DHANALAKSHMI SRINIVASAN

INSTITUTE OF RESEARCH AND TECHNOLOGY

(Deemed to be University under section 3 of UGC Act, 1956.)
PERAMBALUR – 621 212, TAMIL NADU, INDIA.

SCHOOL OF ARTS AND SCIENCE

CURRICULUM AND SYLLABUS

B.Sc., BIOCHEMISTRY

REGULATION 2026

PROGRAMME:

Vision:

To emerge as a leading center of excellence in biochemical sciences, cultivating pioneering researchers, proficient innovators, and conscientious professionals who advance human health, environmental harmony, and societal progress through scientific discovery and application.

Mission:

- To deliver comprehensive, adaptable, and multidisciplinary postgraduate education in biochemistry that blends core scientific principles with emerging technologies, equipping graduates with strong analytical, problem-solving, and technical competencies for dynamic career opportunities and continuous professional growth.
- To promote advanced research and innovation focused on key challenges in healthcare, biotechnology, nutrition, and environmental protection, emphasizing practical solutions that benefit public health and ecological balance.
- To enhance access to quality higher education for students from rural and underprivileged backgrounds, integrating traditional knowledge with modern biochemical practices to develop relevant skills and promote self-reliant career pathways.
- To instill moral values, professional ethics, and societal awareness via hands-on learning, industry collaborations, and community-oriented projects that bridge theoretical knowledge with real-life applications.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO	PROGRAM EDUCATIONAL OBJECTIVES
PEO1	To provide graduates with a strong foundation in core and advanced biochemical concepts, laboratory techniques, and research methodologies, enabling them to pursue successful careers in academia, industry, healthcare, and research institutions
PEO2	To develop critical thinking, analytical skills, and scientific temperament so that graduates can independently design, execute, and evaluate experiments addressing biochemical problems in health, agriculture, and environmental sectors.
PEO3	To foster ethical responsibility, effective communication, and teamwork abilities that prepare graduates to collaborate across disciplines and contribute responsibly to scientific and societal advancements.
PEO4	To encourage lifelong learning and adaptability, empowering graduates to stay updated with evolving biotechnological developments and take up entrepreneurial or higher academic pursuits in biochemistry and allied fields.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	PROGRAM SPECIFIC OUTCOMES
PSO1	Graduates will be able to apply biochemical principles and advanced analytical tools to investigate molecular mechanisms of diseases, develop diagnostic methods, and propose biotechnological interventions.
PSO2	Graduates will demonstrate competence in biochemical research practices, data interpretation, and sustainable laboratory protocols, enabling them to contribute effectively to industry, environmental monitoring, and public health initiatives.

PROGRAM OUTCOMES (Pos)

PO	PROGRAM OUTCOMES
PO1	Apply fundamental and advanced knowledge of Biochemistry and allied sciences.
PO2	Analyze and solve scientific problems using critical and logical thinking.
PO3	Perform experiments and interpret data using modern laboratory and computational tools.
PO4	Demonstrate research aptitude, innovation, and scientific inquiry.
PO5	Communicate effectively and function collaboratively in multidisciplinary teams.
PO6	Uphold ethical values, professionalism, and social responsibility.
PO7	Promote environmental sustainability and community well-being.
PO8	Exhibit leadership, entrepreneurship, and managerial capabilities.
PO9	Adapt to global scientific advancements and diverse professional environments.
PO10	Engage in lifelong learning and continuous skill enhancement.
PO11	Apply digital literacy, bioinformatics, and emerging technologies to address contemporary challenges in life sciences and healthcare.

SEMESTER-I

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
I	I	AEC	Tamil/Hindi/French	TA26C01/ HA26C01/ FA26C01	3	0	0	3	40	60	100
	II	AEC	English	EN26C01	3	0	0	3	40	60	100
	III	Core	Introduction to Biomolecules	UBC26101	3	0	0	3	40	60	100
		Core	Lab in Biomolecules	UBC26102	0	0	4	2	40	60	100
		Core	Cell Biology and Cellular Organization	UBC26103	4	0	0	4	40	60	100
		MDC	Multi-Disciplinary course - I	-	3	0	0	3	40	60	100
	IV	VAC	Human Values	VAC26001	2	0	0	2	40	60	100
								20			**700**

SEMESTER-II

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
II	I	AEC	Tamil/Hindi/French	TA26C02/ HA26C02/ FA26C02	3	0	0	3	40	60	100
	II	AEC	English	EN26C02	3	0	0	3	40	60	100
	III	Core	Human Physiology	UBC26204	3	0	0	3	40	60	100
		Core	Lab in Human Physiology and Enzymology	UBC26205	0	0	4	2	40	60	100
		Core	Enzyme Biochemistry	UBC26206	4	0	0	4	40	60	100
		MDC	Multi-Disciplinary course - II	-	3	0	0	3	40	60	100
	IV	VAC	Environmental studies and sustainability	VAC26002	2	0	0	2	40	60	100
								20			**700**

SEMESTER-III

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
III	I	AEC	Tamil/Hindi/French	TA26C03/ HA26C03/ FA26C03	3	0	0	3	40	60	100
	II	AEC	English	EN26C03	3	0	0	3	40	60	100
	III	Core	Biochemical Techniques	UBC26307	3	0	0	3	40	60	100
		Core	Lab in Biochemical Techniques	UBC26308	0	0	4	2	40	60	100
		MDC	Multi-Disciplinary course - III	-	3	0	0	3	40	60	100
		DEC	Basics of Plant Biochemistry	UBC26001	4	0	0	4	40	60	100
			Hormonal Biochemistry	UBC26002							
			Nutritional Biochemistry	UBC26003							
	IV	VAC	IKS	VAC26003				3	40	60	100
								21			**700**

SEMESTER-IV

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credit	Marks		
									CAT	ESE	Total
IV	I	AEC	Tamil/Hindi/French	TA26C04/ HA26C04/ FA26C04	3	0	0	3	40	60	100
	II	AEC	English	EN26C04	3	0	0	3	40	60	100
	III	Core	Clinical Biochemistry	UBC26409	3	0	0	3	40	60	100
		Core	Lab in Clinical Biochemistry	UBC26410	0	0	4	2	40	60	100
		MDC	Multi - Disciplinary course - IV	-	3	0	0	3	40	60	100
		DEC	Food Processing & Preservation	UBC26004	4	0	0	4	40	60	100
			Biochemistry of Yoga Medicine	UBC26005							
			Biochemistry of Extreme Environment	UBC26006							
	IV	VAC	Ethics in AI	VAC26004	3	0	0	3	40	60	100
	V	EAA	Extra Academic Activity **(NSS, NCC, YRC….)**					1*			
								21			**700**

SEMESTER-V

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
V	III	Core	Biogenetics & Metabolism	UBC26511	2	1	0	4	40	60	100
		Core	Lab in Immunology	UBC26512	0	0	4	2	40	60	100
		Core	Immunology	UBC26513	3	0	0	3	40	60	100
		DEC	Neurochemistry & Brain Health	UBC26007	3	0	2	4	40	60	100
			Biostatistics & Data Analysis	UBC26008							
			Bioprocess Technology & Commercial	UBC26009							
		SEC	Basic Bioinformatics Tools	UBC26S01	3	1	0	4	40	60	100
			Cosmetic Products Formulation	UBC26S02	3	1	0	4	40	60	100
		DEC	Recombinant DNA Technology	UBC26010	3	0	2	4	40	60	100
			Animal Models in Biochemical Research	UBC26011							
			Health and Wellness	UBC26012							
	IV	EE	Experiential Elective (Internship)	UBCEE01				2	*	*	100
								27			**800**

SEMESTER-VI

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
VI	III	Core	Molecular Biochemistry	UBC26614	3	0	0	3	40	60	100
		Core	Lab In Molecular Biochemistry	UBC26615	0	0	4	2	40	60	100
		Core	Project	UBC26616	0	0	12	6	40	60	100
		DEC	Biomedical Instrumentation	UBC26013	3	0	2	4	40	60	100
			Biosensor Application	UBC26014							
			Molecular Oncology	UBC26015							
		SEC	Cosmeceuticals & healthy skin	UBC26S03	3	1	0	4	40	60	100
			Biochemistry Entrepreneurship & Innovation	UBC26S04	3	1	0	4	40	60	100
		DEC	Stem Cells in Lifestyle Diseases	UBC26016	3	0	2	4	40	60	100
			Biochemistry of Cell Signaling	UBC26017							
			Pharmaceutical Biochemistry	UBC26018							
	IV	VAC	Gender Studies	VAC26005	2	0	0	2	40	60	100
								29			**800**

Semester-wise Categorization of Courses

COURSE CATEGORY	Semester						No of Courses	Total Credits
	I	II	III	IV	V	VI		
Ability Enhancement Course	2	2	2	2	-	-	8	24
MSC-Core Courses (Theory & Practicals)	3	3	2	2	3	3	16	48
MDC–Multi Disciplinary Course	1	1	1	1	-	-	4	12
DEC–Disciplinary Elective Course	-	-	1	1	2	2	6	24
SEC–Skill Enhancement Course	-	-	-	-	2	2	4	16
VAC– Mandatory Course	1	1	1	1	-	1	5	12
EE–Experiential Elective	-	-	-	-	1	-	1	2
EAA–Extra Academic Activity	-	-	-	1	-	-	1	-
Total Courses Per Semester	7	7	7	8	8	8	**45(Courses)**	
Total Credits	21	21	22	22	26	28	**138(Credits)**	

MDC OFFERED BY THE DEPARTMENT:

S. No	Course Code	Title of the Course
1.	UBC26901	Basics of Biochemistry
2.	UBC26902	Biochemistry Behind Everyday life
3.	UBC26903	Biochemistry of Beauty and Cosmetics
4.	UBC26904	Sports Biochemistry and Fitness

DEC OFFERED BY THE DEPARTMENT:

S. No	Course Code	Title of the Course
1.	UBC26001	Basics of Plant Biochemistry
2.	UBC26002	Hormonal Biochemistry
3.	UBC26003	Nutritional Biochemistry
4.	UBC26004	Food Processing & Preservation
5.	UBC26005	Biochemistry of Yoga Medicine
6.	UBC26006	Biochemistry of Extreme Environment
7.	UBC26007	Neurochemistry & Brain Health
8.	UBC26008	Biostatistics & Data Analysis
9.	UBC26009	Bioprocess Technology & Commercial
10.	UBC26010	Recombinant DNA Technology
11.	UBC26011	Animal Models in Biochemical Research
12.	UBC26012	Health and Wellness
13.	UBC26013	Biomedical Instrumentation
14.	UBC26014	Biosensor Application
15.	UBC26015	Molecular Oncology
16.	UBC26016	Stem Cells in Lifestyle Diseases
17.	UBC26017	Biochemistry of Cell Signaling
18.	UBC26018	Pharmaceutical Biochemistry

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	UBC26101	Introduction to Biomolecules	Core	3	0	0	3

Pre-Requisite:

1. Basic knowledge of Biology and Chemistry concepts studied at the Higher Secondary (+2) level.
2. Understanding of atomic structure, chemical bonding, and fundamental cellular organization

Co- Requisite:

1. Cell Biology – for understanding cellular organization and the functional role of biomolecules.
2. Practical Course in Biomolecules and Analytical Techniques – for developing laboratory skills related to biomolecule identification and analysis.

Progressive Course:

1. Metabolism and Bioenergetics – to understand the synthesis, degradation, and energy-yielding pathways of biomolecules.
2. Molecular Biology and Genetic Engineering – to explore the functional significance of proteins and nucleic acids in gene expression and regulation.

Course Objectives:

1. To understand the chemical structures, classifications, and biological importance of major biomolecules.
2. To learn the fundamental concepts of pH, buffers, and water as the solvent of life.
3. To develop deep insights into the structural organization and functional diversity of proteins and nucleic acids.
4. To study the structural properties and metabolic significance of lipids and carbohydrates
5. To cultivate analytical skills required to correlate molecular structure with physiological functions.

Course Outcomes:

CO1: Recall and describe the basic structures, properties, and classifications of carbohydrates, lipids, amino acids, nucleic acids, vitamins and minerals (**K1)**

CO2: Explain the biochemical roles of water, weak interactions, and buffers in biological systems. (**K2)**

CO3: Apply structural knowledge to differentiate between types of isomerism, protein folding levels, and DNA/RNA configurations. (**K3)**

CO4: Analyze the structural-functional relationships of macromolecules like hemoglobin, glycogen, and biological membranes. (**K4)**

CO5: Evaluate how changes in biomolecular structures impact health, disease states, and biochemical processes. (**K5)**

Unit-I	Water, Buffers and Carbohydrates	9 Hrs

Molecular Environment: Structure and unique properties of water; Weak interactions in aqueous systems (Hydrogen bonds, ionic, hydrophobic, and Van der Waals interactions).

Acid-Base Concepts: pH, pKa, Henderson-Hasselbalch equation; Biological buffer systems (phosphate, bicarbonate, and protein buffers).

Carbohydrates: Introduction, classification, and biological significance. Monosaccharides: Structure of glucose, fructose, and galactose; Isomerism (epimers, anomers, D/L forms, optical isomerism). Mutarotation.

Oligosaccharides & Polysaccharides: Structure and functions of sucrose, lactose, and maltose. Homo-polysaccharides (starch, glycogen, cellulose) and Hetero-polysaccharides (hyaluronic acid, heparin).

Unit-II	Amino Acids, Peptides and Protein Structure & Function	9 Hrs

Amino Acids: Structure, general properties, classification based on side-chain polarity and nutritional requirement. **Acid–Base Properties:** Zwitterion formation, titration curve of amino acids, isoelectric point (pI). **Peptides:** Peptide bond formation, characteristics; biological importance of glutathione, oxytocin and insulin. **Peptide Synthesis:** Introduction to solid-phase peptide synthesis (SPPS). **Protein Structure:** Primary structure and sequence determination; secondary structure (α-helix, β-sheet, turns); tertiary structure (forces stabilizing structure, myoglobin); quaternary structure (hemoglobin, allosteric regulation, Bohr effect). **Protein Folding and Denaturation:** Factors affecting denaturation; role of molecular chaperones.

Unit-III	Lipids and Membranes	9Hrs

Classification: Introduction, classification (Simple, Compound, and Derived lipids), and biological functions.

Fatty Acids: Nomenclature, structure, and properties of saturated and unsaturated fatty acids; Essential fatty acids; Triacylglycerols (Triglycerides) – properties and saponification value, iodine value, acid value.

Complex Lipids: Structure and functions of phospholipids (lecithin, cephalin), glycolipids (cerebrosides, gangliosides), and sphingolipids. **Steroids:** Structure and biological importance of cholesterol.

Biological Membranes: Brief overview of the Fluid Mosaic Model.

Unit-IV	Nucleic Acids	9 Hrs

Components: Nitrogenous bases (Purines and Pyrimidines), Nucleosides, and Nucleotides; Biological functions of nucleotides (energy carriers, cyclic nucleotides) **DNA Structure**: Watson-Crick model of DNA double helix; Structural variants (A-DNA, B-DNA, Z-DNA). **RNA Structure:** Types of RNA (mRNA, tRNA, rRNA) – structures and specific biological roles. Physicochemical Properties: Denaturation and renaturation of nucleic acids; Hyperchromic effect and melting temperature (*Tm*).

Unit-V	Minerals and Vitamins	9 Hrs

Minerals: Classification into macro minerals and trace elements; biological functions of essential minerals (Ca, P, Na, K, Mg, Fe, Zn, Cu, I); role in enzyme activation, osmotic balance, nerve conduction, and bone formation; deficiency disorders and toxicity. **Vitamins:** Classification into fat-soluble (A, D, E, K) and water-soluble (B-complex and C); sources, biochemical functions, coenzyme roles; deficiency disorders and hypervitaminosis; importance in metabolism and human health.

Text Book(s):

1. Nelson, D. L., & Cox, M. M. (2021). Lehninger Principles of Biochemistry (8th ed.). W. H. Freeman.
2. Satyanarayana, U., & Chakrapani, U. (2021). Biochemistry (6th ed.). Elsevier.
3. Jain, J. L., Jain, S., & Jain, N. (2016). Fundamentals of Biochemistry (7th ed.). S. Chand & Company Ltd.

Reference Book(s):

1. Berg, J. M., Tymoczko, J. L., Gatto, G. J., & Stryer, L. (2019). Biochemistry (9th ed.). W. H. Freeman.
2. Moran, L. A., Horton, R. A., Scrimgeour, K., & Perry, M. (2012). Principles of Biochemistry (5th ed.). Pearson.
3. Campbell, M. K., & Farrell, S. O. (2017). Biochemistry (9th ed.). Cengage Learning.
4. Zubay, G. L. (1998). Biochemistry (4th ed.). Wm. C. Brown Publishers.
5. Conn, E. E., Stumpf, P. K., Bruening, G., & Doi, R. H. (2009). Outlines of Biochemistry (5th ed.). John Wiley & Sons.

e Resources:

1. NPTEL: Biochemistry Course by IIT Delhi / IIT Kharagpur
2. NCBI Bookshelf: Biochemistry by Jeremy M. Berg et al.
3. SWAYAM: Online UG Courses in Biomolecules / Biological Sciences
4. MIT Open Course Ware: Principles of Chemical Science / Biochemistry
5. The Medical Biochemistry Page: Structural Biochemistry Topic

Relationship Matrix for COs, POs and PSOs

Semester	Course code	Title of the course	Hours	Credit
I	UBC26101	Introduction to Biomolecules	3	3

Course Outcomes (COs)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	2	2	2	2	1	-	1	-	2	1	3	3	1.85
CO2	3	3	2	2	2	-	1	1	2	2	-	3	3	2.00
CO3	3	2	2	2	2	2	2	-	2	2	-	3	3	2.08
CO4	3	3	2	2	2	2	2	1	2	2	1	3	3	2.15
CO5	3	2	2	2	2	3	2	2	2	3	2	3	3	2.38
Mean	3.00	2.40	2.00	2.00	2.00	1.80	1.60	1.20	1.80	2.20	1.20	3.00	3.00	2.03

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	UBC26102	Lab in Biomolecules	Practical	0	0	4	2

Pre-Requisite:

1. Basic knowledge of Chemistry and Biology at the Higher Secondary (+2) level.
2. Understanding of fundamental laboratory practices, measurements, and scientific safety procedures.

Co- Requisite:

1. Introduction to Biomolecules (26UBC1CC1) – for understanding the theoretical concepts underlying biomolecular analysis.
2. Cell Biology – for correlating biomolecules with cellular structure and function.

Progressive Course:

1. Lab in Analytical Techniques – for advanced biochemical estimations, chromatography, electrophoresis, and spectroscopic methods.
2. Lab in Metabolism and Enzymology – for studying enzyme assays, metabolic pathways, and biochemical investigations.

Course Objectives:

1. To familiarize students with laboratory safety practices, handling of laboratory instruments, and standard laboratory procedures.
2. To develop skills in the preparation of solutions, standardization of reagents, and operation of spectrophotometric equipment.
3. To enable students to perform qualitative identification of carbohydrates, amino acids, and lipids using standard biochemical tests.
4. To train students in the quantitative estimation of biomolecules and physicochemical analysis of edible oils using biochemical methods.
5. To develop analytical, interpretative, and scientific reporting skills through biochemical experiments and data analysis.

Course Outcomes:

CO1: Demonstrate laboratory safety practices, proper handling of laboratory instruments, and preparation of standard solutions and reagents. **(K2)**

CO2: Perform qualitative identification of carbohydrates, amino acids, and lipids using appropriate biochemical tests and interpret the results. **(K3)**

CO3: Apply spectrophotometric techniques to determine absorption maxima (λmax) and effectively operate laboratory equipment**. (K3)**

CO4: Determine the concentration of biomolecules such as reducing sugars and amino acids using standard quantitative biochemical methods. **(K3)**

CO5: Analyze the physicochemical properties of edible oils through the determination of acid number, saponification number, and iodine value, and interpret experimental data scientifically. **(K4)**

List of Experiments:	60 Hrs

1. Determination of absorption maximum (λmax) of a colored solution using a spectrophotometer/colorimeter.
2. Preparation of solutions of desired normality and molarity.
3. Qualitative identification of carbohydrates (glucose, fructose, sucrose, lactose and starch).
4. Qualitative identification of amino acids (Tryptophan, Tyrosine, Arginine, Proline and Histidine) by specific color reactions.
5. Qualitative analysis of lipids using solubility, Sudan dye and acrolein tests.
6. Determination of reducing sugars by Benedict's titrimetric method.
7. Estimation of amino acids by Ninhydrin method.
8. Determination of acid number of edible oils.
9. Determination of saponification number and iodine value of edible oils
10. Laboratory safety practices and handling of microscopes.
11. Weighing and transfer techniques for chemical reagents.
12. Preparation and standardization of laboratory reagents.
13. Operation and maintenance of spectrophotometer/colorimeter.
14. Interpretation and presentation of experimental data.

Text Book(s):

1. Plummer, D.T. (2006). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co., New Delhi.
2. Jayaraman, J. (2011). Laboratory Manual in Biochemistry. New Age International Publishers.
3. Sadasivam, S. and Manickam, A. (2018). Biochemical Methods. New Age International Publishers.

Reference Book(s):

1. Varley, H. (2006). Practical Clinical Biochemistry. CBS Publishers.
2. Oser, B.L. (2010). Hawk's Physiological Chemistry. Tata McGraw-Hill.
3. Conn, E.E. and Stumpf, P.K. (2012). Outlines of Biochemistry. Wiley Eastern.
4. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (2017). Principles of Biochemistry. W.H. Freeman.
5. Voet, D. and Voet, J.G. (2019). Biochemistry. Wiley.

e Resources:

1. NPTEL Biochemistry Courses – https://nptel.ac.in
2. SWAYAM – https://swayam.gov.in
3. National Digital Library of India – https://ndl.iitkgp.ac.in
4. PubMed – https://pubmed.ncbi.nlm.nih.gov
5. Virtual Labs – https://vlab.co.in

Relationship Matrix for COs, POs and PSOs

Semester	Course code	Title of the course										Hours		Credit
I	UBC26102	Lab in Biomolecules										4		2
Course Outcomes (COs)	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	
CO1	3	2	3	2	2	1	-	-	-	-	-	3	3	2.38
CO2	3	3	3	2	1	-	-	-	-	-	-	3	3	2.57
CO3	3	3	3	2	2	-	-	-	-	-	-	3	3	2.71
CO4	3	3	3	3	2	1	-	-	-	-	-	3	3	2.63
CO5	3	3	2	3	2	2	1	-	-	-	-	3	3	2.44
Mean	3.00	2.80	2.80	2.40	1.80	0.80	0.20	0.00	0.00	0.00	0.00	3.00	3.00	2.14

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	UBC26103	Cell Biology and Cellular Organization	Core	4	0	0	4

Pre-Requisite:

1. Basic knowledge of Biology at Higher Secondary (+2) level.
2. Fundamental understanding of cell structure, basic chemistry, and biological organization of living systems.

Co- Requisite:

1. Introduction to Biomolecules – for linking molecular components with cellular structure and function.
2. Laboratory/Practical in Cell Biology (if applicable) – for hands-on understanding of cell structure and microscopic techniques.

Progressive Course:

1. Molecular Biology – to understand gene expression, DNA replication, and protein synthesis.
2. Biochemistry – to study metabolic pathways and molecular mechanisms in detail.
3. Biotechnology – for applications of cell biology in genetic engineering, tissue culture, and medical diagnostics.

Course Objectives:

1. To introduce the fundamental concepts, history, scope, and significance of Cell Biology and the organization of living cells.
2. To provide knowledge of the structure and functions of cellular organelles and their role in maintaining cellular activities.
3. To explain membrane transport mechanisms, cell communication processes, and signal transduction pathways in cells.
4. To develop an understanding of the cytoskeleton, cell cycle regulation, and mechanisms of cell division.
5. To familiarize students with cell death, stem cells, tissue organization, and the applications of Cell Biology in medicine and biotechnology.

Course Outcomes:

CO1: Recall and describe the fundamental concepts of Cell Biology, cell theory, and the structural organization of prokaryotic and eukaryotic cells. **(K1)**

CO2: Explain the structure and functions of cellular organelles and their roles in cellular metabolism and organization. **(K2)**

CO3: Apply knowledge of membrane transport, cell communication, and signal transduction mechanisms to cellular processes. **(K3)**

CO4: Analyze the organization and functions of the cytoskeleton, cell cycle regulation, and the processes of mitosis and meiosis. **(K4)**

CO5: Evaluate the significance of apoptosis, stem cells, cellular differentiation, and tissue organization in health, disease, medicine, and biotechnology. **(K5)**

Unit-I	Introduction to Cell Biology	12 Hrs
Cell Biology - history and scope, cell theory and its significance, the structural differences between prokaryotic and eukaryotic cells, cell size, shape and diversity, and the organization of cells and tissues.		
Unit-II	**Cellular Organelles**	**12 Hrs**
Cellular Organelles - structure and functions of cellular organelles, plasma membrane and fluid mosaic model, nucleus and nucleolus, endoplasmic reticulum (RER and SER), Golgi apparatus, lysosomes, peroxisomes, mitochondria, chloroplasts, ribosomes, and vacuoles.		
Unit-III	**Membrane Transport and Cell Communication**	**12 Hrs**
Membrane Transport and Cell Communication - passive transport, active transport and facilitated diffusion, endocytosis and exocytosis, cell junctions, cell adhesion molecules, cell signaling and signal transduction pathways, receptors and second messengers.		
Unit-IV	**Cytoskeleton and Cell Cycle**	**12 Hrs**
Cytoskeleton and Cell Cycle - organization and functions of the cytoskeleton comprising microtubules, microfilaments and intermediate filaments, regulation of the cell cycle, cyclins and cyclin-dependent kinases, cell division through mitosis and meiosis, and chromosome organization and segregation.		
Unit-V	**Cell Death and Cellular Organization**	**12 Hrs**
Cell Death and Cellular Organization - apoptosis and necrosis, stem cells and cell differentiation, cellular senescence, cell-cell interactions, the organization of tissues and multicellular systems, and applications of cell biology in medicine and biotechnology.		

Text Book(s):

1. Verma, P.S. and Agarwal, V.K. (2022). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand Publishing.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2018). Cell and Molecular Biology. Lea & Febiger.
3. Rastogi, S.C. (2021). Cell Biology. New Age International Publishers.
4. Cooper, G.M. and Hausman, R.E. (2019). The Cell: A Molecular Approach. Sinauer Associates.

Reference Book(s):

1. Alberts, B. et al. (2022). Molecular Biology of the Cell. Garland Science.
2. Lodish, H. et al. (2021). Molecular Cell Biology. W.H. Freeman.
3. Becker, W.M., Kleinsmith, L.J. and Hardin, J. (2018). The World of the Cell. Pearson.
4. Pollard, T.D., Earnshaw, W.C. and Lippincott-Schwartz, J. (2019). Cell Biology. Elsevier.
5. Cooper, G.M. (2019). Cell Biology. Sinauer Associates.

e Resources:

1. NPTEL – Cell Biology
2. SWAYAM MOOCs
3. National Digital Library of India (NDLI)
4. Virtual Labs, IIT Delhi
5. PubMed and NCBI Resources

Relationship Matrix for COs, POs and PSOs

Semester	Course code	Title of the course										Hours		Credit
I	UBC26103	Cell Biology and Cellular Organization										4		4
Course Outcomes (COs)	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	
CO1	3	2	1	-	-	-	-	-	-	-	-	3	2	2.20
CO2	3	3	2	1	-	-	-	-	-	-	-	3	2	2.40
CO3	3	3	3	2	1	-	-	-	-	-	-	3	3	2.71
CO4	3	3	3	2	2	1	-	-	-	-	-	3	3	2.83
CO5	3	3	3	3	2	2	1	-	-	1	-	3	3	2.63
Mean	3.00	2.80	2.40	1.60	1.00	0.60	0.20	0.00	0.00	0.20	0.00	3.00	2.80	2.32

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	UBC26204	Human Physiology	Core	3	0	0	3

Pre-Requisite:

1. Basic knowledge of Human Biology at Higher Secondary (+2) level.
2. Fundamental understanding of cell structure, tissues, and basic physiological processes.

Co- Requisite:

1. Cell Biology – to understand cellular basis of physiological functions.
2. Biochemistry – for correlating physiological processes with biomolecular and metabolic mechanisms.

Progressive Course:

1. Advanced Physiology – for deeper understanding of integrated organ system functions and regulation.
2. Pathophysiology – to study dysfunctions of organ systems in disease conditions.
3. Clinical Biochemistry – for application of physiological and biochemical principles in medical diagnosis.

Course Objectives:

1. To understand the composition, distribution, and physiological roles of body fluids, blood components, and buffering systems in maintaining homeostasis.
2. To study the structure and functions of cardiovascular and respiratory systems and their roles in circulation, gas exchange, and acid–base balance.
3. To acquire knowledge on digestive and excretory systems, including digestion, absorption, metabolism, and waste elimination mechanisms.
4. To understand the physiology of muscle contraction, nervous system organization, sensory mechanisms, and coordination in the human body.
5. To develop an integrated understanding of the reproductive system, hormonal regulation, and reproductive health processes.

Course Outcomes:

CO1: Recall and describe the composition, functions, and regulation of body fluids, blood components, hemopoiesis, and blood coagulation mechanisms. **(K1–K2)**

CO2: Explain the structure and physiological functions of cardiovascular and respiratory systems, including blood circulation, gas exchange, and acid–base balance. **(K2)**

CO3: Apply knowledge of digestive and excretory systems to understand processes of digestion, absorption, metabolism, and homeostatic regulation of water and electrolytes. **(K3)**

CO4: Analyze the functions of muscular, nervous, and sensory systems with respect to coordination, signal transmission, and physiological regulation. **(K4)**

CO5: Evaluate the structure and hormonal regulation of the reproductive system and relate physiological processes such as gametogenesis, fertilization, and pregnancy to human health. **(K4–K5)**

Unit-I	Body fluids	9 Hrs
Extracellular fluid—plasma, interstitial fluid and transcellular fluid. Intracellular fluid. Lymph and blood—composition and functions, osmolarity of body fluids, ionic composition, electrolytes and body buffers. Blood cells, hemoglobin, hemopoiesis, blood coagulation and blood groups.		
Unit-II	**Cardiovascular and Respiratory Systems**	**9 Hrs**
Circulation: Structure and functions of heart, blood vessels and their types, cardiac cycle, factors controlling blood pressure, electrocardiogram and functions of heart. Respiration: Anatomy and physiology of respiration, pulmonary surfactant, exchange of gases between lungs and blood and between blood and tissues, role of lungs in acid-base balance.		
Unit-III	**Digestive and Excretory Systems**	**9 Hrs**
Digestive System: Overview of digestive system; structure and functions of gastrointestinal tract and associated glands; digestive secretions and hormones; digestion, absorption and assimilation of carbohydrates, proteins, fats, and nucleic acids; absorption of vitamins, minerals, and water; regulation of digestion. **Excretory System:** Structure and functions of human excretory system; anatomy of kidney and nephron; urine formation (filtration, reabsorption, secretion); regulation of water, electrolyte and acid–base balance; hormonal control by ADH and aldosterone.		
Unit-IV	**Muscle, Nervous System and Special Senses**	**9 Hrs**
Muscle Physiology: Structure and functions of kidney; urine formation; renal regulation of acid–base balance; common excretory disorders. Types of muscles; structure of muscle; mechanism of muscle contraction; sliding filament theory. **Nervous System:** Organization of nervous system; synaptic transmission and neurotransmitters; neuromuscular junction; brain chemistry; cerebrospinal fluid and functions. **Special Senses:** Physiology of olfaction, gustation, vision, hearing, and equilibrium.		
Unit-V	**Reproductive System**	**9 Hrs**
Structure and functions of male and female reproductive systems; gametogenesis (spermatogenesis and oogenesis); menstrual cycle and its hormonal regulation; fertilization and early embryonic development; pregnancy and parturition; reproductive hormones (FSH, LH, estrogen, progesterone, testosterone) and their roles; contraception methods and reproductive health.		

Text Book(s):

1. Guyton, A.C. and Hall, J.E. (2021). Textbook of Medical Physiology, 14th Edition, Elsevier.
2. Sembulingam, K. and Sembulingam, P. (2020). Essentials of Medical Physiology, Jaypee Brothers Medical Publishers.
3. Jain, A.K. (2021). Textbook of Physiology, Avichal Publishing Company.
4. Chaudhuri, S.K. (2019). Concise Medical Physiology, New Central Book Agency.
5. Tortora, G.J. and Derrickson, B.H. (2020). Principles of Anatomy and Physiology, Wiley.

Reference Book(s):

1. Ganong, W.F. (2019). Review of Medical Physiology, McGraw Hill.
2. Vander, A.J., Sherman, J.H. and Luciano, D.S. (2018). Human Physiology: The Mechanisms of Body Function, McGraw Hill.
3. Berne, R.M. and Levy, M.N. (2018). Physiology, Elsevier.
4. Widmaier, E.P., Raff, H. and Strang, K.T. (2019). Vander's Human Physiology, McGraw Hill.
5. Sherwood, L. (2021). Human Physiology: From Cells to Systems, Cengage Learning.

e Resources:

1. NPTEL – Human Physiology Courses
2. SWAYAM Online Learning Portal
3. National Digital Library of India (NDLI)
4. PubMed Database (NCBI)
5. Virtual Labs, Ministry of Education, Government of India

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
II	UBC26204			Human Physiology								3		3
Course Outcomes (COs)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	2	2	1	-	-	-	-	-	-	-	3	2	2.20
CO2	3	3	2	2	1	-	-	-	-	-	-	3	2	2.40
CO3	3	3	3	2	2	1	-	-	-	-	-	3	3	2.60
CO4	3	3	3	3	2	2	-	-	-	-	-	3	3	2.80
CO5	3	3	3	3	2	2	1	-	-	1	-	3	3	2.83
Mean	3.00	2.80	2.60	2.20	1.20	0.80	0.20	0.00	0.00	0.20	0.00	3.00	2.40	2.28

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	UBC26205	Lab in Human Physiology and Enzymology	Practical	0	0	4	2

Pre-Requisite:

1. Basic knowledge of human physiology and biological systems.
2. Fundamental understanding of biomolecules, enzymes, and laboratory safety practices.

Co- Requisite:

1. Human Physiology.
2. Enzymology.

Progressive Course:

1. Clinical Biochemistry.
2. Medical Laboratory Technology and Diagnostic Biochemistry.

Course Objectives:

1. To impart fundamental laboratory skills in hematological, physiological, enzymological, and clinical biochemistry techniques.
2. To train students in safe handling of biological samples and adherence to good laboratory practices (GLP).
3. To develop practical understanding of blood analysis, enzyme activity, and urine examination techniques.
4. To enable students to correlate theoretical knowledge with experimental outcomes in human physiology and clinical biochemistry.
5. To build competence in data recording, interpretation, and analysis of biochemical experiments.

Course Outcomes:

CO1: Demonstrate proper laboratory safety practices and perform basic hematological techniques such as hemoglobin estimation and blood cell counting. **(K3)**

CO2: Analyze physiological parameters including pulse rate, blood pressure, respiratory rate, BMI, and interpret their clinical significance. **(K3)**

CO3: Apply enzymology principles to study enzyme activity and evaluate the effects of pH, temperature, and substrate concentration. **(K4)**

CO4: Perform clinical enzyme assays and understand enzyme kinetics, inhibition, and their biomedical relevance.**(K5)**

CO5: Conduct qualitative and quantitative urine analysis and interpret results for diagnosis of metabolic and pathological conditions. **(K4)**

List of Experiments:	60 hrs.

1. Determination of Hemoglobin by Sahli's Method
2. Total RBC Count using Hemocytometer
3. Total WBC Count using Hemocytometer
4. Blood Grouping (ABO System and Rh Typing)
5. Estimation of Bleeding Time and Clotting Time
6. Measurement of Blood Pressure and Pulse Rate
7. Assay of Salivary Amylase Activity and Effect of pH on Enzyme Activity
8. Effect of Temperature and Substrate Concentration on Enzyme Activity (Amylase)
9. Qualitative Analysis of Urine (Glucose, Protein, Ketone Bodies, and Bile Pigments)
10. Assay of Catalase Activity and Study of Enzyme Kinetics

Text Book(s):

1. Pal, G.K. and Pal, P. (2021). Textbook of Practical Physiology. Universities Press.
2. Satyanarayana, U. and Chakrapani, U. (2021). Biochemistry. Elsevier.
3. Sadasivam, S. and Manickam, A. (2022). Biochemical Methods. New Age International.
4. Plummer, D.T. (2021). An Introduction to Practical Biochemistry. McGraw-Hill Education.
5. Wilson, K. and Walker, J. (2022). Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.

Reference Book(s):

1. Sherwood, L. (2021). *Human Physiology: From Cells to Systems*. Cengage Learning.
2. Fox, S.I. (2023). *Human Physiology*. McGraw-Hill Education.
3. Litwack, G. (2021). *Human Biochemistry*. Elsevier.
4. Ochs, R.S. (2021). *Biochemistry*. CRC Press.
5. Derrickson, B.H. (2024). *Human Physiology*. Wiley.

e Resources:

1. NPTEL – **https://nptel.ac.in**
2. SWAYAM – **https://swayam.gov.in**
3. National Digital Library of India (NDLI) – **https://ndl.iitkgp.ac.in**
4. Virtual Labs – **https://www.vlab.co.in**
5. PubMed (NCBI) – **https://pubmed.ncbi.nlm.nih.gov**

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
II	UBC26205			Lab in Human Physiology and Enzymology								4		2
Course Outcomes (COs)	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	
CO1	3	2	-	3	2	-	2	1	-	-	1	3	3	2.15
CO2	3	-	3	2	-	2	2	1	2	2	1	2	3	2.23
CO3	3	3	2	-	-	2	-	1	2	-	-	3	2	2.23
CO4	3	-	-	2	2	-	2	2	-	2	-	2	2	2.31
CO5	3	3	3	3	2	3	3	2	3	3	2	3	3	2.77
Mean	3.00	2.60	2.40	2.60	2.00	2.40	2.20	1.40	2.20	2.20	1.40	3.00	3.00	2.34

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	UBC26206	Enzyme Biochemistry	Core	4	0	0	4

Pre-Requisite:

1. Basic understanding of biomolecules, including proteins, carbohydrates, lipids, and nucleic acids.
2. Fundamental knowledge of cell biology and biochemical reactions.

Co- Requisite:

1. Understanding of human physiological processes related to enzyme function.
2. Knowledge of analytical techniques used in biochemical investigations.

Progressive Course:

1. Provides the foundation for studying Metabolism and Metabolic Regulation.
2. Supports advanced learning in Clinical Biochemistry and related biomedical sciences.

Course Objectives:

1. To provide fundamental knowledge on the classification, structure, properties, and biological significance of enzymes.
2. To explain the mechanisms of enzyme action and the factors influencing enzyme-catalyzed reactions.
3. To develop an understanding of enzyme kinetics, catalytic efficiency, and methods for evaluating enzyme activity.
4. To impart knowledge on enzyme inhibition, regulation, and their roles in metabolic control.
5. To familiarize students with the clinical, industrial, and biotechnological applications of enzymes and recent advances in enzymology.

Course Outcomes:

CO1: Explain the classification, properties, nomenclature, and biological significance of enzymes, cofactors, coenzymes, and metalloenzymes. **(K2)**

CO2: Apply the principles of enzyme action to interpret enzyme-substrate interactions, catalytic mechanisms, and factors affecting enzyme activity. **(K3)**

CO3: Analyze enzyme kinetic parameters such as Km and Vmax using Michaelis-Menten kinetics and graphical methods. **(K4)**

CO4: Differentiate various types of enzyme inhibition and evaluate mechanisms involved in enzyme regulation and metabolic control. **(K4)**

CO5 : Assess the clinical, industrial, and biotechnological applications of enzymes and evaluate recent developments in enzyme engineering and therapeutics. **(K5)**

Unit-I	Introduction and Classification of Enzymes	12 Hrs
History and significance of enzymes. Properties and nomenclature of enzymes. IUBMB classification of enzymes with examples. Enzyme specificity and catalytic power. Active site and substrate binding. Coenzymes, cofactors, prosthetic groups and metalloenzymes. Enzyme assay, enzyme activity units, specific activity and turnover number. Vitamins as precursors of coenzymes.		
Unit-II	**Mechanism of Enzyme Action**	**12 Hrs**
Concept of enzyme-substrate complex. Lock and Key model and Induced Fit model. Transition state theory. Factors affecting enzyme activity – pH, temperature, substrate concentration and enzyme concentration. Catalytic mechanisms involving acid-base catalysis, covalent catalysis and metal ion catalysis. Multienzyme complexes and zymogens		
Unit-III	**Enzyme Kinetics**	**12 Hrs**
Chemical kinetics and rate equations. Michaelis-Menten equation and its significance. Determination of Km and Vmax. Lineweaver-Burk plot and Eadie-Hofstee plot. Significance of Km and turnover number. Effect of pH and temperature on enzyme activity. Single substrate and multi substrate reactions. Enzyme activity assays and units.		
Unit-IV	**Enzyme Inhibition and Regulation**	**12 Hrs**
Reversible and irreversible inhibition. Competitive, non-competitive, uncompetitive and mixed inhibition. Allosteric enzymes and cooperativity. Feedback inhibition and feed-forward regulation. Covalent modification of enzymes. Isoenzymes and their physiological significance. Regulation of enzyme synthesis, induction and repression mechanisms.		
Unit-V	**Clinical, Industrial and Biotechnological Applications of Enzymes**	**12 Hrs**
Diagnostic enzymes and isoenzymes. Therapeutic enzymes and enzyme replacement therapy. Immobilized enzymes and biosensors. Industrial applications of enzymes in food, pharmaceutical, textile, leather and detergent industries. Enzymes in biotechnology and genetic engineering. Enzyme engineering and protein engineering. Recent advances in enzymology.		

Text Book(s):

1. Nelson, D.L. and Cox, M.M. (2021). Lehninger Principles of Biochemistry, 8th Edition, W.H. Freeman.
2. Voet, D. and Voet, J.G. (2023). Biochemistry, 6th Edition, Wiley.
3. Berg, J.M., Tymoczko, J.L., Gatto, G.J. and Stryer, L. (2023). Biochemistry, 10th Edition, W.H. Freeman.
4. Palmer, T. and Bonner, P.L. (2022). Enzymes: Biochemistry, Biotechnology and Clinical Chemistry, 3rd Edition, Woodhead Publishing.

Reference Book(s):

1. Dixon, M. and Webb, E.C. Enzymes, Academic Press.
2. Segel, I.H. Enzyme Kinetics: Behavior and Analysis of Rapid Equilibrium and Steady-State Enzyme Systems, Wiley.
3. Cornish-Bowden, A. Fundamentals of Enzyme Kinetics, Wiley-Blackwell.
4. Price, N.C. and Stevens, L. Fundamentals of Enzymology, Oxford University Press.
5. Copeland, R.A. Evaluation of Enzyme Inhibitors in Drug Discovery, Wiley

e Resources:

1. NCBI Bookshelf – Biochemistry https://www.ncbi.nlm.nih.gov/books/
2. ExPASy Enzyme Portal https://enzyme.expasy.org/
3. BRENDA Enzyme Database https://www.brenda-enzymes.org/
4. KEGG Pathway Database https://www.genome.jp/kegg/
5. PubMed Database https://pubmed.ncbi.nlm.nih.gov/

Relationship Matrix for COs, POs and PSOs

Semester	Course code	Title of the course										Hours		Credit
II	UBC26206	Enzyme Biochemistry										4		4
Course Outcomes (COs)	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	
CO1	3	2	2	2	2	–	–	–	–	1	–	3	3	2.00
CO2	3	3	2	2	2	2	–	–	1	2	–	3	3	2.08
CO3	3	3	3	3	2	2	1	–	2	2	–	3	3	2.31
CO4	3	3	2	3	2	2	2	–	2	2	1	3	3	2.31
CO5	3	3	3	3	3	2	2	1	2	3	2	3	3	2.54
Mean	3.00	2.80	2.40	2.60	2.20	1.60	1.00	0.20	1.00	2.00	0.60	3.00	3.00	2.25

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	UBC26901	Basics of Biochemistry	MDC I	3	0	0	3

Pre-Requisite:	Co- Requisite:	Progressive Course:

Course Objectives:

- To provide a fundamental understanding of biochemical principles and biomolecules.
- To explain the structure and functions of carbohydrates, proteins, lipids, and nucleic acids
- To understand basic metabolic pathways and energy production.
- To introduce enzyme functions and their applications.
- To familiarize students with the role of biochemistry in health and disease

Course Outcomes:

CO1: Describe the structure and biological significance of major biomolecules. **(K2)**

CO2: Explain enzyme functions and their role in biochemical reactions **(K2)**

CO3: Illustrate basic metabolic pathways involved in energy production. **(K3)**

CO4: Discuss the biochemical basis of nutrition, health, and disease. **(K2)**

CO5: Apply fundamental biochemical concepts in allied life science disciplines. **(K2)**

Unit-I	Introduction to Biochemistry	09 Hrs.

Scope and importance of biochemistry. Cellular organization. Water and its biological significance. pH, buffers, and biological systems. Overview of biomolecules.

Unit-II	Carbohydrates and Lipids	09 Hrs.

Classification, structure, and functions of carbohydrates. Monosaccharides, disaccharides, and polysaccharides.

Lipids: classification, properties, biological functions, and significance of fatty acids and cholesterol.

Unit-III	Proteins and Enzymes	09Hrs.

Amino acids: classification and properties. Structure and functions of proteins. Enzymes: classification, mechanism of action, factors affecting enzyme activity, and clinical significance.

Unit-IV	Nucleic Acids and Metabolism	09 Hrs.

Structure and functions of DNA and RNA. Central dogma of molecular biology. Introduction to metabolism. Glycolysis, TCA cycle, electron transport chain, and ATP synthesis.

Unit-V	Applied Biochemistry in Health and Disease	09 Hrs.

Nutrition and balanced diet. Vitamins and minerals. Biochemical basis of diabetes mellitus, obesity, cardiovascular diseases, and malnutrition. Applications of biochemistry in medicine, agriculture, and biotechnology.

Text Book(s):

1. Satyanarayana, U. & Chakrapani, U. *Biochemistry*.
2. Jain, J.L., Jain, S. & Jain, N. *Fundamentals of Biochemistry*.
3. Nelson, D.L. & Cox, M.M. *Lehninger Principles of Biochemistry*.

Reference Book(s):

1. Murray, R.K. et al. *Harper's Illustrated Biochemistry*.
2. Voet, D. & Voet, J.G. *Biochemistry*.
3. Devlin, T.M. *Textbook of Biochemistry with Clinical Correlations*.
4. Chatterjea, M.N. & Shinde, R. *Textbook of Medical Biochemistry*.

e Resources:

1. National Digital Library of India (NDLI).
2. NCBI Bookshelf – Biochemistry Resources.
3. SWAYAM and NPTEL Biochemistry Courses.
4. Khan Academy – Biochemistry Modules.
5. WHO and NIH Educational Resources.

Relationship Matrix for COs, POs and PSOs

Semester	**Course code**	**Title of the course**								**Hours**		**Credit**
I	UBC26901	Basics of Biochemistry								**3**		**3**
Course Outcomes (COs)	**Programme Outcomes (POs)**									**Programme Specific Outcomes (PSOs)**		**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	
CO1	**3**	**2**	**2**	**2**	**–**	**–**	**–**	**–**	**–**	**1**	**–**	**3**	**2.00**
CO2	**3**	**3**	**2**	**2**	**2**	**–**	**–**	**–**	**1**	**2**	**–**	**3**	**2.08**
CO3	**3**	**3**	**3**	**2**	**2**	**1**	**–**	**–**	**2**	**2**	**–**	**3**	**2.15**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**–**	**2**	**2**	**–**	**3**	**2.31**
CO5	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**1**	**2**	**3**	**1**	**3**	**2.38**
Mean	**3.00**	**2.80**	**2.40**	**2.40**	**1.80**	**1.00**	**0.60**	**0.20**	**1.00**	**2.00**	**0.20**	**3.00**	**2.18**

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	UBC26902	Biochemistry Behind Everyday Life	MDC II	3	0	0	3

Pre-Requisite:	Co- Requisite:	Progressive Course:

Course Objectives:

1. To provide an understanding of the role of biochemistry and biomolecules in maintaining health and supporting daily life activities.
2. To explain the principles of nutrition, digestion, metabolism, and their importance in healthy living.
3. To familiarize students with the biochemical basis of lifestyle, aging, and common metabolic disorders
4. To introduce the applications of biochemistry in household products, environmental sustainability, and microbial processes.
5. To acquaint students with recent advances in biochemistry, biotechnology, diagnostics, and emerging technologies.

Course Outcomes:

CO1: Describe the structure, functions, and significance of biomolecules, vitamins, minerals, and their role in maintaining homeostasis. **(K2)**

CO2: Explain the principles of nutrition, digestion, absorption, and the biochemical basis of balanced diet, malnutrition, and obesity. **(K3)**

CO3: Illustrate the relationship between energy metabolism, hormonal regulation, antioxidants, and lifestyle-related diseases for promoting preventive healthcare. **(K4)**

CO4: Discuss the biochemical principles underlying household products, fermentation, environmental protection, waste management, and sustainability. **(K2)**

CO5: Apply the concepts of modern biochemistry in medicine, biotechnology, personalized nutrition, nanotechnology, biosensors, and emerging healthcare technologies with ethical awareness. **(K3)**

Unit-I	**Biomolecules in Daily Life**	**09Hrs.**

Introduction to biochemistry and its significance in everyday life. Structure and functions of carbohydrates, proteins, lipids, nucleic acids, vitamins, and minerals. Water and pH in biological systems. Energy-rich molecules and ATP. Importance of biomolecules in maintaining health and homeostasis

Unit-II	**Food, Nutrition and Digestion**	**09 Hrs.**

Balanced diet and nutritional requirements. Digestion and absorption of carbohydrates, proteins, and lipids. Role of enzymes in digestion. Dietary fibers and probiotics. Functional foods and nutraceuticals. Food preservation and food additives. Biochemical basis of malnutrition and obesity.

Unit-III	Biochemistry of Health and Lifestyle	09Hrs.
Exercise and energy metabolism. Stress and hormonal regulation. Sleep and circadian rhythms. Biochemistry of aging. Antioxidants and free radicals. Lifestyle diseases including diabetes, cardiovascular diseases, obesity and hypertension. Importance of healthy habits and preventive healthcare.		
Unit-IV	**Biochemistry in Household Products and Environment**	**09Hrs.**
Biochemistry of soaps, detergents and cosmetics. Fermentation in food products. Biofuels and biodegradable products. Water purification and environmental pollutants. Role of microbes in waste degradation. Biochemical aspects of climate change and sustainability.		
Unit-V	**Biochemistry in Modern Life and Emerging Technologies**	**09 Hrs.**
Biochemistry in medicine and diagnostics. Vaccines and immunization. Biotechnology in agriculture and healthcare. Personalized nutrition and precision medicine. Artificial intelligence in biological sciences. Applications of nanotechnology and biosensors. Future prospects and ethical issues in biotechnology.		

Text Book(s):

1. Nelson, D.L. and Cox, M.M., Lehninger Principles of Biochemistry, 9th Edition, W.H. Freeman, 2025.
2. Berg, J.M., Tymoczko, J.L., Gatto, G.J. and Stryer, L., Biochemistry, 10th Edition, W.H. Freeman, 2023.
3. Voet, D., Voet, J.G. and Pratt, C.W., Fundamentals of Biochemistry, 6th Edition, Wiley, 2024.
4. Campbell, M.K. and Farrell, S.O., Biochemistry, 10th Edition, Cengage Learning, 2022.
5. Devlin, T.M., Textbook of Biochemistry with Clinical Correlations, 9th Edition, Wiley, 2023

Reference Book(s):

1. Koolman, J. and Röhm, K.H., Color Atlas of Biochemistry, 4th Edition, Thieme, 2022.
2. Garrett, R.H. and Grisham, C.M., Biochemistry, 8th Edition, Cengage Learning, 2023.
3. Satyanarayana, U. and Chakrapani, U., Biochemistry, 7th Edition, Elsevier, 2022.
4. Murray, R.K., Bender, D.A. et al., Harper's Illustrated Biochemistry, 32nd Edition, McGraw-Hill, 2022.
5. Rodwell, V.W. et al., Harper's Illustrated Biochemistry, 33rd Edition, McGraw-Hill, 2025.

e Resources:

1. National Digital Library of India (NDLI) – https://ndl.iitkgp.ac.in
2. SWAYAM – https://swayam.gov.in
3. NPTEL – https://nptel.ac.in
4. NCBI Bookshelf – https://www.ncbi.nlm.nih.gov/books
5. PubMed – https://pubmed.ncbi.nlm.nih.gov

Relationship Matrix for COs, POs and PSOs

Semester	Course code	Title of the course								Hours		Credit
I	UBC26902	Biochemistry Behind Everyday Life								3		3
Course Outcomes (COs)	Programme Outcomes (POs)									Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	
CO1	3	2	2	2	1	–	1	–	–	1	–	3	2.00
CO2	3	3	2	2	2	–	–	–	1	2	–	3	2.09
CO3	3	3	3	2	2	1	2	–	2	2	–	3	2.16
CO4	3	3	3	3	2	2	1	–	2	2	–	3	2.31
CO5	3	3	2	3	3	2	2	1	2	3	1	3	2.38
Mean	3.00	2.80	2.40	2.40	1.80	1.00	0.60	0.20	1.00	2.00	0.20	3.00	2.03