UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A ++' GRADE' UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION
(25/Oct./Adp./69)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the syllabi and courses of studies for **Post Graduate Programme** in **Biochemistry** under **NEP-2020** as per details given below:-

Two Year Post Graduate Programme under NEP-2020

Subject	Semester	For the examinations to be held in the year
Biochemistry	Semester-I	December 2025, 2026 and 2027
	Semester-II	May 2026, 2027 and 2028
	Semester-III	December 2026, 2027 and 2028
	Semester-IV	May 2027, 2028 and 2029

One Year Post Graduate Programme under NEP-2020

Subject	Semester	For the examinations to be held in the year
Biochemistry	Semester-I	December 2026, 2027 and 2028
	Semester-II	May 2027, 2028 and 2029

The Syllabi of the courses are also available on the University website: www.jammuuniversity.ac.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/25/10826-837
Dated: 08/10/25
Copy for information and necessary action to:

1. Dean, Faculty of Life- Science
2. Convener, Board of Studies in **Biotechnology/Biochemistry/Microbiology**
3. Director, CITES&M, University of Jammu for directing the concerned to upload the notification on University Website
4. All members of the Board of Studies
5. Joint Registrar (Evaluation/P.G. Exam.)
6. Programmer, Computer Section, Examination Wing

7/10/25
Joint Registrar (Academic)

7/7/25 9z 7/10/25

SYLLABI FRAMEWORK PG PROGRAMME BIOCHEMISTRY (2 YEAR)

PG Syllabi 2025

S. No.	Course No.	Course Title	No. of Credits	Credits Level	Credit Points	Course Type Core/Elective /Any other	Marks Theory	Marks Practical	Nature of Course Global	National	Regional	Skill	SWAYAM/MOOC	Vocational Course	Research Project/ Summer Internship/ Dissertation
1.	P2BCTC101	Fundamental of Molecular Biology	4	6.5	26	Core	100	-	✓	✓	✓	✓			
2.	P2BCTC102	Cellular Biology	4	6.5	26	Core	100	-	✓	✓	✓	✓			
3.	P2BCTC103	Chemistry of Biomolecules	4	6.5	26	Core	100	-	✓	✓	✓	✓			
4.	P2BCPC104	Laboratory course based on Fundamental of Molecular	2	6.5	13	Core	-	50	✓	✓	✓	✓			
5.	P2BCPC105	Laboratory course based on Cellular Biology	2	6.5	13	Core	-	50	✓	✓	✓	✓			
6.	P2BCPC106	Laboratory course based on Chemistry of Biomolecules	2	6.5	13	Core	-	50	✓	✓	✓	✓			
7.	P2BCTE107	Molecular Virology and Vaccinology	4	6.5	26	Elective	100	-	✓	✓	✓				
8.	P2BCTE108	Analytical techniques in Biology	4	6.5	26	Elective	100	-	✓	✓	✓	✓			
9.	P2BCTE109	Micronutrients and Mammalian Hormones	4	6.5	26	Elective	100	-	✓	✓	✓				
10	P2BCPE110	Laboratory course based on Molecular Virology and Vaccinology	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
11	P2BCPE111	Laboratory course based on Analytical techniques in Biology	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
12	P2BCPE112	Laboratory course based on Micronutrients and Mammalian Hormones	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
13	P2BCTC201	Recombinant DNA technology	4	6.5	26	Core	100	-	✓	✓	✓	✓			
14	P2BCTC202	Enzyme and enzyme technology	4	6.5	26	Core	100	-	✓	✓	✓	✓			
15	P2BCTC203	Plant Physiology and Biochemistry	4	6.5	26	Core	100	-	✓	✓	✓	✓			
16	P2BCPC204	Laboratory course based on Recombinant DNA technology	2	6.5	13	Core	-	50	✓	✓	✓	✓			
17	P2BCPC205	Laboratory course based on Enzyme and enzyme technology	2	6.5	13	Core	-	50	✓	✓	✓	✓			
18	P2BCPC206	Laboratory course based on Plant Physiology and Biochemistry	2	6.5	13	Core	-	50	✓	✓	✓	✓			
19	P2BCTE207	Applied Biotechnology	4	6.5	26	Elective	100	-	✓	✓	✓	✓			
20	P2BCTE208	Human diseases biology	4	6.5	26	Elective	100	-	✓	✓	✓	✓			
21	P2BCTE209	Proteomics and Metabolomics	4	6.5	26	Elective	100	-	✓	✓	✓	✓			
22	P2BCTE210	Laboratory course based on Applied Biotechnology	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
23	P2BCTE211	Laboratory course based on Human diseases and disorders*	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
24	P2BCTE212	Laboratory course based on Proteomics and Metabolomics	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
25	P2BCVC251	Industrial technology	4			Vocational	-	-	✓	✓	✓	✓		✓	
26	P2BCVC252	Diagnostic Techniques in Biochemistry and Microbiology	4			Vocational	-	-	✓	✓	✓	✓		✓	
27	P2BCTC301	Metabolism	4	6.5	26	Core	100	-	✓	✓	✓	✓			

28	P2BCTC302	Fundamentals of Genetics and Genomics	4	6.5	26	Core	100	-	✓	✓	✓	✓			
29	P2BCTC303	Biochemistry of Nutrition	4	6.5	26	Core	100	-	✓	✓	✓	✓			
30	P2BCTC304	Fundamental of Bioinformatics and Biostatistics	2	6.5	13	Core	50	-	✓	✓	✓	✓			
31	P2BCPC305	Laboratory course based on Metabolism	2	6.5	13	Core	-	50	✓	✓	✓	✓			
32	P2BCPC306	Laboratory course based on Molecular Genetics and Genomics	2	6.5	13	Core	-	50	✓	✓	✓	✓			
33	P2BCPC307	Laboratory course in Fundamental of Bioinformatics and Biostatistics	2	6.5	13	Core	-	50	✓	✓	✓	✓			
34	P2BCTE308	Artificial Intelligence in Biology	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
35	P2BCTE309	Computational Genomics	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
36	P2BCTE310	Microbiomics	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
37	P2BCTE311	Lab Course based on Artificial Intelligence in Biology	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
38	P2BCTE312	Lab Course based on Computational Genomics	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
39	P2BCTE313	Lab Course based on Microbiomics	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
40	P2BCMO351	MOOCs Course	4	6.5	13	Core	100	-	✓	✓	✓	✓	✓		
41	P2BCTC401	Immunology and Immunotechnology	4	6.5	26	Core	100	-	✓	✓	✓	✓			
42	P2BCTC402	Medical Biochemistry	4	6.5	26	Core	100	-	✓	✓	✓	✓			
43	P2BCPC403	Laboratory course based on Immunology and Immunotechnology	2	6.5	13	Core	-	50	✓	✓	✓	✓			
44	P2BCPC404	Laboratory course based on Medical Biochemistry	2	6.5	13	Core	-	50	✓	✓	✓	✓			
45	P2BCTE406	Functional Nutraceuticals	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
46	P2BCTE407	IPRs and Bioethics	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
47	P2BCTE408	Bio Entrepreneurship	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
48	P2BCTE409	Research methodology and Scientific communication	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
49	P2BCPRC410	Research Project	16	13	208	Core	400	-	✓	✓	✓	✓			

UNIVERSITY OF JAMMU

SYLLABI AND COURSE OF STUDY IN BIOCHEMISTRY

For the Examination to be held in Year 2025, 2026 & 2027

BIOCHEMISTRY COURSE

M.Sc. Biochemistry

2-year PG Program as per NEP-2020

Syllabus for 2-year PG Program as per NEP-2020

Scheme **Total Credits= 104**

Semester-I

COURSE CODE	PAPER	CREDITS
	Core Courses	
P2BCTC101	Fundamentals of Molecular Biology	4
P2BCTC102	Cellular Biology	4
P2BCTC103	Chemistry of Biomolecules	4
P2BCPC104	Laboratory course based on Molecular Biology	2
P2BCPC105	Laboratory course based on Cellular Biology	2
P2BCPC106	Laboratory course based on Chemistry of Biomolecules	2
	Electives*	
P2BCTE107	Molecular Virology and Vaccinology	4
P2BCTE108	Analytical Techniques in Biology	4
P2BCTE109	Micronutrients and Mammalian Hormones	4
P2BCPE110	Practical based on Molecular Virology and Vaccinology	2
P2BCPE111	Laboratory course based on Analytical techniques in Biology	2
P2BCPE112	Laboratory course based on Micronutrients and hormones	2
TOTAL		24

*Student will opt for only one elective course along with respective laboratory course

Semester-II

COURSE CODE	PAPER	CREDITS
	Core Courses	
P2BCTC201	Recombinant DNA Technology	4
P2BCTC202	Enzymes and Enzyme Technology	4
P2BCTC203	Plant Physiology and Biochemistry	4
P2BCPC204	Laboratory course based on Recombinant DNA Technology	2
P2BCPC205	Laboratory course based on Enzymes and Enzyme Technology	2
P2BCPC206	Laboratory course based on Plant Physiology and Biochemistry	2
	Electives*	
P2BCTE207	Applied Biotechnology	4
P2BCTE208	Human Disease Biology	4
P2BCTE209	Proteomics and Metabolomics	4
P2BCPE210	Laboratory course based on Applied Biotechnology	2
P2BCPE211	Laboratory course based on Human Diseases and Disorders	2
P2BCPE212	Laboratory course based on Proteomics and Metabolomics	2
P2BCVC251	Industrial technology	4
P2BCVC252	Diagnostic Techniques in Biochemistry and Microbiology	4
TOTAL		24

*Student will opt for only one elective course along with respective laboratory course

Syllabus for 2-year PG Program as per NEP-2020

Semester-III

COURSE CODE	PAPER	CREDITS
	Core Courses	
P2BCTC301	Metabolism	4
P2BCTC302	Fundamentals of Genetics and Genomics	4
P2BCTC303	Biochemistry of Nutrition	4
P2BCTC304	Fundamentals of Bioinformatics and Biostatistics	2
P2BCPC305	Laboratory course based on Metabolism	2
P2BCPC306	Laboratory course based on Molecular Genetics and Genomics	2
P2BCPC307	Laboratory course based on Fundamentals of Bioinformatics and Biostatistics	2
	Electives*	
P2BCTE308	Artificial Intelligence in Biology	2
P2BCTE309	Computational Genomics	2
P2BCTE310	Microbiomics	2
P2BCPE311	Laboratory course based on AI in Biology	2
P2BCPE312	Laboratory course based on Computational Genomics	2
P2BCPE313	Laboratory course based on Microbiomics	2
P2BCMO351	MOOCs Course	
TOTAL		24

*Student will opt for only one elective course along with respective laboratory course

* Students will register for a 4-credit course from MOOC's platform and complete it by the end of 3rd Semester

Syllabus for 2-year PG Program as per NEP-2020

Scheme Semester-IV

COURSE CODE	PAPER	CREDITS
	Core Courses	
P2BCTC401	Immunology and Immunotechnology	4
P2BCTC402	Medical Biochemistry	4
P2BCTC403	Laboratory course based on Immunology and Immunotechnology	2
P2BCPC404	Laboratory course based on Medical Biochemistry	2
	Electives*	
P2BCTE406	Functional Nutraceuticals	2
P2BCTE407	IPRs and Bioethics	2
P2BCTE408	Bio entrepreneurship	2
P2BCTE409	Research Methodology and Scientific Writing	2
P2BCPR410	Research Project	16
TOTAL		32

*Students have to select one elective course from the given three elective courses

Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
SEMESTER– I
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027

COURSE TITLE: FUNDAMENTALS OF MOLECULAR BIOLOGY

Course code: P2BCTC101
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Course Objectives : In today's scientific world no biological study is complete till it is studied at the molecular level. This course will guide students about the basic background (physical and chemical) of molecular biology. The primary objective is to make students achieve a simple, comprehensive and interested view of basic composition of nucleic acids, their structure and their mode of replication. The study deals with conversion of genetic information coded in DNA to cellular macromolecules. The contents cover important aspects like, synthesis, modification and regulation of important cellular macromolecules, namely RNA and Protein. **Course Outcome:** CO101.1: Understands the genomic organization of living organisms, study of genes genome, chromosome. CO101.2: Aware of molecular mechanism underlying in the process of prokaryotic DNA replication. CO101.3: Importance of gene expression (transcription & translation) and their regulations.

UNIT-I: DNA STRUCTURE AND FUNCTION

i. Techniques to study nucleic acids; centrifugation, crystallography, electron-microscopy, spectroscopy and chromatography.
ii. DNA as a genetic material, DNA Structure and function: Physical and chemical structure of DNA, Alternate forms of DNA A, B, Z; Alternate DNA structure H-, G-; DNA loops; D-loop, R-loop, cruciforms, hairpin loops their biological significance & secondary structure.
iii. DNA structures; Primary, secondary, tertiary and quaternary DNA structure; Function of alternate forms and structures of DNA, Topography and superhelicity of DNA.
iv. Denaturation analysis of DNA; denaturation curve and assessment of GC% and Tm, hyper and hypochromic effect of DNA

UNIT-II: DNA REPLICATION AND INTRODUCTION TO RNA

i. Interaction of DNA with proteins; role of these interactions on the function of DNA, e.g. Zn finger, lucine zipper, helix turn helix and helix-loop -helix proteins
ii. Replication of DNA, Replication of extrachromosomal DNA, Elements and factors required for replication of core genome in eukaryotes, prokaryotes
iii. Replication of core gene, chromosomal replication with chromosomal replication in *E.coli* and *S. cerevisae*, as reference.
iv. Extra chromosomal elements replication with phi X174, Plasmid and mitochondrial replication as reference

UNIT-III: GENE EXPRESSION I - TRANSCRIPTION

i. RNA structure and function. RNA as a structural molecule: transfer and ribosomal RNA, RNA as information molecule: messenger RNA, small RNA, non-coding RNA

Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
SEMESTER– I
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027

COURSE TITLE: FUNDAMENTALS OF MOLECULAR BIOLOGY
Course code: P2BCTC101
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

ii. Mechanism of transcription in prokaryotes; Elements and factors involved in transcription; Promoter sequences and other regulatory factors, Inhibitors of replication and transcription.
iii. Operon concept; Inducible and repressible operons in prokaryotes. Attenuation, anti-termination, auto-regulation of gene expression. Negative and positive control of gene expression.
iv. Mechanism of transcription in eukaryotes: Gene activation in eukaryotes, Basal transcription apparatus, Eukaryotic promoter, enhancers, silencers, sequences, General and specific factors. Initiation, elongation and termination of transcription in Eukaryotes.

UNIT-IV: GENE EXPRESSION II- TRANSCRIPTION/TRANSLATION

i. Post transcriptional regulation: mRNA processing capping and polyadenylation, mRNA splicing and editing, nucleo-cytoplasmic mRNA transport, mRNA stability, degradation and half-life period. Differential gene expression
ii. Genetic Code: Universality and degeneracy of code and exceptions to code, Wobble hypothesis, Codon usage bias.
iii. Mechanism of translation in prokaryotes: Elements and factors required for translation, Co-transcriptional- translation regulation of prokaryotic translation.
iv. Initiation, elongation and termination of translation in prokaryotes. Non- ribosomal peptide synthesis.

UNIT V: GENE EXPRESSION III- TRANSLATION AND DNA DAMAGE AND REPAIR.

i. Mechanism of translation/ Protein biosynthesis in eukaryotes: Elements and factors required for translation, Initiation, elongation and termination of translation in eukaryotes Codon-Anticodon recognition, Recycling of ribosome, Posttranslational modifications, Inhibitors of protein synthesis
ii. Regulation of eukaryotic translation. Non ribosomal translation and its importance
iii. DNA Damage: radiation damage, alkylation damage, mutagen and carcinogen damage, oxidative damage and instability in water
iv. DNA repair: direct reversal of damage, base excision repair, nucleotide excision repair, mismatch repair and SOS repair

Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
SEMESTER– I
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027

COURSE TITLE: FUNDAMENTALS OF MOLECULAR BIOLOGY

Course code: P2BCTC101
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Scheme of Examination:

MCQ on LMS + Subjective test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**% Weightage (Marks)**
Test I (after 30 days)	25%	1 hour	10+10
Test II (after 60 days)	26 TO 50%	1 hour	10+10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical/Research			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of four short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II.** Those candidates who have appeared in Test I and Test Hand failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

MajorTest

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/Research (Thesis/project/patent) examination

Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
SEMESTER– I
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027

COURSE TITLE: FUNDAMENTALS OF MOLECULAR BIOLOGY

Course code: P2BCTC101
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

External Practical/Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professor of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/dissertation of the students.

BOOKS RECOMMENDED

1. Krebs JE, Goldstein ES, Kilpatrick S (2020) Lewin's Essential genes-4th edition, Jones and Bartlett Publishers, Inc.
2. Karp's (2019) Cell and Molecular Biology- 9th Edition | Wiley.
3. Nelson and Cox (2021) Lehninger Principles of Biochemistry- 8th Edition, Macmillan learning
4. Watson J.D (2017). Molecular biology of the gene- 7th Edition, Pearson Education.
5. Krebs J.E, Goldstein E.S, Kilpatrick S.T (2018). Lewin's Genes XII. Jones & Bartlett Learning
6. Russell (2016). Genetics: A molecular approach. Pearson Education.
7. Bruce Alberts (2014) Molecular Biology of the Cell- 6th Edition, Garland Science
8. Burton E (2012). Molecular Biology: genes to proteins - 4th Edition, Jones & Bartlett Publishers.
9. Krebs J, Goldstein E, Kilpatrick S (2011) Lewin's Genes X -10th Edition, Jones & Bartlett Publishers
10. Hartwell L (2010). Genetics from genes to genomes- 4th Edition. Macgraw-hill Education.
11. Clark &Pazdernik (2009). Biotechnology: applying the genetic revolution. Academic Press
12. Lodish, Harvey F (2016) Molecular cell biology- 8th Edition, New York: W.H. Freeman

Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
SEMESTER– I
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years Dec 2027, Dec 2028 & Dec 2029 .

COURSE TITLE: CELLULAR BIOLOGY
Course code: P2BCTC102
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Course Objective:
To provide a thorough understanding of the structure, organization, and functional mechanisms of cells, with emphasis on molecular and cellular processes governing life, health, and disease. Upon completion of the course students will know: CO102.1: Introduction about the origins of cells, diversity, structure and function of cell organelles. CO102.2: Acquainted with various sophisticated instruments and their implementation in biological research. CO102.3: Concept of cell signalling, communication, cell growth, division, cell cycle and its regulations. CO102.4: Brief idea of cellular basis of differentiation and development.

UNIT I: Cell Structure and Organization

i. Cell Theory & Cell Types: Cell theory, prokaryotic and eukaryotic cells, diversity in size and shape, unicellular vs. multicellular, cellular compartments.
ii. Biomembranes: Fluid mosaic model, lipid bilayer, integral/peripheral proteins, membrane transport, membrane asymmetry.
iii. Cellular Organelles: Structure of nucleus, ER, Golgi, mitochondria, chloroplasts, lysosomes, peroxisomes.
iv. Cytoskeleton and Motility: Microtubules, microfilaments, intermediate filaments, motor proteins, cilia & flagella.

UNIT II: Membrane Dynamics and Intracellular Trafficking

i. Transport Mechanisms: Passive and active transport, ion channels, Na /K ATPase, ABC transporters, co-transporters.
ii. Endocytosis & Exocytosis: Clathrin-mediated uptake, caveolae, vesicle formation, exocytic pathways, recycling endosomes.
iii. Vesicular Trafficking: ER-Golgi transport, vesicle budding/fusion, SNAREs, Rab proteins, lysosomal targeting.
iv. Nuclear Transport & Chromatin: Nuclear pore complex, import/export signals, chromatin structure, histones, chromatin remodeling.

UNIT III: Cell Signaling and Communication

i. Signal Transduction Pathways: Hormones and receptors, GPCRs, second messengers, Ras/MAPK, RTKs.
ii. Microbial & Plant Signaling: Quorum sensing, bacterial chemotaxis, two-component systems, Ca^{2} signaling, phytochromes.
iii. Cell-Cell Communication: ECM, integrins, cell adhesion molecules, junctional complexes, general signaling principles.
iv. Neuronal Signaling: Neurotransmission, synapse structure, neurotransmitter types, receptor regulation.

Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
SEMESTER– I
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years Dec 2027, Dec 2028 & Dec 2029 .

COURSE TITLE: CELLULAR BIOLOGY
Course code: P2BCTC102
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

UNIT IV: Cell Cycle, Growth, and Death

i. Cell Cycle Control: Phases, cyclins/CDKs, checkpoints, DNA replication licensing, mitotic exit.
ii. Mitosis & Meiosis: Stages, spindle formation, chromosome alignment/separation, synapsis, recombination.
iii. Cell Death Mechanisms: Apoptosis pathways, caspases, autophagy, necrosis, survival signaling.
iv. Cancer Cell Biology: Oncogenes, tumor suppressors, cell cycle defects, EMT & metastasis, cancer models.

UNIT V: Development biology and Cellular aging

i. Gametogenesis & Early Development: Gamete formation, fertilization mechanisms, cleavage patterns, gastrulation, embryonic layers.
ii. Plant Developmental Biology: Shoot/root apical meristem, leaf development, floral development, seed germination.
iii. Animal Model Systems: Drosophila segmentation, C. elegans development, homeotic genes, organogenesis.
iv. Aging and Senescence: Telomere shortening, mitochondrial dysfunction, Cellular Senescence Mechanisms. Molecular control of Longevity.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

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Theory	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical/Research			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
SEMESTER– I
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years Dec 2027, Dec 2028 & Dec 2029 .

COURSE TITLE: CELLULAR BIOLOGY
Course code: P2BCTC102
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of four short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II.** Those candidates who have appeared in Test I and Test Hand failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/Research (Thesis/project/patent) examination

External Practical/Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professor of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/dissertation of the students.

BOOKS RECOMMENDED

1. Molecular Biology of the Cell. **7th Edition** published July 1, 2022 by W. W. Norton & Co.
2. Molecular Biology of the Cell (Alberts et al.) — 7th Edition (2022) by W. W. Norton. Hardcover ISBN 978-0393884821; eText ISBN 978-0393427080
3. Cell Biology (Pollard, Earnshaw, LippincottSchwartz, Johnson) **4th Edition** (2023) published by Elsevier
4. Becker's World of the Cell. **10th Global Edition** (2022), by Hardin, Bertoni & Kleinsmith.
5. Karp's Cell and Molecular Biology, **9th Edition** (2020) by Gerald Karp, Janet Iwasa, Wallace Marshall.

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Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER– I
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: CHEMISTRY OF BIOMOLECULES

Course code: P2BCTC103
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Objectives: This course focuses on the chemistry behind the biological roles of proteins, carbohydrates, nucleic acids and lipids and the link between structure and function of these molecules at a chemical level within a biological context. The course will give an overall knowledge and apply it to key chemical process relevant to life. **Course outcomes:** CO103.1: Structure and biological importance of macromolecules. CO103.2: Comprehend the role played by various bonds and chemical interactions in maintenance of different structural hierarchy of macromolecules. CO103.3: Figure out the role of three-dimensional structures with biological activity of macromolecule.

UNIT- 1: CHEMISTRY OF CARBOHYDRATES

i. Introduction: Biological fitness of organic compounds, dimensions and shape of biomolecules, supramolecular assemblies and cell organelles.
ii. Carbohydrates: Classification; Monosaccharides, Isomerism, D and L forms, Stereoisomerism, epimers, anomers, pyrans and furans.
iii. Sugar acids, sugar alcohols, aminosugars and their derivatives. Dissacharides: Homo and hetero-disaccharides.
iv. Polysaccharides: Storage forms- Glycogen, Starch, Inulin. Structural forms- Cellulose, Chitin. Heteropolysaccharides/ Glycosamine Glycans: Hyaluronic acid, Heparin, Chondroitin sulfate, Dermatan sulfates and their biological functions. Important biomolecules possessing sugar moieties.

UNIT-2: CHEMISTRY OF LIPIDS

i. Classification of Lipids: Fatty acids, saturated/unsaturated, odd and even-carbon, essential fatty acids.
ii. Fats/Triacylglycerols; waxes, Phosphoglycerides- Lecithins, Cephalins, Phosphatidyl serine, Phosphatidyl inositol and their derivatives, Phospho-sphingolipids/sphingomyelins.
iii. Glycolipids, Gangliosides, Plasmalogens, Cardiolipins, Cholesterol and Prostaglandins.
iv. Functions of lipids, Lipid bilayer, micelles and liposomes. Functions of lipids and lipoproteins.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER– I
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: CHEMISTRY OF BIOMOLECULES

Course code: P2BCTC103
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Unit-3: CHEMISTRY OF PROTEINS

i. Amino acids and their classification, pKa values and pI, peptide bond formation.
ii. Essential amino acids, amino acids as building blocks of proteins, chemical synthesis of polypeptides.
iii. Φ and ψ bonds and angles, primary, secondary, tertiary and quaternary- structure of proteins.
iv. α and β pleated sheets; classification and functions of proteins, conjugated proteins-glycoproteins and lipoproteins.

UNIT-4: CHEMISTRY OF NUCLEIC ACIDS

i. Nucleic Acids: Definition, importance and functions, structure of purines and pyrimidine bases.
ii. Structure of nucleosides and nucleotides, biologically important nuleotides,
iii. Structure of different types of nucleic acids, hydrolysis of nucleic acids.
iv. Other nucleotide derivatives- active sulphates, S-adenosylmethionine (SAM), Purine and Pyrimidine analogues

UNIT-5: PORPHYRINS AND VITAMINS

i. Porphyrins: Nucleus and classification of porphyrins, important metallo porphyrins occurring in nature, chemical nature and physiological significance of bile pigments.
ii. Vitamins: Structure and functions of Fat-soluble vitamins, A, D, E, K.
iii. Structure and role of Water-soluble vitamins, Thiamine, Riboflavin, Niacin, Pyridoxine.
iv. Structure and role of cyano-cobalamin, Folic acid, Biotin and Vitamin C.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

MCQ on LMS + Subjective questions	Syllabus to be covered in the examination	Tie allotted for the examination	Weightage of marks
Minor Test – 1 (after 30 days)	20 %	1 hour	10+10
Minor Test – 2 (after 60 days)	20 %	1 hour	10+10
Major test - (after 90	60 %	3 hour	60

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER– I
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: CHEMISTRY OF BIOMOLECULES

Course code: P2BCTC103
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

days)			
			100 marks

The student must be evaluated continuously during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of four short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II**. Those candidates who haveappeared in Test I and Test Hand failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be gap of more than two days in between two exams**

BOOKS RECOMENDED

1. Lehninger: Principles of Biochemistry (2021) 8th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13:978-1-4641-0962-1 / ISBN:10:1-4641-0962-1.
2. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York), ISBN: 978-0-470-28173-4 / BRV ISBN: 978-0-470- 60152-5.
3. Harper's Biochemistry (2023) 32nd ed., Murray, R.K., Granner, D.K., Mayes and P.A., Rodwell, V.W., Lange Medical Books/McGraw Hill. ISBN:978-0-07-176-576-3.
4. Voet D, Voet JG and Pratt CW (2024). Fundamentals of Biochemistry, 6th Edition. John Wiley & Sons. New York.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER I
ELECTIVE-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: MOLECULAR VIROLOGY AND VACCINOLOGY

Course Code: P2BCTE107
Duration of Examinations
Minor Test 1: 1 hour
Minor Test 2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 20
Minor Test 2: 20
Major Test: 60

Course Objectives: Upon completing this course, students will be able to describe the fundamental properties and classification of viruses, explain the mechanisms of viral infection and replication, identify and describe various types of viruses, discuss the pathogenesis and immune response to viral infections, apply knowledge of virology to understand viral diseases and control measures, analyze and interpret data related to viral infections and diseases, and evaluate the role of viruses in human, animal, and plant diseases, ultimately developing skills in viral detection, genome analysis, vaccine development, and critical thinking. **Course Outcomes:** CO107.1: Able to discuss principles of viral pathogenesis. CO107.2: Familiarity to different type of diseases causing viruses. CO107.3: Explain host antiviral resistance mechanisms. CO107.4: Could building concepts for controlling viral infections.

UNIT-I: VIRUS-HOST INTERACTION

i. Viral pathogenesis mechanism: viral entry, multiplication, viral gene expression and regulation: Cap snatching, IRES, ribosomal frameshifting, Inhibition of host translation, intracellular trafficking, viral assembly, and release. Case study: Covid-19, HIV.
ii. Host response to viral infection: Innate Immunity and Viral Recognition: Toll-like receptors, RIG-I-like receptors, Type I interferons, NK cells.
iii. Adaptive Immunity to Viruses: B cells and neutralizing antibodies, CD8+ cytotoxic T cells, CD4+ helper T cells, Memory responses.
iv. Evasion of Immune Responses by Viruses: Inhibition of interferon signalling, Downregulation of MHC molecules, Latency and antigenic variation, Cytokine storms, Viral triggers of autoimmunity.

UNIT II: VIRAL PATHOGENESIS AND CONTROL-I

i. Animal viruses: dsDNA viruses (Adenoviruses, Herpes virus, Pox virus, Arbovirus); ssDNA viruses: Parvovirus- M13, AAV).
ii. dsRNA viruses: Rotavirus, Reovirus; ss (-) sense RNA viruses: Orthomyxovirus and Paramyxovirus (Influenza and Measles).
iii. ss (+) RNA viruses: Poliovirus, SARS-CoV-2, Hepatitis virus.
iv. Retroviruses: ssRNA- HIV and dsDNA viruses with reverse transcriptase activity- Hepatitis B; and Oncogenic viruses- HPV.

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M.Sc. Biochemistry
SEMESTER I
ELECTIVE-THEORY

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COURSE TITLE: MOLECULAR VIROLOGY AND VACCINOLOGY

Course Code: P2BCTE107
Duration of Examinations
Minor Test 1: 1 hour
Minor Test 2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 20
Minor Test 2: 20
Major Test: 60

UNIT - III: VIRAL PATHOGENESIS AND CONTROL-II

i. Bacteriophage structural organization, Life cycle; lysogenic and lytic. Case study Bacteriophage T4 for lytic and Lambda for Lysogeny
ii. Brief details on M13, Mu, T-even, T-odd and P1. Bacteriophage typing and its application in bacterial genetics.
iii. Plant viruses: TMV, Cauliflower mosaic virus, Potato mosaic virus.
iv. Viruses of Cyanobacteria, algae and fungi, Virus related agents; viroids and prions

UNIT-IV: INTRODUCTION TO VACCINES AND ANTIVIRALS

i. History and evolution of vaccines, public health importance, Diagnostics and detection: Serological tests, Molecular techniques
ii. Types of vaccines (live attenuated, inactivated, subunit, conjugate, mRNA, DNA, vector-based), Personalized and pan-pathogen vaccines.
iii. Antivirals: designing and screening for antivirals, mechanisms of action; Antiretrovirals mechanism of action and drug resistance.
iv. Modern approaches of virus control: Anti-sense RNA, siRNA, ribozymes.

UNIT V: VACCINE MANUFACTURING AND QUALITY CONTROL

i. Pre-clinical stages; Antigen selection and purification; formulation development and delivery system; Dosage determination; immunogenicity in animal models
ii. Regulatory Review and Approval; Evaluation of safety immunogenicity, and efficacy, stability testing; ethics and regulations.
iii. Clinical development stages: upstream and downstream process; Clinical trial design: Phases I-IV; Production technologies (e.g., cell culture, bioreactors), Good manufacturing practices (GMP).
iv. Distribution and Vaccination Program; Strategies for vaccine delivery (routine, mass campaigns), Global vaccine initiatives (e.g., GAVI, WHO programs), Vaccine coverage and herd immunity.

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M.Sc. Biochemistry
SEMESTER I
ELECTIVE-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: MOLECULAR VIROLOGY AND VACCINOLOGY

Course Code: P2BCTE107
Duration of Examinations
Minor Test 1: 1 hour
Minor Test 2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 20
Minor Test 2: 20
Major Test: 60

SCHEME OF EXAMINATION:

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**%Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	10 + 10
TEST II (after 60days)	21 to 40%	1 hour	10 + 10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical / Research (thesis/project/patent)			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II**. Those candidates who have appeared in Test I and Test II

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER I
ELECTIVE-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: MOLECULAR VIROLOGY AND VACCINOLOGY

Course Code: P2BCTE107 | **Contact hours: 48**
Duration of Examinations | **Credits: 4**
Minor Test 1: 1 hour | **Max. Marks: 100**
Minor Test 2: 1 hour | **Minor Test 1: 20**
Major Test: 3.0 hours | **Minor Test 2: 20**
Major Test: 60

and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/ Research (thesis/project/patent) examination

External Practical/ Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professors of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/ dissertation of the students.

BOOKS RECOMMENDED

1. Adoga M.P (2017). Molecular Virology. 7th edition. Publisher: Intech
2. Bhat, A. I., & Rao, G. P. (2020). Characterization of plant viruses: Methods and protocols. Springer.
3. Carter J., Saunders V. (2013). Virology: Principles and Applications. 2nd edition, Wiley.
4. Dimmock, N., Easton, A., & Leppard, K. (2016). Introduction to modern virology (6th ed.). Wiley-Blackwell.
5. Flint S.J., Racaniello V.R., Enquist L.W., Rancaniello V.R., Skalka A.M. (2020) Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses. 5th Edition. Publisher: American Society Microbiology.
6. Gaur, R. K., Khurana, S. M. P., & Dorokhov, Y. (2020). Plant viruses: Diversity, interaction and management. CRC Press.
7. Howley, P. M., & Knipe, D. M. (2020). Fields virology: Emerging viruses (7th ed.). Wolters Kluwer.
8. Lostroh, P. (2019). Molecular and cellular biology of viruses. Garland Science.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER I
ELECTIVE-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: MOLECULAR VIROLOGY AND VACCINOLOGY

Course Code: P2BCTE107	**Contact hours: 48**
Duration of Examinations	**Credits: 4**
Minor Test 1: 1 hour	**Max. Marks: 100**
Minor Test 2: 1 hour	**Minor Test 1: 20**
Major Test: 3.0 hours	**Minor Test 2: 20**
	Major Test: 60

9. Riedel S, Hobden JA, Miller S, Morse S A., Mietzner T A., Detrick B, Mitchell T G., Sakanari J A., Hotez P, Mejia R (2019) Medical Microbiology. McGraw-Hill Education. 28th edition
10. Stephen K. Tyring. (2004) Field Virology Vol.1 and 2. Antiviral Agents, Vaccines, and Immunotherapies. Publisher: Marcel Dekker.
11. Wagner, E. K., Hewlett, M. J., Bloom, D. C., & Camerini, D. (2017). Basic virology (3rd ed.). Wiley-Blackwell.
12. Vaccinology: Principles and Practice. (2012). Germany: Wiley. ISBN: 9781118345344, 11.18345347
13. System Vaccinology: The History, the Translational Challenges and the Future. (2022). Netherlands: Elsevier Science. ISBN: 9780323897860, 032389786X

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Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-I
ELECTIVE-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: ANALYTICAL TECHNIQUES IN THE BIOLOGY

Course code: P2BCTE108
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

OBJECTIVES AND EXPECTED LEARNING OUTCOMES: This course provides a comprehensive understanding of the fundamental and advanced principles, along with the applications of various analytical techniques crucial for modern biological and biomedical research. It systematically covers methodologies ranging from basic microscopy to cutting-edge sophisticated analytical and imaging tools. Emphasis will be placed on the theoretical underpinnings, practical applications, and recent advancements in these dynamic fields. Course Outcome: CO108.1: Understand the principle, working and applications of analytical techniques available for studying biochemical and biophysical nature of life. CO108.2 Understand the various microscopy techniques and principles of electrochemical techniques. CO108.3. Understand various spectroscopic techniques including UV, Visible and NMR. CO108.4 Understand various separation techniques. CO108.5 Understanding of purification techniques and radioisotopic methods of analysis.

Unit-1: Introduction, Microscopy and electrochemical Techniques

i. Introduction to Analytical Techniques - Classification: Qualitative vs Quantitative technique. homogenization techniques
ii. Organ and tissue slice technique, histopathology analysis including Immunohistochemistry, Immunocytochemistry
iii. Basic principles, instrumentation and applications of microscopy: Bright field, Phase-contrast, Fluorescence and Confocal Microscopy, Electron Microscope – SEM, TEM, Atomic Force Microscopy.
iv. Principles of electrochemical techniques – measurement of pH by glass electrode and hydrogen electrode. Oxygen electrode – principles, and its applications.

Unit 2: Spectroscopic Techniques

i. Introduction to spectroscopy: Concept of absorptions, transmission, scattering, phosphorescence, fluorescence spectra.
ii. Principle, instrumentation, working and application of UV - Visible spectroscopy, spectrofluorimetry, flame photometry, atomic absorption spectrometry.
iii. Principle and application of Nuclear Magnetic Resonance (NMR) and X-ray Crystallography

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M.Sc. Biochemistry
SEMESTER-I
ELECTIVE-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: ANALYTICAL TECHNIQUES IN THE BIOLOGY

Course code: P2BCTE108 | **Contact hours: 48**
Duration of Examinations | **Credits: 4**
Minor Test: 1 hour | **Max. Marks: 100**
Major Test: 3 hours | **Minor Test 1: 10+10**
Minor Test 2: 10+10
Major Test: 60
Total: 100

iv. Mass spectrometry: Matrix-assisted laser desorption/ionization, Time- of Flight Mass spectroscopy (MALDI-TOF MS). Principles and applications of Surface Plasmon Resonance (SPR)

Unit 3: Separation Techniques

i. Electrophoresis: Basic principles and Factors affecting electrophoresis. Agarose gel SDS-PAGE, Capillary and Pulsed field – instrumentation and application.
ii. Isoelectric focusing: principle, ampholyte, development of pH gradient and application. 2D electrophoresis.
iii. Electro-transfer techniques: Principle, methodology and applications of Western, Southern and Northern blotting
iv. Sedimentation Techniques: Basic principles of Centrifugation, Differential centrifugation, Density gradient centrifugation.

Unit 4: Purification Techniques

i. Principles- adsorption and partition, Planar chromatography vs Column chromatography, Phases: Stationary vs Mobile, Retention factor (Rf).
ii. Paper chromatography, TLC, HPTLC, Ion-exchange chromatography, Gel-filtration chromatography and Affinity chromatography
iii. Gas liquid chromatography- principle, instrumentation, detectors and applications. GC-MS, LC-MS/MS
iv. High pressure liquid chromatography- principle, instrumentation and application. Reverse HPLC

Unit 5: Radio isotopic methods of analysis:

i. Introduction to Radioisotopes: Isotopes, radioisotopes, radionuclides, Types of radiation, Half-life, decay constant, specific activity, units of radioactivity.
ii. Production and Properties of Radioisotopes: Natural vs. artificial radioisotopes, Cyclotrons, nuclear reactors, and isotope generators, Radiolabeling strategies for biomolecules.
iii. Detection and Measurement of Radioactivity: Geiger-Müller counter, Scintillation counters, Gamma counters, Autoradiography.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-I
ELECTIVE-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: ANALYTICAL TECHNIQUES IN THE BIOLOGY

Course code: P2BCTE108
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

iv. Applications of Radioisotopes in Biology: Tracer Techniques - Metabolic pathway studies. Nutrient uptake and distribution, Radiolabeled Probes - DNA/RNA hybridization (Southern/Northern blot), hormone assays.

Reference Book

1. Keith Wilson, John Walker (2018) Principles and Techniques of Biochemistry and Molecular Biology (8th ed) Cambridge University Press
2. Holme, David J., and Hazel Peck. (1998). *Analytical Biochemistry*. (3rd ed.) Harlow: Pearson Education
3. David Sheehan (2009), Physical Biochemistry: Principles and Applications (2nd ed), Wiley-Blackwell
4. David M. Freifelder (1982) Physical Biochemistry: Applications to Biochemistry and Molecular Biology,W.H.Freeman
5. Rodney F.Boyer (2012), Biochemistry Laboratory: Modern Theory and techniques, (2nd ed), Prentice Hall
6. Kaloch Rajan (2011), Analytical techniques in Biochemistry and Molecular Biology, Springer
7. Segel I.H (1976) Biochemical Calculations (2nd ed), John Wiley and Sons
8. Robyt JF (2015) Biochemical techniques: Theory and Practice (1st ed), CBS Publishers & Distributors

SCHEME OF EXAMINATION:

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**%Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	10 + 10
TEST II (after 60days)	21 to 40%	1 hour	10 + 10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-I
ELECTIVE-THEORY

Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: ANALYTICAL TECHNIQUES IN THE BIOLOGY

Course code: P2BCTE108
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Total			100
Practical / Research (thesis/project/patent)			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II**. Those candidates who have appeared in Test I and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/ Research (thesis/project/patent) examination

External Practical/ Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professors of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/ dissertation of the students.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-I
ELECTIVE-THEORY
Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: MICRONUTRIENTS AND MAMMALIAN HORMONES

Course code: P2BCTE109 | **Contact hours: 48**
Duration of Examinations | **Credits: 4**
Minor Test: 1 hour | **Max. Marks: 100**
Major Test: 3 hours | **Minor Test 1: 10+10**
Minor Test 2: 10+10
Major Test: 60
Total: 100

OBJECTIVES AND EXPECTED LEARNING OUTCOMES

Course Outcome: The course provides knowledge of Vitamins and Hormones. After successful completion of course, the students will be able to understand:CO109.1. Importance of fat- soluble vitamins in growth and development, their recommended dietary allowance, dietary source and deficiency diseases. CO109.2. Importance of water-soluble vitamins in growth and development, their recommended dietary allowance, dietary source and deficiency diseases CO109.3. Various Hormones released by endocrine glands their importance and disorders due to imbalance.

Unit 1: Fat Soluble Vitamins

i. Vitamins: Definition, pro-vitamins, Vitamins as Coenzymes.
ii. Structure, Biochemical and Physiological roles, Sources, Recommended daily dosages and deficiency symptoms of Vitamin A.
iii. Structure, Biochemical and Physiological roles, Sources, Recommended daily dosages and deficiency symptoms of Vitamin D.
iv. Structure, Biochemical and Physiological roles, Sources, Recommended daily dosages and deficiency symptoms of Vitamin E and K. Porphyrins: the porphyrin ring system, chlorophyll, hemoglobin, myoglobin and cytochrome.

Unit 2: Water Soluble Vitamins

i. Structure, Biochemical and Physiological roles, Sources, Recommended daily dosages and deficiency symptoms of Thiamine (TPP), Riboflavin (FMN&FAD).
ii. Structure, Biochemical and Physiological roles, Sources, Recommended daily dosages and deficiency symptoms of Niacin, Pantothenic acid.
iii. Structure, Biochemical and Physiological roles, Sources, Recommended daily dosages and deficiency symptoms of Pyridoxine, Biotin.
iv. Structure, Biochemical and Physiological roles, Sources, recommended daily dosages and deficiency symptoms of Folic acid, Vitamin B12, Recommended Dietary Allowance, dietary source and deficiency, vitamins like compounds; PABA, bioflavonoids, antivitamins.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-I
ELECTIVE-THEORY
Syllabi for the examinations to be held in the years Dec 2025, Dec 2026 & Dec 2027.

COURSE TITLE: MICRONUTRIENTS AND MAMMALIAN HORMONES

Course code: P2BCTE109 | **Contact hours: 48**
Duration of Examinations | **Credits: 4**
Minor Test: 1 hour | **Max. Marks: 100**
Major Test: 3 hours | **Minor Test 1: 10+10**
Minor Test 2: 10+10
Major Test: 60
Total: 100

Unit 3: Minerals and their role in Body

i. Macro and Micro nutrients including trace elements. Minerals: their source, functions and deficiency symptoms.
ii. Role of Calcium and Phosphate in bone and dentine formation, role of Iodine in thyroid.
iii. Role of Iron in Heme synthesis, role of Magnesium.
iv. Role of Zinc and Copper. Metal activated enzymes and metalloenzymes, activation of alkali metal cations, alkaline earth metals and transition metal cations.

Unit 4: Vertebrate Hormones-I

i. Introduction, classification, mechanism of action of steroid hormones.
ii. Hypothalamic Hormones; TRH, CRH and GnRH,
iii. Anterior and Posterior pituitary hormones
iv. Growth Hormone, Glycoprotein hormones, oxytocin- their functions and disorders due to imbalance.

Unit 5: Vertebrate Hormones-II

i. Thyroid hormone, Hormones of adrenal cortex,
ii. Hormones of Gonads; androgens, estrogens and Progesterone - their functions and disorders due to imbalance.
iii. Insulin, Insulin-mediated glucose transport, regulation of blood glucose, sources of blood glucose.
iv. Diabetes Mellitus; classification, glucose tolerance test, comparison of two types of diabetes mellitus, glycosuria, metabolic changes in diabetes, management.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-I
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COURSE TITLE: MICRONUTRIENTS AND MAMMALIAN HORMONES

Course code: P2BCTE109 **Contact hours: 48**
Duration of Examinations **Credits: 4**
Minor Test: 1 hour **Max. Marks: 100**
Major Test: 3 hours **Minor Test 1: 10+10**
Minor Test 2: 10+10
Major Test: 60
Total: 100

SCHEME OF EXAMINATION:

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**%Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	10 + 10
TEST II (after 60days)	21 to 40%	1 hour	10 + 10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical / Research (thesis/project/patent)			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II.** Those candidates who have appeared in Test I and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

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SEMESTER-I
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COURSE TITLE: MICRONUTRIENTS AND MAMMALIAN HORMONES

Course code: P2BCTE109 **Contact hours: 48**
Duration of Examinations **Credits: 4**
Minor Test: 1 hour **Max. Marks: 100**
Major Test: 3 hours **Minor Test 1: 10+10**
Minor Test 2: 10+10
Major Test: 60
Total: 100

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/ Research (thesis/project/patent) examination

External Practical/ Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professors of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/ dissertation of the students.

BOOKS RECOMMENDED:

1. Voet D, Voet JG and Pratt CW (2024). Fundamentals of Biochemistry, 6th Edition. John Wiley & Sons. New York.
2. Nelson DL and Cox MM. (2021) Lehninger Principles of Biochemistry, 8th Edition. Macmillan Worth Publishers, New Delhi.
3. Guyton, A. C. (2015). Text Book of Medical Physiology, 13th ed. W. B. Saunders Co., USA 978-1455770168.
4. Gangong F. William: Review of Medical Physiology 20th Edition.
5. Gaw, A., Cowan, R.A., O'Reilly, D.S.J., Stewart, M.J., Shepherd, J. 5th Edition (2013) Clinical Biochemistry, Churchill Livingstone, Edinburgh London.
6. Smith, A.F., Beckett, G.J., Walker, S.W. and Rae, P.W.H. (2013): Clinical Biochemistry. 8th Edition, Blackwell Science.

Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
SEMESTER-II
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

COURSE TITLE: RECOMBINANT DNA TECHNOLOGY

Course code: P2BCTC201 | **Contact hours: 48**
Duration of Examinations | **Credits: 4**
Minor Test: 1 hour | **Max. Marks: 100**
Major Test: 3 hours | **Minor Test 1: 10+10**
Minor Test 2: 10+10
Major Test: 60
Total: 100

Course objective: The aim of the course is to extend the student's understanding of new concepts and expertise in molecular biology and fundamentals of recombinant DNA technology. **Course Outcome:** Upon the completion of the course students will have knowledge about. CO201.1: Genetic engineering and its benefits, Basic principles, the tools and techniques of cloning and gene sequencing. CO201.2: Various vectors for transformation, Advantages and limitations of expression vectors, model organism for gene cloning. CO201.3: Skills of applying genetic engineering technologies in various fields of Biotechnology.

UNIT-I: TOOLS AND TECHNIQUES USED IN GENETIC ENGINEERING

Principles and mechanism of isolation, purification, quantification and electrophoresis of nuclear and cytoplasmic, Molecular tools and their uses DNA and RNA.

Size standards for DNA and RNA, Principles and mechanism of isolation, purification, quantification and electrophoresis of environmental DNA and RNA.

Enzymes used in genetic engineering: restriction endonucleases, Ligases, Kinases, Phosphatases, Polymerases, terminal transferases.

Gene cloning vectors: plasmids, bacteriophages, cosmids and artificial chromosomes.

UNIT-II: GENE CLONING TECHNIQUES

Construction of genomic library. Preparation of vector and insert for cloning and construction of recombinant DNA molecule. Transformation of E.coli with recombinant DNA.

Construction of DNA library, RNA enrichment techniques. Cloning differentially active genes.

NAAT, Isothermal amplification & thermal amplification, primer design and programming. modifications of basic PCR.

Southern, Northern and Western blotting; Preparation of labeled DNA probes-radioactive and non- radioactive labeling.

UNIT-III: GENE/S EXPRESSION TECHNIQUES

Gene centric cloning and genome centric cloning, Isolation, identification and characterization of gene.

Screening and analysis of genomic and cDNA library by function and sequence based methods.

Identification of interacting genes; two and three hybrid system, RNase protection assay and reporter assay, Phage display.

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COURSE TITLE: RECOMBINANT DNA TECHNOLOGY

Course code: P2BCTC201
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Expression strategies for heterologous genes; vector engineering and codon optimization, host engineering, Expression in eukaryotic and prokaryotic systems; In vitro transcription and translation, methods and application.

UNIT-IV: ADVANCED TECHNIQUES IN GENETIC ENGINEERING

DNA sequencing Sanger's Chain termination methods, next generation sequencing (NGS), Short read sequencing: Illumina. Ion Torrent, SOLiD, long read sequencing: Single Molecule Real-Time (SMRT), Oxford Nanopore, HiFi sequencing
Targeted sequencing and whole genome sequencing methods using NGS
Genome engineering: Genome/gene editing methods, strategies and applications
Introduction to synthetic biology; chemical synthesis of nucleic acids, methods, strategies and applications, Gene circuits.

UNIT-V: APPLICATION OF GENETIC ENGINEERING

Gene knockout: Site directed mutagenesis Protein engineering Directed protein evolution.
Genetic engineering in molecular diagnostics, Nucleic based diagnostics and protein-based diagnostics Production of genetically engineered drugs and vaccines, industrial products of genetically modified organisms.
Artificial intelligence and Machine learning in recombinant DNA technology and its application.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Scheme of Examination:

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Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

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Course code: P2BCTC201 | **Contact hours: 48**
Duration of Examinations | **Credits: 4**
Minor Test: 1 hour | **Max. Marks: 100**
Major Test: 3 hours | **Minor Test 1: 10+10**
Minor Test 2: 10+10
Major Test: 60
Total: 100

MCQ on LMS + Subjective test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**% Weightage (Marks)**
Test I (after 30 days)	25%	1 hour	10+10
Test II (after 60 days)	26 TO 50%	1 hour	10+10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical/Research			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of four short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II.** Those candidates who have appeared in Test I and Test Hand failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/Research (Thesis/project/patent) examination

External Practical/Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professor of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/dissertation of the students.

Syllabus for 2-year PG Program as per NEP-2020
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Course code: P2BCTC201 | **Contact hours: 48**
Duration of Examinations | **Credits: 4**
Minor Test: 1 hour | **Max. Marks: 100**
Major Test: 3 hours | **Minor Test 1: 10+10**
Minor Test 2: 10+10
Major Test: 60
Total: 100

BOOKS RECOMMENDED

Brown, T.A (2020) Gene Cloning and DNA Analysis: An Introduction. Wiley- Blackwell Publishing, UK.

Glick B. R and Patten C. L. (2017) Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press, USA.

Green M. R. and Sambrook J. (2012) Molecular Cloning: A Laboratory Manual. CSHL Press, USA.

Primrose, S. B. and Twyman, R. M. (2006) Principles of Genetic Manipulation and Genomics. Blackwell Publishing, UK.

Voet, D., Voet, J. G. and Pratt C. W. (2024), 6th Edition. Voet's Principles of Biochemistry. John Wiley & Sons, UK.

6. Andreas Hofmann and Samuel Clokie (2018) Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.

Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
SEMESTER-II
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

COURSE TITLE: ENZYME AND ENZYME TECHNOLOGY

Course code: P2BCTC202
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Course objective: The course is structured to provide the students insight into protein/ enzyme structure, enzyme kinetics and mechanism & control of enzyme action, enzyme folding, enzyme purification and enzymes characterization. It also aims at acquainting students with clinical and industrial applications of enzymes.

Course Outcomes: After completion of the course the students are: CO202.1: Able to understand structure, function and mechanism of action of enzymes in living systems. CO202.2: Able to acquire knowledge on enzyme classes and nomenclature, kinetics, role of enzymes in regulation and metabolism. CO202.3: Able to apply the knowledge for developing application based technological processes in a variety of areas such as food, feed, pharmaceutical, textile, leather, and others.

UNIT-I: INTRODUCTION TO ENZYMES

i. General characteristics of enzymes, nature of enzymatic and non-enzymatic catalysis, Enzyme specificity, biocatalysts vs chemical catalysts
ii. Criteria for Nomenclature and IUB classification of enzymes, significance of nomenclature and classification of enzymes; significance of numbering system,
iii. Holoenzyme, apoenzyme cofactor, coenzyme, prosthetic group, Basis of enzyme assays, Units of enzyme activity- IU, katal, turn over number and specific activity;
iv. Structure of enzyme proteins, N and C terminal amino acid determination, sequencing of polypeptides, protein folding, amino acid side chains and their influence on preferred folding; other catalytic bio-molecules.

UNIT-II: MECHANISM OF ENZYME ACTION

i. Enzyme catalysis; effect of enzyme on the rate and equilibrium of a reaction; Specificity of enzyme action: type of specificity, lock and key, induced fit hypothesis,
ii. Chemical mechanisms involved in biocatalysis, proximity and orientation effect, acid/base catalysis covalent catalysis, strain and distortion theory;
iii. Active (catalytic) site, elucidation of amino acids involved in active site, identification of functional groups at active sites;

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COURSE TITLE: ENZYME AND ENZYME TECHNOLOGY

Course code: P2BCTC202
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

iv. Mechanism of action of chymotrypsin, carboxypeptidase, ribonuclease and lysozyme;

UNIT-III: KINETICS OF ENZYME CATALYSED REACTIONS

i. Principles of bioenergetics, basis of kinetics of enzyme catalyzed reactions.
ii. Steady state vs equilibrium assumption, Henri and Michaelis-Menten equations, Michaelis-Menten equation for uni-substrate enzyme catalyzed reactions and its significance.
iii. Kinetic parameters V_{max}, K_m, Lineweaver-Burk plots, kinetic parameters, Eadie-Hofstee and Hanes plots, factors affecting enzyme activity: enzyme/substrate concentration, pH and temperature dependence of enzymes.
iv. Enzyme inhibitions: Reversible and irreversible inhibition, types of enzyme inhibitions, and determination of K_i.

UNIT-IV: REGULATORY ENZYMES

i. Enzymes in regulation of metabolic pathways.

ii. Enzyme regulation, covalent and noncovalent modification of enzymes, Allosteric enzymes, sigmoidal kinetics and its physiological significance.
ii. General mechanisms of enzyme regulation: Feedback inhibition, Feedback repression, induction.
iii. Partial Proteolysis; Covalent modification of enzymes-reversible covalent modification.
iv. Phosphorylation, adenylation, uridylation, ADP-ribosylation, methylation, disulphide reduction as means of regulation.

UNIT-V: ENZYME TECHNOLOGY

i. Strategies for bulk enzyme production, sources of enzyme isolation, Enzyme purification.
ii. Criteria and aim for purification, techniques /steps involved, Chromatography, ion exchange, adsorption, hydrophobic, and gel filtration; salting out.

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Course code: P2BCTC202
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Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

iii. Ascertaining purity level of enzyme, specific activity; criteria of enzyme purity, characterization of an enzyme, determination of the molecular weight (Mr).
iv. Industrial applications of enzymes- in diagnosis, therapy, brewery, dairy, food processing, detergent, textile; enzyme immobilization and its industrial importance; protein engineering, enzyme inhibitors and drug design.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Scheme of Examination:

MCQ on LMS + Subjective test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**% Weightage (Marks)**
Test I (after 30 days)	25%	1 hour	10+10
Test II (after 60 days)	26 TO 50%	1 hour	10+10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical/Research			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

Test I and Test II
The Subjective Test of Test I and Test II would consist of four short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II.** Those candidates who have appeared in Test I and Test Hand failed to get the

Syllabus for 2-year PG Program as per NEP-2020
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Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

COURSE TITLE: ENZYME AND ENZYME TECHNOLOGY

Course code: P2BCTC202
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

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Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test
There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/Research (Thesis/project/patent) examination
External Practical/Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professor of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/dissertation of the students.

BOOKS RECOMMENDED:

1. Keshavamurthy, M., Avinash, K. O., & Kiran, K. S. (2024). Advances in enzymology. P.K. Publishers & Distributors.
2. Likhtenshtein, G. I. (2024). Enzyme catalysis today and the chemistry of the 21st century. Springer Cham.
3. Copeland, R. A. (2023). Enzymes: A practical introduction to structure, mechanism, and data analysis (3rd ed.). Wiley.
4. Goyal, A., & Sharma, K. (Eds.). (2023). Glycoside hydrolases: Biochemistry, biophysics, and biotechnology. Elsevier.
5. Rai, A. K., Sirohi, R., Vandenberghe, L. P. S., & Binod, P. (Eds.). (2023). Microbial enzymes in production of functional foods and nutraceuticals. CRC Press.
6. Kim, I. J. (2022). Enzyme catalysis: Advances, techniques, and outlooks. MDPI.
7. Belorkar, S. A., & Jogaiah, S. (2021). Protocols and applications in enzymology. Academic Press.
8. Whittall, J., & Sutton, P. W. (Eds.). (2020). Applied biocatalysis: The chemist's enzyme toolbox. Wiley.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-II
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

COURSE TITLE: PLANT PHYSIOLOGY AND BIOCHEMISTRY

Course code: P2BCTC203
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Course Objective: To offer basic concepts of carbon dioxide fixation in plants and biochemistry of nitrogen fixation. To offer detailed knowledge on Nitrogenase enzyme complex and its function. To provide knowledge on concept of nitrate assimilation, photorespiration, nitrogen fixation and the role of different phytohormones in plant growth and development. To acquire knowledge on factors effecting seed germination and secondary metabolites in plants. **Course Outcomes:** CO1: Understand the structure, functions, and specialization of plant cells and their biochemical components. CO2: Describe plant transport systems and their physiological mechanisms. CO3: Explain the metabolic and enzymatic mechanisms of nitrogen and sulphur assimilation. CO4: Evaluate the synthesis and functions of secondary metabolites in plant development and defence. CO5: Understand the biochemical mode of action of plant hormones and light signalling.

Unit 1: Plant Cell Biochemistry and Biomolecules

i. Structure and function of plant cells and organelles (cell wall, plasmodesmata, meristematic cells, vacuoles, root quiescent zone, chloroplast).
ii. Plant-specific biomolecules: Structure and functions of Cellulose, lignin and pectin, biosynthesis of cell wall.
iii. Transport mechanisms: xylem and phloem, water movement, ascent of sap, mechanisms for movement of solutes, and source-sink relationships.
iv. Secretory structures in plants and their functions.

Unit 2: Photosynthesis and Carbon Assimilation

i. Light receptors- chlorophyll, light harvesting complexes, ferredoxin, plastocyanin, plastoquinone, carotenoids. Photosystem I & II, their location.
ii. Mechanism of quantum capture and transfer between photosystems, Light-dependent reactions: Photophosphorylation, Proton gradient and electron transfer in chloroplasts of plants.
iii. Light-independent reactions: Calvin cycle, C3, C4, and CAM pathways, Regulation of photosynthesis, photorespiration and its significance.
iv. Starch and sucrose metabolism, Role of sugar signalling in plant development.

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Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Unit 3: Nitrogen & Secondary Metabolism

i. Nitrogen fixation: Development and structure of root nodules, Role of nod factors in nodule development, Structure of plant nitrogenase system, Role of symbiotic and non-symbiotic pathways, Nitrate and ammonium assimilation, Glutamine biosynthesis and their regulation.
ii. Sulphur uptake and assimilation in plants, Sulphate reduction and their incorporation into amino acids.
iii. Biosynthesis, role & functions of alkaloids, phenolics, flavonoids, terpenoids, lignin and tannins.
iv. Lipid-based signalling molecules & Cuticle and wax metabolism.

Unit 4: Nitrogen & Secondary Metabolism

i. Structure, biochemical mode of action and molecular effects of auxins in the regulation of cell extension.
ii. Structure, biochemical mode of action ethylene, Biochemistry of fruit development and ripening including postharvest ripening.
iii. Structure and Functions of gibberellins, cytokinin and abscisic acid, stigmolactones, their role in regulation of seed dormancy, germination, growth, development and embryogenesis.
iv. Structure and function of phytochrome, hormonal regulation of flowering, photoperiodism, and vernalization.

Unit 5: Plant Stress Physiology and Biotechnological Applications

i. Defence systems in plants: Structural, Chemical, Physiological – reactive oxygen species and their generation, enzymic and non-enzymic components of antioxidative defence mechanism.
ii. Role of Brassinosteroids, Salicylic Acid, Jasmonates, Polyamines, Nitric oxide (NO) in Plant stress management (Environmental, salinity, water stress, heat, chilling, anaerobiosis, heavy metals).
iii. Tissue culture: somatic cell culture, soma clonal variation, protoplast isolation, fusion and culture); micropropagation.
iv. Transgenic plants: Overview of genetic transformation techniques (Agrobacterium, CRISPR), Insect Resistance Crops: Bt-cotton, Biofortified Transgenic Crops: Golden Rice, Edible Vaccines-Banana as vehicles for antigen production.

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COURSE TITLE: PLANT PHYSIOLOGY AND BIOCHEMISTRY
Course code: P2BCTC203
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Scheme of Examination:

MCQ on LMS + Subjective test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**% Weightage (Marks)**
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Theory	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical/Research			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

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Major Test

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02

40

M.Sc. Biochemistry
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Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

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Minor Test: 1 hour
Major Test: 3 hours

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Minor Test 2: 10+10
Major Test: 60
Total: 100

questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/Research (Thesis/project/patent) examination

External Practical/Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professor of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/dissertation of the students.

Recommended Books:

1. Heldt, H.W. and Heldt, F. (2025). Plant Biochemistry, 6th ed. Academic Press. ISBN 9780123849861.
2. Buchanan, B.B., Gruissem, W., and Jones, R.L. (2015). Biochemistry & Molecular Biology of Plants. 2nd ed, John Wiley & Sons. ISBN: 978-0470714218.
3. Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A. (2023). Plant Physiology and Development. 7th ed, Sinauer Associates Inc. ISBN: 978-1605353531.
4. Plummer, D. T. (2017). An Introduction to Practical Biochemistry,3rd edition. Mc Graw Hill Education (India) Pvt. Ltd. ISBN 978-0070994874.
5. Guyton, A. C. (2025). Text Book of Medical Physiology, 15th ed. W. B. Saunders Co., USA 978-1455770168.
6. Heldt, H. S. (2005). Plant Biochemistry and Molecular Biology, 2nd ed. Oxford University Press. ISBN 978-0198501794.
7. Nelson, D. L. and Cox, M. M. (2021) Lehninger's Principles of Biochemistry, 8th edition. W. H. Freeman and company, New York. ISBN 0716764385.
8. Dey, P. M. and Harborne J. B (1997). Plant Biochemistry, 1st edition. Academic Press.
9. Khan, N.A. and Singh, K.N. (2014) Laboratory Manual of Biochemistry & Biotechnology. Daya publishing house. ISBN: 978-9351302537.

M.Sc. Biochemistry
SEMESTER-II
ELECTIVE-THEORY
Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

COURSE TITLE: APPLIED BIOTECHNOLOGY

Course code: P2BCTE207
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Course Objective: To equip students with in-depth knowledge and practical understanding of advanced topics in nanobiotechnology, green, white, red, and blue biotechnology, focusing on their applications, ethical considerations, and technological innovations.
Course Outcomes: CO1: Understand the core concepts and applications of major biotechnology branches. CO2: Evaluate the role of biotechnology in sustainable agriculture and food security. CO3: Explore marine and aquatic resources for sustainable biotechnological development. CO4: Analyse modern medical biotechnology innovations and their healthcare impact. CO5: Explore marine and aquatic resources for sustainable biotechnological development.

Unit I: Green Biotechnology

i. Green Biotechnology, Introduction, history and scope, advantages.

ii. Genetically Modified Crops: Introduction, benefits and threats.

iii. Application of GMO's: Biopesticides, Bioinsecticides, Biofungicides Bioherbicides, Biofertilizers.

iv. Biofortification: Introduction and Case studies on Iron and Zinc rich crops, Increased protein content crops, combating vitamin A deficiency crops.

Unit II: White Biotechnology

i. Introduction to White Biotechnology: Definition, Scope, significance in industrial applications and environmental benefits.

ii. Microbial Cell Factories: Yeast, bacteria, and fungi in bioproduction.

iii. Industrial Enzymes: Production, purification, industrial applications in food, textiles, Pharmaceuticals.

iv. Bioplastics and Biofuels: Development of biodegradable plastics, renewable fuels (microbial and enzymatic processes).

Unit III: Red Biotechnology

i. Introduction to Red Biotechnology: Definition, Scope, significance in healthcare.

ii. Molecular Medicine: Gene therapy, RNA-based therapies: Monoclonal antibody therapies, Regenerative medicine and stem cells.

M.Sc. Biochemistry
SEMESTER-II
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Major Test: 60
Total: 100

iii. Diagnostics and Therapeutics: CAR-T cell therapy, Stem cell engineering for disease modeling, Molecular diagnostic (RT-PCR, CRISPR), Biosensors for health monitoring.

iv. Advanced Applications: mRNA vaccine technology, nanocarriers and smart drug delivery systems, Biopharmaceutical pipeline development, Personalized medicine.

Unit IV: Blue Biotechnology

i. Introduction to Blue Biotechnology: Definition, scope, significance in marine environments.

ii. Aquaculture Biotechnology: Developing disease-resistant fish strains, Fish vaccines, Sources in Aquafeed.

iii. Marine Bioresources and Applications: Microalgae in Biofuels, CO capture, Marine bacteria in drug discovery, Marine-derived biomaterial.

iv. Ocean Bioremediation & ethics: Marine pollution cleanup using engineered organisms, Marine biodiversity conservation, Ethical considerations in marine biotechnology.

Unit V: Nanobiotechnology

i. Overview of Nanobiotechnology: Definition, scope, and interdisciplinary applications in biology and medicine.

ii. Nanomaterials: Classification, synthesis approaches (top-down and bottom-up), surface functionalization, nanotoxicity in biological systems.

iii. Characterization Tools: SEM, TEM, AFM, DLS, UV-Vis, and FTIR spectroscopy.

iv. Applications: nanofertilizers, nanopesticides, nanomedicine nano-vaccines, biosensors, and environmental remediation.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

M.Sc. Biochemistry
SEMESTER-II
ELECTIVE-THEORY
Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

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Total: 100

Scheme of Examination:

MCQ on LMS + Subjective test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**% Weightage (Marks)**
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Test II (after 60 days)	26 TO 50%	1 hour	10+10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Major test (after 90days)	100%	3 hours	60
Total			100
Practical/Research			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of four short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II.** Those candidates who have appeared in Test I and Test Hand failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/Research (Thesis/project/patent) examination

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M.Sc. Biochemistry
SEMESTER-II
ELECTIVE-THEORY
Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

COURSE TITLE: APPLIED BIOTECHNOLOGY
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Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
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Major Test: 60
Total: 100

BOOKS RECOMMENDED

1. Bhushan, B. (2017). Springer Handbook of Nanotechnology (3rd ed.). Springer.
2. Nel, A. E., & Madler, L. (2020). Nanoparticles and the Immune System. Elsevier.
3. Wong, J. E. M., & Spatz, J. P. (2018). Nanobiotechnology: Concepts, Applications and Perspectives. Wiley-VCH.
4. Gupta, R. B., & Kompella, U. B. (2006). Nanoparticle Technology for Drug Delivery. Taylor & Francis.
5. Choudhary, D. K., Sharma, A. K., & Agarwal, P. (2017). Microbial-mediated Induced Systemic Resistance in Plants. Springer.
6. Srivastava, S., & Srivastava, A. K. (2013). Plant Biotechnology and Molecular Markers. Anamaya Publishers.
7. Pérez de Luque, A. (2017). Nanotechnology in Plant Science. Springer.
8. Malik, Z. A., et al. (2021). Green Biotechnology for Sustainable Agriculture. Springer.
9. Bhowmik, D., & Tripathi, A. (2023). Eco-friendly Nano-Hybrid Materials for Sustainable Agriculture. CRC Press.
10. Zhang, X., & Hua, Y. (2019). White Biotechnology: R&D and Business Perspectives. Springer.
11. El-Mansi, M., Bryce, C. F. A., Demain, A. L., & Allman, A. R. (2019). Fermentation Microbiology and Biotechnology (5th ed.). CRC Press.
12. Singh, O. V. (2010). Bio-nanotechnology: A Revolution in Food, Biomedical and Health Sciences. Wiley.
13. Koutinas, A. A., & Webb, C. (2013). White Biotechnology for Sustainable Chemistry. Royal Society of Chemistry.
14. Singh, B. D. (2019). Biotechnology: Expanding horizons (3rd ed.). Kalyani Publishers.
15. Glick, B. R., & Pasternak, J. J. (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA (4th ed.). ASM Press.
16. Cresswell, M. A. D., & Sweeney, L. F. (2005). Red Biotechnology: A Handbook for Advanced Biomedical Research. Springer.
17. Kim, S. K. (2013). Marine Biotechnology: Enabling the Blue Revolution. Springer.
18. Smith, J. L., & Bishop, R. L. (2009). Marine Biotechnology in the Twenty-First Century: Problems, Promise and Policy. National Academies Press.
19. Bhattacharya, S., & Prajapati, P. K. (2021). Nanotechnology in biology and medicine: Research advancements & future perspectives. Springer.

M.Sc. Biochemistry
SEMESTER-II
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Major Test: 60
Total: 100

20. Wang, Y., & Xie, J. (2020). Nanobiotechnology: Concepts, applications and perspectives. Springer.
21. Ahmad, A., Mukherjee, P., & Senapati, S. (2013). Green synthesis of nanoparticles. In Nanotechnology in life sciences (Vol. 2, Springer).
22. Singh, J. S., & Pandey, V. C. (2018). White biotechnology for sustainable chemistry. Royal Society of Chemistry.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-II
ELECTIVE - THEORY
Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

COURSE TITLE: HUMAN DISEASE BIOLOGY

Course code: P2BCTE208
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
20
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1:

Minor Test 2: 20
Major Test: 60
Total: 100

Course Objectives: The course has been designed to provide knowledge to the students of Human Genetics about the importance of Genetics in medicine, various human mitochondrial diseases, study of human genetic diseases using animal model. Students will be taught inheritance patterns, of different genetic diseases. This course will make the students to learn about the management of human genetic diseases. **Course Outcomes:** CO1. Explain the molecular and cellular basis of cancer. CO2: Analyse critical signalling pathways and biomarkers involved in cancer. CO3: Understand diseases caused by protein misfolding and structural malfunctions. CO4: Identify the features and therapeutic interventions of rare genetic disorders. CO7: Develop an integrated understanding of human disease mechanisms to inform diagnosis and treatment.

Unit 1: Fundamentals of Cancer

i. Hallmarks of cancer, Types and classification. process of carcinogenesis: initiation, promotion and progression, Metastasis.

ii. Oncogenes and proto-oncogenes, Tumor suppressor genes, Cell cycle regulation and checkpoints. Apoptosis and cancer.

iii. Signal transduction pathways in cancer (e.g., PI3K/AKT, MAPK, JAK-STAT), angiogenesis in cancer, Epithelial-mesenchymal transition (EMT).

iv. Cancer biomarkers, Cancer diagnostics, Cancer therapy, Drug resistance in cancer.

Unit 2: Diseases due to protein malfunctions

i. Introduction to protein folding and proteosome removal of misfolded proteins.

ii. Aetiology and biochemical basis for Alzheimer's Disease.

iii. Sickle cell anaemia and Thalassemia – cause, Pathophysiology, Clinical Features, Diagnosis and treatment.

iv. Receptor and transport defects: Cystic fibrosis and familial hypercholesterolemia.

Unit 3: Microbial Pathogens and Disease Mechanisms

i. Bacterial pathogens: Types, virulence factors, pathogenesis.

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M.Sc. Biochemistry
SEMESTER-II
ELECTIVE - THEORY
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20
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Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1:

Minor Test 2: 20
Major Test: 60
Total: 100

ii. Viral pathogens: Structure, replication, and mechanisms of viral diseases.

iii. Fungal and parasitic diseases: Overview of important fungal pathogens and parasites.

iv. Molecular mechanisms of pathogenicity: Adhesion, invasion, toxin production and Host immune evasion strategies by pathogens. Case studies: Tuberculosis, HIV/AIDS, Malaria.

Unit 4: Complex disorders

i. Introduction to multifactorial disorders

ii. Neurodegenerative diseases: Parkinson, Alzheimer's,

iii. Mental Illnesses: Schizophrenia, bipolar disorders & depression

iv. Metabolic disorders: CVD, Hyperthyroidism, Obesity.

Unit 5 Rare Disorders

i. Introduction to rare genetic diseases, Disorders amenable to Hematopoietic Stem CellTransplantation (HSCT): Lysosomal storage diseases.

ii. Disorders amenable to organ transplantation: Maple Syrup urine disease, Fabry disease.

iii. Disorders amenable to hormone/ specific drugs forms of therapy: Neonatal Onset Multisystem Inflammatory Disease (NOMID), Wilson's disease.

iv. Neurofibromatosis, Progeria, Werewolf syndrome, Skeletal dysplasia.

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M.Sc. Biochemistry
SEMESTER-II
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Credits: 4
Max. Marks: 100
Minor Test 1:

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Major Test: 60
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Test II (after 60 days)	26 TO 50%	1 hour	10+10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Major test (after 90days)	100%	3 hours	60
Total			100
Practical/Research			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

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Major Test

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/Research (Thesis/project/patent) examination

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-II
ELECTIVE - THEORY
Syllabi for the examinations to be held in the years May 2026, May 2027 & May 2028.

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20
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Books Recommended

1. F Vogel A.G. Motulusky. Human Genetics: Problems and Approaches. 5th Edition, BMC, 2010.

2. Helen M Kingston, ABC of Clinical genetics, 4th Edition, BMJ, 2015.

3. Robert Nussbaum et al. Thompson & Thompson genetics in Medicine, 8th Edition, Elsevier, 2015.

4. Micheal R. Cummings Human Heredity: Principles and Issues; 11th edition, 2016.

5. Emerys & Rimoin, Principles & Practice of Medical Genetics, 7th Edition, Elsevier, 20

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Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
SEMESTER-II
ELECTIVE-THEORY
Syllabi for the examinations to be held in the years May 2025, May 2026 & May 2027.

COURSE TITLE: PROTEOMICS AND METABOLOMICS

Course code: P2BCTE209
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 20
Minor Test 2: 20
Major Test: 60
Total: 100

Objectives: Deciphering the protein population in an organism is among the elementary approaches in biological sciences. The course is envisaged to provide the student an understanding in proteomics and understanding of the basic metabolic processes involving major biomolecules in a cell and how these processes can be manipulated in a suitable living system for meeting the demands of various related industries, the different approaches and techniques employed in these fundamental fields of study. **Course Outcome:** CO1: Understand the structure, properties, and separation of proteins. CO2: Analyze proteomes using advanced electrophoresis and identification techniques. CO3: Classify and extract key metabolites from biological systems. CO4: Apply instrumental techniques for metabolite identification and quantification. CO5: Evaluate the applications of proteomics and metabolomics in real-world contexts.

UNIT I: INTRODUCTION TO PROTEOMICS

i. Introduction to Proteins, Amino acids and their properties and analysis
ii. Basics of protein structure, Protein folding and misfolding.
iii. Levels of Protein structure: primary, secondary, tertiary and quaternary, Protein organization.
iv. Protein Separation Techniques: Chromatography and its types: ion-exchange, size-exclusion and affinity chromatography, applications of chromatography.

UNIT II: PROTEOME ANALYSIS

i. Evolution from protein chemistry to proteomics, Proteome.
ii. Analysis of proteomes - Two-dimensional polyacrylamide gel electrophoresis (2-DE), Fluorescence 2-D Difference Gel Electrophoresis (DIGE), Application of 2-DE and DIGE techniques in biological systems.
iii. Protein identification: Mass spectrometry, Edman degradation, Western blotting.
iv. An overview of Protein Microarrays, Data bases and search engines for protein identification, challenges in proteomics.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry

SEMESTER-II

ELECTIVE-THEORY

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Minor Test2: 1 hour

Major Test: 3.0 hours

Contact hours: 48

Credits: 4

Max. Marks: 100

Minor Test 1: 20

Minor Test 2: 20

Major Test: 60

Total: 100

UNIT-III: METABOLISM AND METABOLITES

i. Metabolism: an overview, scope and applications.

ii. Metabolites: Primary and secondary metabolites, their properties. Extraction of metabolites and their functions.

iii. Metabolic regulation, Homeostasis, Metabolic control and analysis, Metabolic flux.

iv. Metabolome, Metabolomics and its resources. Metabolic engineering: Concept, scope, feed-back inhibition.

UNIT-IV: METABOLITE IDENTIFICATION

i. Tools of metabolomics- Capillary electrophoresis, Gas chromatography, Electrochemical detectors.

ii. Detecting and quantifying metabolites: Principle, protocol and applications of electrospray ionization (ESI), Matrix assisted laser desorption ionization (MALDI) and Fourier transform-ion resonance (FTIR).

iii. Principle, protocol and applications of liquid chromatography-mass spectrometry (LC-MS), Nuclear Magnetic Resonance (NMR) and its types.

iv. Metabolomic Data and its processing, online metabolic databases (Human Metabolome Databases, KEGG, BioCyc) and pipelines.

UNIT V: APPLICATIONS OF PROTEOMICS AND METABOLOMICS

i. Proteomics in drug target discovery and development, and pharmaceutical applications.

ii. Understanding protein- protein interactions (Yeast two-Hybrid system) for studying cellular processes.

iii. Metabolomics approach for disease progression and identifying biomarkers, Environmental science and Toxicology.

iv. Agricultural and Plant metabolomics, Microbial metabolomics.

Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
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Practical/Research			
Internal Examination	100%	4 hours	50
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The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

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Syllabus for 2-year PG Program as per NEP-2020
M.Sc. Biochemistry
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Max. Marks: 100
Minor Test 1: 20
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Major Test

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be a gap of more than two days in between two tests.**

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BOOKS RECOMMENDED

1. TA Brown (2023) Genomes 5 (5th edition) CRC press, ISBN 9780367674076
2. RC Sobti, Manishi Mukesh, Aastha Sobti (2023) Genomic, Proteomics, and Biotechnology, CRC press, ISBN 9781003220831
3. Jonathan Pevsner (2015) Bioinformatics and Functional Genomics (Third Edition) Department of Neurology, Kennedy Krieger Institute, Baltimore, Maryland, USA
4. Arthur M. Lesk (2012) Introduction to Genomics 2nd Edition, Oxford University Press, New York
5. Jamil Momand and Eliot Bush (2025) Concepts in Bioinformatics and Genomics (Second Edition) Oxford University Press, New York, ISBN: 9780198882381

M.Sc. Biochemistry
SEMESTER– III
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: METABOLISM

Course code: P2BCTC301
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Course Objectives: In this course the student is exposed to detailed metabolic events, their regulation and interrelationship, including bioenergetics. Metabolic disorders, however, are indicated but dealt in with more details in the course Clinical Biochemistry. **Course Outcomes:** CO1. Understanding about the importance of metabolism. CO2. Aware of the metabolism of amino acids, nucleic acids and its regulation. CO3. Describe the metabolic regulation of carbohydrates pathway. CO4. Illustrate the metabolism of lipids and its regulation.

UNIT-1: METABOLISM OF CARBOHYDRATES

i. Introduction to metabolism, methods of studying metabolism, bioenergetics and biological oxidation. Digestion and absorption of carbohydrates, glycolysis, glycogenesis, glycogenolysis, gluconeogenesis.
ii. Citric acid cycle, amphibolic role of citric acid cycle, Oxidative Phosphorylation, Uncouplers of oxidative phosphorylation, effect of starvation and diabetes mellitus on carbohydrate metabolism.
iii. Pentose phosphate pathway, shuttle and other minor pathways.
iv. Biosynthesis of polysaccharides, inter-conversion of sugars and their conversion to respective alcohols and acids, regulation of carbohydrate metabolism.

UNIT-2: METABOLISM OF LIPIDS

i. Digestion and absorption of lipids, α, β and ω oxidation of fatty acids. Influence of starvation and diabetes mellitus on ketosis.
ii. Biogenesis of fatty acids, elongation of fatty acids, triacylglycerol, phosphoglycerides, sphingolipids, cholesterol, prostaglandins and other protanoids.
iii. Catabolism of triacylglycerols, phosphoglycerides, sphingolipids.
iv. Regulation of lipid metabolism.

UNIT-3: METABOLISM OF AMINO ACIDS

i. Digestion and absorption of proteins, General reaction of amino acid metabolism i.e transamination, deamination and decarboxylation.
ii. Catabolism of amino-acids and amphibolic role of citric acid cycle, urea cycle.
iii. Biogenesis of essential and non-essential amino acids and their regulation.
iv. Metabolism of amino acid precursors.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER– III
COMPULSORY-THEORY
Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: METABOLISM
Course code: P2BCTC301
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

UNIT-4: NUCLEIC ACID METABOLISM

i. Biosynthesis of purine and pyrimidine nucleotides.
ii. Formation of nucleoside di and tri-phosphates and their de-oxy derivatives.
iii. Catabolism of nucleotides and salvage pathways.
iv. Importance of HGPRTase and regulation of nucleotide biosynthesis.

UNIT-5: INTEGRATION OF METABOLISM

i. Metabolic fates of glucose-6 phosphate, pyruvate and acetyl CoA.
ii. Metabolic profiles of brain, muscle, adipose tissue, liver and kidney.
iii. Hormonal regulation of metabolism.
iv. Regulation of major metabolic pathways and hormonal regulation of metabolism

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Scheme of Examination:

MCQ on LMS + Subjective test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**% Weightage (Marks)**
Test I (after 30 days)	25%	1 hour	10+10
Test II (after 60 days)	26 TO 50%	1 hour	10+10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical/Research			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry

SEMESTER– III

COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: METABOLISM

Course code: P2BCTC301
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Total	100

The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of four short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II.** Those candidates who have appeared in Test I and Test Hand failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/Research (Thesis/project/patent) examination

External Practical/Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professor of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/dissertation of the students.

BOOKS RECOMMENDED:

i. Berg JM, Tymoczko, JL and Stryer L, Gregory Gatto (2019) Biochemistry, 9th Edition, WH Freeman & Co., New York.

ii. Cohn EE, Stumph PK, Bruening G and Doi RH (1987) Outlines of Biochemistry, 5th Edition, John Wiley & Sons, New York.

iii. Victor W. Rodwell, David Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil (2018). Harper's Illustrated Biochemistry, 31st Eidtion, Applaton and Lange Publications, California, USA.

M.Sc. Biochemistry
SEMESTER– III
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: METABOLISM

Course code: P2BCTC301
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

iv. Nelson DL and Cox MM. (2021) Lehninger Principles of Biochemistry, 8th Edition. Macmillan Worth Publishers, New Delhi.
v. Voet D, Voet JG and Pratt CW (2024). Fundamentals of Biochemistry, 6th Edition. John Wiley & Sons. New York.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry

SEMESTER– III

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: FUNDAMENTALS OF GENETICS AND GENOMICS

Course code: P2BCTC302
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Objectives: In recent years, genetics and genomics have grown explosively, generating large amount of new information regarding the fine structure of gene and gene expression in pro- and eukaryotes. Besides, the genomic approaches are being adopted in altering genotype and tailoring plants and animals to answer human needs. **Course Outcome:** CO1. This course will introduce students to the basic concepts of genetics and genomics. CO2 The students shall learn the principles of Mendelian and Neo-mendelian inheritance. CO3 Understand the principles and mechanisms of linkage and crossing over. CO4. Broad understanding of the fundamentals of genomics. CO5. Familiarity to cutting edge technologies used in the field.

UNIT-I: GENETICS-I

i. Mendelian genetics: Laws of inheritance: Mendel's Laws, concept of dominance, segregation, independent assortment, Gene interaction and their types.

ii. Chromosome theory of inheritance, tetrad analysis in *Neurospora crassa*, gene conversion.

iii. Crossing over and Linkage, concept, molecular mechanism of crossing over, reciprocal and non- reciprocal recombination, Holliday Model of recombination.

iv. Bacterial genetic system: transformation, transduction, conjugation and F-mediated sexduction, Site specific recombination.

UNIT-II: GENETICS-II

i. Mutation: Physical and Chemical mutagens, induction of mutations; molecular basis of mutations; detection of mutations.

ii. Transposons; molecular characteristics of transposable elements in bacteria, Mechanism of transposition, Transposable elements in eukaryotes and prokaryotes.

iii. Introduction to human genetics, Role of genetics in medicine, Patterns of single gene inheritance -autosomal recessive, Autosomal dominant.

iv. Human pedigrees; X linked inheritance, Sex influenced and sex-limited expression.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry

SEMESTER– III

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: FUNDAMENTALS OF GENETICS AND GENOMICS

Course code: P2BCTC302
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

UNIT- III: GENETICS-III

i. Multiple alleles, Non-dysjunction; Dosage compensation.

ii. Sex determination; Role of Y chromosome; Genetic recombination; Maternal inheritance.

iii. Structural aberrations of chromosomes: deletions, duplications, inversions and translocation.

iv. Molecular cytogenetics: Fluorescence in situ hybridization (FISH); Genomic in situ hybridization (GISH), Comparative Genomic hybridization (CGH).

UNIT- IV: GENOMICS-I

i.Molecular markers-hybridization and PCR based markers; RFLP, RAPD, STS, ESTs, SSR, AFLP, SNP markers.

ii. DNA fingerprinting-principles and applications, Construction of high-density linkage map and physical maps

iii. Gene pyramiding, Marker assisted Selection for major and minor genes, Fine mapping of the genes

iv. Chromosome walking and jumping, Human Genome Project, Genetic ethics

UNIT- V: GENOMICS-II

i.Comparative genomics: method and applications, collinearity among the genomes

ii. Understanding evolution of eukaryotes, Orthologues and paralogues genes

iii. DNA microarrays: Concept, cDNA and oligonucleotide-based microarrays, limitations and applications

iv. Concept of TILLING and Eco-TILLING, Pan-genomics: concept and applications

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry

SEMESTER– III

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: FUNDAMENTALS OF GENETICS AND GENOMICS

Course code: P2BCTC302
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

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Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

Scheme of Examination:

MCQ on LMS + Subjective test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**% Weightage (Marks)**
Test I (after 30 days)	25%	1 hour	10+10
Test II (after 60 days)	26 TO 50%	1 hour	10+10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical/Research			
Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of four short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II.** Those candidates who have appeared in Test I and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry

SEMESTER– III

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: FUNDAMENTALS OF GENETICS AND GENOMICS

Course code: P2BCTC302
Duration of Examinations
Minor Test: 1 hour
Major Test: 3 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test 1: 10+10
Minor Test 2: 10+10
Major Test: 60
Total: 100

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/Research (Thesis/project/patent) examination

External Practical/Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professor of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/dissertation of the students.

BOOKS RECOMMENDED

1. Lewin, B. (2018) Gene XII, John Goldstein and Stephen, Jones and Bartlett Publishers, Inc; 12th edition.
2. Gardner, E.J., Simmons, M.J. and Snustad, D. P. (2015) Principles of Genetics (7th Edition). John Wiley and sons, New York.
3. Erich Grotewold, Joseph Chappell, Elizabeth A. Kellogg (2015) Plant Genes, Genomes and Genetics. John Wiley & Sons.
4. Michael Kaufmann, Claudia Klinger, Andreas Savelsbergh (2017) Functional Genomics Methods and Protocols, Humana Press, Springer.
5. Arthur Lesk (2017) Introduction to Genomics, OUP Oxford.
6. Dale J.W. (2019) From Genes To Genomes Concepts And Applications of DNA Technology (3Ed), Wiley India.

M.Sc. Biochemistry
SEMESTER-III
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: BIOCHEMISTRY OF NUTRITION

Course code: P2BCTC303
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100 marks

Objectives: To gain knowledge about the glycemic index, balanced diets, micronutrient deficiencies and how to treat them, the value of nutraceuticals, and the dangers of junk food. to comprehend why people with diabetes, pregnancy, or inherited genetic disorders require special food. To understand the significance and application of alternative crops, such as pulses and cereals. Recognizing the benefits and drawbacks of both vegetarian and non-vegetarian cuisine. **Course Outcomes:** CO1. Understanding about the importance of nutritional requirements and nitrogen balance in human health. CO2. Role of the macro and micro minerals in health and diseases. CO3. Differentiate between fat soluble vitamins and water-soluble vitamins, biochemical functions and synthesis for these vitamins. CO4. To formulate diet for persons affected by diseases related life style or nutritional in insufficiency.

Unit 1: Introduction to Nutrition and Energy Metabolism

i. Defining nutrition, role of nutrients. unit of energy, biological oxidation of foodstuff. measurement of energy content of food,
ii. Physiological energy value of foods, Specific Dynamic Activity (SDA). Measurement of energy expenditure - direct and indirect Calorimetry, factors affecting thermogenesis,
iii. Energy utilization by cells, energy output – Basal and Resting metabolism, physical activity, factors affecting energy input - hunger, appetite, energy balance, energy expenditure in man. Estimating energy requirements,
iv. BMR- definition, Factors influencing BMR, Recommended Nutrient Intakes (RNI) and Recommended Dietary Allowances (RDA) for different age groups.

Unit 2: Dietary carbohydrates and lipids.

M.Sc. Biochemistry
SEMESTER-III
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

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Course code: P2BCTC303
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Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100 marks

I. Review functions of carbohydrates: Digestion, absorption, utilization and storage, hormonal regulation of blood glucose. Dietary requirements and source of carbohydrates.

II. Review of dietary lipid: classification, sources, functions, digestion, absorption, utilization and storage. Essential Fatty Acids; Functions of EFA, RDA, – excess and deficiency of EFA. Lipotropic factors, role of saturated fat, cholesterol, lipoprotein and triglycerides.

III. Importance of the following: a) Omega – fatty acids with Omega 3/ omega 6 ratio b) Phospholipids c) Cholesterol in the body d) Mono, Polyunsaturated and Saturated Fatty Acids.

IV. Dietary fiber, role of fibre in lipid metabolism, colon function, blood glucose level and GI tract functions.

Unit 3: Health impacts of dietary Proteins and Vitamins

i. Review of functions of proteins in the body, Digestion and absorption.

ii. Essential and Non-essential amino acids. Amino Acid Availability Antagonism, Toxicity and Imbalance, Amino acid Supplementation.

iii. Food source and Recommended Dietary Allowances for different age group.

iv. Amino acid pool. NPU, Biological Value, Nitrogen balance. Effects of deficiency. - PEM and Kwashiorkor.

Unit 4: Nutrient-Gene Interactions and Nutritional Genomics

i) Nutrigenomics vs Nutrigenetics, Classification and biochemical mechanisms of nutraceuticals.

ii) Role of genetic polymorphisms in nutrient metabolism (e.g., MTHFR and folate metabolism), Epigenetic modifications influenced by diet (DNA methylation, histone modification).

M.Sc. Biochemistry
SEMESTER-III
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: BIOCHEMISTRY OF NUTRITION

Course code: P2BCTC303
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100 marks

iii) Molecular basis of metabolic disorders: Diabetes, Metabolic Syndrome, Obesity, Bioenergetics and mitochondrial function in nutrition.

iv) Molecular techniques in nutritional genomics research.

Unit 5: Advanced Therapeutic Nutrition of Immune and Gut Health

i) Dietary supplements: Efficacy, safety, regulatory aspects; Concept of Parenteral and enteral nutrition: Biochemical considerations in formulation and delivery.

ii) Overview of Microbiome-nutrient interactions, Biochemistry of Probiotics, prebiotics, and synbiotics.

iii) Gut-associated lymphoid tissue (GALT) and nutrition; Gut microbiota and its metabolic products (SCFAs, bile acids); Nutrient absorption and metabolism with aging.

iv) Role of dietary fiber in immune-gut axis; and Leaky gut syndrome and nutritional modulation.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-III
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: BIOCHEMISTRY OF NUTRITION

Course code: P2BCTC303
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Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
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Major Test: 60
Total: 100 marks

NOTE FOR PAPER SETTING AND COURSE EVALUATION

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**%Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	05 + 05
TEST II (after 60days)	21 to 40%	1 hour	05 + 05
Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
Major test (after 90 days)	100%	2.5 hours	30
Total			50

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II**. Those candidates who have appeared in Test I and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set

M.Sc. Biochemistry
SEMESTER-III
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

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Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100 marks

from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

BOOKS RECOMMENDED

Books Recommended:

1. Delvin, T. M. *Textbook of Biochemistry with Clinical Correlations,* John Wiley & Sons, Inc
2. Gibson, R. *Principles of Nutritional Assessment*, Oxford University Press
3. Jain, J. L., Jain, S. and Jain, N. *Fundamentals of Biochemistry*, S. Chand.
4. Satyanarayana, U. and Chakrapani, U. *Biochemistry*, Arunabha Sen Books and Allied (P) Ltd.
5. Thimmaiah, S. R. *Standard Methods of Biochemical Analysis*, Kalyani Publisher
6. Haslberger, A.G. 2022. Advances in Precision Nutrition, Personalization and Healthy Aging. Hardcover ISBN 978-3-031-10152-6, Softcover ISBN 978-3-031-10155-7.
7. Litwack, G. 2021. Human Biochemistry. Academic Press. ISBN: 9780323910538
8. Biswas, D., and Rahaman, S.O.(Eds.). 2020. Gut Microbiome and Its Impact on Health and Disease. Springer.
9. Nelson, D. L., and Cox, M. M. (2017). Lehninger Principles of Biochemistry. W.H. Freeman and Company.
10. Ferguson, L.R. 2014 (e-book 2016). Nutrigenomics and Nutrigenetics in Functional Foods and Personalized Nutrition. CRC Press.
11. Watson, R.R., Preedy, V.R. 2015. Probiotics, Prebiotics, and Synbiotics: Bioactive Foods in Health Promotion. Academic Press. ISBN-10: 0128021896

M.Sc. Biochemistry
SEMESTER-III
COMPULSORY-THEORY

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: BIOCHEMISTRY OF NUTRITION

Course code: P2BCTC303
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Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100 marks

12. Litwack, G. (Ed.). 2008. Human Biochemistry and Disease. Academic Press. ISBN 978-0-12-452815-4.
13. Kaput, J., and Rodriguez, R. L. 2006. Nutritional genomics: Discovering the path to personalized nutrition. Wiley-Interscience.

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SEMESTER-III

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027, Dec 2028.

COURSE TITLE: FUNDAMENTALS OF BIOINFORMATICS AND BIOSTATISTICS

Course code: P2BCTC304 | **Credit: 2**

Contact hours: 24 | **Max. Marks: 50**

Duration of Examinations | **Minor Test1: 5+5**

Minor Test1: 1.0 hour | **Minor Test 2: 5+5**

Minor Test2: 1.0 hour | **Major Test: 40**

Major Test: 2.5 hours | **Total: 50**

Objectives: The last decade has seen veritable explosion of information generated by molecular biologists. To come in grips with the cascade of information knowledge of computers and their applications has become very important. Bioinformatics, loosely defined as interaction of molecular and computational biology, has to do this and to unravel more of nature's secrets. The present course has been designed to provide the students basic knowledge about statistical methods and bioinformatics. **Course Outcome:** CO1. Basic concepts of Bioinformatics and its significance in biological data analysis. CO2. Knowledge about various Biological databases and database search tools. CO3. Broad understanding about statistical methods and application of different statistical packages in Biological research. CO4. Familiarity to sequence analysis.

Unit I: Statistical Methods and Inference

i. **Descriptive Statistics and Probability Fundamentals-** Measures of central tendency: Mean, median, and mode; Measures of dispersion: Range, variance, standard deviation; Fundamentals of probability: Definitions, types (classical, empirical, and subjective); Combinatorics: Permutations and combinations; basic probability computations

ii. **Probability Distributions and Statistical Hypotheses-** Theoretical probability distributions: Binomial, Poisson, and Normal; Introduction to hypothesis testing: Null and alternative hypotheses; Statistical errors: Type I and Type II errors

iii. **Inferential Statistical Techniques-** Tests of significance: *t*-test (independent and paired), chi-square test; Analysis of variance (ANOVA): One-way and two-way ANOVA

iv. **Correlation and Regression Analysis-** Simple correlation: Concepts, calculation, and interpretation; Simple linear regression: Estimation of parameters, model interpretation; Application and limitations in predictive analysis.

Unit II: Bioinformatics and Biological Databases

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Syllabi for the examinations to be held in the years Dec 2026, Dec 2027, Dec 2028.

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Course code: P2BCTC304	**Credit: 2**
Contact hours: 24	**Max. Marks: 50**
Duration of Examinations	**Minor Test1: 5+5**
Minor Test1: 1.0 hour	**Minor Test 2: 5+5**
Minor Test2: 1.0 hour	**Major Test: 40**
Major Test: 2.5 hours	**Total: 50**

I. **Introduction to Bioinformatics**- Role of the internet in modern biological research; Scope and applications of bioinformatics in life sciences; Overview and classification of biological databases: Primary databases, Secondary databases, Composite database

II. **Nucleotide Sequence Databases**- Structure, content, and access to major nucleotide databases: GenBank (NCBI), EMBL-EBI Nucleotide Sequence Database, DDBJ (DNA Data Bank of Japan)

III. **Protein Sequence Databases**- Key repositories for protein sequence information; SWISS-PROT, TrEMBL, UniProt, PROSITE and Pfam, OWL

IV. **Structural Databases and Classification Systems**- Resources for macromolecular 3D structures: Protein Data Bank (PDB), Molecular Modelling Database (MMDB), Nucleic Acid Database (NDB); Structural classification systems: SCOP (Structural Classification of Proteins), CATH (Class, Architecture, Topology, Homologous superfamily)

UNIT III: Information Retrieval and Computational Analysis of Biological Databases

I. **Data Retrieval Systems**- SRS (Sequence Retrieval System) for flat-file databases, ENTREZ (NCBI) global search platform, LinkDB for pathway and link-based data retrieval.

II. **Sequence Analysis and Submission Tools**- Sequence similarity tools: BLAST, FASTA, CLUSTALW; Sequence submission: BankIt, Sequin, Webin, SAKURA

III. **Genomics and the Human Genome Project**- Overview of the Human Genome Project, latest advancements: T2T consortium, Human Pangenome Reference Consortium (HPRC), Genome India Project (GIP). Genome sequencing and mapping techniques, Applications of genome maps.

IV. **Genome and Phylogenetic Analysis**- Sequence assembly and genome annotation, Phylogenetic analysis methods; Comparative genomics: COGs and HomoloGene (NCBI)

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SEMESTER-III

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027, Dec 2028.

COURSE TITLE: FUNDAMENTALS OF BIOINFORMATICS AND BIOSTATISTICS

Course code: P2BCTC304 **Credit: 2**

Contact hours: 24 **Max. Marks: 50**

Duration of Examinations **Minor Test1: 5+5**

Minor Test1: 1.0 hour **Minor Test 2: 5+5**

Minor Test2: 1.0 hour **Major Test: 40**

Major Test: 2.5 hours **Total: 50**

NOTE FOR PAPER SETTING AND COURSE EVALUATION

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**%Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	05 + 05
TEST II (after 60days)	21 to 40%	1 hour	05 + 05
Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
Major test (after 90 days)	100%	2.5 hours	30
Total			50

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II**. Those candidates who have appeared in Test I and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

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M.Sc. Biochemistry

SEMESTER-III

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027, Dec 2028.

COURSE TITLE: FUNDAMENTALS OF BIOINFORMATICS AND BIOSTATISTICS

Course code: P2BCTC304	**Credit: 2**
Contact hours: 24	**Max. Marks: 50**
Duration of Examinations 5+5	**Minor Test1:**
Minor Test1: 1.0 hour 5+5	**Minor Test 2:**
Minor Test2: 1.0 hour	**Major Test: 40**
Major Test: 2.5 hours	**Total: 50**

Major Test

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

BOOKS RECOMMENDED:

1. Baxivanis, A.D. and Francis Onellete, B.F. (2020) Bioinformatics. Wiley Interscience, John Wiley and sons New York.

2. Lesk, AM (2019). Introduction to Bioinformatics 5th edition. Oxford University press.

3. Higgs PG, Attwood T.K. (2013) Bioinformatics and Molecular Evolution. Blackwell Publications

4. Zweig G, Sherma J (2016) Principles, statistics and applications: Analytical methods. Academy Press.

5. Attwood, T.K. and Parry- Smith, D.J. (1999) Introduction to bioinformatics. Pearson Education, Singapore.

6. Curtin, D.P. et. al., (1999). Information technology. Tata McGraw-Hill Publishing Company, New Delhi.

7. Dhar M.K. and Kaul, S (1997) Statistics in Biology. Malhotra Brothers, Jammu.

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SEMESTER–III
ELECTIVE – THEORY

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027, Dec 2028.

COURSE TITLE: ARTIFICIAL INTELLIGENCE IN BIOLOGY

Course code: P2BCTE308	**Credit: 2**
Contact hours: 24	**Max. Marks: 50**
Duration of Examinations	**Minor Test1: 5+5**
Minor Test1: 1.0 hour	**Minor Test 2: 5+5**
Minor Test2: 1.0 hour	**Major Test: 30**
Major Test: 2.5 hours	**Total: 50**

Course Objective : Is to Enable students with the knowledge and skills to apply artificial intelligence (AI) techniques to solve complex problems and drive innovation in biology. Encourage students to think critically and creatively to develop basic AI tools that address real-world biological challenges. **Course Outcomes:** CO1. Understand the fundamentals of Artificial Intelligence and its relevance in biological sciences. CO2. Identify and classify different types of biological data and their associated computational challenges. CO3. Apply data management and preprocessing techniques to biological datasets. CO4. Understand the principles of machine learning and deep learning in the context of biology. CO5. Gain proficiency in AI programming tools, languages, and frameworks for biology.

UNIT 1: Introduction to Artificial Intelligence and databases

i. Artificial intelligence and Its foundations Definition and history of AI; Branches of AI: Machine Learning (ML), Deep Learning (DL): AI vs. traditional programming: Generative AI: ChatGPT, DeepSeek: AI vs. Biological Intelligence.

ii. Biological data:Types of biological data: imaging, experimental, clinical and environmental: Challenges in biological data analysis.

iii. Computational tools and data management: Need for computational tools in biology: Data storage and analysis: Cloud vs. server-based data storage and analysis: Data privacy and security: Algorithmic bias and fairness: Sources of bias in biological datasets.

iv. Data processing techniques: Data cleaning and handling: Dealing with missing values, noise, and outliers: Data transformation: Normalization, standardization and scaling of data.

UNIT 2: Machine learning and deep learning

i. Machine learning: Types of ML: Supervised, unsupervised, Reinforcement learning; Use cases in biology: AlphaFold, trRosetta, AIDDISON; Common tools and libraries: BioPython, EMBOSS, etc.

Syllabus for 2-year PG Program as per NEP-2020
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SEMESTER–III
ELECTIVE – THEORY

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COURSE TITLE: ARTIFICIAL INTELLIGENCE IN BIOLOGY

Course code: P2BCTE308 **Credit: 2**
Contact hours: 24 **Max. Marks: 50**
Duration of Examinations **Minor Test1: 5+5**
Minor Test1: 1.0 hour **Minor Test 2: 5+5**
Minor Test2: 1.0 hour **Major Test: 30**
Major Test: 2.5 hours **Total: 50**

ii. Deep learning: Basics of neural networks: Neurons, layers, weights (conceptual).

iii. Deep Learning architectures: CNNs and RNNs: Applications, advantages, and limitations in biology.

iv. Programming languages: Python, BioPython, R, Shell/Bash; Practical examples and hands-on coding exercises. Programming without coding.

UNIT 3: Applications in biology

i. Bioinformatics: Overview of commonly used AI-based tools and databases for nucleic acid, protein, metabolite analysis.

ii. Drug discovery and development: Target identification and validation: Lead discovery and optimization: Preclinical and clinical trial data analysis: Personalized medicine: Drug repurposing using molecular and clinical data.

iii. Diagnostics and precision medicine: Analysis of medical images (e.g., X-rays, MRIs, CT scans) using CNNs: Genomic data analysis for diagnosis and subtyping of disease.

iv. Agricultural and environment: Crop yield prediction; Disease and pest detection; Resource optimization (e.g., water, fertilizers); Environmental monitoring and sustainability. Ethical principles and bias in AI applications for biology.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

MCQ on LMS + Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
TEST I (after 30 days)	20%	1 hour	05 + 05
TEST II (after 60days)	21 to 40%	1 hour	05 + 05

Syllabus for 2-year PG Program as per NEP-2020
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Syllabi for the examinations to be held in the years Dec 2026, Dec 2027, Dec 2028.

COURSE TITLE: ARTIFICIAL INTELLIGENCE IN BIOLOGY

Course code: P2BCTE308 **Credit: 2**
Contact hours: 24 **Max. Marks: 50**
Duration of Examinations **Minor Test1: 5+5**
Minor Test1: 1.0 hour **Minor Test 2: 5+5**
Minor Test2: 1.0 hour **Major Test: 30**
Major Test: 2.5 hours **Total: 50**

Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
Major test (after 90 days)	100%	2.5 hours	30
Total			50

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II**. Those candidates who have appeared in Test I and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

BOOKS RECOMMENDED

1. "In Silicon Dreams: How Artificial Intelligence and Biotechnology Will Create the Medicines of the Future" by Brian S. Halibut (**WILEY**, Publisher) 1st Edition 2021, ISBN-113:978-1119745570 ISBN-10:1119745578

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COURSE TITLE: ARTIFICIAL INTELLIGENCE IN BIOLOGY

Course code: P2BCTE308 **Credit: 2**
Contact hours: 24 **Max. Marks: 50**
Duration of Examinations **Minor Test1: 5+5**
Minor Test1: 1.0 hour **Minor Test 2: 5+5**
Minor Test2: 1.0 hour **Major Test: 30**
Major Test: 2.5 hours **Total: 50**

2. Next Gen Biology: AI's Transformative Impact on Life Sciences: Ai Innovations in Biotechnology, Healthcare, And Agriculture" by Anita Margret A,Chrisanne Freeman, Merlyn Diana A S (2025) ISBN-10: 9365542308, ISBN:13:978-93655542301

3. Future of AI in Biomedicine and Biotechnology" edited by Shankar Mukundrao Khade and Raj Gaura Mishra (2024) **IGI GLOBAL** Publisher, ISBN-13:979-8369354827

4. Biotechnological Approach to Sustainable Farming (AI-Driven Agriculture)" by Dr. Alok Kumar Srivastav et al. (2023) ISBN-10, 9355455534, ISBN-13,978-9355455536

5. Think Python: How to Think Like a Computer Scientist" by Allen B. Downey (**Shroff/O'Reilly**, Publisher 2016) ISBN -10, 9789352134755, ISBN-13,978-9352134755

6. Python Crash Course: A Hands-On, Project-Based Introduction to Programming" by Eric Matthes (2019) ISBN-10:1593279280, ISBN-13:978-1593279288

7. Machine Learning for Absolute Beginners: A Plain English Introduction" by Oliver Theobald

8. Machine Learning for Dummies" by John Paul Mueller and Luca Massaron (**Dummies**, Publisher 2016) ISBN-10:1119245516, ISBN-13:978-1119245513

9. Grokking Deep Learning" by Andrew W. Trask (**Manning** Publisher, 2019) ISB-10:1617293709, ISBN-13:978-1617293702

10. "Neural Networks and Deep Learning" by Charu C. Aggarwal (**Springer**, Publisher 2018) ISBN -10:3319944622, ISBN-13:978-3319944623

11. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

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ELECTIVE – THEORY

Syllabi for the examinations to be held in the years Dec 2026, Dec 2027, Dec 2028.

COURSE TITLE: ARTIFICIAL INTELLIGENCE IN BIOLOGY

Course code: P2BCTE308	**Credit: 2**
Contact hours: 24	**Max. Marks: 50**
Duration of Examinations	**Minor Test1: 5+5**
Minor Test1: 1.0 hour	**Minor Test 2: 5+5**
Minor Test2: 1.0 hour	**Major Test: 30**
Major Test: 2.5 hours	**Total: 50**

12. R Programming for Dummies" by Andrie de Vries and Joris Meys (**Wiley** Publisher, 2016) ISBN-10:8126562188, ISBN-13:9788-8126562183

13. R for Data Science" by Hadley Wickham and Garrett Grolemund (**Shroff/O'Reilly**, Publisher 2017) ISBN-10:9789352134977, ISBN-13:978-9352134977

M.Sc. Biochemistry
SEMESTER – III
ELECTIVE – THEORY
Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: COMPUTATIONAL GENOMICS

Course code: P2BCTE309
Duration of Examinations
Minor Test: 1.0 hour
Major Test: 2.5 hours

Contact hours: 24
Credits: 2
Max. Marks: 50
Minor Test 1: 5+5
Minor Test 2: 5+5
Major Test: 30

Course Objective: This course aims to provide students with a comprehensive understanding of genomics and microbiomics, focusing on the structure, function, and evolution of genomes, as well as the composition and role of microbial communities in health, disease, and the environment. Students will learn the principles and methods used in genome sequencing, bioinformatics analysis, and microbiome profiling. Through lectures, case studies, and hands-on analysis, students will develop the skills to critically evaluate scientific literature and conduct basic genomic and microbiomic data analysis. **Course Outcome: CO1:** Understand the principles and platforms of Next Generation Sequencing (NGS). CO2: Interpret sequencing data formats, quality, and data submission protocols. CO3: Operate computing platforms and tools for genomic data analysis. CO4: Analyze transcriptomic data and perform gene expression studies. CO5: Explore epigenomic modifications and their impact on gene regulation.

UNIT - I: INTRODUCTION TO NEXT GENERATION SEQUENCING AND DATA ANALYSIS

i. Next generation sequencing (NGS) technologies: overview, principal, sequencing chemistry and their types; Short read sequencing: Illumina, Ion torrent; Concept of single and pair end; Long read sequencing: Pacific BioSciences, Oxford Nanopore Technologies; Hybrid sequencing approaches.

ii. Sequence formats: FASTA, FASTQ, GenBank, EMBL, XML, FAST5; Sequencing quality and coverage estimation; Overview of sequence databases; Data submission: NCBI SRA, NCBI Genomes, bio-project, accessions.

iii. Introduction to High Performance Computing and servers, specifications of workstations needed for NGS analysis, Data retrieval from sequencing using wget, FTP, FileZilla.

iv. Introduction to Linux, Windows vs Linux, basic commands for file handling on Linux, processing, installation of data analysis software.

UNIT - II: INTRODUCTION TO GENOMICS

M.Sc. Biochemistry
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Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: COMPUTATIONAL GENOMICS

Course code: P2BCTE309
Duration of Examinations
Minor Test: 1.0 hour
Major Test: 2.5 hours

Contact hours: 24
Credits: 2
Max. Marks: 50
Minor Test 1: 5+5
Minor Test 2: 5+5
Major Test: 30

i. Genomics: C-value content and genome size: estimation methods, genome coverage, Sequencing and preprocessing, assembly: de-novo and reference-based assembly, genome assemblers; assembly algorithms: de-Bruijn graph and Over-Layout Consensus (OLC); Assembly statistics: N50, L50, genome coverage, Genome completeness estimation, Contigs, Scaffolds, Pseudochromosome and Chromosome.

ii. Genome Annotation: Gene prediction: tools and models, genome annotations: determining the functions of individual genes; functional databases.

iii. Comparative Genomics: Synteny and whole-genome alignment, Molecular phylogenetics and phylogenomics, Adaptive evolution; Concept of Pangenomes and Super reference genome; Core genome and accessory genome, population genomics.

iv. Genome wide association studies (GWAS): Overview, Identifying genetic associations; Statistical Association Testing, Rare variant analysis; Genotyping.

UNIT - III: FUNCTIONAL GENOMICS AND EPIGENOMICS

i. Transcriptomics: Biological replicates and controls; Sampling methods and RNA extraction, RIN value, rRNA depletion and mRNA enrichment; Short-read vs long- read sequencing (Illumina, PacBio, ONT); RNA-seq data analysis: de-novo and reference-based transcriptome assembly; Read Alignment and Quantification: RPKM, FPKM, TPM, normalization; differential expression analysis; Functional Enrichment and Pathway Analysis; Single-cell transcriptomics.

ii. Whole exome sequencing: Genomic vs exomic sequencing; Exome enrichment and sequencing, Reference alignment, Variant calling and annotation, copy number variants (CNVs). Applications of WES in disease research, clinical diagnostics, and personalized medicine, Ethical considerations and societal implications of WES.

iii. Epigenomics: Introduction to Epigenetics: DNA methylation, histone modifications, and ATP-dependent chromatin remodeling, ChIP-seq, ATAC-seq, Bisulfite-seq, MeDIP-seq, etc, Data alignment, Peak Calling and Annotation, Differential peak analysis, Functional Interpretation and Integration, Single-Cell Epigenomics.

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Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: COMPUTATIONAL GENOMICS

Course code: P2BCTE309
Duration of Examinations
Minor Test: 1.0 hour
Major Test: 2.5 hours

Contact hours: 24
Credits: 2
Max. Marks: 50
Minor Test 1: 5+5
Minor Test 2: 5+5
Major Test: 30

iv. Genome projects: The Human genome project, HapMap Project, The 1000 genome project, The Human Epigenome Project (HEP), The Genome India Project (GIP) and The ENCODE Project.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**%Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	05 + 05
TEST II (after 60days)	21 to 40%	1 hour	05 + 05
Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
Major test (after 90 days)	100%	2.5 hours	30
Total			50

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II**. Those candidates who have appeared in Test I and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

M.Sc. Biochemistry
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Syllabi for the examinations to be held in the years Dec 2026, Dec 2027 & Dec 2028.

COURSE TITLE: COMPUTATIONAL GENOMICS

Course code: P2BCTE309
Duration of Examinations
Minor Test: 1.0 hour
Major Test: 2.5 hours

Contact hours: 24
Credits: 2
Max. Marks: 50
Minor Test 1: 5+5
Minor Test 2: 5+5
Major Test: 30

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

BOOKS RECOMMENDED

1. TA Brown (2023) Genomes 5 (5 th edition) CRC press, ISBN 9780367674076.

2. RC Sobti, Manishi Mukesh, Aastha Sobti (2023) Genomic, Proteomics, and Biotechnology, CRC press, ISBN 9781003220831.

3. Jonathan Pevsner (2015) Bioinformatics and Functional Genomics (Third Edition) Department of Neurology, Kennedy Krieger Institute, Baltimore, Maryland, USA.

4. Arthur M. Lesk (2012) Introduction to Genomics 2nd Edition, Oxford University Press, New York.

5. Jamil Momand and Eliot Bush (2025) Concepts in Bioinformatics and Genomics (Second Edition) Oxford University Press, New York, ISBN: 9780198882381.

6. Filippo Geraci, Indrajit Saha, Monica Bianchini (2020) RNA-Seq Analysis: Methods, Applications and Challenges, Frontiers Media SA, ISBN: 9782889637058, 2889637050.

7. Richard C. Deonier, Simon Tavare, Michael S. Waterman, (2005) Computational Genome Analysis: An Introduction. Springer India.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER–III
ELECTIVE – THEORY
Syllabi for the examinations to be held in the years Dec 2026, Dec 2027, Dec 2028.

COURSE TITLE: MICROBIOMICS

Course code: P2BCTE310	**Credit: 2**
Contact hours: 24	**Max. Marks: 50**
Duration of Examinations	**Minor Test**
1:5+5	
Minor Test1: 1.0 hour	**Minor Test**
2:5+5	
Minor Test2: 1.0 hour	**Major Test: 30**
Major Test: 2.5 hours	**Total: 50**

Course Objective: This course aims to provide students with a comprehensive understanding of microbiomics, focusing on the composition and role of microbial communities in health, disease, and the environment. Students will learn the principles and methods used in bioinformatics analysis and microbiome profiling. **Course Outcomes:** CO1. Understand the principles and technologies of Next Generation Sequencing (NGS). CO2. Manage and process sequencing data using appropriate formats and computing platforms. CO3. Explore the diversity and ecological roles of microbiomes across environments. CO4. Apply culturomics and metagenomic approaches to study unculturable microorganisms. CO5. Analyse metagenomic data for taxonomic and functional insights.

UNIT - I: INTRODUCTION TO NEXT GENERATION SEQUENCING AND DATA ANALYSIS

i. Next generation sequencing (NGS) technologies: overview, principal, sequencing chemistry and their types; Short read sequencing: Illumina, Ion torrent; Concept of single and pair end; Long read sequencing: Pacific Bio-Sciences, Oxford Nanopore Technologies; Hybrid sequencing approaches.

ii. Sequence formats: FASTA, FASTQ, GenBank, EMBL, XML, FAST5; Sequencing quality and coverage estimation; Overview of sequence databases; Data submission: NCBI SRA, NCBI Genomes, bio-project, accessions.

iii. Introduction to High Performance Computing and servers, specifications of workstations needed for NGS analysis, Data retrieval from sequencing using wget, FTP, FileZilla.

iv. Introduction to Linux, Windows vs Linux, basic commands for file handling on Linux, processing, installation of data analysis software.

UNIT - II: INTRODUCTION TO MICROBIOMICS

i. Microbiomics: Overview of microbial diversity across different habitats, Host- Microbe Interactions, Human microbiome, extreme habitats microbiome, Plant microbiome, Concept of Holobiome; Human Microbiome Project and Earth Microbiology Project, The Earth Bio-Genome Project.

ii. Culturomics: Isolation & cultivation of microbes, identification based on morphology, microscopy, biochemical characterization and molecular characterization, media engineering to cultivate yet to be cultured microorganism

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SEMESTER–III
ELECTIVE – THEORY
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COURSE TITLE: MICROBIOMICS

Course code: P2BCTE310	**Credit: 2**
Contact hours: 24	**Max. Marks: 50**
Duration of Examinations	**Minor Test**
1:5+5	
Minor Test1: 1.0 hour	**Minor Test**
2:5+5	
Minor Test2: 1.0 hour	**Major Test: 30**
Major Test: 2.5 hours	**Total: 50**

iii. Metagenomics: Great plate anomaly, Metagenomic DNA extraction and sequencing, Sequencing quality and metagenome coverage estimation; Metagene centric approach (Metabarcoding, 16S rRNA, housekeeping genes): ASV vs OTU estimation, 16S rRNA; ITS databases and custom databases; Taxonomy databases and algorithm; diversity indices, alpha/beta diversity.

iv. Whole metagenome centric approach: metagenome assembly: algorithms and assemblers, downstream annotation: functional metagenomic databases and softwares; taxonomic classification and functional annotation; Pathway analysis; Comparative metagenomics; Concept of pan-microbiome, core microbiome and lineage specific microbiome

UNIT-III: METAGENOME ASSEMBLED GENOME AND METATRANSCRIPTOMICS

i. Metagenome assembled genomes (MAGs): Binning & Genome Reconstruction, bin contamination and completeness; MAG annotations, MAGs Databases, software and algorithms; Synthetic genomes and their applications: Genomic stability, Regulatory and societal implication, Intellectual property

ii. Meta-transcriptomics: Overview of meta-transcriptomics and its significance in microbial ecology, meta-transcriptomics RNA extraction, rRNA depletion and mRNA enrichment; transcriptome sequencing, assembly and annotation, differential gene expression

iii. Metagenome-Wide Association Studies: Concept of MWAS, difference between MWAS and GWAS.

iv. Applications of microbiomics: Microbiome-based therapies and personalized medicine, Case study of MWAS in health, agriculture, and environment.

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ELECTIVE – THEORY
Syllabi for the examinations to be held in the years Dec 2026, Dec 2027, Dec 2028.

COURSE TITLE: MICROBIOMICS

Course code: P2BCTE310 — **Credit: 2**
Contact hours: 24 — **Max. Marks: 50**
Duration of Examinations — **Minor Test**
1:5+5
Minor Test1: 1.0 hour — **Minor Test**
2:5+5
Minor Test2: 1.0 hour — **Major Test: 30**
Major Test: 2.5 hours — **Total: 50**

NOTE FOR PAPER SETTING AND COURSE EVALUATION

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**%Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	05 + 05
TEST II (after60days)	21 to 40%	1 hour	05 + 05
Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
Major test (after 90 days)	100%	2.5 hours	30
	Total		50

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

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Major Test

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

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M.Sc. Biochemistry
SEMESTER–III
ELECTIVE – THEORY
Syllabi for the examinations to be held in the years Dec 2026, Dec 2027, Dec 2028.

COURSE TITLE: MICROBIOMICS

Course code: P2BCTE310	**Credit: 2**
Contact hours: 24	**Max. Marks: 50**
Duration of Examinations	**Minor Test**
1:5+5	
Minor Test1: 1.0 hour	**Minor Test**
2:5+5	
Minor Test2: 1.0 hour	**Major Test: 30**
Major Test: 2.5 hours	**Total: 50**

BOOKS RECOMMENDED

1. Zhong Wang (2022) Introduction to Computational Metagenomics World Scientific Publishing Company. ISBN: 9789811242489, 9811242488

2. Rolf Daniel, Wolfgang R. Streit (2018) Metagenomics: Methods and Protocols Springer New york. ISBN: 9781493982745, 1493982745

3. John Parkinson, Robert G. Beiko, Will Hsiao (2018) Microbiome Analysis: Methods and Protocols. Springer New York. ISBN: 9781493987283, 1493987283

4. Muniyandi Nagarajan (2024) Metagenomics: Perspectives, Methods, and Applications, Elsevier Science ISBN: 9780323916318, 0323916317

Syllabus for 2-year PG Program as per NEP2020
M.Sc. Biochemistry
SEMESTER-IV
COMPULSORY-THEORY
Syllabi for the examination to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course code: P2BCTC401
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Objectives: This course introduces students to molecular and cellular immunology, including antigen and antibody structure and function, major histo-compatibility complexes, B- and T- cell receptors, antibody formation and immunity and regulation of immune system. Students will understand how the innate and adaptive immune systems function to protect the body from disease and what happens when the immune system breaks down, leading to immunodeficiency and autoimmunity. Also, students will learn immunology concepts that are linked to the treatment of disease.

Course outcome: CO1. Basic understanding about immune cells and organs of immune system CO2. Understanding about the concept of humoral and cell mediated immunity. CO3. Knowledge about the concept of immune pathology. CO4. Become conscious about immunological methods used in diagnosis and vaccine production

UNIT - I: INTRODUCION TO THE IMMUNE SYSTEM

i. Introduction to immune system, Innate and acquired immunity, clonal nature of immune response; Organization and structure of lymphoid organs

ii. Hematopoiesis and differentiation, Cells of the immune system: B- lymphocytes, T lymphocytes, Macrophages, Dendritic cells, Natural killer and Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells.

iii. Nature and Biology of antigens and super antigens, Antibody structure and function, antibody mediated effector functions, antibody classes and biological activity

iv. Antigenic determinants on immunoglobulins, Immunoglobulin superfamily, BCR & TCR, generation of antibody diversity.

UNIT - II: HUMORAL AND CELL MEDIATED IMMUNITY

Syllabus for 2-year PG Program as per NEP2020
M.Sc. Biochemistry
SEMESTER-IV
COMPULSORY-THEORY
Syllabi for the examination to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course code: P2BCTC401 — **Contact hours: 48**
Duration of Examinations — **Credits: 4**
Minor Test1: 1 hour — **Max. Marks: 100**
Minor Test2: 1 hour — **Minor Test1: 20**
Major Test: 3.0 hours — **Minor Test2: 20**
Major Test: 60
Total: 100

i. Regulation of immune response, Antigen processing and presentation, generation of humoral and cell mediated immune responses, Activation of B- and T- lymphocytes,
ii. Complement System: components of complement, complement activation, complement cascade, regulation of complement System
iii. Cytokines, cytokines receptors, cytokines antagonists, role of cytokines in T_H1/T_H2 subset development and their role in immune regulation, MHC: MHC molecules and genes, MHC restriction,
iv. Cell-mediated cytotoxicity: Mechanism of T cell and NK cell mediated lysis, Antibody dependent cell mediated cytotoxicity, macrophage mediated cytotoxicity.

UNIT - III: FAILURE OF THE IMMUNE SYSTEM

i. Autoimmunity and auto immune disordersimmunological tolerance: organ specific and systemic autoimmune diseases, animal models for autoimmune diseases and the molecular mechanism, immunodeficiency disorder- AIDS
ii. Hypersensitivity: IgE mediated Hypersensitivity, Antibody mediated cytotoxic Hypersensitivity, Immune complex-mediated Hypersensitivity, Delayed type Hypersensitivity
iii. Transplantation immunology: Immunological basis of graft rejection, clinical manifestation of graft rejection, general immunosuppressive therapy, specific immunosuppressive therapy, immune tolerance to allografts
iv. Immunological tolerance: central tolerance, peripheral tolerance, component of peripheral tolerance

UNIT IV:IMMUNODIAGNOSTIC PROCEDURES

i. Antigen-Antibody interactions and Techniques – ELISA and its variants, ELISPOT, Radio immunoassay, Immunofluorescence, Flow cytometry and Fluorescence, Immunoelectron microscopy

Syllabus for 2-year PG Program as per NEP2020
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Syllabi for the examination to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course code: P2BCTC401 — **Contact hours: 48**
Duration of Examinations — **Credits: 4**
Minor Test1: 1 hour — **Max. Marks: 100**
Minor Test2: 1 hour — **Minor Test1: 20**
Major Test: 3.0 hours — **Minor Test2: 20**
Major Test: 60
Total: 100

ii. Agglutination and haemagglutination assays
iii. Types of immundiffusion and immunoelectrophoretic procedures, isolectric focusing
iv. Affinity chromatographic methods and Immunoblotting.

UNIT - V: IMMUNOLOGY-BASED THERAPIES

i. Immunotherapy: CAR T-cell therapy, Immune checkpoint inhibitors, Monoclonal antibodies, interleukine therapy, vaccines.
ii. Chimeric antigen receptor (CAR) T-cell therapy: working, application and side effects, approved CAR T-cell therapies.
iii. Hybridoma Technology and Monoclonal antibodies detection and application of monoclonal antibodies.
iv. Vaccines: History of vaccine development, introduction to the concept of vaccine, Active and passive immunization, Designing vaccines for active immunization: Conventional vaccines, subunit vaccines, conjugate vaccines, DNA vaccines, RNA vaccines, Recombinant vector vaccines.

Note for paper setting and course Evaluation

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**%Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	10 + 10
TEST II (after 60days)	21 to 40%	1 hour	10 + 10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	(Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical/Research (thesis/project/patent)			

Syllabus for 2-year PG Program as per NEP2020
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SEMESTER-IV
COMPULSORY-THEORY
Syllabi for the examination to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course code: P2BCTC401
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. No preparatory holidays shall be provided for the Test I and Test II. Those candidates who have appeared in Test I and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. In major test there should not be a gap of more than two days in between two tests.

External Practical/ Research (thesis/project/patent) examination

External Practical/ Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professors of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/ dissertation of the students.

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M.Sc. Biochemistry
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Syllabi for the examination to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course code: P2BCTC401
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

BOOKS RECOMMENDED

1. Kuby Immunology; 8th Edition 2023 By Jenni Punt & Sharon Stranford
2. Cellular And Molecular Immunology 10th Edition 2022 By Abul K Abbas
3. Paul's Fundamental Immunology by Martin Flajnik, Publisher: Wolters Kluwer Health; 8th edition (19 October 2022)
4. Immunology, International 9th Edition 2020 by David Male
5. Coleman, R.M., Lombard, M.F. and Sicard, R.E. (1992). Fundamental Immunology. Wm. C. Brown publishers, USA.
6. Roitt,I., Brostoff, J. and Male, D. (1999). Immunology. Hartcourt Brace and Company, Asia Pte.Ltd.
7. Benjamini, E.,Coico,R., and Sunshine, G. (2000). Immunology – a short course. John Wiley and Sons. Inc., New York.
8. Davies,H. (1997). Introductory Immunology. Chapman and Hall, New York
9. Bratke & Myrtek (2007). Immunology: The experimenter series.Elsener Pub.
10. Wood, Peter (2008). Understanding Immunology Elseiver Pub. 2nd edition.

Syllabus for 2-year PG Program as per NEP-2020

M.Sc. Biochemistry
SEMESTER-IV
COMPULSORY THEORY

Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: MEDICAL BIOCHEMSITRY

Course code: P2BCTC402
Duration of Examinations
Minor Test1: 1.5 hour
Minor Test2: 1.5 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Course Objectives: This course teaches the student the clinical applications of Biochemistry in diagnosis of diseases and metabolic disorders and the principles involved in the use of special instruments and methodologies in such investigations. **Course Outcomes:** CO1. Concept building on relevance of physiological alterations and disease onset. CO2. Understanding about the patho-physiology of metabolic disorders. CO3. Role of enzymes in diagnosis of diseases. CO4. Tool and diagnostic methods adapted for diagnosis of genetic disorders.

Unit-I Introduction

i. Definition and scope of clinical biochemistry in diagnosis, use of clinical laboratory and interpretation of results and Factors influencing accuracy of results.

ii. Principles of diagnostic methodologies, end-point and Kinetic measurements; Quality control in Clinical Biochemistry: control of pre-analytical variables, external and internal quality control; Quality assurance and related statistics. Chemistry analyzers and use of enzymes and coupled enzyme assays in the quantification of analytes

iii. Body Fluids: Biochemistry of urine, blood and cerebrospinal fluid, normal and abnormal constituents and clinical entities in body fluids.

iv. Water, Distribution of water in body, water turnover and balance. Electrolyte composition of body fluids, regulation of electrolyte balance.

Unit-II Disorders of metabolism-I

i. Diabetes mellitus, Diabetes insipidious, Glycosylated haemoglobin, Glucose Tolerance test (GTT), Galactosemia.

ii. Glycogen storage diseases and hypoglycaemia.

iii. Lipid Storage diseases, Ketone bodies and ketoacidosis.

iv. Serum lipid profile, Hypertriacylglycerolemia and cholesterolemia, Role of HDL and Apo-Lipoproteinemia.

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Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: MEDICAL BIOCHEMSITRY
Course code: P2BCTC402
Duration of Examinations
Minor Test1: 1.5 hour
Minor Test2: 1.5 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

UNIT-III Disorders of Metabolism-II

i. Inborn errors of amino acid metabolism- Alkaptonuria, Phenylketonuria, Albinism, Homocysteruria, Tyroninemia and other aminoaciduria.
ii. Disorders of lipids: lipid mal-absorption and steatorrhea, sphingolipidosis, Clinical interrelationships of lipids, lipoproteins and apolipoproteins
iii. Disorders of nucleic acid metabolism (Purine and Pyrimidine metabolism).
iv. Disorders of iron, porphyrin and mineral metabolism, Metabolism under stress conditions.

UNIT IV Haematology, acid-Base balance and Detoxification

i. Haematology: Haemolytic anaemia, G6PDH deficiency, Hemoglobinopathies, Thalassemias, thrombosis.
ii. Blood clotting-extrinsic and intrinsic pathways, Bleeding and clotting time.
iii. Production of acids and bases by the body, maintenance of body pH. Acid-base balance and its disorders; metabolic and respiratory acidosis and alkalosis.
iv. Mechanism of detoxification: oxidation, reduction, hydrolysis and conjugation, clinical aspects of detoxification.

Unit –V Clinical Enzymology

i. Principles of diagnostic enzymology, clinical significance of alkaline and acid phosphatase, SGOT, SGPT, LDH, CPK, Aspartate Aminotransferase, Alanine Aminotransferase, Creatine kinase.
ii. Hepatic and Renal Function tests.
iii. Cardiac and Gastric Function tests.
iv. Prostrate and Thyroid Function tests.

G Program as per NEP-2020

Biochemistry

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Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: MEDICAL BIOCHEMSITRY
Course code: P2BCTC402
Duration of Examinations
Minor Test1: 1.5 hour
Minor Test2: 1.5 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Scheme of Examination:

MCQ on LMS + Subjective test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Test I (after 30 days)	20%	1 hour	10+10
Test II (after 60 days)	40%	1 hour	10+10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
	Total		100

The student shall be continuously evaluated during the conduct of each course of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of four short answer type questions (05 marks each). Students are required to answer two questions. No preparatory holidays shall be provided for the Test I and Test II. Those candidates who have appeared in Test I and Test Hand failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

MajorTest

There shall be ten questions in the Major Test out of which 08 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 02 questions (as Section B) would be set across the units of the 40% of the

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Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: MEDICAL BIOCHEMSITRY
Course code: P2BCTC402
Duration of Examinations
Minor Test1: 1.5 hour
Minor Test2: 1.5 hour
Major Test: 3.0 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabus covered in the Test I and Test II. In major test there should not be a gap of more than two days in between two tests.

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts, compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given

Books Recommended:

1. Smith, A.F., Beckett, G.J., Walker, S.W. and Rae, P.W.H. (2013): Clinical Biochemistry.

8th Edition, Blackwell Science.

2. Gaw, A., Cowan, R.A., O'Reilly, D.S.J., Stewart, M.J., Shepherd, J. 5th Edition (2013) Clinical Biochemistry, Churchill Livingstone, Edinburgh London.
3. Montgomry Biochemistry: A case oriented approach 4th edition (2011).
4. Marshall and Bangert. Clinical Chemistry. Churchill Livingstone 9th edition (2020).
5. Marshall: Clinical Biochemistry.
6. Gangong F. William: Review of Medical Physiology 26th Edition (2019).

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M.Sc. Biochemistry
SEMESTER-IV
ELECTIVE – THEORY

Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: FUNCTIONAL NUTRACEUTICALS
Course code: P2BCTE406
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 2
Max. Marks: 50
Minor Test1: 5+5
Minor Test2: 5+5
Major Test: 30
Total: 50

Course Objectives: The objectives of the course are to understand the fundamental concepts of nutrient-gene interactions, including nutrigenomics and nutrigenetics. To explore the molecular and epigenetic mechanisms influencing nutrient metabolism and disease susceptibility. To examine the hormonal and biochemical regulation of metabolism, appetite, and eating behaviour. To investigate the clinical and molecular basis of metabolic disorders and their nutritional implications. To analyse the role of gut microbiota, immunity, and therapeutic nutrition in maintaining health and managing disease. **Course Outcomes:** By the end of this course, students will be able to: CO1. Differentiate between nutrigenomics and nutrigenetics and explain the role of genetic and epigenetic mechanisms in nutrition. CO2. Explain the molecular mechanisms behind metabolic disorders like diabetes, obesity, and metabolic syndrome, including mitochondrial dysfunction and bioenergetics. CO3. Apply knowledge of molecular techniques (e.g., PCR, SNP analysis, gene expression profiling) in the context of nutritional genomics research. CO4. Assess the role of hormones (leptin, ghrelin, insulin, etc.) and signalling pathways (AMPK, mTOR, PPARs) in metabolism and appetite regulation. CO5. Explain the functions and responsibilities of FSSAI and DCGI in regulating food and pharmaceutical products in India.

Unit 1: Nutrient-Gene Interactions and Nutritional Genomics

i) Nutrigenomics vs Nutrigenetics, Classification and biochemical mechanisms of nutraceuticals.

ii) Role of genetic polymorphisms in nutrient metabolism (e.g., MTHFR and folate metabolism), Epigenetic modifications influenced by diet (DNA methylation, histone modification).

iii) Molecular basis of metabolic disorders: Diabetes, Metabolic Syndrome, Obesity, Bioenergetics, and mitochondrial function in nutrition.

iv) Molecular techniques in nutritional genomics research.

Unit 2: Hormonal and Molecular Regulation of Metabolism and Eating Behaviour

i) Hormonal regulation of appetite: Ghrelin, leptin, insulin, PYY, GLP-1; Nutrient sensing pathways (e.g., SIRT1, AMPK).

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COURSE TITLE: FUNCTIONAL NUTRACEUTICALS
Course code: P2BCTE406
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 2
Max. Marks: 50
Minor Test1: 5+5
Minor Test2: 5+5
Major Test: 30
Total: 50

ii) Hormonal control of carbohydrate, lipid, and protein metabolism (insulin, glucagon, cortisol, leptin, ghrelin), Signal transduction pathways (e.g., mTOR, AMPK, PPARs).

iii) Neuro-biochemistry of food intake and reward system (dopamine, serotonin pathways) and Eating-disorders: biochemical and metabolic consequences. Biochemical response to fasting, starvation, and refeeding syndrome.

iv) Clinical biomarkers of nutritional status (serum proteins, lipid profile, vitamin levels), Biochemical basis of malnutrition and overnutrition.

Unit 3: Advanced Therapeutic Nutrition of Immune and Gut Health

i) Dietary supplements: Efficacy, safety, regulatory aspects; Concept of Parenteral and enteral nutrition: Biochemical considerations in formulation and delivery.

ii) Overview of Microbiome-nutrient interactions, Biochemistry of Probiotics, prebiotics, and synbiotics.

iii) Gut-associated lymphoid tissue (GALT) and nutrition; Gut microbiota and its metabolic products (SCFAs, bile acids); Nutrient absorption and metabolism with aging, Role of dietary fiber in immune-gut axis; and Leaky gut syndrome and nutritional modulation.

iv) FSSAI: Overview, functions, food safety regulations, licensing, and recent developments. DCGI: Role in drug regulation, clinical trials, approval processes, and quality control of pharmaceuticals.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

MCQ on LMS + Subjective questions	Syllabus to be covered in the examination	Tie allotted for the examination	Weightage of marks
Minor Test – 1 (after 30 days)	20 %	45 min	5+5
Minor Test – 2 (after	20 %	45 min	5+5

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COURSE TITLE: FUNCTIONAL NUTRACEUTICALS
Course code: P2BCTE406
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 2
Max. Marks: 50
Minor Test1: 5+5
Minor Test2: 5+5
Major Test: 30
Total: 50

60 days)			
Major test - (after 90 days)	60 %	2.5 hour	30
			50 marks

The student must be evaluated continuously during the conduct of each curse on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of four short answer type questions (2.5 marks each). Students are required to answer two questions. No preparatory holidays shall be provided for the Test I and Test II. Those candidates who have appeared in Test I and Test Hand failed to get the minimum required marks i.e. 7 out of 20 will be eligible to re-appear in the Test I and Test II only once.

MajorTest

There shall be 5 questions in the Major Test out of which 04 questions (as Section A) would be set out of the 60% of the Syllabus not covered in the Test I and Test II. The remaining 01 questions (as Section B) would be set across the units of the 40% of the Syllabus covered in the Test I and Test II. In major test there should not be gap of more than two days in between two exams

RECOMMENDED BOOKS:

1. Haslberger, A.G. 2022. Advances in Precision Nutrition, Personalization and Healthy Aging. Hardcover ISBN 978-3-031-10152-6, Softcover ISBN 978-3-031-10155-7.

2. Litwack, G. 2021. Human Biochemistry. Academic Press. ISBN: 9780323910538

3. Biswas, D., and Rahaman, S.O.(Eds.). 2020. Gut Microbiome and Its Impact on Health and Disease. Springer.

4. Nelson, D. L., and Cox, M. M. (2017). Lehninger Principles of Biochemistry. W.H Freeman and Company.

5. Ferguson, L.R. 2014 (e-book 2016). Nutrigenomics and Nutrigenetics in Functional Foods and Personalized Nutrition. CRC Press.

M.Sc. Biochemistry
SEMESTER-IV
ELECTIVE – THEORY

Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

COURSE TITLE: FUNCTIONAL NUTRACEUTICALS

Course code: P2BCTE406

Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 2
Max. Marks: 50
Minor Test1: 5+5
Minor Test2: 5+5
Major Test: 30
Total: 50

6. Watson, R.R., Preedy, V.R. 2015. Probiotics, Prebiotics, and Synbiotics: Bioactive Foods in Health Promotion. Academic Press. ISBN-10: 0128021896

7. Litwack, G. (Ed.). 2008. Human Biochemistry and Disease. Academic Press. ISBN 978-0-12-452815-4.

8. Kaput, J., and Rodriguez, R. L. 2006. Nutritional genomics: Discovering the path to personalized nutrition. Wiley-Interscience.

M.Sc. Biochemistry
SEMESTER-IV
ELECTIVE-THEORY

Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029

Course Title: IPRs and Bioethics
Course code: P2BCTE407
Duration of Examinations
Minor Test1: 1 hour
Minor Test 2:1 hour

Contact hours: 24
Max. Marks: 50
Minor Test 1: 5+5 marks
Minor Test 2: 5+5 marks
Major Test:30 marks
Major Test: 2.5 hour

Total: 50 marks

Objectives: The objectives of the course are: To introduce the fundamentals of Intellectual Property Rights (IPRs) and their relevance in biotechnology and life sciences. To explain the patenting process, including the legal, procedural, and institutional aspects related to biological innovations. To explore the concept of Sui generis systems for plant varieties, databases, and traditional knowledge. To impart knowledge on international IPR frameworks such as WIPO, TRIPS, and Indian legislations. **Outcomes:** By the end of this course, students will be able to: CO1. Identify and describe various forms of intellectual property (trademarks, patents, copyrights, GIs, trade secrets) and their roles in biotechnology. CO2. Explain the criteria and processes for obtaining patents in the biological sciences, including novelty, non-obviousness, and industrial applicability. CO3. Differentiate between patentable and non-patentable inventions in biotechnology, and assess the concept of biological and gene patents. CO4. Analyse the significance and provisions of TRIPS Agreement and WIPO, and relate them to Indian IP laws and biodiversity protection acts. CO5. Describe and interpret the biological patenting challenges and application procedures in India, USA, and Europe including PCT, opposition systems, and licensing. CO6. Evaluate the role of technology transfer offices and licensing practices in translating innovations to commercial use, and understand the legal consequences of patent infringement.

Unit-I: Intellectual Property

i.Introduction to IPRs; various types of IPRs: Trademarks, Copyrights, Geographical indications, Trade Secrets; Role of IPRs in Biotechnology.

ii. Patents: Criteria for patenting in Biotechnology/Microbiology/Biochemistry: novelty, non-obviousness, and utility; Patentable and non-patentable inventions; Biological Patents; Purpose of patents.

iii. *Sui generis* system of IPRs: Need for *Sui generis* system; Plant variety protection, Database protection, other forms of *Sui generis* protection.

iv. Introduction to WIPO and TRIPS, various provisions in the TRIPS Agreement; Indian legislations for the protection of various types of IPs; National Biodiversity protection initiatives.

Unit-II: PATENTING PROCESS

i. Specific challenges in biological patenting: gene patents, diagnostic patents and biopharmaceuticals patents.
ii. Patent application: various components of Patent application, patent search, patent filing, Pre grant and post grant opposition, Patent Cooperation Treaty (PCT).
iii. Introduction to Indian patent office, US patent office and European patent office.

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Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029

Course Title: IPRs and Bioethics
Course code: P2BCTE407
Duration of Examinations
Minor Test1: 1 hour
Minor Test 2:1 hour

Contact hours: 24
Max. Marks: 50
Minor Test 1: 5+5 marks
Minor Test 2: 5+5 marks
Major Test:30 marks
Major Test: 2.5 hour

Total: 50 marks

iv. Patent Licensing; Technology Transfer; The role of technology transfer offices in academic and research institutions; Patent Infringement.

Unit-III: Bioethics

i. Introduction to Bioethics, Statement of Bioethical Principles; Rules and regulations of ethical issues in India.
ii. Traditional knowledge and bioethics; Gene therapy: Somatic genome editing; Germ line gene therapy Moratorium; Medical privacy and genetic discrimination.
iii. Bioethics in research: Stem cells, animal cloning; Use of animals in research, animal rights; Human experimentation; Organ transplantation.
iv.Genetically Modified foods, environmental risk, labelling and public opinion; Protection of environment and biodiversity; Biopiracy, case studies

NOTE FOR PAPER SETTING AND COURSE EVALUATION

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**%Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	05 + 05
TEST II (after 60days)	21 to 40%	1 hour	05 + 05
Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
Major test (after 90 days)	100%	2.5 hours	30
Total			50

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II**. Those candidates who have appeared in Test I

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Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029

Course Title: IPRs and Bioethics — **Contact hours: 24**
Course code: P2BCTE407 — **Max. Marks: 50**
Duration of Examinations — **Minor Test 1: 5+5 marks**
Minor Test1: 1 hour — **Minor Test 2: 5+5 marks**
Minor Test 2:1 hour — **Major Test:30 marks**
Major Test: 2.5 hour

Total: 50 marks

and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

BOOKS RECOMENDED:

1. Ahuja VK; (2015) Intellectual Property Rights in India Lexis, Nexis, and New Delhi.
2. Arthur William et al.; (2005) Expanding Horizons in Bioethics, Springer.
3. Ganguli P.; (2006) Intellectual Property Rights, Tata Mcgraw Hill Publishing Co Ltd.
4. Padma N; (2017) An introduction to Ethical, Safety and intellectual property rights issues in Biotechnology, Academic press (Elsevier), UK.
5. Rao MB; (2008) Biotechnology, IPRs and biodiversity, Pearson Publications.
6. Singh HB, Jha A and Keswani C; (2016) Intellectual property issues in Biotechnology, CABI, UK.
7. Pattinson S; (2025) Medical Law and Ethics (7th Edition), Sweet & Maxwell Publishers, ISBN: 9780414125070
8. Keswani C and Possas C (2024); Intellectual Property Issues in Life Sciences: Disputes and Controversies, CRC Press USA
9. Stasi A and David TWC (2023); An Introduction to Legal, Regulatory and Intellectual Property Rights Issues in Biotechnology, Bentham Science Publishers UAE.

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M.Sc. Biochemistry
Semester-IV
ELECTIVE-THEORY

Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

Course Title: BIOENTREPRENEURSHIP
Course Code: P2BCTE408
Contact hours: 24
Duration of Examinations:
Minor Test 1: 1hour
Major Test: 2.5 hours

Course Credits: 2
Max. Marks: 50
Minor Test 1: 5+5
Minor Test 2: 5+5
Major Test: 30
Total: 50

Objectives:
This course will provide an in-depth understanding of bioentrepreneurship, focusing on the intersection of biotechnology, innovation, and business strategies. The course covers the essential aspects of starting, managing, and scaling a biotechnology company, including market analysis, financing, regulatory considerations, and commercialization strategies. Students will engage with case studies, develop business plans, and explore real-world examples of successful biotech startups.
Course Outcomes: By the end of this course, students will be able to: CO1. Define and explain the concept of bioentrepreneurship and evaluate its relevance and scope in biotechnology and allied life sciences. CO2. Identify innovative opportunities in biotechnology and apply out-of-the-box thinking to explore emerging technologies and business models. CO3. Analyse different entrepreneurial domains (agri-biotech, pharma-biotech, microbial biotech, etc.) and assess the basic characteristics and motivation factors for becoming an entrepreneur. CO4. Develop a business plan addressing feasibility, financial management, statutory/legal requirements, and partnership strategies. CO5. Identify funding opportunities and differentiate between various financial instruments like seed money, venture capital, angel investing, government schemes (BIRAC, SISFS, etc.). CO6. Evaluate successful case studies of biotech startups to extract best practices and design effective entrepreneurial strategies for new ventures.

UNIT -I INTRODUCTION TO BIOENTREPRENEURSHIP

i. Overview of Bioentrepreneurship; Definition, scope, and importance of Bioentrepreneurship.
ii. Integration of science, technology and business for Bioentrepreneurship; creativity; innovation – types, out of box thinking.
iii. Various Entrepreneurial opportunities in Biotechnology/Microbiology/ Biochemistry; New evolving areas in Biotechnology.
iv. Social and business entrepreneurship; basic characteristics of entrepreneurship; Developing entrepreneurship through training and motivation.

UNIT -II MANAGING ENTREPRENEURSHIP

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Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

Course Title: BIOENTREPRENEURSHIP
Course Code: P2BCTE408
Contact hours: 24
Duration of Examinations:
Minor Test I: 1hour
Major Test: 2.5 hours

Course Credits: 2
Max. Marks: 50
Minor Test 1: 5+5
Minor Test 2: 5+5
Major Test: 30
Total: 50

i. Translating scientific research into commercially viable products; IP and technology transfer from academic/research institutions.
ii. Business plan preparation including statutory and legal requirements, Business feasibility study, financial management, collaborations and partnerships.
iii. Assessment of market demand for potential product(s) of interest; Market conditions, segmentation; Identifying needs of customers including gaps in the market.
iv. Branding issues; Developing distribution channels; Pricing/Competition; Promotion/ Advertising.

UNIT -III DEVELOPING A BUSINESS MODEL FOR STARTUPS

i. Development and upgradation of technology, Quality control; Regulatory Compliances and procedures.
ii. Concept of startups and associated challenges, stages of startups, incubation centre, acceleration centre.

iii. Understanding the biotech venture funding lifecycle: Seed money, venture capital, angel investors, crowdfunding; Government grants Schemes like SISFS, CGSS, AIM etc., BIRAC: SEED fund, BIG etc.
iv. Startups/companies working in different areas of specialization (agri-based, pharma -based etc.); Case studies of successful biotech startups.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**%Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	05 + 05
TEST II (after 60days)	21 to 40%	1 hour	05 + 05
Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)

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Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

Course Title: BIOENTREPRENEURSHIP
Course Code: P2BCTE408
Contact hours: 24
Duration of Examinations:
Minor Test 1: 1hour
Major Test: 2.5 hours

Course Credits: 2
Max. Marks: 50
Minor Test 1: 5+5
Minor Test 2: 5+5
Major Test: 30
Total: 50

Major test (after 90 days)	100%	2.5 hours	30
Total			50

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II**. Those candidates who have appeared in Test I and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

Books Recomemded:

1. Ahmetoglu et al., (2017) The Wiley handbook of entrepreneurship, John Wiley and sons.
2. Craig S; (2020) Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies, Academic Press (Elsevier), UK.
3. Patzelt, H, Brenner T; (2008) Handbook of Bioentrepreneurship, Springer Publications.
4. Hopkins T and Perui O; (2019) The smart start up, Jaico publishing house, Mumbai
5. Venkatratnam JB; (2009) Entrepreneurship Development, Heritage Printers, Hyderabad.
6. Zaware N; (2018) Entrepreneurship development and start up management, Educreation publishing, New Delhi

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Minor Test 1: 1hour
Major Test: 2.5 hours

Course Credits: 2
Max. Marks: 50
Minor Test 1: 5+5
Minor Test 2: 5+5
Major Test: 30
Total: 50

7. Bhatt AK, Bhatia RK, Bhalla TC; (2023) Basic Biotechniques for Bioprocess and Bioentrepreneurship, Academic Press Inc.
8. Shimasaki C; (2014) Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies, Academic Press.
9. Patzelt H; (2008) Handbook of Bioentrepreneurship, Springer Publishers.
10. Gupta A, George G, Fewer TJ; (2024) Venture Meets Mission: Aligning People, Purpose, and Profit to Innovate and Transform Society, Stanford Business Books.

Additional Resources:
-Webinars and Guest Lectures: Regular sessions from biotech entrepreneurs and investors sharing industry insights.
-Industry Networking: Opportunities to engage with biotech incubators, accelerators, and funding bodies.

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M.Sc. Biochemistry
Semester-IV
ELECTIVE-THEORY
Syllabi for the examinations to be held in the years May 2027, 2028 & May 2029.

Course Title: Research Methodology and Scientific Communication
Course code: P2BCTE409
Duration of Examinations
Credits: 2
Minor Test1: 1 hour
Minor Test 2:1 hour
Major Test: 30 marks

Contact hours: 24
Max. Marks: 50
Minor Test1: 10 marks
Minor Test 2: 10 marks
Major Test: 2.5 hours
Total: 50 marks

Course objective: The objectives of this course are to give background on history of science, emphasizing methodologies used to do research, use framework of these methodologies for understanding effective lab practices and scientific communication and appreciate scientific ethics. **Course Outcomes:** The outcomes of this course are: CO1.To explain the philosophy of science and describe the principles of empirical and experimental research, including the use of controls. CO2. Identify a potential research area, distinguish between original vs incremental research, and assess its significance and impact. CO3. Design a research process involving hypothesis formulation, experiment planning, and appropriate statistical controls. CO4. Use internet tools effectively for scientific data search, including search engines, the hidden web, and science forums. CO5. Prepare formal and scientific documents, including reports, proposals, and research papers with proper layout and organization. CO6. Identify common challenges in scientific writing, recognize plagiarism, and use plagiarism detection software appropriately.

UNIT I: SCIENCE METHODOLOGIES

i. The philosophy of science; Empirical science, manipulative experiments and controls
ii. Deductive and inductive reasoning; Reductionist vs holistic biology
iii. Identifying a research area of interest, importance of originality and impact, exploratory versus incremental research
iv. The research process, hypothesis testing, experimental design

UNIT II: PROCESS OF COMMUNICATION

i. Concept of effective communication- setting clear goals for communication; Determining outcomes and results
ii. Initiating communication; Preparing and presenting using PowerPoint; Scientific poster preparation & presentation
iii. Computing skills for scientific research - web browsing for information search; Search engines and their mechanism of searching

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Course Title: Research Methodology and Scientific Communication
Course code: P2BCTE409
Duration of Examinations
Credits: 2
Minor Test1: 1 hour
Minor Test 2:1 hour
Major Test: 30 marks

Contact hours: 24
Max. Marks: 50
Minor Test1: 10 marks
Minor Test 2: 10 marks
Major Test: 2.5 hours
Total: 50 marks

iv. Hidden Web and its importance in scientific research; Internet as a medium of interaction between scientists; Effective email strategy using the right tone and conciseness.

UNIT III: SCIENTIFIC COMMUNICATION

i. Technical writing skills - types of reports; layout of a formal report; Scientific writing skills - importance of communicating science;
ii. Problems while writing a scientific document; Plagiarism, Software for plagiarism checking
iii. Scientific publication writing: elements of a scientific paper including abstract, introduction, materials & methods, results, discussion, references; drafting titles and framing abstracts
iv. Publishing scientific papers - peer review process and problems, recent developments such as open access and nonblind review; characteristics of effective technical communication; scientific presentations; ethical issues, scientific misconduct.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

MCQ on LMS + Subjective Test	**Syllabus to be covered in the examination**	**Time allotted for the examination**	**% Weightage (Marks)**
TEST I (after 30 days)	20%	1 hour	10 + 10
TEST II (after 60days)	21 to 40%	1 hour	10 + 10
Theory	Syllabus to be covered in the examination	Time allotted for the examination	%Weightage (Marks)
Major test (after 90 days)	100%	3 hours	60
Total			100
Practical / Research (thesis/project/patent)			

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Course Title: Research Methodology and Scientific Communication
Course code: P2BCTE409
Duration of Examinations
Credits: 2
Minor Test1: 1 hour
Minor Test 2:1 hour
Major Test: 30 marks
Contact hours: 24
Max. Marks: 50
Minor Test1: 10 marks
Minor Test 2: 10 marks
Major Test: 2.5 hours
Total: 50 marks

Internal Examination	100%	4 hours	50
External Examination	100%	4 hours	50
Total			100

The student shall be continuously evaluated during the conduct of each course on the basis of his/her performance as follows:

Test I and Test II

The Subjective Test of Test I and Test II would consist of three short answer type questions (05 marks each). Students are required to answer two questions. **No preparatory holidays shall be provided for the Test I and Test II**. Those candidates who have appeared in Test I and Test II and failed to get the minimum required marks i.e. 14 out of 40 will be eligible to re-appear in the Test I and Test II only once.

Major Test

The Major test will comprise of two sections, Section-A and Section-B. Section-A will have one compulsory question comprising of 08 parts (minimum 01 from each unit) of 03 marks each. Section B will have 06 questions of 12 marks each to be set from the last three units (02 from each unit). In section B students are required to attempt 01 question from each unit. **In major test there should not be a gap of more than two days in between two tests.**

External Practical/ Research (thesis/project/patent) examination

External Practical/ Research examination shall be conducted by Board of Examiners consisting of Head of the Department, one/two Senior Professors of concerned department, concerned teacher and outside expert to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/assess final practical performance/ dissertation of the students.

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Syllabi for the examinations to be held in the years May 2027, 2028 & May 2029.

Course Title: Research Methodology and Scientific Communication

Course code: P2BCTE409
Duration of Examinations
Credits: 2
Minor Test1: 1 hour
Minor Test 2:1 hour
Major Test: 30 marks

Contact hours: 24
Max. Marks: 50
Minor Test1: 10 marks
Minor Test 2: 10 marks
Major Test: 2.5 hours
Total: 50 marks

BOOKS RECOMMENDED:

1. Valiela, I. 2nd Edition (2009). Doing Science: Design, Analysis, and Communication of Scientific Research. Oxford: Oxford University Press.
2. On Being a Scientist: a Guide to Responsible Conduct in Research. 3rd Edition (2009). Washington, D.C.: National Academies Press.
3. Gopen, G. D., & Smith, J. A. The Science of Scientific Writing. American Scientist, 78 (Nov-Dec 1990), 550-558.
4. Mohan, K., & Singh, N. P. (2010). Speaking English Effectively. Delhi: Macmillan India.
5. Movie: Naturally Obsessed, The Making of a Scientist

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Semester-IV
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COURSE TITLE: Research Project
Course code: P2BCPR410 **Contact hours: 192**
Duration of Examinations **Credits: 16**
Max. Marks: 400
Dissertation: 200
Presentation and Viva: 200

COURSE OBJECTIVE:
This course bridges theoretical learning with real-world problem-solving, enabling postgraduate students to apply their academic knowledge through hands-on research projects. Students will develop critical thinking, strengthen data analysis skills, and cultivate a problem-solving mindset. Emphasis is placed on self-directed learning, fostering research competencies, and gaining advanced knowledge through project-based study.

COURSE OUTCOMES:
Upon completion of the project work course, student will be able to

- Apply academic concepts and theoretical knowledge to address real-world problems.
- Demonstrate research competencies, including literature review, data collection, data analysis, and interpretation of results.
- Draw meaningful conclusions from research findings and present them effectively.
- Communicate research outcomes clearly in written, oral, and visual formats.
- Collaborate effectively in teams, demonstrating strong interpersonal and time management skills.
- Exhibit readiness for professional roles or advanced academic research through enhanced problem-solving and self-directed learning abilities.

Scheme of Research Project and Dissertation

Allotment of Supervisor
Each student shall carry out a project work in one of the broad areas of Microbiology in the semester IV under the supervision of the faculty of the department.

Research Work and Dissertation Writing:
1. After the allotment of supervisor, the student will carry out the proposed research work (field/lab.) and post-completion of the research work, students will write the dissertation. During the field/lab work and compilation of the dissertation, the student will work under continuous guidance of the supervisor who will maintain the regular attendance of the student.
2. Student will submit 2 hard copies of the final dissertation in the department along with a soft copy of the same.

Journal Club:

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Course code: P2BCPR410 **Contact hours: 192**
Duration of Examinations **Credits: 16**
Max. Marks: 400
Dissertation: 200
Presentation and Viva: 200

Student has to select a paper related to the dissertation work, prefer recent (last 3-5 years) and high impact articles. Read it multiple times to understand not just the content, but also the context and implications. A well-structured presentation has to be made and present it in front of the faculty members in 10-20 minutes time.

Project Writing:

Project writing is a structured way of presenting ideas, plans, and research in a clear, organized format so that others can understand, evaluate, and support them. Student has to write a research project that will improves writing, critical thinking, and presentation skills, which will be evaluated subsequently

Format for dissertation is given below:

The dissertation should be presented chapter wise. Each chapter will have a precise title as given below. A chapter can be subdivided into sections, and sub-section so as to present the content discretely and with due emphasis.

1. Abstract
2. Content Page
3. List of Figures
4. List of Tables
5. Acknowledgement
6. List of Abbreviations

Chapter 1: Introduction:

It shall justify and highlight the problem posed, define the topic and explain the aim and scope of the work presented in the dissertation. This chapter also include objective of the research work. It may also highlight the significant contributions from the investigation.

Chapter 2: Review of Literature:

This Chapter presents a critical appraisal of the previous work published in the literature pertaining to the topic of the investigation.

Chapter 3: Material and Methods:

This chapter deals with a detail methodology/technique/theory by which researcher used to carry out the research work.

Chapter 4: Results and Discussion:

This chapter includes a thorough evaluation of the investigation carried out and brings out the contributions from the study. The discussion shall logically lead to inferences and conclusions as well as scope for possible further future work.

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Presentation and Viva: 200

Chapter 5: Summary and Conclusion:

A brief report of the work carried out shall form the first part of the Chapter. Conclusions derived from the logical analysis presented in the results and discussions chapter shall be presented and clearly enumerated, each point stated separately. Scope for future work should be stated lucidly in the last part of this chapter.

Chapter 6: References/Bibliography:

The candidates shall follow the style for references as mentioned below. For journal: Loizides, M., Georgiou, A.N., Somarakis, S., Witten, P.E. and Koumoundouros, G., 2014. A new type of lordosis and vertebral body compression in G ilthead sea bream, S parus aurata L.: aetiology, anatomy and consequences for survival. Journal of Fish Diseases, 37(11), pp.949-957.

TYPE -SETTING, TEXT PROCESSING AND PRINTING

1. The text shall be printed employing using a standard text processor. The standard font shall be Times New Roman of 12 pts with 1.5 line spacing.
2. Binding Spiral or hard Binding
3. Front Covers: The front covers shall contain the following details: a. Full title of dissertation in 6 mm/22 point's size font properly centered and positioned at the top. b. Full name of the candidate in 4.5 mm 15 point's size font properly centered at the middle of the page. c. 40 mm wide replica of the College and University emblems followed by the name of department, name of the College, name of the University and the year of submission, each in a separate line and properly centered and located at the bottom of page.
4. Title Sheet: This shall be the first printed page of the thesis and shall contain the submission statement: the dissertation submitted in partial fulfilment of the requirements of the B.Sc. (Honours) Biotechnology, the name, Registration No. and University Roll No. of the candidate, name(s) of the Supervisor, Department, College, University and year of submission. 5. A Declaration of Academic Honesty and Integrity by Candidate: A declaration of Academic honesty and integrity is required to be included along with every dissertation. The format of this declaration is given in Annexure-I attached. 6. Certificate from Supervisor (Annexure-II):
7. Abstract: The 500-word (maximum) abstract shall highlight the important features of the dissertation.

Evaluation of the dissertation:

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Duration of Examinations **Credits: 16**
Max. Marks: 400
Dissertation: 200
Presentation and Viva: 200

1. The project report/dissertation shall be evaluated by the external expert from other University/Institutes
2. The students shall be declared pass in the research project course if she/he secures minimum 40% marks (Dissertation and viva).

ANNEXURE-I

CERTIFICATE

The work embodied in this dissertation entitled " .... " (write the title in capital letters) has been carried out by me under the supervision of .... (give the name of the Guide).

This work is original and has not been submitted byme for the award of any other degree of University of Jammu or any other University. I also declare that no chapter of this manuscript in whole or in part is lifted and incorporated.

.....

.....
(Signature and Name of the Candidate)

Date: .....
Place: .....

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Max. Marks: 400
Dissertation: 200
Presentation and Viva: 200

ANNEXURE-II

CERTIFICATE OF DISSERTATION GUIDE/SUPERVISOR

I certify that the candidate /Mr./Ms./Mrs ..... has planned and conducted the research study entitled "..... ....." under my guidance and supervision and that the report submitted herewith is a genuine, original, and bonafide work done by the candidate in ..... (Place) from..... to ..... (Dates). ....

(Signature and Name of the Supervisor)
Date : .....
Place.....

.....
Name, Signature of HoD

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