.
5	• तिखटामधील कृत्रिम/रासायनिक रंगांची ओळख करणे.
6	• दालचिनीमध्ये कॅसिया सालाची भेसळ ओळख करणे.
7	• जिन्यामध्ये कोळशाच्या भुकटीने रंगविलेल्या गवताच्या बियांची ओळख करणे.
8	• हळदीमध्ये लेड क्रोमेटची भेसळ ओळख करणे.
9	• मातीमधील सूक्ष्मजीवांचे निरीक्षण करणे.
10	• नाण्यांवरील सूक्ष्मजीवांची उपस्थिती निरीक्षण करणे.

B. A. Part II / B. Com. Part II (NEP 2.0) Semester-IV

OPEN ELECTIVE COURSE- 4 (OE-4):

MICROSCOPY AND FOOD ADULTERATION

[CREDITS -02, TOTAL HOURS- 60, PRACTICALS /WEEK - 04]

अध्ययन उद्दिष्टे

1. विविध अन्नपदार्थामधील भेसळ ओळखण्यासाठी आवश्यक प्रात्यक्षिक कौशल्य विकसित करणे.
2. अन्नाची शुद्धता तपासण्यासाठी सोप्या व प्रभावी पद्धती समजून घेणे.
3. अन्नसुरक्षा व ग्राहकांच्या आरोग्याविषयी जागरूकता निर्माण करणे

Practical No.	Title of Experiment
1	Study of mitosis slide
2	Study of meiosis slide
3	Study of Glucose ozone crystal
4	Identification of starch (Spot test)
5	Identification of Protein (Spot test)
6	Identification of fat (Spot test)
7	BMI calculation
8	Introduction to dietary fibers
9	Study of commonly used biopesticides
10	Study of commonly used bioinsecticides

OPEN ELECTIVE COURSE- 4 (OE-4):**सूक्ष्मदर्शकशास्त्र आणि अन्नभेसळ****[CREDITS -02, TOTAL HOURS- 60, PRACTICALS /WEEK - 04]****शिकण्याची उशिष्टे**

1. िैसवगाक पृष्ठभागांर सक्ष्मजींांची िाढ करणे.
2. विविध अन्ि आवण ििस्पती उतपादांमध्ये सक्ष्मजींांमुळे होणाऱ्या खराबीचे विरीक्षण ि परीक्षण करणे.
3. डाळिगीय ििस्पतींमध्ये मुळांरिल गाठींचे महत्त्ि समज्ि घेणे.
4. ििस्पतींसाठी उपयुक्त सक्ष्मजीं सांिधांिची तयारी समज्ि घेणे.
5. प्रचवलत जैविक खते आवण जैविक कीटकिाशकांचे अध्ययि करणे.

अ. क्र.	प्रयोगाचे नाव
1	• समसूत्री विभाजन (Mitosis) स्लाइडचा अभ्यास.
2	• अर्धसूत्री विभाजन (Meiosis) स्लाइडचा अभ्यास.
3	• ग्लुकोज ओसाझोन स्फटिकांचा अभ्यास.
4	• स्पॉट टेस्टद्वारे स्टार्चची ओळख.
5	• स्पॉट टेस्टद्वारे प्रथिनांची ओळख.
6	• स्पॉट टेस्टद्वारे स्निग्ध पदार्थांची (फॅट्स) ओळख.
7	• बॉडी मास इंडेक्स (BMI) चे गणन.
8	• आहारातील तंतुमय पदार्थांचा (Dietary Fibers) परिचय व महत्त्व.
9	• सामान्यतः वापरल्या जाणाऱ्या जैविक कीटकनाशकांचा अभ्यास.
10	• सामान्यतः वापरल्या जाणाऱ्या जैविक किटकनाशकांचा अभ्यास.

LIST OF REFERENCE BOOKS FOR THEORY & PRACTICAL

1. Nelson, D.L. and Cox, M. M. (2009). Lehninger's Principles of Biochemistry.
2. Biochemistry - Lubert stryer.
3. Textbook of Biochemistry and Human Physiology - G .P. Talwar.
4. Harper's Review of Physiological Chemistry - H. A. Harper.
5. Fundamentals of Biochemistry - J. L.Jain.
6. Biochemistry - U. Satyanarayan Methods in Food and Dairy Microbiolgy by Harrigon.
7. Talwar G. P. (2002), Textbook of Human Biochemistry, 3rd edition, Prentice Hall India Learning Pvt. Ltd.
8. Agarwal G. R., Agarwal K., Agarwal O. P. (2014), Textbook of Biochemistry, Goel Publishing House, Meerut
9. Powar C. B. (2010), Cell Biology, Himalaya Publishing House, Mumbai
10. Powar C. B., Chatwal G. R. (2011), Biochemistry, Himalaya Publishing House, Mumbai Citric acid Biotechnology–J. Achrekar.
11. Enzyme Biotechnology–G. Tripathi.
12. Bio fertilizers– Arun Sharma.
13. Biochemistry–Agrawal / Parihar
14. Biotechnology–S. S. Purohit.
15. Agriculture Microbiology–G. Rangaswami & D. J. Bagyaraj
16. Text-book of Biotechnology–G. R. Chhatwal.
17. Pharmaceutical Biotechnology–Purohit / Kakrani / Saluja.
18. Practical Microbiology–R. C. Dubey and D. K. Maheshwari
19. Experimental Microbiology–Rakesh J. Patel & Kiran R. Patel. (Vol.I&II)
20. Fertilizer Control Order–1985 amended up to June, 2011
21. Practical Biochemistry by Plummer.

List of the minimum equipments for B.Sc. Part II Biochemistry course

All the equipments required for B.Sc. Part I Biochemistry course

