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)

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

SYLLABI FRAMEWORK PG PROGRAMME BIOCHEMISTRY (1 YEAR)

1.	P1BCTC101	Metabolism	4	6.5	26	Core	100	-	✓	✓	✓	✓			
2.	P1BCTC102	Fundamentals of Genetics and Genomics	4	6.5	26	Core	100	-	✓	✓	✓	✓			
	P1BCTC103	Biochemistry of Nutrition	4	6.5	26	Core	100	-	✓	✓	✓	✓			
3.	P1BCTC104	Fundamental of Bioinformatics and Biostatistics	2	6.5	13	Core	50	-	✓	✓	✓	✓			
4.	P1BCPC105	Laboratory course based on Metabolism	2	6.5	13	Core	-	50	✓	✓	✓	✓			
5.	P1BCPC106	Laboratory course based on Molecular Genetics and Genomics	2	6.5	13	Core	-	50	✓	✓	✓	✓			
3.	P1BCPC107	Laboratory course in Fundamental of Bioinformatics and Biostatistics	2	6.5	13	Core	-	50	✓	✓	✓	✓			
33	P1BCTE108	Artificial Intelligence in Biology	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
34	P1BCTE109	Computational Genomics	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
35	P1BCTE110	Microbiomics	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
36	P1BCTE111	Lab Course based on Artificial Intelligence in Biology	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
37	P1BCTE112	Lab Course based on Computational Genomics	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
38	P1BCTE113	Lab Course based on Microbiomics	2	6.5	13	Elective	-	50	✓	✓	✓	✓			
39	P1BCTC201	Immunology and Immunotechnology	4	6.5	26	Core	100	-	✓	✓	✓	✓			
40	P1BCTC202	Medical Biochemistry	4	6.5	26	Core	100	-	✓	✓	✓	✓			
42	P1BCPC203	Laboratory course based on Immunology and Immunotechnology	2	6.5	13	Core	-	50	✓	✓	✓	✓			
43	P1BCPC204	Laboratory course based on Medical Biochemistry	2	6.5	13	Core	-	50	✓	✓	✓	✓			
44	P1BCTE206	Functional Nutraceuticals	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
45	P1BCTE207	IPRs and Bioethics	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
46	P1BCTE208	Bio Entrepreneurship	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
47	P1BCBTE209	Research methodology and Scientific communication	2	6.5	13	Elective	50	-	✓	✓	✓	✓			
48	P1BCPRC210	Research Project (Project presentation +Viva-Voce + Dissertation)	16	13	208	Core	400	-	✓	✓	✓	✓			

Syllabus for 1-year PG Program as per NEP-2020

Scheme

Total Credits= 52

Semester-I

COURSE CODE	PAPER	CREDITS
Core Courses		
P1BCTC101	Metabolism	4
P1BCTC102	Fundamentals of Genetics and Genomics	4
P1BCTC103	Biochemistry of Nutrition	4
P1BCTC104	Fundamentals of Bioinformatics and Biostatistics	2
P1BCPC105	Laboratory course based on Metabolism	2
P1BCPC106	Laboratory course based on Molecular Genetics and Genomics	2
P1BCPC107	Laboratory course based on Fundamentals of Bioinformatics and Biostatistics	2
Electives*		
P1BCTE108	Artificial Intelligence in Biology	2
P1BCTE109	Computational Genomics	2
P1BCTE110	Microbiomics	2
P1BCPE111	Practical based on Artificial Intelligence in Biology	2
P1BCPE112	Practical based on Computational Genomics	2
P1BCPE113	Practical based on Microbiomics	2
TOTAL		22

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

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

Semester-II

COURSE CODE	PAPER	CREDITS
Core Courses		
P1BCTC201	Immunology and Immunotechnology	4
P1BCTC202	Medical Biochemistry	4
P1BCPC203	Laboratory course based on Immunology and Immunotechnology	2
P1BCPC204	Laboratory course based on Medical Biochemistry	2
Electives*		
P1BCTE206	Functional Nutraceuticals	2
P1BCTE207	IPR and Bioethics	2
P1BCTE208	Bio entrepreneurship	2
P1BCTE209	Research Methodology and Scientific Methodology	2
P1BCPRC210	Research Project, Project Presentation, Viva Voce and Dissertation	16
TOTAL		30

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

Syllabus for 1-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 2026, Dec 2027 & Dec 2028.

COURSE TITLE: METABOLISM

Course code: P1BCTC101
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:

UNIT-4: NUCLEIC ACID METABOLISM

Syllabus for 1-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 2026, Dec 2027 & Dec 2028.

COURSE TITLE: METABOLISM

Course code: P1BCTC101
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

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 1-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 2026, Dec 2027 & Dec 2028.

COURSE TITLE: METABOLISM

Course code: P1BCTC101
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.

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

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– I

COMPULSORY-THEORY

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

COURSE TITLE: METABOLISM

Course code: P1BCTC101
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 1-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 2026, Dec 2027 & Dec 2028

COURSE TITLE: FUNDAMENTALS OF GENETICS AND GENOMICS

Course code: P1BCTC102
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

Syllabus for 1-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 2026, Dec 2027 & Dec 2028

COURSE TITLE: FUNDAMENTALS OF GENETICS AND GENOMICS

Course code: P1BCTC102
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. Human pedigrees; X linked inheritance, Sex influenced and sex-limited expression.

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

Syllabus for 1-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 2026, Dec 2027 & Dec 2028

COURSE TITLE: FUNDAMENTALS OF GENETICS AND GENOMICS

Course code: P1BCTC102
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

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

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

Syllabus for 1-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 2026, Dec 2027 & Dec 2028

COURSE TITLE: FUNDAMENTALS OF GENETICS AND GENOMICS

Course code: P1BCTC102
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 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.

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

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.

Syllabus for 1-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 2026, Dec 2027 & Dec 2028

COURSE TITLE: FUNDAMENTALS OF GENETICS AND GENOMICS

Course code: P1BCTC102
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

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.

Syllabus for 1-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 2026, Dec 2027 & Dec 2028.

COURSE TITLE: BIOCHEMISTRY OF NUTRITION

Course code: P1BCTC103
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.

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

Syllabus for 1-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 2026, Dec 2027 & Dec 2028.

COURSE TITLE: BIOCHEMISTRY OF NUTRITION

Course code: P1BCTC103
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

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).

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

iv) Molecular techniques in nutritional genomics research.

Syllabus for 1-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 2026, Dec 2027 & Dec 2028.

COURSE TITLE: BIOCHEMISTRY OF NUTRITION

Course code: P1BCTC103
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

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.

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

Syllabus for 1-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 2026, Dec 2027 & Dec 2028.

COURSE TITLE: BIOCHEMISTRY OF NUTRITION

Course code: P1BCTC103
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

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. 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

Syllabus for 1-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 2026, Dec 2027 & Dec 2028.

COURSE TITLE: BIOCHEMISTRY OF NUTRITION

Course code: P1BCTC103
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

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
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.

Syllabus for 1-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 2026, Dec 2027, Dec 2028.

COURSE TITLE: FUNDAMENTALS OF BIOINFORMATICS AND BIOSTATISTICS

Course code: P1BCTC104	**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

M.Sc. Biochemistry
SEMESTER-I
COMPULSORY-THEORY

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: P1BCTC104	**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**

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

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

M.Sc. Biochemistry
SEMESTER-I
COMPULSORY-THEORY

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: P1BCTC104 **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**

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)

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

M.Sc. Biochemistry
SEMESTER-I
COMPULSORY-THEORY

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: P1BCTC104	**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**

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. 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.

Syllabus for 1-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 2026, Dec 2027, Dec 2028.

COURSE TITLE: ARTIFICIAL INTELLIGENCE IN BIOLOGY

Course code: P1BCTE108 **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.

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SEMESTER–I
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: P1BCTE108 **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

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Syllabus for 1-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: P1BCTE108 **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.**

RECOMMENDED BOOKS

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

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

Syllabus for 1-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 2026, Dec 2027, Dec 2028.

COURSE TITLE: ARTIFICIAL INTELLIGENCE IN BIOLOGY

Course code: P1BCTE108 **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**

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

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

Syllabus for 1-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 2026, Dec 2027, Dec 2028.

COURSE TITLE: ARTIFICIAL INTELLIGENCE IN BIOLOGY

Course code: P1BCTE108 **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

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

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

COURSE TITLE: COMPUTATIONAL GENOMICS

Course code: P1BCTE109
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

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

COURSE TITLE: COMPUTATIONAL GENOMICS

Course code: P1BCTE109
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

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

COURSE TITLE: COMPUTATIONAL GENOMICS

Course code: P1BCTE109
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

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

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**

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

COURSE TITLE: COMPUTATIONAL GENOMICS

Course code: P1BCTE109
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

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. 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

M.Sc. Biochemistry
SEMESTER–I
ELECTIVE – THEORY

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

COURSE TITLE: MICROBIOMICS

Course code: P1BCTE110	**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.

M.Sc. Biochemistry
SEMESTER–I
ELECTIVE – THEORY

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

COURSE TITLE: MICROBIOMICS

Course code: P1BCTE110	**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**

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

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.

BOOKS RECOMMENDED

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

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

COURSE TITLE: MICROBIOMICS

Course code: P1BCTE110 — **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**

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

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:

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.

M.Sc. Biochemistry
SEMESTER–I
ELECTIVE – THEORY

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

COURSE TITLE: MICROBIOMICS

Course code: P1BCTE110	**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**

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.**

Syllabus for 1-year PG Program as per NEP 2020
M.Sc. Biochemistry
SEMESTER-II
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: P1BCTC201	**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

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

i. Regulation of immune response, Antigen processing and presentation, generation of humoral and cell mediated immune responses, Activation of B- and T- lymphocytes,

Syllabus for 1-year PG Program as per NEP 2020
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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: P1BCTC201 | **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. 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
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

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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: P1BCTC201 | **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. 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.

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.

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

Syllabus for 1-year PG Program as per NEP 2020
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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: P1BCTC201 **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

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)			
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

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M.Sc. Biochemistry
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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: P1BCTC201 | **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

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 1-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 2027, May 2028, May 2029.

COURSE TITLE: MEDICAL BIOCHEMSITRY
Course code: P1BCTC202
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.

UNIT-III Disorders of Metabolism-II

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M.Sc. 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: P1BCTC202
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

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.

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)

Syllabus for 1-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 2027, May 2028, May 2029.

COURSE TITLE: MEDICAL BIOCHEMSITRY
Course code: P1BCTC202
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

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 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

Syllabus for 1-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 2027, May 2028, May 2029.

COURSE TITLE: MEDICAL BIOCHEMSITRY

Course code: P1BCTC202
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

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).

Syllabus for 1-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 2027, May 2028, May 2029.

COURSE TITLE: FUNCTIONAL NUTRACEUTICALS

Course code: P1BCTE206 | **Contact hours: 48**
Duration of Examinations | **Credits: 2**
Minor Test1: 1 hour | **Max. Marks: 50**
Minor Test2: 1 hour | **Minor Test1: 5+5**
Major Test: 2.5 hours | **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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SEMESTER-II
ELECTIVE – THEORY

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

COURSE TITLE: FUNCTIONAL NUTRACEUTICALS
Course code: P1BCTE206
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	20 %	45 min	5+5

Syllabus for 1-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 2027, May 2028, May 2029.

COURSE TITLE: FUNCTIONAL NUTRACEUTICALS
Course code: P1BCTE206 **Contact hours: 48**
Duration of Examinations **Credits: 2**
Minor Test1: 1 hour **Max. Marks: 50**
Minor Test2: 1 hour **Minor Test1: 5+5**
Major Test: 2.5 hours **Minor Test2: 5+5**
Major Test: 30
Total: 50

30 days)			
Minor Test – 2 (after 60 days)	20 %	45 min	5+5
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.

Syllabus for 1-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 2027, May 2028, May 2029.

COURSE TITLE: FUNCTIONAL NUTRACEUTICALS

Course code: P1BCTE206
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

Freeman and Company.

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

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.

Syllabus for 1 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 2027, May 2028, May 2029

Course Title: IPRs and Bioethics
Course code: P1BCTE207
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.

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M.Sc. Biochemistry
SEMESTER-II
ELECTIVE-THEORY

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: P1BCTE207 — **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

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.
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:

Syllabus for 1 year PG Program as per NEP-2020
M.Sc. Biochemistry
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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: P1BCTE207
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

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 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.

Syllabus for 1 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 2027, May 2028, May 2029.

Course Title: BIOENTREPRENEURSHIP
Course Code: P1BCTE208
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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ELECTIVE-THEORY
Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

Course Title: BIOENTREPRENEURSHIP
Course Code: P1BCTE208 — **Course Credits: 2**
Contact hours: 24 — **Max. Marks: 50**
Duration of Examinations: — **Minor Test 1: 5+5**
Minor Test 1: 1hour — **Minor Test 2: 5+5**
Major Test: 2.5 hours — **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: P1BCTE208 — **Course Credits: 2**
Contact hours: 24 — **Max. Marks: 50**
Duration of Examinations: — **Minor Test 1: 5+5**
Minor Test 1: 1hour — **Minor Test 2: 5+5**
Major Test: 2.5 hours — **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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Syllabi for the examinations to be held in the years May 2027, May 2028, May 2029.

Course Title: BIOENTREPRENEURSHIP

Course Code: P1BCTE208	**Course Credits: 2**
Contact hours: 24	**Max. Marks: 50**
Duration of Examinations:	**Minor Test 1: 5+5**
Minor Test 1: 1hour	**Minor Test 2: 5+5**
Major Test: 2.5 hours	**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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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: P1BCTE209	**Contact hours**: 24
Duration of Examinations	**Max. Marks**: 50
Credits: 2	**Minor Test**1: 10 marks
Minor Test1: 1 hour	**Minor Test 2:** 10 marks
Minor Test 2:1 hour	**Major Test:** 2.5 hours
Major Test: 30 marks	**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
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.

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Course Title: Research Methodology and Scientific Communication
Course code: P1BCTE209 **Contact hours**: 24
Duration of Examinations **Max. Marks**: 50
Credits: 2 **Minor Test**1: 10 marks
Minor Test1: 1 hour **Minor Test 2:** 10 marks
Minor Test 2:1 hour **Major Test:** 2.5 hours
Major Test: 30 marks **Total**: 50 marks

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

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Course Title: Research Methodology and Scientific Communication
Course code: P1BCTE209
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

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.

BOOKS RECOMMENDED:

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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: P1BCTE209	**Contact hours**: 24
Duration of Examinations	**Max. Marks**: 50
Credits: 2	**Minor Test**1: 10 marks
Minor Test1: 1 hour	**Minor Test 2:** 10 marks
Minor Test 2:1 hour	**Major Test:** 2.5 hours
Major Test: 30 marks	**Total**: 50 marks

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

Syllabus for 1-year PG Program as per NEP-2020
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COURSE TITLE: Research Project
Course code: P1BCPRC210 **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:
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

COURSE TITLE: Research Project
Course code: P1BCPRC210 **Contact hours: 192**
Duration of Examinations **Credits: 16**
Max. Marks: 400
Dissertation: 200
Presentation and Viva: 200

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.

Chapter 5: Summary and Conclusion:

COURSE TITLE: Research Project
Course code: P1BCPRC210 **Contact hours: 192**
Duration of Examinations **Credits: 16**
Max. Marks: 400
Dissertation: 200
Presentation and Viva: 200

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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COURSE TITLE: Research Project
Course code: P1BCPRC210 **Contact hours: 192**
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: .....

Syllabus for 1-year PG Program as per NEP-2020
M.Sc. Biochemistry
Semester-II
Syllabi for the examinations to be held in the years May 2027, 2028 & 2029

COURSE TITLE: Research Project
Course code: P1BCPRC210 **Contact hours: 192**
Duration of Examinations **Credits: 16**
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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