

M.Sc. BIOCHEMISTRY

SYLLABUS



UNIVERSITY DEPARTMENT

2026 - 2027

PROGRAM CODE: BCHA

Bharathiar University

**(A State University, Accredited with “A++” Grade by
NAAC and 26th Rank among Indian Universities by
MHRD-NIRF)**

Coimbatore - 641 046, India

Program Educational Objectives (PEOs)	
Upon completion of M. Sc. Biochemistry program, the graduates are expected to attain.	
PEO1	The skills to communicate the concepts and results of their laboratory experiments through effective writing and/or oral communication using discipline standards for reporting and citation.
PEO2	Students will have critical thinking and scientific inquiry in the performance, design, interpretation and documentation of laboratory experiments to the level suitable to succeed at an entry level position in biochemical industries.
PEO3	The summer training, industrial visit & project work help the students to know the practical aspects about the subject.
PEO4	Theory and Knowledge: Upon completion of the biochemistry sequence, students are able to recognize and demonstrate the structure, chemical properties, and reactions of the biomolecules and their biopolymers to predict chemical properties and reactivity
PEO5	Instrumentation: Upon completion of the degree, students are able to understand the theoretical concepts of analytics and instruments that are commonly used in most biochemistry fields, which will help them to excel in relevant fields.
PEO6	The course aims to develop the students in understanding the areas that are widely used as well as on advanced scientific methods This is achieved via lectures, classes, seminars and a problem-based learning exercise.
PEO7	Student would suggest, evaluate and interpret biochemical investigation in a given clinical situation and apply knowledge to solve clinical problems
PEO8	Ability to participate in and report the team work-based investigations of problem-based assignments
PEO9	Build on their knowledge to understand highly advanced and specialized courses in future.
PEO10	Ability to contribute their knowledge and experiences gained during the course to professional and/or communal activities in developing the society.

MSc. Biochemistry-Programme Specific Outcomes (PSOs)

After the successful completion of the MSc. Biochemistry program, students are expected to

PSO1	Enrich the knowledge to recognize, integrate, and demonstrate the chemical, physical and structural properties of biomolecules and their biopolymers
PSO2	Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and industries
PSO3	Expect to diagnose the pathogenic microbes in the laboratory by applying the knowledge of microbial culture techniques

PSO4	Impart practical skills and scientific knowledge of metabolic pathways to detect defects and evaluate solutions for various metabolic disorders
PSO5	Expertise in cellular and molecular biology to organize and execute research initiatives in pertinent areas
PSO6	Develop nanotechnology-based platforms for pharmacological therapy and genetic engineering applications.

MSc. Biochemistry-Programme Outcomes (POs)

On successful completion of the MSc. Biochemistry program,

PO1	Ability to acquire and apply the knowledge of biochemistry
PO2	Ability to perform competently in research laboratories
PO3	Identify Biochemistry problems
PO4	To function well both individually and in multidisciplinary teams, with the ability to lead
PO5	Apply ethical principles in the field of Biochemistry
PO6	Impart knowledge effectively with the general society
PO7	Broaden the knowledge of Biochemistry by providing information about societal and environmental issues on a global scale
PO8	Strengthen the skills and motivation to engage in lifelong, self-directed learning activities
PO9	Ability to increase the knowledge of contemporary issues in allied fields
PO10	To participate and succeed in competitive examinations

BHARATHIAR UNIVERSITY: COIMBATORE 641 046**M. Sc. Biochemistry Curriculum (University Department)**

(For the students admitted during the academic year 2026 – 27 onwards)

Course Code	Title of the Course	Credit	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
13A	Biomolecules and Bioenergetics	4	4	-	25	75	100
13B	Cell and Molecular Biology	4	4	-	25	75	100
13C	Analytical Biochemistry	4	4	-	25	75	100
13D	Microbiology	4	4	-	25	75	100
13P	Biochemistry, Cell biology and Microbiology	4	-	6	25	75	100
1EA	Genetics and Developmental Biology	4	4	-	25	75	100
1EB	Nutritional Biochemistry						
GS108	Supportive I	2	2	-	12	38	50
Total		26	22	6	162	488	650
SECOND SEMESTER							
23A	Enzymology	4	4	-	25	75	100
23B	Intermediary metabolism	4	4	-	25	75	100
23C	Human Physiology and Molecular Physiology	4	4	-	25	75	100
23D	Immunology	4	4	-	25	75	100
23P	Enzymology and Immunology Lab	4	-	6	25	75	100
2EB	Animal Biotechnology	4	4	-	25	75	100
2EC	Nano science and Technology						
GS102	Supportive II	2	2	-	12	38	50
	Summer Training*						
Total		26	22	6	162	488	650

THIRD SEMESTER							
33A	Clinical Biochemistry	4	4	-	25	75	100
33B	Recombinant DNA Technology	4	4	-	25	75	100
33C	Drug Biochemistry	4	4	-	25	75	100
33D	Biostatistics and Research Methodology	4	4	-	25	75	100
33P	Clinical Biochemistry & Molecular Biology Lab	4	-	6	25	75	100
3EC	Plant Biochemistry and Environmental Biotechnology	4	4	-	25	75	100
3ED	Biology of Cancer and Stem cell						
GS109	Supportive III	2	2	-	12	38	50
	Summer Training*	2	-	-	50	-	50
Total		28	22	6	212	488	700
FOURTH SEMESTER							
	Project work***	8	-	-	100	100	200
Total		8	-	-	100	100	200
Grand Total		88	66	18	636	1564	2200
CO-SCHOLASTIC COURSES							
Certification Course in AI in Life science ####		1	4	4	50	-	50
Health & Wellness *****		1	4	4	100	-	100
ONLINE COURSES							
Online Course for a period of 4 weeks duration: Swayam, MOOC Course etc. **		2	-	-	50	-	50
# VALUE ADDED COURSES							
1. Animal Tissue Culture Techniques		-	20	25	50	-	50
2. Pharmacovigilance							
## JOB ORIENTED COURSES							
1. Medical Laboratory Technician		-	20	25	50	-	50
2. Quality Control Biologist							
The scholastic courses are only counted for the final grading and ranking. However, for the award of the degree, the completion of co-scholastic courses is also mandatory.							

* **Summer Training:** All the students have to undergo summer training for a period of minimum 30 days. Final reports have to be submitted which will be evaluated.

** **Online Course for a period of 4 weeks duration** All the students need required to complete online courses offered by **SWAYAM, MOOCs or NPTEL** by the end of 3rd semester. Online courses have an extra credit (other than 90 credits) 4-week program carries 2 credits

*****Project Work:** The report is the Bonafide work carried out by the candidate under the guidance of a faculty authenticated and countersigned by the HOD. This project work must be presented and defended by the candidate preferably along with the publication in the department attended by all faculties and reviewed by an external examiner

**** Compulsory course on **Health and wellness** with 1 credit.

Students need to complete one **Value Added Course** before completion of M. Sc Degree

Students need to complete one **Job Oriented Course** before completion of M. Sc Degree

Students need to complete **Certification course in AI in Life science.**

First Semester

Course code	13A	BIOMOLECULES AND BIOENERGETICS	L	T	P	C
Core/Elective/Supportive	Core – 13A		4	√	-	4
Pre-requisite	Basic Knowledge in Biology		Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to:						
1. This course emphasizes on various biomolecules and its significance.						
2. To enable the students to learn the basic functions, structures and biological importance of lifeless chemical compounds.						
3. On successful completion of the course the students should have understood the significance of the complex biomolecules, polysaccharides, lipids, proteins, nucleic acids, vitamins and minerals.						
Learning Outcomes						
On the successful completion of the course, student will be able to:						
CO 1	Helps to understand about the polysaccharides and its types.			LO1, LO10		
CO 2	Gives a clear understanding about the lipids and its role.			LO8, LO9		
CO 3	A Clear Knowledge regarding amino acids and protein characterization.			LO5, LO8, LO10		
CO 4	Provides the structure and properties of Nucleic acids.			LO5, LO8		
CO 5	Gives an idea about energy level and its synthesis.			LO5, LO8, LO10		
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Self-directed learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1	Water and Carbohydrates			15 Hours		
Water - Unique properties, weak interactions in aqueous systems, ionization of water, buffers. Classification, chemical properties of carbohydrates, Chemistry and biological roles of homo and heteropolysaccharides. Structural elucidation of polysaccharides; Oligosaccharides - lectin interaction in biochemical processes. Structure and role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides).						
Unit:2	Lipids			15 Hours		
Classification of Lipids, Biological significance of lipids, Fatty acids and their physicochemical properties. Structure and properties of Prostaglandins. Storage lipids - triacylglycerol and waxes. Structural lipids in membranes - glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols, structure, distribution and role of membrane lipids. Lipids as signals, cofactors and pigments.						

Unit:3	Amino acids	11 Hours
Amino acids–classification, structure and physicochemical properties, chemical synthesis of peptides - solid phase peptide synthesis. Proteins – classification, purification, and criteria of homogeneity. Structural organization, sequence determination and characterization of proteins.		
Computational approaches for protein structure prediction and sequence analysis. Conformation of proteins - Ramachandran plots. Denaturation of proteins. Apoprotein and Prosthetic group- Porphyrins – Structure and properties of porphyrins – heme, Chlorophyll and Cytochromes.		
Unit:4	Nucleic acids	11 Hours
Nucleotides- structure and properties, physicochemical properties of nucleic acids, cleavage of nucleic acids by enzymatic methods, non – enzymatic transformation of nucleotides and nucleic acids, methylation, Sequencing, chemical synthesis of DNA. Bioinformatics tools for DNA sequencing and nucleic acid analysis. Three-dimensional structure of DNA. Types of DNAssDNA, dsDNA, H-DNA, G4 DNA. Different forms of DNA – circular DNA and Supercoiling. Types of RNA mRNA, tRNA, rRNA, SnRNA, SiRNA, HnRNA, miRNA. Structure of t-RNA. Nucleotides as source of energy, components of coenzymes, second messengers.		
Unit:5	Thermodynamics	11 Hours
Principles of thermodynamics, free energy, enthalpy and entropy, Free energy changes in biological transformations in living systems. Redox potential, phosphate group transfer potential and ATP, High-energy compounds, oxidation and reduction reactions. Mitochondrial electron transport system – organization of components and importance. Substrate level phosphorylation, oxidative phosphorylation, Respiratory control, Mechanism and theories of oxidative phosphorylation. Respiratory chain inhibitors and uncouplers of oxidative phosphorylation.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	D. L. Nelson and M. M. Cox, <i>Lehninger Principles of Biochemistry</i> (8th Edition), W. H. Freeman, 2021	
2	D. Voet and J. G. Voet, <i>Biochemistry</i> , (5th Edition), Wiley & Sons, 2016.	
Reference Books		
1	J. M. Berg, J. L. Tymoczko and L. Stryer, <i>Biochemistry</i> (10th Edition), W.H. Freeman, 2023.	
2	P. W. Kuchel, G. B. Ralston et al., <i>Schaum's outline of theory and problems of biochemistry</i> (3 rd Edition) McGraw-Hill, 2009	
3	W. B. Wood, J. H. Wilson, R. M. Benbow, and L. E. Hood., <i>Biochemistry: A problems approach</i> , (2nd Edition), Benjamin/Cummins Publishing Company, 1981.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	Biochemistry of Biomolecules https://onlinecourses.swayam2.ac.in/cec20_bt12/preview	

2	Biomolecules: Structure, Function in Health and Disease http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/353
3	Introduction to Carbohydrates https://aklectures.com/lecture/carbohydrates/introduction-to-carbohydrates
4	Introduction to Nucleic Acids https://www.youtube.com/watch?v=1Wc4jTH2v_w&list=PL9jo2wQj1WCNG9mFuNBm_J_1m7x1skBNKw-
Course Designed By: Dr. S. Suja	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	S	M	S	M	S
CO2	M	S	S	M	M	S	M	S	S	S
CO3	M	S	S	M	M	M	S	M	M	S
CO4	S	S	S	M	M	M	S	M	M	S
CO5	S	L	M	M	M	M	S	M	M	S

*S-Strong; M-Medium; L-Low

Course code	13B	CELL AND MOLECULAR BIOLOGY	L	T	P	C
Core/Elective/Supportive	Core - II		4	√	-	4
Pre-requisite	Awareness on structure and function of cell organelles and cell division		Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to: 1. To study the structure and function of cells and to know about extracellular Matrix and cell communication. 2. Understanding the function of intracellular organelles and cell cycle mechanism. Also, thorough understanding the replication process as well as DNA damage and repair mechanisms. 3. Upon completion of the course, students might also be thorough about transcription mechanism and its regulations as well as on translation and post translational modification of proteins.						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	The course material will provide clear understanding of structure and functions of cells.				LO1 & LO4	
CO2	Students will advance their knowledge in cell cycle events and regulation of cell cycle at molecular level.				LO3 & LO6	
CO3	The course will provide introduction to cancer and apoptosis.				LO6 & LO11	
CO4	Students will learn the mechanism of replication, transcription and its regulation in detail.				LO1&LO8	
CO5	Course material provides detailed understanding of translation process, including proofreading and post translational modification of proteins.				LO1, LO3 & LO9	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Selfdirected learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1	Structure and Function of Cells				15 Hours	
Structure and function of cells–prokaryotes and eukaryotes, difference, Structure and organization of membrane – structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active & passive transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes. Extracellular matrix, cell-cell communication. Extracellular Vesicle.						
Unit:2	Cell Components & Cell Division				15 Hours	

Plasma membrane, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility and cell division: amitosis mitosis; meiosis and genetic recombination; regulation of cell cycle; factors and genes regulating cell cycle.

Unit:3	Cancer and cell death	10 Hours
Cancer incidence and mortality; Origin of neoplastic cells; Types of Cancer: Benign Tumors Vs. Malignant Tumors, Common Symptoms, Causes of Cancer: Carcinogenesis-Chemical and Irradiation; Oxygen Free Radicals, Aging and Cancer; Genetic Susceptibility and Cancer; Viral Carcinogenesis. Molecular Mechanism of cancer: protooncogenes, oncogene, tumour suppressor genes involved in cancer, errors in cell cycle (Cyclins and CDKs). Apoptosis in cancer – mechanism of apoptosis, intrinsic and extrinsic pathways.		
Unit:4	DNA replication and Transcription	11 Hours
Chromosome-structure and function, Prokaryotic and Eukaryotic DNA replication mechanisms - Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extra chromosomal replicons, DNA damage and repair mechanisms. Transcription- RNA polymerases, Regulatory sequences in protein-coding genes, Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, regulation of transcription factor activity, capping, elongation and termination, Processing of Pre- mRNA, splicing, polyadenylation; RNA transport, Cytoplasmic mechanisms of post-transcriptional control, Processing of rRNA and tRNA. Gene regulation –lac and trp operon.		
Unit:5	Translation	11 Hours
Genetic code, aminoacylation of tRNA, tRNA-identity. Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, translational proof-reading, translational inhibitors, post- translational modification of proteins.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Cell Biology – 2013 by Gerald Karp; Publisher: Wiley; Seventh edition.	
2	Advances in Cell Biology: Volume 2, 2013 by David M. Prescott; Publisher: Springer; Softcover reprint of the original 1st ed. 1971 edition.	
3	Lehninger Principles of Biochemistry: International Edition – 2017 by David L. Nelson and Michael Cox; Publisher: WH Freeman; 7th ed. 2017 edition.	
4	The Molecular Basis of Human Cancer – 2018 by William B. Coleman (Editor), Gregory J. Tsongalis; Publisher: Humana Press Inc.; Softcover reprint of the original 2nd ed. 2017 edition.	

5	Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics– 2012 by Pecorino; Oxford University Press; 3rd edition.
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Reference Books

1	Molecular Cell Biology– 2016 by Arnold Berk, Chris A. Kaiser, Harvey Lodish, Angelika Amon, Hidde Ploegh, Anthony Bretscher, Monty Krieger and Kelsey C. Martin; Publisher: WH Freeman; 8 edition.
2	Molecular Biology of the Cell – 2014 by Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, and Keith Roberts; Publisher: W. W. Norton & Company; 6 edition.
3	Molecular Biology of the Gene – 2017 by James D. Watson, A. Baker Tania, P. Bell Stephen, Gann Alexander, Levine Michael and Losick Richard; Publisher: Pearson Education; Seventh edition.
4	Biochemistry – 2015 by Jeremy M. Berg, Lubert Stryer, John L. Tymoczko and Gregory J. Gatto; Publisher: WH Freeman; 8th ed. edition.
5	Lewin's GENES XII – 2017 by Jocelyn E. Krebs, Elliott S. Goldstein and Stephen T. Kilpatrick; Publisher: Jones and Bartlett Publishers, Inc; 12th Revised edition edition.
6	The Cell: A Molecular Approach -2013 by Geoffrey M. Cooper, and Robert E. Hausman; Publisher: Sinauer Associates Inc; 6 edition

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology/Book%3A_Cells_-_Molecules_and_Mechanisms_(Wong)
2	https://nptel.ac.in/courses/102/106/102106025/#
3	https://www.easybiologyclass.com/molecular-biology-online-tutorials-lecture-notesstudy-materials/
4	https://www.mooc-list.com/tags/molecularbiology?title=MOLECULAR+PHYSIOLOGY

Course Designed By: **Dr. S. Selvakumar**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	L	M	S	S	S
CO3	S	S	M	L	L	L	M	S	S	S
CO3	S	S	M	L	S	M	L	L	L	M
CO4	S	L	M	L	L	L	M	S	S	M
CO5	S	M	M	M	L	M	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code	13C	ANALYTICAL BIOCHEMISTRY	L	T	P	C
Core/Elective/Supportive	Core - III		4	✓	-	4
Pre-requisite	Prior knowledge on modern methods and technologies used in biochemical analysis		Syllabus Version		2026 - 27	

Course Objectives:

The main objectives of this course are to:

1. The main objective of the course is qualitative and quantitative analysis of different molecules taking place in a biochemical reaction.
2. It includes the development of different tools and methods for identification, analysis and examination of physical properties of different biochemical compositions to provide better chemical information.
3. It helps the biochemistry students in understanding the basic science in a variety of applications.

Learning Outcomes:

On the successful completion of the course, student will be able to:

CO1	To obtain the knowledge about the microscope handling and the basic difference between the ordinary microscope and electron microscope.	LO1 & LO8
CO2	To learn the chromatographic techniques for the separation of the individual compound from the mixture of compound.	LO5 & LO6
CO3	To study the interaction between matter and electromagnetic radiation and visible light dispersed according to its wavelength, by a prism.	LO8 & LO1
CO4	To understand the characterization of surfaces using radioisotopes generally involves observing the manner in which the radioactive species interact with the surface	LO6 & LO8
CO5	To obtain knowledge about the separation and analysis of macromolecules and their fragments, based on their size and charge.	LO5 & LO6

LO1: Disciplinary Knowledge **LO2:** Communication skill **LO3:** Critical thinking **LO4:** Problem Solving **LO5:** Analytical Reasoning **LO6:** Research – related Skills **LO7:** Co-operation / Team Work **LO8:** Scientific Reasoning **LO9:** Reflective Thinking **LO10:** Informative Thinking **LO11:** Self-directed learning **LO12:** Multicultural competence **LO13:** Moral and ethical awareness/reasoning **LO14:** Leadership readiness/qualities **LO15:** Life-long learning

Unit:1	Microscopy, Centrifugation and Electrochemical Techniques	15 Hours
Principles of microscopic techniques: Light microscope, Fluorescence microscope, Phase contrast microscope, Electron microscope (SEM, TEM), Confocal microscopy, Artificial Intelligence (AI) assisted Digital Microscopy and Image Analysis. Flow Cytometry. Centrifugation: Small bench top centrifuges, large capacity refrigerated centrifuges, High speed refrigerated centrifuges, preparative and analytical ultra-centrifuge. Electrochemical techniques: Principles of electrochemical techniques, redox reactions, the pH electrode, ion sensitive and gas-sensitive electrodes, The clark oxygen electrode.		

Unit:2	Spectroscopic Techniques	10 Hours
Spectroscopic techniques: Properties of electromagnetic radiation, interaction with matter. Gamma ray spectroscopy, X-ray spectroscopy, UV and Visible spectroscopy, Infrared and Raman spectroscopy, Electron spin resonance spectroscopy, Nuclear magnetic resonance spectroscopy, Circular dichroism spectroscopy, Atomic absorption spectroscopy. Lasers, Spectro fluorimetry, turbidometry and nephelometry, Mass spectrometry, MALDI-TOF, Artificial Intelligence (AI)-based MALDI-TOF Data Analysis and Biomarker Identification, Fluorescent spectroscopy.		
Unit:3	Chromatography	15 Hours
Principles of chromatography, Thin layer chromatography (TLC), size exclusion, Ion-exchange and affinity chromatography. High performance liquid Chromatography (HPLC), High performance Thin Layer chromatography (HPTLC), Gas liquid chromatography (GLC), Paper chromatography, GC-MS, LC-MS/MS, ICPMS and Surface Plasma Resonance methods.		
Unit:4	Electrophoresis	11 Hours
Electrophoresis: General principles, Detection, estimation and recovery of proteins. Electrophoresis of proteins: SDS-PAGE, Native gels, Gradient gel, Isoelectric focusing, 2-D gel electrophoresis (2-D PAGE), Immunoblotting. Electrophoresis of nucleic acids: agarose gel electrophoresis of DNA, Pulse field gel electrophoresis, Capillary electrophoresis.		
Unit:5	Radio Isotope Techniques	11 Hours
Radio isotope techniques: The nature of radioactivity, detection and measurement of radioactivity: detection based on gas ionization- Geiger Muller counter- principles and applications. Detection based on excitation- Liquid Scintillation counter-principle and applications. Radio-labelled compounds, specific activity, inherent advantages and restrictions of radiotracer experiments, safety aspects, applications of radio isotopes in biological sciences. Flowcytometry.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Instrumental methods of chemical analysis – P.K. Sharma	
2	Biophysical chemistry – Upadhyay., Upadhyay and Nath	
3	Basha M. Analytical Techniques in Biochemistry. Humana Press; 2020.	
4	Wilson, K. and Walker, J. (2018) Practical Biochemistry – Principles and techniques of Biochemistry and Molecular Biology, 8th Edition, Cambridge University Press, India	
Reference Books		

1	A Biologist's guide to principle and techniques of practical biochemistry – Brigan L. Williams.
2	Experimental methods in Biophysical chemistry- Nicolau, C.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://epgp.inflibnet.ac.in/
2	http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=944
Course Designed By: Dr. K. M. Saradhadevi	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	L	S	M	M
CO2	S	S	S	S	S	M	L	S	M	S
CO3	S	S	M	S	S	M	L	M	M	S
CO4	S	M	M	S	S	M	L	M	M	S
CO5	S	S	S	S	S	M	L	S	M	S

*S-Strong; M-Medium; L-Low

Course code	13D	MICROBIOLOGY	L	T	P	C
Core/Elective/Supportive		Core - IV	4	√	-	4
Pre-requisite		Basic knowledge in cell and molecular biology	Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to:						
1. Provide knowledge about microbial culture techniques. 2. Learn the concepts of Microbial Fermentation and its industrial applications. 3. Know the basic concepts of diagnosing infectious, Food borne diseases and diagnosis 4. Understand the concepts of assessment of antimicrobial activity in textiles. 5. Offer knowledge about industrial applications of microbes						
Learning Outcomes:						
On the successful completion of the course, students will be able to:						
CO1	Apply culture techniques for isolation of microbes from various sources and preserve the isolates.				LO1, LO4, LO6, LO8	
CO3	Students will gain knowledge about Microbial Fermentation process and its industrial applications of Artificial intelligence.				LO1, LO5, LO8	
CO3	Students will learn about the techniques involved in Clinical laboratories for pathogen detection.				LO1, LO3, LO8	
CO4	Students will be able to diagnose Microorganisms in Food samples.				LO1, LO4, LO5, LO13	
CO5	Students will know the concepts of production, harvest, recovery and uses of industrially beneficial microbial products.				LO1, LO5, LO6, LO14	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Self- directed learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1	Culture Techniques				15 Hours	
Isolation of microbes from various sources, serial dilution techniques, pure culture techniques, anaerobic culture methods - chemical and physical methods. Gut microbes. Culture preservation techniques. Microbial nutrition-Nutritional requirements. Culture media- types of media, composition of media-carbon sources, nitrogen sources, vitamin and growth factors, minerals, inducers, precursors and inhibitors. Sterilization methods.						
Unit:2	Fermentation Techniques				15 Hours	
Introduction to Fermentation process: Media for industrial fermentation: Essential criteria for media, Media components, Media formulation, Media optimization. Introduction to bioreactors - Instrumentation. Aerobic and anaerobic fermentation; solid state and submerged fermentation. Application of AI in Fermentation-Strain Optimization, Process Optimization and Monitoring Predictive Analytics.						

Unit:3	Clinical Microbiology	10 Hours
Infectious Diseases – Diagnosis – Process of sample collection, transport and examinations of the specimens (Bacteria, Fungi and Virus). Antibioqram. Bacteriology: Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of Gram - positive organisms - <i>Staphylococcus aureus</i> , Mycoplasma; Gram negative organisms: <i>E. coli</i> . Hospital acquired infections: Antimicrobial agents for textiles, international standards for the assessment of antimicrobial activity of textiles. Applications of Artificial intelligence in clinical microbiology testing.		
Unit:4	Microbiology of Food	11 Hours
Microbiology of Fermented Foods - yoghurt, cheese, bread, sauerkraut. Mushroom farming – Use of enzymes in food industry. Food borne diseases- Bacterial and Non- Bacterial. Microbial quality and safety – Determining microorganisms in food culture, Microscopy and sampling methods – Chemical and immunological methods.		
Unit:5	Industrial Microbiology	11 Hours
Microbial fermentation and production of small and macro molecules. Major Products of Industrial Microbiology: Microbial products in pharmaceutical and agriculture industry: Production, harvest, recovery and uses Enzymes, Antibiotics (Penicillins, Tetracycline), vitamins (B2, B12), Amino acids (lysine, glutamic acid, Organic solvents (acetone, ethanol); Organic acids (acetic acid, citric acid). Formulation of Biofertilizer (<i>Rhizobium</i>) and Biopesticides (<i>Bacillus thruingiensis</i>).		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Prescott, Harley and Klein’s Microbiology 12th edition Joanne M. Wwilley, Linda M. Sherwood, Christopher j. Woolverton McGraw Hill Education 2021 ISBN -13: 9781264088393.	
2	Principles of Fermentation Technology by P.F. Stanbury and A. Whitaker, Pergamon press. Fourth edition. 2022.Elsevier.	
3	Gerard J. Tortora, Berdell R. Funke, Christine L. Case. (2023) Microbiology: An Introduction, 14 th edition, Pearson Education, Inc. Company Ltd, New Delhi.	
4	Pelczar, M.J., Chan, E.C. and Krieg, N.R. (2021) Microbiology, 6th Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi.	
Reference Books		
1	Kathleen Park Talaro. (2022) Foundations in Microbiology, Tata McGraw Hill Publishing Company Ltd, New Delhi.	
2	Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton. (2024) Prescott's Microbiology, 12 th edition, Tata McGraw Hill Publishing Company Ltd, New Delhi.	
3	Fermentation microbiology and Biotechnology. Fourth edition, edited by El-Mansi, C.F.A. Bryce, A.L. Demain, A.R. Allman. Taylor and Francis, 2025.	
4	Casida., J.R. (2021) Industrial Microbiology, 4th Edition, Wiley Eastern Ltd, New Delhi.	
5	Gupta, P.K (2006) Biotechnology and Genomics, 1st Edition, Rastogi Publications, Meerut.	

6	Yuan Gao and Robin Cranston. Recent Advances in Antimicrobial Treatments of Textiles, Textile Research Journal, 2008 78: 60. SAGE publications.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://asm.org/podcasts/editors-in-conversation/episodes/artificial-intelligence-in-the-microbiology-labora
2	https://link.springer.com/article/10.1007/s11947-025-03981-9
3	https://www.researchgate.net/publication/399602482_Artificial_intelligence_and_fermentation_applications_publications_and_trend_analysis
4	https://www.sciencedirect.com/science/article/abs/pii/S0924224425005862
5	Sciencedirect.com/topics/agricultural-and-biological-sciences/industrial-microbiology
6	Hospital-Acquired Infections: Practice Essentials, Background ... emedicine.medscape.com › article › 967022-overview
Course Designed By: Dr. R. Kavitha	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	L	S	S	S	S	M	S
CO3	S	S	S	L	S	S	S	M	S	S
CO3	M	M	S	M	S	S	M	S	S	S
CO4	S	S	S	M	S	S	S	S	S	S
CO5	M	S	S	M	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code	13P	BIOCHEMISTRY, CELL BIOLOGY MICROBIOLOGY	L	T	P	C
Core/Elective/Supportive		Core Practical - I	6	-	√	4
Pre-requisite		Basic knowledge in Biochemistry, cell biology and microbiology	Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to: 1. The course enables the students to learn the basic biochemical tests 2. Give basic knowledge about the cell biology techniques 3. Learn the microbial culture techniques						
Learning Outcomes:						
On the successful completion of the course, students will be able to:						
CO1	Helps to understand the basic biochemical techniques				LO1 & LO8	
CO2	Gives a clear understanding about the estimation and separation of biomolecules				LO5 & LO8	
CO3	Perform the basic cell biology techniques and evaluate the biological samples				LO1 & LO6	
CO4	Apply basic microbiological culture techniques and to analyze the microbes present in the biological samples				LO4 & LO6	
CO5	Apply bacterial Isolation and Identification techniques and evaluate the bacterial sample				LO5 & LO6	
LO1: Disciplinary Knowledge LO2: Communication skills LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research-Related Skills LO7: Cooperation/Teamwork LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Self-directed learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Biochemistry						
1.	Estimation of Glucose by Anthrone method.					
2.	Estimation of Total Cholesterol by ZAK's method.					
3.	Separation of amino acids using paper chromatography.					
4.	Separation of amino acids and plant pigments using thin layer chromatography (TLC).					
5.	Separation of two proteins using column chromatography.					
6.	Estimation of protein using Bradford and Lowry's methods.					
7.	Estimation of DNA using Diphenylamine.					
8.	Estimation of RNA using Orcinol reagent.					

9.	Separation of protein by Gel filtration, HPLC, flow cytometry
10.	Estimation of Methionine
Cell biology	
1.	Microtome and histochemical techniques
2.	Squash preparation of onion root tip and Determination of mitotic index
3.	Cell counting methods – use of hemocytometer - calibration of the ocular micrometer and measurement of average cell size and chromosome length.
Microbiology	
1.	Preparation of culture media- Nutrient Broth, Nutrient Agar, Blood Agar, Macconkey Agar, Potato Dextrose Agar.
2.	Isolation of bacteria from soil and marine water
3.	Staining techniques – simple, differential and special staining, streaking method.
4.	Plotting of bacterial growth curve.
5.	Identification of unknown bacteria by biochemical tests, IMVIC test.
6.	Motility of bacteria by hanging drop method.
7.	Assay of antibiotics by disc diffusion method
8.	MIC assay
9.	Bacteriological examination of water / food sample.
Reference Books	
1.	Nelson, D. L., & Cox, M. M. (2021). <i>*Lehninger Principles of Biochemistry*</i> (8th ed.). W.H. Freeman.
2.	Karp, G. (2021). <i>*Cell and Molecular Biology: Concepts and Experiments*</i> (9th ed.). Wiley.
3.	Bancroft, J. D., & Gamble, M. (2019). <i>*Theory and Practice of Histological Techniques*</i> (8th ed.). Elsevier.
4.	Wilson, K., & Walker, J. (2018). <i>*Principles and Techniques of Biochemistry and Molecular Biology*</i> (8th ed.). Cambridge University Press.
5.	Cappuccino, J. G., & Welsh, C. (2017). <i>*Microbiology: A Laboratory Manual*</i> (11th ed.). Pearson Education.
Course Designed By: Dr. S. Suja and Dr. R. Kavitha	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	M	S	S
CO3	S	S	S	S	M	S	S	M	S	S
CO3	S	S	S	S	M	S	S	M	S	S
CO4	S	S	S	S	M	S	S	M	S	S
CO5	S	S	S	S	M	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code	1EA	GENETICS AND DEVELOPMENT BIOLOGY	L	T	P	C
Core/Elective/Supportive		Elective -1	4	√	-	4
Pre-requisite		To acquire knowledge in Mendelian and Non mendelian genetics and developmental concepts	Syllabus Version		2026 - 27	

Course Objectives:

The main objectives of this course are to:

1. The main objective of this course is to introduce about concepts in Genetics and Developmental Biology. This course emphasizes to learn about principles involved in mendelian genetics and non-mendelian inheritance and techniques used to diagnose genetic diseases and mutation concepts.
2. The course aims to give exposure to learn the basic concepts involved in developmental biology such as Potency, commitment, specification, induction, competence, determination and differentiations and morphogenetic gradients
3. This course also provides knowledge about Cell division in cleavage, Rudimental organs, Gametogenesis and Fertilization approaches.

Learning Outcomes:

On the successful completion of the course, student will be able to:

CO1	To learn Mendelian genetics, history, Monohybrid, Dihybrid and Trihybrid cross, Mendelian ratio of segregation, interaction of genes, alleles, Extrachromosomal inheritance, Extensions of mendelian principles	LO1
CO2	To understand the types, causes and detection, mutant types and techniques involved in Prenatal diagnosis of genetic diseases, DNA/RNA probes in the diagnosis of genetic diseases	LO6, LO8
CO3	To learn the concept of determination and differentiation; morphogenetic gradients; cell fate and cell lineages and imprinting.	LO6, LO8
CO4	To understand the process of cell division in cleavage, patterns in embryonic cleavage after fertilization. To know about the development of primary organs and Rudimental organs	LO9, LO10
CO5	To learn the process involved in spermatogenesis, gametogenesis and fertilization	LO1, LO13

LO1: Disciplinary Knowledge **LO2:** Communication skill **LO3:** Critical thinking **LO4:** Problem Solving **LO5:** Analytical Reasoning **LO6:** Research – related Skills **LO7:** Co-operation / Team Work **LO8:** Scientific Reasoning **LO9:** Reflective Thinking **LO10:** Informative Thinking **LO11:** Self-directed learning **LO12:** Multicultural competence **LO13:** Moral and ethical awareness/reasoning **LO14:** Leadership readiness/qualities **LO15:** Life-long learning

Unit:1	Mendelian Inheritance and Its Extensions	15 Hours
Principles of Mendelian inheritance; Mendel's experiments-monohybrid, dihybrid trihybrid and multi hybrid crosses. Concept of gene: Allele, multiple alleles, pseudo allele, complementation tests. Extensions of mendelian principles: Codominance, Incomplete dominance, Gene interactions, Pleiotropy, Genomic imprinting, Penetrance and expressivity, Phenocopy, Linkage and crossing over. Sex linkage, Sex limited and sex influenced characters. Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.		
Unit:2	Mutations & Genetic Diseases	15 Hours
Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis, HIV mutation. Prenatal diagnosis of genetic diseases- amniocentesis, karyotyping. DNA probes in diagnosis of genetic diseases: Cystic fibrosis, Sickle cell anemia, Leukaemia, Burkets lymphoma.		
Unit:3	Basic Concepts of Development	10 Hours
Potency, commitment, specification, induction, competence, determination and differentiation; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development. ABC model of flower development in Arabidopsis thaliana		
Unit:4	Cell Differentiation	11 Hours
Cell division in cleavage–Chemical changes–Patterns of embryonic cleavage – Morula and Blastula – Role of egg cortex – Morphogenetic gradients – Fate map – Gastrulation – Primary organ, Rudimental organs, Organizer – Morphogenetic movements. Anterior and posterior axis differentiation in drosophila		
Unit:5	Gametogenesis	11 Hours
Gametogenesis–Origin of germ cells–Significance of gametogenesis. Oogenesis – Types of eggs–growth, development and maturation of oocyte, Egg envelopes, Polarity and symmetry, Spermatogenesis–Sperm Structure, Types of sperm, Fertilization – Approach of spermatozoon–Reaction of egg, essence of activation – Changes in egg cytoplasm caused by fertilization		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Snustad D. P, Simmons M. J. (2015) Principles of Genetics, 7 th Edition, ISBN: 978-1-11914228-7 JohnWiley & Sons.	
2	Scott F Gilbert, , Michael J.F. Barresi, (2016) Developmental biology, Sinauer Associates Inc; 11th edition	
3	Pierce,B.A (2020) Genetics: A conceptual approach, Seventh edition, W.H Freeman and company publishing, New york	
4	Klug,W., Cummings, M., Spencer, C., Palladino, M and killian D (2020) Concepts of Genetics, 12 Edition, Pearson Higher education and professional Group	

5	Wolpert L, Tickle C, and Martinez Arias A (2019) Principles of development 5th edition, Oxford University Press, Oxford, United Kingdom ISBN: 9780198800569									
Reference Books										
1	Genes VII, Benjamin Lewin, 2000, Oxford University Press.									
2	Genetics, 3rd edition, 2002, Strickberger, Prentice Hall of India.									
3	Genetics, Gupta PK., 5 th edition, 2018, Rastogi Publications, Meerut, India.									
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]										
1	https://nptel.ac.in/courses/121/106/121106008/									
2	https://nptel.ac.in/courses/102/104/102104052/									
3	https://www.toppr.com/guides/biology/human-reproduction/gametogenesis-in-humans/									
4	https://www.ndsu.edu/pubweb/~mcclean/plsc431/mutation/mutation4.htm									
Course Designed By: Dr. S. Suja										
Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	L	S	S	S	S	M	S
CO3	S	S	S	L	S	S	S	M	S	S
CO3	M	M	S	M	S	S	M	S	S	S
CO4	S	S	S	M	S	S	S	S	S	S
CO5	M	S	S	M	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code	1EB	NUTRITIONAL BIOCHEMISTRY	L	T	P	C
Core/Elective/Supportive		Elective - I	4	√	-	4
Pre-requisite		Basic Knowledge in energy content in foods, nutritional requirements and its associated diseases	Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to:						
1. Learn about dietary requirements, dietary sources and Energy content of Food 2. Learn the basic concepts of protein nutrition and malnutrition and diseases that occur due to malnutrition. 3. Provide the knowledge about inherited metabolic disorders, foodborne toxicants and antinutritional factors						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	To determine the energy content in foods using different techniques involved in the measurement of energy expenditure.					LO1 & LO8
CO2	To analyze the nutritional requirements during different stages.					LO1 & LO5
CO3	To know Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper.					LO5, LO6 & LO8
CO4	To get knowledge about role of diet and nutrition in the prevention and treatment of diseases.					LO8, LO10
CO5	To attentive of naturally occurring foodborne toxicants, Allergy causing foods, and management.					LO8, LO10
LO1: Disciplinary Knowledge LO2: Communication skills LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research-Related Skills LO7: Co-operation / Teamwork LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Self-directed learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1	Dietary Sources and Energy content of Foods					15 Hours
Composition of human body. Energy content of foods. Measurement of energy expenditure: direct and indirect calorimetry. Definition of BMR and SDA and factors affecting these. Carbohydrates - Dietary requirements and sources of available and unavailable carbohydrates. Physico-chemical properties and physiological actions of unavailable carbohydrates (dietary fibre). Lipids – Major classes of dietary lipids. Properties and composition of plasma lipoproteins. Dietary needs of lipids. Essential fatty acids and their physiological functions.						

Unit:2	Protein Nutrition and Malnutrition	15 Hours
Protein reserves of human body. Nitrogen balance studies and factors influencing nitrogen balance. Essential aminoacids for men and concept of protein quality. Cereals proteins and their limiting aminoacids. Nutritional requirements at different stages of life. Protein energy malnutrition, clinical features, metabolic disorders and management of marasmus and Kwashiorkar diseases: starvation - Techniques for the study of starvation. Protein metabolism in prolonged fasting. Proteins bearing treatments during fasting. Basic concepts of high protein and low calorific weight reduction diets.		
Unit:3	Nutrition Requirements During Different Stages	11 Hours
Dietary sources, biochemical functions and specific deficiency diseases associated with fat- and water-soluble vitamins. Hyper vitaminosis and their symptoms. Nutrition requirements during pregnancy, lactation and of infants and children. Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper.		
Unit:4	Inherited Metabolic Disorders	11 Hours
Role of diet and nutrition in the prevention and treatment of diseases: Dental carries, Fluorosis, Renal failure, Hyperlipidemia, Atherosclerosis, Inherited metabolic disorders: Phenylketonuria, Maple syrup diseases, Homocystinuria, Galactosemia, Gout, Diabetes Insipidus and Diabetes Mellitus.		
Unit:5	Allergy	10 Hours
Types of diagnosis and management of allergy. Naturally occurring food borne toxicants: protease inhibitors, Antinutritional factors, Hepatotoxins, Allergens, Oxalates, Toxins from mushrooms, animal food stuffs and sea foods.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Gropper, S. S., Smith, J. L., & Carr, T. P. (2024). Advanced Nutrition and Human Metabolism (8th Edition). Cengage Learning.	
2	Srilakshmi, B. (2022). Nutrition Science (7th Edition). New Age International Publishers.	
3	Gropper, S. S., & Smith, J. L. (2021). Nutrition and Metabolism (7th Edition). Cengage Learning.	
4	Swaminathan, M. (2019). Advanced Textbook on Food Science and Nutrition (Vol. 2, 2nd Edition). Bangalore Printing & Publishing Co., Bangalore.	
5	Bamji, M. S., Reddy, V., & Rao, N. P. (2018). Textbook of Human Nutrition (3rd Edition). Oxford & IBH Publishing, New Delhi.	
6.	Krause, M. V., & Marcia, H. H. (2017). Food, Nutrition, & Diet Therapy (12th Edition). W.B. Saunders Company.	
Reference Books		
1	Shils, M. E., Shike, M., Ross, A. C., Caballero, B., & Cousins, R. (2020). Modern Nutrition in Health and Disease (12th Edition). Wolters Kluwer.	

2	Gopalan, C., Ramasastry, B. V., & Balasubramanian, S. (2019). Nutritive Value of Indian Foods (Updated Edition). National Institute of Nutrition, Hyderabad.									
3	Swaminathan, M. (2016). Essentials of Food and Nutrition (Vols. I & II). Ganesh & Co., Madras.									
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]										
1	SWAYAM – Nutritional Biochemistry Courses (2023–24) https://swayam.gov.in/									
2	FAO & WHO Nutrition Databases (2022) http://www.fao.org/nutrition/en/ https://www.who.int/nutrition/en/									
3	NPTEL – Balanced Diet and Food Groups (2021) https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week5_03-Balanced%20diet%20and%20food%20groups.pdf									
4	NPTEL – Relationship Between Food, Nutrition, and Health (2020) https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-1_01-Relationship%20between%20Food,%20Nutrition%20and%20Health%201A.pdf									
5	PubMed / NCBI (Ongoing, continuously updated) https://pubmed.ncbi.nlm.nih.gov/									
Course Designed By: Dr. R. Kavitha										
Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	S
CO3	S	S	S	L	S	S	S	S	M	S
CO3	S	M	S	M	S	S	S	S	S	S
CO4	S	M	S	M	S	S	S	S	S	S
CO5	M	M	S	L	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Second Semester

Course code	23A	ENZYMOLOGY	L	T	P	C
Core/Elective/Supportive	Core - V		4	√	-	4
Pre-requisite	Background ideas on enzyme catalyzed reactions		Syllabus Version	2026 - 2027		
Course Objectives:						
The main objectives of this course are to: 1. To understand the classification of enzymes and fundamentals of enzyme assay. Also, understanding of kinetics of enzyme catalyzed reactions and derivation of Michaelis Menten equation. 2. To advance the knowledge on mechanism of enzyme action as well as regulation of enzyme action with relevant examples. 3. To study about the techniques of immobilization and application in enzymes in food and pharmaceutical industries.						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	Course material will help in understanding of nomenclature and classification of enzymes and also the fundamentals of enzyme assay.				LO1, LO3	
CO2	Students will thoroughly understand the Kinetics of enzyme assay and derivation of velocity equations.				LO3, LO5	
CO3	Course will advance the knowledge of students on mechanism of enzyme action.				LO9, LO10, LO11	
CO4	Understanding of detailed mechanism in enzyme regulation with relevant examples.				LO6, LO15	
CO5	Students will gain knowledge in various immobilization techniques and industrial application of enzymes				LO4, LO6, LO11	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Self - directed learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1		Introduction to Enzymes			15 Hours	
Concept of convergent and divergent evolution of enzymes. Nomenclature and classification of enzymes. Specificity and active site- Lock & key model, Induced fit model. Co-enzymes. Fundamentals of enzyme assay – enzyme Units, coupled kinetic assay, immobilized enzymes. Enzyme localization. Criteria of purity of enzymes. Monomeric and oligomeric enzymes- Monomeric enzymes; serine proteases, zymogen activation, multifunctional enzymes, oligomeric enzymes and multi- enzyme complexes, Coenzymes.						

Unit:2	Kinetics of Enzyme-catalyzed Reactions	15 Hours
Methods used in the investigation of the kinetics of enzyme-catalyzed reactions, initial velocity studies, rapid reaction techniques and relaxation technique. Enzyme kinetics of single substrate reactions – Michaelis Menten and Briggs and Haldane theory (rapid equilibrium and steady state state kinetics. Kinetic analysis of Bisubstrate enzymes. Integrated velocity equation. Haldane equation. King-Altman procedure for deriving the rate equation. Mechanism of enzyme inhibition Competitive, Non-competitive and Un-competitive. Effect of pH & temperature on enzymatic reactions, Arrhenius plot, determination of activation energy.		
Unit:3	Mechanism of Enzyme Action	11 Hours
Acid-base catalysis, covalent catalysis, proximity, orientation effect. Strain & distortion theory. Chemical modification of active site groups. Site directed mutagenesis of enzymes. Mechanism of action of chymotrypsin, lysozyme, glyceraldehyde 3- phosphate dehydrogenase, aldolase, carboxypeptidase.		
Unit:4	Enzyme Regulation	11 Hours
General mechanisms of enzyme regulation, product inhibition. Reversible (glutamine synthase & phosphorylase) and irreversible (proteases) covalent modifications of enzymes. Mono cyclic and multicyclic cascade systems with specific examples. Feedback inhibition and feed forward stimulation. Allosteric enzymes, qualitative description of “concerted” & “sequential” models for allosteric enzymes. Half site reactivity, Flipflop mechanism, positive and negative co-operativity with special reference to aspartate trans carboxylase & phosphofructokinase. Protein ligand binding measurement, analysis of binding isotherms, Hill and Scatchard plots.		
Unit:5	Applications of Enzymes	10 Hours
Application of enzymes in food, Pharmaceutical, pulp, textile and other industries; diagnostic & therapeutic applications. Enzyme data repositories and their types and classification. Datamining– software types and its usage. Immobilized enzymes-Techniques of enzyme immobilization; applications of immobilized enzymes.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Fundamentals of Enzymology, 3rd Edition – 2009 by Nicholas C. Price; Oxford University Press.	
2	Molecular Enzymology (Tertiary Level Biology)- 2013 by Christopher W. Wharton; Springer	
3	ENZYMES– 2008 by Trevor Palmer and Philip Bonner; East West, New Delhi.	
Reference Books		
1	Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis – 2008 byRobert A. Copeland; Wiley India Pvt Ltd.	
2	Enzyme Kinetics and Mechanism – 2007 by Paul F. Cook and W. W. Cleland; Publisher: Garland Science.	

3	Fundamentals and Application of New Bioproduction Systems (Advances in Biochemical Engineering/Biotechnology) – 2016 by An-Ping Zeng; Publisher: Springer
4	Enzyme Kinetics: Rapid–Equilibrium Applications of Mathematica: 53 (Methods of Biochemical Analysis) – 2011 by Robert A. Alberty; Publisher: Wiley-Blackwell.
5	Fundamentals of Enzyme Kinetics – 2004 by Athel Cornish-Bowden; Publisher: Portland Press.
6	Fundamentals of Enzyme Engineering 2017 by Young Je Yoo, Yan Feng, Yong-Hwan Kim and Camila Flor J. Yagonia; Publisher: Springer.
7	Enzyme Kinetics: Behavior and Analysis of Rapid Equilibrium and Steady–State Enzyme Systems (Wiley Classics Library)-1993 by Irwin H. Segel; Publisher: Wiley
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.classcentral.com/course/swayam-enzymology-19860
2	https://www.udemy.com/course/enzymology/
3	https://www.mooc-list.com/course/biochemistry-biomolecules-methods-andmechanisms-edx
4	Introduction to Data Mining, Pang-Ning Tan (2018) Pearson Education India https://books.google.co.in/books?id=64GVEjpTWIAC
Course Designed By: Dr. S. Selvakumar	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	L	S	M	M	S	M
CO3	S	S	M	M	S	L	S	M	M	S
CO3	S	M	L	M	S	M	M	M	M	M
CO4	S	S	S	S	M	M	L	M	S	S
CO5	S	S	M	L	M	L	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code	23B	INTERMEDIARY METABOLISM	L	T	P	C
Core/Elective/Supportive	Core - VI		4	√	-	4
Pre-requisite	Basic knowledge in Chemistry Biomolecules		Syllabus Version		2026 - 27	

Course Objectives:

The main objectives of this course are to:

1. To provide the Knowledge about carbohydrates, lipids, proteins and nucleic acid.
2. To impart knowledge of the concepts of regulation of metabolism.
3. To offer basic knowledge of Porphyrin Metabolism.

Learning Outcomes:

On the successful completion of the course, student will be able to:

CO1	Get Knowledge on the concepts of carbohydrate metabolism and its regulation	LO1, LO3, LO5, LO8
CO3	Get knowledge on the concepts of lipids metabolism and its regulation	LO1, LO3, LO5, LO8
CO3	Get Knowledge on the concepts of metabolism of amino acids and urea cycle	LO1, LO3, LO5, LO8
CO4	Get knowledge on the concepts of nucleotide metabolism and regulation mechanism	LO1, LO3, LO5, LO8
CO5	Apply the knowledge of metabolic concepts in pathway analysis	LO1, LO3, LO5, LO8, LO14, LO15

LO1: Disciplinary Knowledge **LO2:** Communication skill **LO3:** Critical thinking **LO4:** Problem Solving **LO5:** Analytical Reasoning **LO6:** Research – related Skills **LO7:** Co-operation / Team Work **LO8:** Scientific Reasoning **LO9:** Reflective Thinking **LO10:** Informative Thinking **LO11:** Self-directed learning **LO12:** Multicultural competence **LO13:** Moral and ethical awareness/reasoning **LO14:** Leadership readiness/qualities **LO15:** Life-long learning

Unit:1	Metabolism of Carbohydrates	15 Hours
Metabolism of carbohydrates - Reactions, energetics and regulation of glycolysis; Feeder pathways for glycolysis; Fate of pyruvate under aerobic and anaerobic conditions; Pyruvate dehydrogenase complex and its regulation; Reactions, regulation and amphibolic nature of TCA cycle; Anaplerotic reactions; Glyoxylate cycle; Polyol pathways; ED pathway: Pentose phosphate pathway; Gluconeogenesis; Cori cycle; Biosynthesis of lactose, sucrose and starch; Glycogenesis and Glycogenolysis; Control of glycogen metabolism.		
Unit:2	Metabolism of Lipids	15 Hours
Fatty acid oxidation - Franz Knoop's experiment; β oxidation of saturated, unsaturated and odd carbon fatty acids; Peroxisomal β oxidation; α - and ω - oxidations of fatty acids; Ketone bodies – Formation and utilization; Biosynthesis of saturated fatty acids; Elongation and desaturation of fatty acids; Triacylglycerols – Biosynthesis, and mobilization from adipose tissue; Regulation of fatty acid		

metabolism; Cholesterol biosynthesis and its regulation; Biosynthesis of phosphoglycerides and sphingolipids. Biosynthesis of Eicosanoids. Lipoprotein metabolism.

Unit: 3	Amino acid metabolism	11 Hours
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Amino acid metabolism - Degradation of amino acids, oxidative and nonoxidative deamination, transamination, decarboxylation, detoxification of ammonia - Urea cycle catabolism of carbon skeletons of amino acids - ketogenic and glucogenic amino acids.

Unit:4	Nucleic Acid Metabolism	11 Hours
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Biosynthesis of purines and pyrimidines- De novo and salvage pathways and their regulation. Catabolism of purine and pyrimidines. Structure and regulation of ribonucleotide reductase. Biosynthesis of ribonucleotides and deoxyribonucleotides.

Unit:5	Integration of Metabolism	10 Hours
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Overview of metabolism of Porphyrins, Biosynthesis and degradation of heme. Nitrogen balance Factors affecting nitrogen balance-conversion of amino acids to specialized products. Basic principles of metabolomics and pathway analysis.

Unit:6	Contemporary Issues	2 Hours
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Expert lectures, online seminars - webinars

Total Lecture hours		64 Hours
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Text Book(s)

1	Lehninger: Principles of Biochemistry (2021) 8th ed., Nelson, D.L. and Cox, M.M., W. H. Freeman and Company (New York).
2	Textbook of Biochemistry with Clinical Correlations (2022) 7th ed., Devlin, - T.M., JohnWiley & Sons, Inc. (New York).

Reference Books

1	Biochemistry (2015) 8th ed., Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. FreemanandCompany (New York).
2	Harper's Biochemistry (2018) 31st ed., Murray, R.K., Granner, D.K., Mayes and P. A., Rodwell, V.W., Lange Medical Books/McGraw Hill.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.researchgate.net/publication/322407168_Machine_Learning_Methods_for_Analysis_of_Metabolic_Data_and_Metabolic_Pathway_Modeling
2	https://www.nature.com/articles/s41540-018-0054-3
3	https://www.researchgate.net/publication/263474674_A_Comprehensive_View_on_Metabolic_Pathway_Analysis_Methodologies

Course Designed By: **Dr. R. Kavitha**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	S	M	S	S	S	S
CO4	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L-Low

Exo and Endocrine glands, basic mechanism of hormone action, Types of hormones and diseases; reproductive processes, neuroendocrine regulation.		
Unit:3	Signaling components	11 Hours
Endocrine, Paracrine and Autocrine signaling; Signaling molecules - Hormones (agonists and antagonists) NO; Receptor Classification: Receptor linked to Trimeric G proteins (G proteins linked Receptors), Receptors with intrinsic or associated enzymatic activity (TGF - cytokine, Receptor Tyrosine kinase, Receptor guanylyl cyclase, Receptor Phosphotyrosine phosphatase, T - Cell Receptor), Ion Channels as receptors, receptors involving proteolysis (Wnt, Hedgehog Hh, Notch/ Delta, NF –k), intracellular receptor (NO. Pathway, Nuclear receptor). Membrane anchoring process - myristoylation, palmitoylation, Farnesylation, Geranylation, GPI anchor.		
Unit:4	Signal Transmission and its Regulations	11 Hours
G Protein Coupled Signal Transmission: GPCR Structure and classification, ligand binding domain; Signaling pathways via cAMP, ion Channel regulation, Phospholipase C; Trimeric and monomeric G proteins and their effectors; Regulation – GTPase superfamily and GTP hydrolysis; Regulation of GPCR signaling – GDP/GTP cycling, GTPase activity, phosphodiesterase activity, feedback inhibition, heterologous desensitization, phosphorylation of receptors, β-arrestin in regulation of GPCR.		
Unit:5	Integration of Signals and Gene Controls	10 Hours
TGF Receptors and Smad activation; cytokine receptors and JAK - STAT pathway; RTK and Ras activation; MAP Kinase pathways; phosphoinositides as signal transducers; Signal induced protein cleavage (NF-kB, Notch /Delta, Wnt, Hedgehog). Inflammatory signaling. Classifications of Bio Database (Primary and Secondary). Types of the database - Nucleotide and Protein Database.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Human Physiology by C. C. Chatterjee, CBS Publishers & Distributors; 13th revised edition, volume 2 (2020).	
2	Textbook of Medical Physiology, Guyton and Hall 15th Edition, <i>Publisher:</i> Saunders (2015)	
3	Biochemistry of Signal Transduction and Regulation – 2014 by Gerhard Krauss; <i>Publisher:</i> Wiley VCH; 5th edition.	
4	The Cell: A Molecular Approach -2013 by Geoffrey M. Cooper, and Robert E. Hausman; <i>Publisher:</i> Sinauer Associates Inc; 6 edition.	
Reference Books		
1	Review of Medical Physiology by William. F. Ganong. McGraw-Hill Medical; 26th edition (2022).	

2	Physiology and Mechanisms of Disease by Arthur C. Guyton, John E. Hall. Saunders, 6 th Edition (1997).
3	V. Bhuvaneswari, T. Devi, Big Data Analytics, Scitech Publisher, 2018
4	Han Hu, Yonggang Wen, Tat- Seng, Chua, Xuelong Li „Toward Scalable Systems for Big Data Analytics: A Technology Tutorial“, IEEE, 2014.
5	Molecular Cell Biology– 2016 by Arnold Berk, Chris A. Kaiser, Harvey Lodish, Angelika Amon, Hidde Ploegh, Anthony Bretscher, Monty Krieger and Kelsey C. Martin; Publisher: WH Freeman; 8 edition.
6	Molecular Biology of the Cell – 2014 by Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, and Keith Roberts; Publisher: W. W. Norton & Company; 6 edition.
7	Arthur M Lesk (2014). Introduction to bioinformatics. Oxford University Press. Oxford, United Kingdom

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	NOC: Animal Physiology https://nptel.ac.in/courses/102/104/102104058/
2	Animal Physiology https://nptel.ac.in/courses/102/104/102104042/#
3	Introductory Human Physiology https://www.coursera.org/learn/physiology

Course Designed By: **Dr. S. Suja**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	S	M	S	M	S
CO3	S	S	S	M	M	M	S	M	M	S
CO3	S	S	S	M	M	M	S	S	M	S
CO4	S	M	M	M	S	S	M	S	M	S
CO5	S	S	S	M	M	M	S	M	M	S

*S-Strong; M-Medium; L-Low

Course code	23D	IMMUNOLOGY	L	T	P	C
Core/Elective/Supportive	Core - VIII		4	√	-	4
Pre-requisite	Prior knowledge on the components of immune system		Syllabus Version	2026 - 27		

Course Objectives:

The main objectives of this course are to:

1. The study of immunology helps the students in understanding the immune system in all organism especially the physiological functioning of the immune system in states of both health and disease.
2. To understand the malfunctions of the immune system in immunological disorders such as autoimmune disease, hypersensitive, immune deficiency and transplant rejection.
3. To understand the physical, chemical and physiological characteristics of the components of immune system in in vitro, in situ and in vivo.

Learning Outcomes:

On the successful completion of the course, student will be able to:

CO1	To obtain the knowledge about the immune system, as a host defense system comprising many biological structures and processes within an organism that protects against disease.	LO1 & LO8
CO3	To concentrate on the antigen and antibody reactions and immunological techniques	LO5 & LO6
CO3	Understanding about the two branches of immune system such as humoral immunity and cellular immunity, cytokines and complement system.	LO1 & LO8
CO4	Clear about the hypersensitivity reaction or intolerance with undesirable reactions produced by the normal immune system, including allergies and autoimmunity.	LO3 & LO8
CO5	To obtain the knowledge about the hybridoma technology is to produce large numbers of identical antibodies (monoclonal antibodies) and a recombinant DNA technology that involves inserting the DNA encoding an antigen that stimulates an immune response	LO6 & LO5

LO1: Disciplinary Knowledge **LO2:** Communication skill **LO3:** Critical thinking **LO4:** Problem Solving **LO5:** Analytical Reasoning **LO6:** Research – related Skills **LO7:** Co-operation / Team Work **LO8:** Scientific Reasoning **LO9:** Reflective Thinking **LO10:** Informative Thinking **LO11:** Self - directed learning **LO12:** Multicultural competence **LO13:** Moral and ethical awareness/reasoning **LO14:** Leadership readiness/qualities **LO15:** Life-long learning

Unit:1	Cells of The Immune System	15 Hours
Cells of the immune System - Macrophages, B and T lymphocytes, Dendritic cells, Natural killer and Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells. Organs of the immune system: Thymus, Bone marrow, Spleen, lymph nodes, MALT, GALT. Haemopoiesis and differentiation, lymphocyte trafficking. Structure and functions of different classes of Immunoglobulin. Biology of antigen and Superantigens.		

Unit:2	Antigen-Antibody Reactions	15 Hours
Antigen antibody reactions, Applications of Immunological techniques- ELISA, RIA, Immunofluorescence, immunoblotting and immunoelectrophoresis, immunocytochemistry, genetic control of immune response, effector mechanisms, MHC, antigen recognition and presentation, activation of B and T lymphocytes.		
Unit:3	Humoral and Cell Mediated Immunity	11 Hours
Humoral and cell mediated immunity. Cell mediated Cytotoxicity: Mechanism of T cell and NK Cell mediated lysis, Antibody dependent cell mediated Cytotoxicity and macrophage mediated Cytotoxicity. Interleukins and Cytokines - their role in immune regulation, Biology of Complement system, and Complement fixation test. Immune suppression and immune tolerance.		
Unit:4	Immunity Versus Diseases	11 Hours
Hyper sensitivity reactions, Autoimmune disorders, Transplantation immunology- MLR, HLA Typing, Bone marrow transplantation, Organ transplants. Immunity to Infectious agents - Bacteria, Viruses, Malaria, and Helminthes. Tumor immunology and immunotherapy. AIDS and other immune deficiencies, Structure of HIV, envelope glycoproteins, destruction of T cells: immunologic symptoms of AIDS, AIDS vaccine.		
Unit:5	Applications of Antibodies	11 Hours
Vaccine technology and recombinant vaccines, Identification of B and T epitopes for vaccine development. In situ characterization of cells from tissues, Immunoscreening of Recombinant library, Hybridoma – Monoclonal Antibody production and applications; MAbs in diagnosis and therapy.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
Total Lecture hours 64 Hours		
Text Book(s)		
1	J. Kuby, 2018, Immunology 8th edition, W.H. Freeman and Company, Newyork.	
2	C. V. Rao. 2005, An Introduction to Immunology, Narosa Publishing House, Chennai.	
3	Barker, Taylor. Applied immunology and biochemistry. Scientific e-Resources, 2019.	
Reference Books		
1	I.Roitt, 2017, Essential Immunology, 13 th edition, Blackwell Science, Singapore.	
2	Abul Abbas Andrew H. Lichtman Shiv Pillai, 2017, Cellular and Molecular immunology 11th Edition	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.hindawi.com/journals/bmri/2014/437987/	
2	https://www.tandfonline.com/doi/full/10.1080/1744666X.2019.1623670	

3	https://www.technologynetworks.com/immunology/articles/using-the-internet-of-things-to-fight-virus-outbreaks-331992
Course Designed By: Dr. K. M. Saradhadevi	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	S	S	M	S	W
CO3	S	S	M	L	S	M	S	M	W	W
CO3	S	S	S	L	S	M	S	M	M	M
CO4	S	S	S	L	S	M	M	L	M	M
CO5	S	S	S	M	S	M	M	L	S	W

*S-Strong; M-Medium; L-Low

Course code	23P	IMMUNOLOGY AND ENZYMOLOGY LAB	L	T	P	C
Core/Elective/Supportive	Core Practical - II		6	-	√	4
Pre-requisite	Basic knowledge in Biochemical Analysis		Syllabus Version		2026 - 27	

Course Objectives:

The main objectives of this course are:

To familiarize students with the various immunological techniques that includes antigen-antibody interactions, quantitation of antigens or antibody, ELISA, agglutination reactions etc.
To gain knowledge on enzymology in the aspects of isolation and purification, kinetics as well as native PAGE analysis.

Learning Outcomes:

On the successful completion of the course, student will be able to:

CO1	Understood the principles of immunology and the methods of studying immune reactions	LO1, LO6
CO2	Apply basic techniques for identifying antigen antibody interactions.	LO5, LO6
CO3	Analyse the kinetics of enzyme catalysis and learn the basics of isolation and purification of enzymes.	LO5, LO6, LO8
CO4	Understand the concepts of isoenzyme analysis and inhibitory mechanisms of enzyme activity	LO5, LO10
CO5	Acquire technical proficiency, data analysis, and practical application	LO3, LO5, LO15

LO1: Disciplinary Knowledge **LO2:** Communication skill **LO3:** Critical thinking **LO4:** Problem Solving **LO5:** Analytical Reasoning **LO6:** Research – related Skills **LO7:** Co-operation / Team Work **LO8:** Scientific Reasoning **LO9:** Reflective Thinking **LO10:** Informative Thinking **LO11:** Self-directed learning **LO12:** Multicultural competence **LO13:** Moral and ethical awareness/reasoning **LO14:** Leadership readiness/qualities **LO15:** Life-long learning

Immunology

1	Immuno diffusion – single radial and double diffusion	3 Hours
2	Immuno electrophoresis	3 Hours
3	Rocket immuno electrophoresis	3 Hours
4	Haemagglutination and passive hemagglutination	3 Hours
5	Identifying blood group and Rh typing	3 Hours
6	ELISA-Direct and Indirect	3 Hours
7	Isolation and purification of IgG from serum	3 Hours

8	Dissection and identification of Thymus, Spleen, Lymph node from rat	3 Hours
Enzymology		
1	Isolation and Purification of Salivary Amylase enzyme.	3 Hours
2	Determination of total and specific activity of salivary amylase.	3 Hours
3	Effect of pH on enzyme activity (Acid phosphatase/ Alkaline phosphatase).	3 Hours
4	Effect of temperature on enzyme activity (ACP/ALP) and determination of activation energy.	3 Hours
5	Effect of substrate concentration on enzyme activity (Salivary Amylase) and determination of Km value.	3 Hours
6	Effect of inhibitor on activity of Salivary Amylase.	3 Hours
7	Assay of lactate dehydrogenase (LDH).	3 Hours
8	Isoenzyme analysis (LDH) from serum sample- Native PAGE.	3 Hours
Total practical hours		48 hours
Text Book(s)		
1	K. Wilson and J. Walker, Practical Biochemistry, Principles and Techniques, Cambridge University Press, eighth edition 2018.	
2	J. Jayaraman, Laboratory Manual in Biochemistry - New age international pvt. ltd,2011	
3	D.T. Plummer, Practical Biochemistry - TATA McGraw-Hill education; 3rd edition,2006	
4	R. C. Gupta & S. Bhargava Practical Biochemistry - CBS publishers and distributors,5th revised edition, 2013	
5	Experimental Biochemistry – A Student Companion - B.S. Rao & V. Deshpande, I. K. Interational Pvt. Ltd. (N. Delhi, Mumbai, Bangalore) 2005.	
Reference Books		
1	R. Boyer, Modern Experimental Biochemistry, 3rd., Pearson Education (Singapore) Pvt. Ltd.,2001.	
2	R. L. Switzer and L. F. Garritty, Experimental Biochemistry, 3rd edition., W. H. Freeman,1999.	
Course Designed By: Dr. S. Selvakumar and Dr. K. M. Saradhadevi		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	L	M	M	S	S	M	S
CO2	S	S	S	L	M	M	S	S	M	S
CO3	S	S	M	S	S	M	L	S	M	S
CO4	S	S	M	M	M	M	M	S	L	S
CO5	S	S	S	M	S	M	M	L	S	W

*S-Strong; M-Medium; L-Low

Course code	2EB	ANIMAL BIOTECHNOLOGY	L	T	P	C
Core/Elective/Supportive	Elective - II		4	√	-	4
Pre-requisite	Knowledge about basic concepts of Animal cell culture and its applications		Syllabus Version		2025 - 26	
Course Objectives:						
The main objectives of this course are to:						
1. To understand the basics of animal cell culture and importance of stem cells and regenerative medicine						
2. To acquire knowledge about animal transgenesis						
3. To learn about the applications of Animal biotechnology						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	Course will advance the understanding of basics of Animal cell culture				LO1, LO6 & LO13	
CO2	Students will understand about the cell lines, cytotoxicity and viability assays				LO3, LO5	
CO3	Advancement in knowledge in stem cell culture and its applications				LO6, LO8	
CO4	Students will acquire knowledge in Genetic engineering of animal cells				LO6, LO1	
CO5	Understanding about the applications of animal biotechnology				LO14, LO15	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Selfdirected learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1		Animal Cell and tissue culture			15 Hours	
Introduction-History and scope; Qualitative and Quantitative requirements of Animal tissue culture. Role and importance of growth factors, types of culture media—natural and artificial media. Initiation of cell cultures-types-primary culture, cell lines, maintenance of cultures-monolayer and suspension cultures- preservation and authentication. Layout of animal tissue culture laboratory and sterilization methods						
Unit:2		Modification and applications of cultured cells			15 Hours	
Large-scale culture of cell lines - Scaling up of animal cell cultures, genetic modification - transfection of animal cells and markers to select transformants. Cellular senescence-measurement of cell death, cytotoxicity and viability assays. Growth kinetics of cell culture; embryo and organ culture.						

Unit:3	Stem cell culture	10 Hours
Stem cell culture - Origin, types - adult, embryonic culture and applications, adult stem cells in clinical trials - reprogramming somatic cells into induced pluripotent stem cells - direct reprogramming of cells. Stem cells in livestock, Three-dimensional culture; tissue engineering - stages, support materials, cell sources, applications in regenerative medicine; cell fusion and its applications. Ethical aspects in stem cell research.		
Unit:4	Cloning and its applications	11 Hours
Somatic cell nuclear transfer - Genetic engineering of animal cells - embryo technology, gene knockout technologies and mice model for human genetic disorder. Cloning of animals -principles. Human therapeutic cloning - the relationship between stem cells and cloning - xenotransplantation, Model organisms in Biotechnology and Biomedical sciences, developments in molecular markers in livestock - developments in livestock genomics and applications of molecular markers. The Dolly story - cloning of pets and endangered species; Ethical aspects of cloning; IVF and artificial insemination.		
Unit:5	Animal Transgenesis	11 Hours
Animal transgenesis — principles and methods - biopharming in animal transgenesis, disease resistant transgenic animals and transgenesis in aquaculture. Pest management using juvenile hormone analogs, biocontrol agent, Pheromones, Biotechnology of silkworms, insect cell culture and its products. Marine Biotechnology — therapeutics from marine organism resources. Nutrigenomics, metabolomics and its role in animal production.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Freshney, R.I. (2005) Culture of Animal Cells - A Manual of Basic Techniques, 5th Edition, John Wiley and Sons, New York.	
2	Purohit, S.S. (2006) Biotechnology: Fundamentals and Applications, Agriobios, India	
3	Cheria Ranjit, (2021), Animal Physiology and Biochemistry, Academic Aspirations.	
4	Sathyanarayana, U. (2005), Biotechnology, 2nd Edition, Books and Allied Ltd., Calcutta.	
5	Davis, J.M. (Ed.) (2005) Basic Cell Culture, 2nd Edition, a Practical Approach, Oxford University, New York.	
6	Butler, M. (2004) Animal Cell Culture Technology — Basics, 1st Edition, Academic Press, New York.	
Reference Books		
1	Ranga, M.M. (2007) Animal Biotechnology, 3 rd Edition, Agrobios, India.	
2	Potten, C.S. (2006) Stem cells - Academic Press, UK.	
3	Arthur M Lesk (2014). Introduction to bioinformatics. Oxford University Press. Oxford, United Kingdom	
4	Srivastava, A.K., Singh, R.K., Yadav, M.P. (2009) Animal Biotechnology, Oxford and IBH Publishing and company	

5	Singh. B, Gautam, S.K and Chauhan M.S. (2015) Textbook of animal Biotechnology, The Energy Resource Institute, TERI press, New Delhi, India
Course Designed By: Dr. S. Selvakumar	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	L	M	M	S	L	S	S
CO3	S	S	M	L	S	M	L	M	M	M
CO3	M	S	L	L	L	M	S	S	M	M
CO4	S	M	S	M	S	L	S	S	L	S
CO5	S	L	S	M	M	L	L	M	M	M

*S-Strong; M-Medium; L-Low

Unit:2	Nanomaterials	15 Hours
Top down and bottom-up synthesis -Physical, Chemical and Biological synthesis of Nanoparticles; Polymers in nano material synthesis- natural and synthetic polymers. Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials - green synthesis.		
Unit:3	Characterization techniques	10 Hours
Characterization of Nano material; UV-visible spectroscopy, FTIR, SEM, TEM, AFM, STM, XRD. Confocal and TIRF imaging.		
Unit:4	Biomolecules and Biomimetics	11 Hours
Reactive groups on biomolecules (DNA & Proteins); Surface modification and conjugation to nanomaterials. Fabrication and application of DNA nanowires; Nano fluidics to solve biological problems. Nano-biomimetics.		
Unit:5	Nanocarriers	11 Hours
Properties of nanocarriers; drug delivery systems used in nanomedicine; Types of Nanocarriers- Liposomes, Polymeric Nanoparticles, Dendrimers, Carbon nanotubes, Gold Nanoparticles; Enhanced Permeability and Retention effect; Blood-brain barrier; Active and passive targeting of diseased cells; Health and environmental impacts of nanotechnology. Big data at Nanoscale; Use of data mining and machine learning in Nanomedicine		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Bio-nanotechnology Concepts and applications. Madhuri Sharon, Maheshwar Sharon, Sunil Pandey and Goldie Oza, Ane Books Pvt Ltd, 1 edition 2012.	
2	Nanobiotechnology: Bioinspired Devices and Materials of the Future by Oded Shoseyov and Ilan Levy, Humana Press; 1 edition 2007.	
3	Microscopy Techniques for Material Science. A. R. Clarke and C. N. Eberhardt (Editors) CRC Press. 1st Edition, 2002.	
Reference Books		
1	Nanobiotechnology: Concepts, Applications and Perspectives, Christof M. Niemeyer (Editor), Chad A. Mirkin (Editor), Wiley-VCH; 1 edition, 2004.	
2	Nanobiotechnology Protocols (Methods in Molecular Biology) by Sandra J Rosenthal and David W. Wright, Humana Press; 1 edition, 2005.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	Nanotechnology and Big data analysis for computer aided diagnosis https://pubmed.ncbi.nlm.nih.gov/26979668/	

2	The use of data mining and machine learning in Nanomedicine https://www.oatext.com/the-use-of-data-mining-and-machine-learning-innanomedicine-a-survey.php#gsc.tab=0
3	<u>Kethineni P. Applications of internet of nano things: A survey</u> <u>Proc. of the IEEE International Conference for Convergence in Technology (I2CT)</u> <u>Mumbai, India (2017), pp. 371-375</u>
Course Designed By: Dr. S. Selvakumar	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO1	L	M	S	M	L	S	M	S	S	S
CO2	M	S	S	M	M	S	M	S	S	S
CO3	M	S	S	M	L	S	M	S	S	S
CO4	L	M	S	M	M	S	S	S	S	S
CO5	L	L	S	M	M	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Third Semester

Course code	33A	CLINICAL BIOCHEMISTRY	L	T	P	C
Core/Elective/Supportive		Core - IX	4	√	-	4
Pre-requisite		Basic knowledge in Metabolism of Biomolecules and Analytical Techniques	Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to:						
1. Provide knowledge about carbohydrate, lipid and nucleic acid metabolic disorders 2. Offer knowledge about hemoglobin metabolism and associated diseases 3. Give knowledge about functional tests of organs and clinical diagnosis of diseases by enzymatic assays 4. Give basic knowledge about free radicals and diseases. 5. Provide awareness and concepts about Disease diagnosis with automated analyzers						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	Students will acquire insight into disorders of carbohydrates, lipids and nucleic acid				LO1, LO3, LO4, LO8	
CO3	Students will be able to do functional tests and enzymatic assays to diagnose the function of liver, kidney, thyroid, gastrointestinal and pancreas.				LO1, LO6, LO5, LO8	
CO3	Students will gain knowledge about disorders of nitrogen metabolism				LO1, LO3, LO8	
CO4	Students will learn about the disorders of hemoglobin metabolism				LO1, LO34, LO5, LO13	
CO5	Students will learn about the applications of Automated and semi-automated analyzers				LO1, LO5, LO6, LO14	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Self-directed learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1	Disorders of Carbohydrate and Lipid Metabolism				15 Hours	
Clinical investigation of sugar levels in blood and urine; factors influencing blood glucose level, Glycosylated hemoglobin; carbohydrate tolerance tests-procedures and interpretation. Biochemical basis of Diabetes, glycogen storage diseases; carbohydrate metabolic disorders. Disorders associated with lipid metabolism and its therapeutic intervention, ketone bodies and ketosis; Fatty liver, Atherosclerosis.						

Unit:2	Disorders of Nitrogen Metabolism	15 Hours
Abnormalities of nitrogen metabolism - uremia, aminoaciduria- phenylketonuria, Alkaptonuria, Albinism. Excretion of nitrogenous waste products-ammonia, urea, uric acid, creatine, creatinine. Disorders of acid base balance.		
Unit:3	Disorders of Nucleotide and Heme Metabolism	11 Hours
Gout, Xanthinuria, orotic aciduria. Lesch- Nyhan syndrome: Heme metabolism associated diseases- porphyrias, porphyrinurias, sickle cell anemia, thalassemia. Hemorrhagic disorders, disseminated intravascular coagulation, acquired prothrombin complex disorders. Biochemical basis of Jaundice.		
Unit:4	Biochemical Diagnosis of Diseases	11 Hours
Functional tests of liver, kidney, thyroid, gastrointestinal and pancreas, biochemical diagnosis of diseases by enzymatic assays - ALP, SGOT, SGPT, creatinine, cholinesterase, creatine kinase and LDH. Clinical research guidelines. Disease diagnosis -Types of analyzers - Automated and semiautomated analyzers - Semi-auto analyzer - Batch analyzer – Random Access autoanalyzers. Steps in the automated systems - Responsibilities of a technician in the maintenance of the analyzers)		
Unit:5	Free Radical and Diseases	10 Hours
Free radicals - reactive oxygen species and reactive nitrogen species. Formation of free radicals- Oxidative stress and diseases. Metabolism of iron, calcium and phosphorus, Trace elements and their deficiency.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Chatterjee and Shindae (: 2012). Text book of medical biochemistry, Eighth Edition	
2	Textbook of Biochemistry with Clinical Correlations, 7th Edition ISBN: 978-0-47060976-7 June 2022. Harper illustration Biochemistry Thirty Second edition.	
Reference Books		
1	Clinical Biochemistry 5th Edition (2013) Allan Gaw Michael Murphy Rajeev Srivastava Robert Cowan Denis O'Reilly	
2	Sembulingam, K and Sembulingam, P 6th Edition (2010). Essentials of Medical Physiology, fifth edition. Jaypae Brothers (p) ltd, New Delhi.	
3	Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds): Tietz Textbook of Clinical Chemistry and Molecular Diagnosis (5th edition) Elsevier, St. Louis, USA, 2012, 2238 pp, 909 illustrations. ISBN: 978-1-4160-6164-9	

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]										
1	Big Data Analytics and Its Applications https://www.researchgate.net/publication/320345031_Big_Data_Analytics_and_Its_Applications									
2	Big Data Analytics in Medicine and Healthcare https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6340124/									
3	Implications of big data analytics in developing healthcare https://www.sciencedirect.com/science/article/pii/S1319157817302938									
4	Critical analysis of Big Data challenges and analytical methods www.sciencedirect.com › science › article ›									
5	Artificial Intelligence in Medicine https://www.datarevenue.com/en-blog/artificial-intelligence-in-medicine https://www.frontiersin.org/articles/10.3389/fmed.2020.00027/full									
Course Designed By: Dr. R. Kavitha										
Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	L	S	S	S	S
CO2	S	S	S	L	S	M	S	S	S	S
CO3	S	S	S	M	S	M	S	S	S	S
CO4	S	S	S	M	S	M	S	S	S	S
CO5	S	S	S	M	S	M	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code	33B	RECOMBINANT DNA TECHNOLOGY	L	T	P	C
Core/Elective/Supportive	Core – X		4	√	-	4
Pre-requisite	Knowledge on basic concepts of recombinant DNA technology and DNA sequencing		Syllabus Version		2026 – 27	

Course Objectives:

The main objectives of this course are to:

1. To study about the DNA modifying enzymes and Vectors used in recombinant DNA technology
2. Understanding the cloning strategies and preparation of probes. In addition, acquiring thorough knowledge about confirmation of rDNA expression by various techniques, including blotting and immunological screening.
3. Upon completion of the course, students might also be thorough about various types of sequencing techniques as well as on biotechnological applications of rDNA technology.

Learning Outcomes:

On the successful completion of the course, student will be able to:

CO1	The course material will provide clear understanding about DNA modifying enzymes and their uses in rDNA technology	LO1, LO6
CO2	Students will advance their knowledge on host cells and vectors that are highly suitable for rDNA-based expression of desirable genes.	LO3, LO4, LO6
CO3	The course will provide detailed understanding of cloning strategies and various methods adapted for confirmation of rDNA expression.	LO3, LO8, LO9
CO4	Students will learn about advances in sequencing techniques and their advantages.	LO6, LO11
CO5	Course material provides detailed understanding of Biotechnological applications of rDNA technology.	LO10, LO14

LO1: Disciplinary Knowledge **LO2:** Communication skill **LO3:** Critical thinking **LO4:** Problem Solving **LO5:** Analytical Reasoning **LO6:** Research – related Skills **LO7:** Co-operation / Team Work **LO8:** Scientific Reasoning **LO9:** Reflective Thinking **LO10:** Informative Thinking **LO11:** Selfdirected learning **LO12:** Multicultural competence **LO13:** Moral and ethical awareness/reasoning **LO14:** Leadership readiness/qualities **LO15:** Life-long learning

Unit:1	DNA modifying enzymes	15 Hours
DNA modifying enzymes and their uses in Molecular Biology a) Restriction enzymes b) DNA Polymerase i) Klenow ii) DNA polymerase I iii) T4/T7 DNA Polymerase c) Reverse Transcriptase d) Terminal Transferases e) T4 Polynucleotide kinases & Alkaline phosphatase f) DNA dependent RNA polymerases. g) DNA ligases h) Nucleases: - Bal 31, S1 nucleases, DNase I, Mungbean nucleases, Ribonucleases, EXO III. Thermostable DNA polymerases used in PCR.		
Unit:2	Vectors	15 Hours
Host cells and Vectors - Host Cell Types (Prokaryotic and eukaryotic). Plasmid vectors for use in E. coli and Gram-positive bacteria. Bacteriophage - Lambda and M13 vectors c) Cosmids d) Phagemids. Artificial chromosomes (YACs, PACs, BACs, MACs and HACs). Specialized vectors & their uses a) Expression vectors for Prokaryotes & Eukaryotes - Inducible vectors; vectors with tags (Histidine tags, signalling peptides for exportation), b) Gene fusion vectors.		

Unit:3	Cloning and Screening strategies	11 Hours
Cloning strategies: DNA cloning a) Sticky ends b) Blunt ends c) Homopolymeric tailing d) Use of adapters & linkers. Methods of gene transfer into plant and animal cells: chemical, biological and mechanical methods. Construction of genomic DNA libraries (shotgun cloning) and cDNA libraries. Screening of recombinants - Antibiotic resistance, lacZ complementation (Blue-white selection), fluorescent markers (e.g. GFP). Preparation of radiolabelled/non-radiolabelled DNA & RNA probes. Southern/Northern/Western blot, dot blot and Zoo blot. Screening of genomic libraries with oligo-probe. Immunological screening for expressed genes.		
Unit:4	Gene sequencing	11 Hours
PCR and RT-PCR– basic process and applications. DNA sequencing- Maxam-Gilbert (chemical degradation) and Sanger (chain termination) methods, Microchip based Sanger Sequencing of DNA. Next generation (second generation) sequencing - high throughput Pyrosequencing, Lynx Therapeutics' Massively Parallel Signature Sequencing (MPSS), Polony sequencing, Ligation based sequencing (SOLiD sequencing), Ion semiconductor sequencing, DNA nanoball sequencing, sequencing based on reversible dye-terminators (Illumina or Solexa sequencing), RNA sequencing (RNA-Seq) Third-generation sequencing- Single molecule RealTime DNA sequencing (SMRT), Optical sequencing, Oxford nanopore sequencing. Biological sequence retrieval and data accession.		
Unit:5	Applications of rDNA technology	10 Hours
Biotechnological applications of rDNA technology: CRISPR-Cas9 gene editing, Synthesis and purification of proteins from cloned genes- Native and fusion proteins. Yeast expression system/production of enzymes. Therapeutic products for use in human health care- insulin, growth hormones, TPA, alpha interferon, Hepatitis B vaccine and Factor VIII. Medical and forensic applications of rDNA technology- DNA Profiling, Multiplex PCR, Diagnosis of inherited disorders and infectious diseases, RFLP. Treatment using rDNA technology- Gene therapy for ADA and cystic fibrosis. Big data analytics for genomic medicine and its application.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1.	Principles of Gene Manipulation and Genomics - 2013 by Sandy B. Primrose, Richard Twyman; Publisher: Wiley-Blackwell; 7 edition.	
2.	Molecular Cloning: A Laboratory Manual (3 Volume Set): 4th Edition – 2013 by Michael R Green, Joseph Sambrook; Publisher: Viva Books Private Limited	
3.	Gene Cloning and DNA Analysis: An Introduction – 2016 by T. A. Brown; Publisher: Wiley-Blackwell; 7th edition	
4.	Gene cloning and DNA analysis: an introduction (Dr. Hansie peterson) – 2015 by Dr. Hansie Peterson; Publisher: Koros	
Reference Books		
1.	Gene Cloning -2006 by Julia Lodge, Peter Lund, Steve Minchin; Publisher: Taylor & Francis; 1 edition	

2.	An Introduction to Genetic Engineering – 2008 by Desmond S. T. Nicholl; Publisher: Cambridge University Press; 3 edition.
3.	Next-Generation Genome Sequencing: Towards Personalized Medicine 1st Edition-2011 by Michal Janitz; Publisher: Wiley-Blackwell.
4.	Recombinant DNA: Genes and Genomes – 2007 by James D. Watson, Amy A. Caudy, Richard M. Myers and Jan A. Witkowski; Publisher: WH Freeman; 3rd ed.
5.	Gupta SK, Bencurova E, Srivastava M, Pahlavan P. Improving re-annotation of annotated eukaryotic genomes. In: Big data analytics in genomics. Cham: Springer; 2016. p. 171–95.
6.	Big Data Analytics: Systems, Algorithms, Applications (2019) Authors: Prabhu, C.S.R., Sreevallabh Chivukula, A., Mogadala, A., Ghosh, R., Livingston, L.M.J. Springer Book Archives – ISBN 978-981-15-0093-0

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1.	https://onlinecourses.nptel.ac.in/noc19_bt15/preview
2.	https://www.classcentral.com/course/swayam-genetic-engineering-theory-andapplication-14090
3.	http://biology.kenyon.edu/courses/biol114/Chap08/Chapter_08a.html

Course Designed By: **Dr. S. Selvakumar**

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	M	M	S	L	L	S
CO2	S	S	L	M	L	M	M	L	M	S
CO3	S	S	M	M	S	M	M	L	S	M
CO4	S	S	M	L	S	M	M	M	M	M
CO5	S	M	L	M	S	M	S	M	M	S

*S-Strong; M-Medium; L-Low

Course code	33C	DRUG BIOCHEMISTRY	L	T	P	C
Core/Elective/Supportive		Core - XI	4	√	-	4
Pre-requisite		Basic knowledge in Pharmacodynamics, Pharmacokinetics and toxicology	Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to: 1. To study about the basic principles about pharmacokinetics, routes of drug administration 2. Get knowledge of drug action, drug receptor interactions, factors affecting the drug receptor interaction and its mechanism. 3. Offer knowledge about drug discovery process, AI in drug discovery process ethical issues and preclinical toxicological studies.						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	To understand about basic principles involved in pharmacokinetics and routes of drug administration processes.				LO1, LO4, LO8	
CO3	To understand the factor modifying drug action, metabolism and excretion of drugs.				LO1, LO3, LO8	
CO3	To understand the factors affecting the drug receptor interactions, mechanism of drug action.				LO4, LO6, LO8	
CO4	To obtain knowledge on drug discovery process, ethical issues and able to understand the scope and applications of AI in drug discovery				LO1, LO5, LO13	
CO5	To gain knowledge in preclinical toxicological studies				LO1, LO5, LO6, LO8	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Selfdirected learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1		Basic Principles of Pharmacokinetics			11 Hours	
General Principles: Basic principles of drug action-Pharmacokinetics: Absorption, distribution and elimination of drugs, routes of drug administration. Pharmacogenetics. origin of drug from plants and animals. Computer aided drug design: Introduction to docking: Docking software - Protein - ligand.						
Unit:2		Drug Metabolism			15 Hours	
Drug metabolism – general pathways of drug metabolism (different types of reaction in phase I and phase II with examples), metabolism and excretion of drugs. Mechanism of drug action, combined						

effect of drugs. Factors modifying drug action, tolerance and dependence. Molecular simulation: Introduction to molecular dynamic simulations – MD simulation software.		
Unit:3	Pharmacodynamics	15 Hours
Pharmacodynamics - receptor concepts, theory, drug receptor interaction (DRI), Factors affecting DRI, Drug Synergism and antagonism, Cholinergic and anticholinergic drugs, Adrenergic and adrenergic blockers, General anesthetics, Local anesthetics. Adverse reactions to drugs and common drug receptor interactions.		
Unit:4	Application for New Drug Discovery	11 Hours
Application for New Drug Discovery (NDD) according to Indian Control Authority and USFDA guidelines. Ethical considerations in utilizing human subjects for drug discovery process. Helsinki's declaration. Regulatory requirements for conducting clinical trials. Overview of drugs and cosmetics act. Regulatory process for export of pharmaceutical products and medicines from India. Docking tools and databases in ADME, Toxicity prediction: ADMETlab 2.0 and SwissADME.		
Unit:5	Toxicology	10 Hours
Toxicology: Principles of toxicology and treatment of poisoning. Heavy metals and antagonists. Nonmetallic environmental toxicants. Methods involved in the development of new drugs. Preclinical toxicological studies: Calculation of LD50 and ED50. Acute, subacute and chronic toxicity studies; Basics of OECD guidelines. Irwin profile test, pre-clinical pharmacokinetic and dynamic studies. Lipinski's rule for drug like molecule.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Satoskar, R.S and Bhandarkar, S.D. (2000) Pharmacology and Pharmacotherapeutics, 13 th edition, Vol. I and II, Popular Prakeshan PVT Ltd, Mumbai.	
2	Tripathi, K.D. (2013) Essentials of Medical Pharmacology, 7 th edition, Jaypee brothers' medical publishers, New Delhi.	
3	Rang, H.P., Dale, M.M., Ritter, J. and Flower, R.J. (2007) Pharmacology, 6 th edition, Churchill Living Stone Elsevier	
4	Brenner, G.M. and Stevens, C.W. (2010) Pharmacology, Reed Elsevier India Pvt. Ltd.	
5	Sharma, P.D. (2003) Toxicology, 2 nd edition, Rastogi Publications, Meerut.	
6	Patrick Bultinck, Hans De Winter, Wilfried Langenaeker, Jan P. Tollenare, Computational Medicinal Chemistry for Drug Discovery 1st Edition Marcel Dekker Inc.2004.	

Reference Books										
1	Barar, F.S.K. (2013) Text Book of Pharmacology, 1 st edition, S.Chand and Company Pvt. Ltd.									
2	Shargel,L. et al., 2012. Applied Biopharmaceutics and Pharmacokinetics, 6 th Edition, McGraw-Hill Medical									
3	Cohen, N.C. “Guide Book on Molecular Modeling on Drug Design”, Academic Press /Elsevier, 2006									
4	Andrew R. Leach Molecular Modeling Principles and Applications (2nd Ed.). Prentice Hall ,2009.									
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]										
1	https://dth.ac.in/medical/courses/pharmacology/1/8/index.php									
2	Mak, K.-K. & Pichika, M. R. (2019) Artificial intelligence in drug development: present status and future prospects. <i>Drug Discov. Today</i> . https://doi.org/10.1016/j.drudis.2018.11.014									
3	https://www.nature.com/articles/d41586-018-05267-x									
4	https://nptel.ac.in/courses/127/106/127106137/									
Course Designed By: Dr. R. Kavitha										
Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	S	S
CO2	S	S	S	M	M	S	S	S	S	S
CO3	S	M	M	M	S	S	S	S	S	S
CO4	M	S	S	L	S	S	S	S	S	S
CO5	S	L	S	M	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code	33D	BIostatISTICS AND RESEARCH METHODOLOGY	L	T	P	C
Core/Elective/Supportive		Core - XII	4	√	-	4
Pre-requisite		Basic knowledge in Biostatistics and Research Methodology	Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to:						
1. To understand the statistical tools commonly used in biological research 2. To assimilate the concepts of hypothesis testing and its importance in research 3. To know the aspects fundamental to research and to understand the methods of research 4. To know the nuances of technical writing of scientific documents like thesis and journal articles.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	Helps to collect data and organize the data				LO1, LO3	
CO2	Gives a clear understanding about the basic statistical analysis				LO5, LO7, LO8	
CO3	A Clear Knowledge on probability and its application				LO5, LO8	
CO4	Provides the sampling distribution techniques and its analysis				LO6, LO8, LO10	
CO5	Gives an idea about thesis writing, funding agencies and patenting				LO8, LO9, LO10	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research - related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Self-directed learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1		Statistical Survey			15 Hours	
Organizing a statistical survey - Planning and executing the survey. Source of data - Primary and secondary data, Collection - observation; interview; enquiry forms, questionnaire schedule and checklist. Classification and tabulation of data. Diagrammatic & graphic presentation of data.						
Unit:2		Measures of central tendency and Measures of Variation			15 Hours	
Measures of central tendency; arithmetic mean, median, mode, quartiles, deciles and percentiles. Measures of variation: range, quartile, deviation, mean deviation, standard deviation. Correlation analysis: Scatter diagram, Karl Pearson's coefficient of correlation and Spearman's rank method. Regression analysis.						
Unit:3		Probability			11 Hours	
Probability - definition, concepts, theorems (proof of the theorems not necessary) and calculations of probability. Theoretical, distributions. Binomial - Poisson and normal distribution. Normal - importance, properties, conditions and constants of the distribution (proof not necessary). Simple problems.						

Unit:4	Sampling Distribution and Experimental Design	11 Hours
Sampling distribution and test of significance: Testing of hypothesis errors in hypothesis testing, standard error and sampling distribution. sampling of variables (large samples and small samples). Student's 't' distribution and its applications. Chi - square test & goodness of fit. Analysis of variance one-way and two-way classification, Duncan's Multiple Range Test. Design of experiment - completely randomized block design. Introduction to R programming. MS Excel, Introduction to SPSS package. Clinical trials and machine learning algorithms to find association across biological data.		
Unit:5	Research Methodology	10 Hours
Thesis writing, Publication in a scientific journal, Preparation of Abstract and manuscript. Contents-Preamble, the problem, objectives, hypothesis to be tested, study, design, setup, measurement procedures, analysis of data, organization of report; Displaying data tables, graphs and charts – preparation of project proposal: Thrust area - funding agencies (National and International) – kinds of research program in India and abroad – career development in laboratory research – principle and method of patenting. Introduction to AI-assisted literature survey, plagiarism detection tools, reference management software and ethical issues in AI-based biomedical research.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars Case study -Medical Statistics, collection of data - startup companies		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Statistical Methods, S. P. Gupta 45th Edition; Sultan Chand & Sons, 2017	
2	Research methodology: Methods and Techniques, C. R. Kothari. New Age International, 2004	
Reference Books		
1	Biostatistics: A Foundation for Analysis in the Health Sciences, 11 th Edition, Wayne W. Daniel, Chad L. Cross, Wiley, 2018.	
2	Biostatistical analysis - Jerrold H. Zar. Pearson Education, 5th Edition Pearson Education, 2010.	
3	Arshdeep Bahga, Vijay Madisetti, „Internet of Things: A Hands-on Approach, 2014. ISBN:978-0996025515.	
4	Ajai S Gaur and Sanjaya S. Gaur, 2009," Statistical methods for practice and Research: A guide to data analysis using SPSS". 2nd edition, Sage Publications Pvt. Ltd., New Delhi.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	Data handling and Analytics– Lecture 55 http://nptel.ac.in/courses/106/105/106105166	

2	Introduction to IoTs Part I & Part II - Lectures 1 & 2 http://nptel.ac.in/courses/108108098/
3	Introduction to IoT – Lecture I – https://ocw.cs.pub.ro/course/iot/courses/01
4	Mathematical Biostatistics Boot Camp 1 https://www.coursera.org/learn/biostatistics
5	Mathematical Biostatistics Boot Camp 1 https://www.coursera.org/learn/biostatistics-2
6	Application of big data https://journalofbigdata.springeropen.com/articles/10.1186/s40537-019-0217-0

Course Designed By: **Dr. S. Suja**

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	S	L	S	S	M	M	S
CO3	M	S	S	S	M	M	M	S	M	S
CO3	M	S	M	S	M	M	S	S	M	S
CO4	M	S	S	S	M	S	S	S	M	S
CO5	M	M	S	M	M	S	S	S	M	M

*S-Strong; M-Medium; L-Low

Course code	33P	CLINICAL BIOCHEMISTRY AND MOLECULAR BIOLOGY	L	T	P	C
Core/Elective/Supportive		Core Practical-III	6	-	√	4
Pre-requisite		Familiarity in Principles of Clinical and Molecular Biological Techniques	Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to:						
1. Familiarize the students with specific characteristics of a laboratory of clinical biochemistry, know the analytical methods commonly used in the clinical laboratory and know how can the clinical laboratory contribute to assess the health status of individuals.						
2. Obtain hands on experience in some of the important molecular biology techniques and to learn the basic principles of recombinant DNA technology.						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	It trains the students to gain concepts of assessing the human physiology using biological fluid.				LO1, LO6	
CO2	Helps the students to understand, evaluate and analysis the abnormal constitutes in various serum biological profile				LO5, LO3,	
CO3	Aids in the technical understanding of the bacterial transformation and isolation of genetic components				LO3, LO6	
CO4	Understand and familiarize in the modern molecular biological techniques and its applications				LO6, LO8	
CO4	Design experiments, master DNA/RNA manipulation, and interpret data for scientific inquiry				LO9, LO11 & LO15	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Selfdirected learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Clinical Biochemistry						
1.	Differential, cell count				3 hours	
2.	Blood sugar determination by glucose oxidase method				3 hours	
3.	Estimation of bilirubin				3 hours	
4.	Estimation of blood urea				3 hours	
5.	Estimation of serum enzymes - Creatine phosphokinase (CPK), ALP, AST, SGPT and SGOT				3 hours	
6.	Normal and abnormal constituents of urine				3 hours	

7.	Determination of Lipid Profile	3 hours
8.	Estimation of glycosylated hemoglobin	3 hours
9.	Estimation of total protein and albumin from serum	3 hours

Molecular Biology

1.	Subcellular fractionation of organelle	3 hours
2.	Bacterial Transformation	3 hours
3.	Isolation of DNA from E. coli/ liver/ plant	3 hours
4.	Agarose gel electrophoresis of DNA	3 hours
5.	Restriction digests of DNA.	3 hours
6.	Isolation of plasmid	3 hours
7.	Separation of serum protein by SDS -PAGE	3 hours
8.	Western blotting	3 hours
9.	PCR amplification	3 hours
Total practical hours		50 Hours

Text Book(s)

1.	Experiments in Molecular Biology-R. J. Slater, Humana Press, 1986.
2.	Molecular cloning - Sambrook and Russell, Cold Spring Harbor Laboratory Press, 2001
3.	Practical Biochemistry - David T Plummer, Tata McGraw-Hill, 1988.

Reference Books

1.	Experimental Biochemistry - B. S. Rao and V. Deshpande, I.K. International Pvt. Ltd.
2.	Practical Biochemistry - Keith Wilson and John Walker, Cambridge University Press, 1997.
3.	Experiments in Molecular Biology - R. J. Slater, Humana Press, 1986.

Course Designed By: **Dr. S. Selvakumar and Dr. K. M. Saradhadevi**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	L	M	M	S	S	M	S
CO2	S	S	S	L	M	S	M	M	M	S
CO3	S	M	M	S	L	S	M	L	M	S
CO4	S	S	S	S	L	S	L	M	M	M
CO5	S	L	S	S	M	S	L	S	M	S

*S-Strong; M-Medium; L-Low

Course code	3EC	PLANT BIOCHEMISTRY AND ENVIRONMENTAL BIOTECHNOLOGY	L	T	P	C
Core/Elective/Supportive		Elective - III	4	√	-	4
Pre-requisite		Basic concepts in plant biochemistry, plant biotechnology and environmental biotechnology	Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to:						
1. This course emphasizes to learn about principles involved in photosynthesis process, types and nitrogen fixation.						
2. The course aims to give exposure to learn the concepts involved in plant tissue culture, secondary metabolite production, Machine learning for big data analytics in plants and genetic transformation techniques for the generation of transgenic plants.						
3. This course provides basic concepts about environmental pollution						
4. This course also provides knowledge about Disaster management and role of big data in Disaster management.						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	Learn the organization of photosynthesis process and types					LO1 & LO8
CO3	Understand about nitrogen fixation in plants and enzymology of nitrogen fixation.					LO1 & LO8
CO3	Understand about plant tissue culture, plant secondary metabolites, elicitation and methods involved in gene transfer of plants and machine learning in analysis of plant					LO3, LO6 & LO7
CO4	Learn about types of ecosystems, biogeochemical cycles and global environmental problems					LO8 & LO15
CO5	Students will learn about bioenergy and renewable resources, bioremediation and waste management					LO6, LO8 & LO15
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Self-directed learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1	Photosynthesis and Its Types					15 Hours
Photosynthesis –organization of thylakoid; role of photosynthetic pigments; light absorption and energy conservation. Light absorption by pigment molecules; the reaction center complex. The photo systems I and II; cyclic and noncyclic photophosphorylation. Carbon reactions in C3, C4 and CAM plants - Calvin cycle; Hatch- Slack pathway. pathways of glucose oxidation in plants; starch biosynthesis and degradation. Photorespiration: role of photorespiration in plants.						

Unit:2	Nitrogen Fixation and Enzymology of Nitrogen Fixation	15 Hours
Nitrogen fixation – symbiotic and non-symbiotic. Symbiotic nitrogen fixation in legumes by Rhizobia– enzymology of nitrogen fixation; regulation of nif and nod genes of nitrogen fixation. Interaction between nitrate assimilation and carbon metabolism. Sulphur chemistry and functions; reductive sulfate assimilation pathway. Synthesis and function of glutathione and its derivatives. Metabolic transport between organelles.		
Unit:3	Plant Tissue Culture and Genetic Transformation	10 Hours
Plant cell and tissue culture. Tissue culture media-composition and preparation. Micropropagation; somoclonal variation. Callus induction, somatic embryogenesis. Protoplast culture-isolation and purification of protoplast. Alkaloids, Flavanoids, terpenoids, phenol- Nature, distribution and functions. Production of secondary metabolites in plants, elicitation, Machine learning for big data analytics in plants. Gene transfer to plant; <i>Agrobacterium</i> mediated transformation-Ti plasmids, Ri plasmids, Direct DNA transfer to plants- Protoplast transformation, Plant viruses as vectors- CAMV, Gemini viruses, RNA viruses (TMV, Potato virus X) as vectors. Advantages and uses of transgenic plants.		
Unit:4	Concept of Ecology and Ecosystem	11 Hours
Concept of Ecology and Ecosystem: Ecosystem-Introduction, Structure, components, types, and functions, Food chain, Food web, Ecological pyramids and Energy flow. Biogeochemical cycles Carbon, Nitrogen, sulphur, Phosphorus and Oxygen cycles. Human impact on carbon and Nutrient cycles. Strategies for preserving Ecosystems. Environmental pollution-water, soil, air, noise and thermal. Global environmental problems – Greenhouse effect, reforestration through micropropagation, biodiversity, species conservation.		
Unit:5	Environmental Biotechnology	11 Hours
Bioenergy and renewable resources: Biofuels (bioethanol, biodiesel, biogas, hydrogen and algal biofuels). Bioremediation and Waste Management: Treatment of Waste water from distillery, dairy and tannery industries –parameters – BOD, COD, TSS, TDS - physical, chemical and biological wastewater treatment - primary, secondary and tertiary treatment - Solid waste management. Plastic biodegradation and sustainable alternatives (Bioplastics). Phytoremediation and mycoremediation. Genetically engineered microorganisms (GEMs) to degrade environmental pollutants.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Buchanan, B.B., Gruissem, W. and Jones, R.L., (2002); Biochemistry and Molecular Biology of Plants; ISBN: 978-0-943088-39-6; American Society of Plant Physiologists, 2 nd Indian Reprint (2007), I.K. International Pvt. Ltd. N. Delhi.	
2	Srivastava, H.S. (2006), Plant Physiology, Biochemistry and Biotechnology, Rastogi Publications, Meerut.	
3	Khurana, SM Paul, and Rajarshi Kumar Gaur, eds. Plant biotechnology: Progress in Genomic era. Springer, 2019.	

4	Razdan, M.K. (2007), Introduction to Plant Tissue culture, II edition, Oxford and IBA Publications Co Pvt Ltd.
5	Russell Jones, Helen Ougham, Howard Thomas, Susan Waaland, (2012), The Molecular life of Plants, ISBN 978-0-470-87011-2; Wiley-Blackwell Publishers
6	Taiz, L. Zeiger, E., Moller, I.M. and Murphy, A. (2015) Plant Physiology and Development. 6th Edition, Sinauer Associates, Sunderland, CT.
7	Rittmann, B. F., & McCarty, P.L (2020). Environmental Biotechnology: principles and applications (2nd Edition), McGraw-Hill
8	Sharma, P. (2022) Environmental Biotechnology; Principles and applications. Springer

Reference Books

1	Saikia, R., Bezbarrah, R. L., Bora, T., (2008) Microbial Biotechnology, New India Publishing agency, New Delhi
2	Dubey, R.C. (2010) A textbook of Biotechnology, S. Chand and Company Ltd, New Delhi
3	Wang, L.K. (2010), Environmental Biotechnology, 1st edition, A Product of Humana Press.
4	Malaviya, D., & Singh, H (2022), Advances in Bioenergy and Microbial Biotechnology Elsevier
5	Lens, P., & Pol, L (2020). Biotechnology for waste management and energy production. IWA publishing

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	<u>Yu, M., Yang, C., & Li, Y. (2018). Big data in natural disaster management: A review. <i>Geosciences</i>, 8(5), 165.</u>
2	<u>Akter, S., & Wamba, S. F. (2017). Big data and disaster management: A systematic review and agenda for future research. <i>Annals of Operations Research</i>. https://doi.org/10.1007/s10479-017-2584-2.</u>
3	<u>Ma C, Zhang HH, Wang X. (2014) Machine learning for big data analytics in plants. <i>TrendsPlant Sci</i>. Dec;19(12):798-808.</u>

Course Designed By: **Dr. K. M. Saradhadevi**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	L	S	M	M	S	S
CO2	S	L	S	L	M	S	S	S	M	S
CO3	M	S	S	M	M	S	M	M	M	S
CO4	L	M	S	M	M	S	S	S	S	S
CO5	L	L	S	M	M	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code	3ED	BIOLOGY OF CANCER AND STEM CELL	L	T	P	C
Core/Elective/Supportive		Elective - III	4	√	-	4
Pre-requisite		Preliminary knowledge on cell Signaling and Characteristics of Stem Cells	Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to:						
1. To update knowledge on types of cancer, causes of cancer as well as on molecular mechanism of carcinogenesis. 2. To be familiar with various methods used for cancer diagnosis and on therapeutic strategies used to control tumor cell proliferation. 3. To become updated on types of stem cell, its characterization, pluripotency and niche specification.						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	The course will introduce the biology of cancer metabolism and its impact on life expectancy				LO1, LO3	
CO2	Students will become updated on types of cancer, causes of cancer as well as on molecular mechanism of carcinogenesis.				LO5, LO6, LO8	
CO3	The course will help in detailed understanding of cancer, its diagnosis & therapy.				LO8, LO9	
CO4	Course material provides understanding on types of stem cell, its characterization, pluripotency and niche specification.				LO3, LO5	
CO5	Students will understand the types and differentiations of stem cell and its biological applications				LO9, LO10	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Self-directed learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1		Cancer development and progression			15 Hours	
Metabolic Alterations in Cancer: Aerobic glycolysis, Glutaminolysis, Lipid metabolism, Serine and glycine metabolism. Angiogenesis: Role of endothelial cells, Regulation, Physiological and pathological significance, Angiogenesis inhibitors.						
Unit:2		Metastasis and Invasion			15 Hours	
Molecular principles of invasion and metastasis, Secondary tumors, Tumor microenvironment (TME), Key components of the TME, Role of TME in invasion and metastasis, Immunosuppression and therapeutic response, TME in immune evasion.						

Unit:3	Cancer Diagnosis & Therapy	10 Hours
Cancer, Diagnosis & Therapy: Tumor Markers; Gene Expression Microarrays; Proteomic Methods; Circulating Epithelial Cells; Circulating Endothelial Cells and Endothelial Progenitor Cells; Molecular Imaging; Application of cancer database in health care and industries. Haplotype Mapping. Cancer therapy: Surgery, Radiotherapy, Chemotherapy, Hormone therapy, Immune, Prodrug and Targeted therapies, Bone marrow transplantation, CAR T-cell therapy.		
Unit:4	Stem Cell Biology	11 Hours
Introduction to Stem Cell: Definition, Types of Stem cell, characterization, pluripotency, niche specification – Drosophila germ line stem cells, self-renewal and differentiation, tooth primordia, gut specifications. Occurrence of stem cell in mammals: In Mesenchymal cells - Hemangioblasts, skeletal muscle cells, adipose cells, bladder cells; In Epidermal cells – skin, mammary gland, dental and neural cells; In Endodermal cells – liver, GI tract, pancreatic cells		
Unit:5	Stem Cell Types and Applications	11 Hours
Embryonic Stem Cells: Blastocyst and inner cell mass cells, Organogenesis, Adult versus embryonic stem cells, post genomic adult stem cells, stemness, characteristics, hierarchy, stem cell niche; Adult stem cell from amniotic fluid and cord blood; induced pluripotency stem cells (ips cells). Stem cell characterization techniques and cryopreservation, Shelf life of stored stem cells.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	64 Hours
Text Book(s)		
1	Principles of Cancer Biology – 2016 by Kleinsmith; Publisher: Pearson Education India; First edition	
2	Molecular biology of cancer, 3rd edition – 2014 by Pecorino; Publisher: Oxford University Press	
3	The Biology of Cancer – 2013 by Robert Weinberg; Publisher: W. W. Norton & Company; 2 nd edition	
Reference Books		
1	The Molecular Basis of Human Cancer – 2018 by William B. Coleman (Editor), Gregory J. Tsongalis; Publisher: Humana Press Inc.; Softcover reprint of the original 2nd ed. 2017 edition.	
2	Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics– 2012 by Pecorino;Oxford University Press; 3rd edition.	
3	Stem Cells: Current Challenges and New Directions (Stem Cell Biology and Regenerative Medicine) – 2013 by Kursad Turksen; Publisher: Humana Press; 2013 edition.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://swayam.gov.in/nd2_aic20_ge02/preview	

2	https://nptel.ac.in/content/storage2/courses/104103068/module1/lec1/2.html
3	https://www.coursera.org/learn/cancer
4	https://www.classcentral.com/course/stem-cells-10745
Course Designed By: Dr. S. Selvakumar and Dr. K. M. Saradhadevi	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	M	S	M	S	M
CO2	S	S	L	M	S	S	S	S	M	S
CO3	M	S	S	S	L	S	M	S	M	S
CO4	S	M	M	M	S	M	S	M	S	L
CO5	M	S	S	M	M	L	M	M	S	M

*S-Strong; M-Medium; L-Low

Supportive Course

Course code	GS108	TOOLS AND TECHNIQUES IN BIOSCIENCE	L	T	P	C
Core/Elective/Supportive		Supportive - I	2	√	-	2
Pre-requisite		Prior knowledge on modern methods and technologies used in biochemical analysis	Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to:						
1. Methods and tools in biosciences represent a new standard of comprehensive paper for all students in various fields of biology and medicine. 2. The series emphasizes important developments in methodology and research tools and their potential for application to human and other biologic systems						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
1	To obtain the knowledge on the cell fractionation techniques to separate cellular components and to demonstrate the cellular location of various biochemical processes. Understood about radionuclide as an unstable atom and are used in biology and nuclear medicine					LO1 & LO6
2	Understood about the centrifugation technique to separate particles from a solution according to their size, shape, density, viscosity of the medium and rotor speed.					LO5 & LO6
3	To learn the chromatographic techniques for the separation of the individual compound from the mixture of compound and measuring the relative proportions of analytes in a mixture.					LO5 & LO6
4	To obtain knowledge about the separation and analysis of macromolecules and their fragments, based on their size and charge					LO5 & LO6
5	To study the interaction between matter and electromagnetic radiation and visible light dispersed according to its wavelength, by a prism					LO8 & LO1
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Selfdirected learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1		Fractionation Techniques			7 Hours	
Cell fractionation techniques: Cell lysis, homogenization, extraction, salting in, salting out, dialysis and ultra-filtration. Radioisotopes in Biology: Concept of half-life, decay constant, detection and quantitation - GM counter and solid and liquid scintillation counter. Specific activity, autoradiography and Applications of radioactivity.						
Unit:2		Centrifugation and Microscopy			7 Hours	
Centrifugation: Svedberg's constant, sedimentation velocity and sedimentation equilibrium. Differential and density gradient centrifugation, centrifugal elutriation, construction of preparative						

and analytical ultra-centrifuge. Microscopy: Principles and application of light phase contrast, fluorescence, scanning and transmission electron microscopy.

Unit:3	Chromatographic Techniques	6 Hours
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Chromatographic techniques: Principles and applications of paper, TLC, HPTLC, adsorption, ion exchange, gel filtration, affinity, GC - MS, chromatofocusing and HPLC.

Unit:4	Electrophoretic Techniques	5 Hours
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Electrophoretic techniques: Polyacrylamide gel electrophoresis, SDS PAGE, 2D electrophoresis, Native PAGE, agarose gel electrophoresis, isoelectric focusing, and pulse field electrophoresis

Unit:5	Spectroscopic Techniques	5 Hours
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Spectroscopic techniques: Principles of colorimeter, spectrophotometer, fluorimeter. Beer Lambert's Law and its limitations. Extinction coefficient, Atomic absorption spectroscopy, UV- Visible, Spectro fluorimetry, Flame Photometry.

Unit:6	Contemporary Issues	2 Hours
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Expert lectures, online seminars - webinars

	Total Lecture hours	32 Hours
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Text Book(s)

1	Wilson, K. and Walker, J. (2012) Practical Biochemistry – Principles and techniques of Biochemistry and Molecular Biology, 7th Edition, Cambridge University Press, India
2	Upadhyay,A.Upadhyay,K. and Nath,N. 2009. Biophysical Chemistry: Principles and Techniques, Third Edition, Himalaya Publishing. 11th Edition

Reference Books

1	Sharma, B. K. 2004. Instrumental Methods of Chemical analysis, 23rd Edition Goel Publications.
2	Basha M. Analytical Techniques in Biochemistry. Humana Press; 2020.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	http://epgp.inflibnet.ac.in/
2	http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=944

Course Designed By: **Dr. K. M. Saradhadevi**

Course code	GS102	MEDICAL LAB TECHNOLOGY	L	T	P	C
Core/Elective/Supportive		Supportive - II	2	√	-	2
Pre-requisite		Basic laboratory principles, laboratory functions and solution preparations	Syllabus Version		2026 - 27	
Course Objectives:						
The main objectives of this course are to:						
1. The main objective of this course is to introduce basic concepts in medical laboratories. 2. This course emphasizes to understand about the functioning of medical laboratories and laboratory personnel with good clinical practices 3. Automation in clinical biochemistry provides the learner to know about the instrumental concept and quality control. solution preparation provides exposure to prepare normality, molarity and percent solutions.						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	Learn basic laboratory concepts and principles, know about the role of medical laboratory personnel, safety measures in laboratory, know about clinical born infections and personnel hygiene				LO1, LO3	
CO2	Acquire knowledge on sterilization methods and staining techniques.				LO3, LO6	
CO3	Know about Quality control, Quality assurance and Instrumentation.				LO3, LO10	
CO4	Get wide knowledge on Clinical samples, common laboratory infections and Anticoagulants				LO5, LO6, LO10	
CO5	Calculate Normality, Molar and percent solutions. know about pH and methods to measure liquids				LO6, LO8	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research - related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Selfdirected learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1		Basic Laboratory Principles			7 Hours	
Basic laboratory principles - Code of conduct of medical laboratory personnel - Organization of clinical laboratory - Role of medical laboratory technician - Safety measures - Good clinical practices. Hospital and clinic borne infections and personnel hygiene. Overview of laboratory accreditation.						
Unit:2		Sterilization Methods and Staining Techniques			6 Hours	
Common glass wares in clinical laboratory - care and maintenance - Calibration of pipettes and volumetric apparatus - Cleaning and sterilization methods - antiseptics and disinfectants - staining techniques – vital stains						

Unit:3	Automation in Clinical Biochemistry	6 Hours
Automation in Clinical Biochemistry- Instrumental concept, Selection of Instrument, Quality assurance, Control of pre-analytical and analytical variables, External and internal quality control measurements. Clinical laboratory records- Modern laboratory set up - Quality control: Accuracy, Precision, and Reference values. Role of AI in clinical Biochemistry laboratories.		
Unit:4	Clinical Samples and Specimens	6 Hours
Clinical samples and specimens - Specimen collection, transport, storage and disposal – common laboratory infections - Anticoagulants: EDTA, Di-potassium salts of EDTA, double oxalate, single oxalate, sodium citrate and sodium fluoride.		
Unit:5	Buffers and Solutions Preparation	5 Hours
Acid - Base balance – Electrolytes - Buffer and pH- Preparation of solution: Normal, per cent, Mole and Molar solution - normal saline -Methods of measuring liquids.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	32 Hours
Text Book(s)		
1	Mukerjee, K. L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume I, McGraw Hill, New Delhi	
2	Sood.R., 2006. Textbook of Medical Laboratory Technology, Jaypee, New Delhi.	
3	Fischbach, F.T. and M.B. Dunning, 2009. A Manual of laboratory and Diagnostic Tests, Lippincott Williams Wilkins, New York.	
Reference Books		
1	Sonnenwirth, A.C. and L. Jarret, 2000 Gradwohls“ Clinical laboratory methods and diagnosis. M.D.B.I., New Delhi.	
2	Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science, Theory and Practice, McGraw Hill, New Delhi.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/102/103/102103015/	
2	https://nptel.ac.in/content/storage2/courses/102103047/PDF/mod1.pdf	
Course Designed By: Dr. K. M. Saradhadevi		

Course code	GS109	CLINICAL DIAGNOSIS IN HEALTH AND DISEASES	L	T	P	C
Core/Elective/Supportive		Supportive - III	2	√	-	2
Pre-requisite		Knowledge about diseases and diagnosis	Syllabus Version		2026 -27	
Course Objectives:						
The main objectives of this course are to:						
1. To introduce basic concepts in Clinical diagnosis in health and diseases. 2. This course emphasizes to understand about analysis of body fluids, detection of body metabolites, organ functions and communicable and non-communicable diseases						
Learning Outcomes:						
On the successful completion of the course, student will be able to:						
CO1	Learn about general health and common diseases, to learn how to analyse the samples (Blood, urine, pleural fluid, synovial fluid, cerebro spinal fluid and tissues and histology)				LO1, LO5	
CO2	Acquire knowledge on detection of body metabolites and its importance, liver function and kidney function				LO5, LO6, LO8	
CO3	Know about heart function, lung function test				LO5, LO8	
CO4	Get wide knowledge on Bacterial viral and fungal infections				LO5, LO8	
CO5	Know about non-communicable diseases and cancer markers				LO8, LO10	
LO1: Disciplinary Knowledge LO2: Communication skill LO3: Critical thinking LO4: Problem Solving LO5: Analytical Reasoning LO6: Research – related Skills LO7: Co-operation / Team Work LO8: Scientific Reasoning LO9: Reflective Thinking LO10: Informative Thinking LO11: Self- directed learning LO12: Multicultural competence LO13: Moral and ethical awareness/reasoning LO14: Leadership readiness/qualities LO15: Life-long learning						
Unit:1	Introduction to Diagnosis				7 Hours	
General health, syndrome and common diseases – communicable and noncommunicable diseases. Samples for analysis: Blood, urine, pleural fluid, synovial fluid, cerebro spinal fluid and tissues and histology. General checkup: Blood group, Hb, height and weight, waist to hip ratio, electro cardio gram, X-ray, abdomen scan and appearance of scars, urine analysis – routine analysis (protein, sugar, pigments and cells).						
Unit:2	Detection of Metabolites and Its Importance				6 Hours	
Tests for liver function: Enzyme assay (SGOT, SGPT, Alkaline phosphatase, GGT), Total protein, albumin /globulin ratio and their significance. Test for kidney function: Urea and creatinine estimation and their significance.						
Unit:3	Diagnosis for Organ Function				6 Hours	
Test for heart function: Blood pressure (cystolic and diastolic), lipid profile (cholesterol, triglycerides, HDL, LDL estimation) and their importance. Test for lung function: Chest X-ray, Spirometry. Test for Brain function: EEG, MRI, CT. Test for Surgery: Bleeding time, clotting time. Special test: X-ray, CT, MRI, Doppler, TMT, angioplasty.						

Unit:4	Diagnosis of Infections	5 Hours
Infection: Bacterial, viral, fungal and protozoans. Blood: Total cell count, differential count, erythrocyte sedimentation rate. Infectious diseases: Tuberculosis, Leprosy, Malaria, Hepatitis, Cholera, Dengue, HIV, Chikungunya and H1N1. TORCH – Panel (infertility profile), Infection in pregnancy, Koch postulations – Microscopic examination of body fluids, ELISA and PCR tests.		
Unit:5	Non-communicable Diseases	6 Hours
Diabetes: Blood sugar, urine sugar, glucose tolerance test, HbA1c. Hyper tension: Lipid profile, electrolyte (sodium, potassium, chloride and bicarbonate) investigation. Cancer markers: ELISA and DNA Probes.		
Unit:6	Contemporary Issues	2 Hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	32 Hours
Text Book(s)		
1	Burtis, C. and Bruns, D. 2007. Teitz Fundamentals of Clinical Chemistry, 3rd Edition, W.B. Saunders Company.	
2	Devlin, T. M. 1998. Text book of Biochemistry with Clinical Correlation, 4th Edition, John Wiley and Sons.	
3	Mayne, P. D. 1994. Clinical Chemistry in Diagnosis and Treatment, 6th Edition, Hodder Arnold Publication	
4	Marshall, W.J. and Bangeit, S.K. 1995. Clinical Biochemistry - Metabolic concepts and Clinical aspects, Churchill Livingstone.	
Reference Books		
1	Guyton, A.C. and Hall, J.E. 2010. Text Book of Medical Physiology, 12 Edition, Saunders.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.verywellhealth.com/liver-enzyme-and-function-3157004	
2	https://nptel.ac.in/content/storage2/courses/109104029/pdf_lecture/Lecture10.pdf	
Course Designed By: Dr. S. Selvakumar		

CERTIFICATE COURSE IN AI IN LIFE SCIENCE

Unit-1: Introduction To Fundamentals of AI & Life Science

Introduction to Artificial Intelligence and its role in Life Sciences. Basics of Machine Learning (ML), Deep Learning (DL) and Natural Language Processing (NLP). Overview of pharmaceutical, biotechnology and healthcare industries with biological data types such as genomic, proteomic, clinical and biomedical imaging data. Introduction to AI tools and platforms including Python, TensorFlow, PyTorch and R basics.

Unit-II: AI in Drug Discovery, Genomics & Bioinformatics

Role of AI in drug discovery and development. Virtual screening, molecular docking and drug-target interaction studies using AI. AI in Next-Generation Sequencing (NGS), genome annotation and gene expression analysis. Personalized medicine, predictive genetic risk analysis.

Unit-III: AI in Medical Imaging, Diagnosis, Clinical Trials & Healthcare Data

Use of AI in medical imaging, diagnostics and disease prediction. Computer vision in radiology, pathology imaging and detection of cancer, cardiovascular and neurological disorders. AI in clinical trial design, patient recruitment, drug safety and efficacy prediction. Electronic health records (EHR), pharmacovigilance and healthcare data management.

Unit-IV: AI in Biotechnology & Agriculture Life Sciences

Applications of AI in biotechnology and agricultural life sciences. AI in crop genomics, protein structure prediction, microbiome research and vaccine development.

Unit-V: Ethical, Regulatory & Future Perspectives

Ethical and regulatory aspects of AI in Life Sciences, including FDA, EMA and CDSCO guidelines for AI-based solutions. Applications of AI in precision medicine, digital health and future career opportunities in AI and Life Sciences.

Case studies on AI applications in healthcare, drug discovery and biomedical research.

REFERENCE BOOKS:

1. **Artificial Intelligence in Healthcare**” by Adam Bohr and Kaveh Memarzadeh, Academic Press, First Edition, 2020.
2. **Deep Learning for the Life Sciences**” by Bharath Ramsundar, Peter Eastman, Patrick Walters and Vijay Pande, O’Reilly Media, First Edition, 2019.
3. **Bioinformatics and Machine Learning**” by Jason T. L. Wang, Mohammed J. Zaki, Hannu T. T. Toivonen and Dennis Shasha, Springer Publications, First Edition, 2006.
4. **Artificial Intelligence in Drug Discovery**” by Nathan Brown, Royal Society of Chemistry Publications, First Edition, 2020.
5. **“Bioinformatics - A Beginner's Guide**” by Jean Michel Claverie and Cedric Notredame, Wiley- Dream Tech India Pvt. Ltd, First Edition, 2007.

Value Added Course

Value added course: I

ANIMAL CELL CULTURE TECHNIQUES	
Name of the Department	BIOCHEMISTRY
Name of the Faculty Member i/c With Complete Address with Phone and e- mail	Dr. S. Selvakumar, Assistant Professor, Department of Biochemistry, Bharathiar University E-mail: selvakumar@buc.edu.in Phone:8220119898
Inter / Intra Department Course	Intra Department Course
Duration of the Course	45 Hours
Eligibility	B.Sc., Biochemistry
Number of Candidates to be Admitted	25
Registration Procedure	Application will be issued by the department office. Filled in applications will be evaluated based on their Undergraduate percentage.
Job Opportunities:	
Build their career as Cell Culture analyst, Downstream Process development officer in various companies like Pharmaceutical Industries, Research laboratories, Stem cell laboratories, Vaccine production industries, etc.,	
The objectives of the Course are:	
The main objectives of this course are to:	
1	Learn aseptic techniques involved in handling of animal cell cultures
2	Focus on practical aspects of cell culture, like design and layout of the laboratory.
3	Provide proper procedure to make and sterilize media.
4	Focus on principles of cryopreservation and Nutritional requirements of cultured cells.
Course Content	Lecture / Practical / Project / Internship
Lecture / Practical	

Module 1	Theory: Safety Procedures - Design of the Cell Culture Laboratory - Maintenance of sterility - Do's & Don'ts in Tissue Culture Lab.	3 Hours
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Module 2	Theory: Essential facility equipment - biological safety cabinets, inverted microscopes, table top centrifuges, pH meters, cell culture incubators, refrigerator, and vacuum pumps - its importance and uses	4 Hours
Module 3	Theory: Types of medium, Preparation of medium and required solutions: Chemical constituents - its importance – uses. Primary Cell Culture Establishment.	4 Hours
Module 4	Theory: Cell line revival (recovery) - Maintaining Cells. Contamination and Storage- Sub-culturing (passaging) - Counting & viability test for cells. Freezing of cells (cryopreservation) and Reviving cryopreservation cells	4 Hours
Module 5	Practical: 1. Preparation of medium and required solutions.	6 Hours
Module 6	2. Primary Cell Culture Establishment.	6 Hours
Module 7	3. Cell line revival (recovery) - Maintaining Cells.	6 Hours
Module 8	4. Sub-culturing (passaging) - Counting & viability test for cells.	6 Hours
Module 9	5. Freezing of cells (cryopreservation).	3 Hours
Module 10	6. Reviving cryopreservation cells.	3 Hours
		45 Hours

Book(s) for reference	
1	Animal Cell Culture Techniques. Ed. Martin Clynes, springer, 1998.
2	Cells: a Laboratory Manual, Spector, D. L., Goldman, R.D., and Leinwand, L.A., Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press, 1998.
Related Online Contents	
1	Verma, A. (2014). Animal tissue culture: Principles and applications. In <i>Animal Biotechnology</i> (pp. 211-231). Academic Press. https://doi.org/10.1016/B978-0-12416002-6.00012-2
2	NPTEL: NOC:Cell Culture Technologies , by Prof. Mainak Das, IIT Kanpur. https://nptel.ac.in/courses/102/104/102104059
3	ATCC® ANIMAL CELL CULTURE GUIDE tips and techniques for continuous cell lines. https://www.atcc.org/~media/PDFs/Culture%20Guides/AnimCellCulture_Guide.ashx

Book(s) for Study	
1.	Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, R. Ian Freshney, John Wiley & Sons, 2016, Seventh edition.

2.	Animal Cell Culture - Practical Approach, Ed. John R.W. Masters, OXFORD, Third edition, 2000.
3.	Animal Cells: Culture and Media, D. C. Darling and S. J. Morgan, BIOS Scientific Publishers Limited, 1994.
4.	Methods in Cell Biology, Jennie P. Mathur and David Barnes, Animal Cell Culture Methods Academic Press, Volume 57, 1998.

Value Added Course: II

PHARMACOVIGILANCE	
Name of the Department	BIOCHEMISTRY
Name of the Faculty Member i/c With Complete Address with Phone and e-mail	Dr. R. Kavitha Assistant Professor Department of Biochemistry Bharathiar University Email: kavitha@buc.edu.in Phone: 9944353524
Inter / Intra Department Course	Intra Department Course
Duration of the Course	45 Hours
Eligibility	B. Sc Biochemistry
Number of Candidates to be Admitted	25
Registration Procedure	Application will be issued by the department office. Filled in applications will be evaluated based on their Undergraduate percentage.
Job Opportunities:	
Build a rewarding career in pharmacovigilance, progressing through roles in drug safety assessment, regulatory affairs, and clinical research within pharmaceutical companies, regulatory agencies, research organizations, and other related fields.	
The objectives of the Course are:	
The main objectives of this course are to:	
1	Provide basic knowledge about pharmacovigilance
2	Develop skills in assessing and understanding the Adverse Drug reactions
3	Enhancing the problem-solving abilities
4	Give exposure to Drug safety
Course Content	Lecture / Practical /
Lecture / Practical	

Module 1	Theory: Introduction to pharmacovigilance: History and development of Pharmacovigilance. Importance of safety monitoring of medicine. WHO international drug monitoring programme. Pharmacovigilance program of India (PvPI): Services of Indian pharmacopoeia commission (IPC), Adverse drug reaction (ADR) reporting in India, Pharmacovigilance system Master File & Capacity Building, and recent developments and future perspectives.	6 Hours
Module 2	Introduction to adverse drug reactions: Definitions and classification of ADRs. Detection and reporting, Development Safety Update Report (DSUR), Periodic Adverse Drug Experience Report (PADER), Periodic Benefit Risk Evaluation Report (PBRER), and Periodic Safety Update Report (PSUR). Pharmacogenomics of adverse drug reactions: Genetics related ADR Drug safety evaluation in special population.	3 Hours
Module 3	Pharmacovigilance of Herbal Drugs: Needs of pharmacovigilance in herbals, Herbals concept of adverse effect, Pharmacovigilance of herbal medicines: current state and future directions and Challenges in Herbal Drugs Pharmacovigilance	3 Hours
Module 4	Vaccine safety surveillance: Vaccine pharmacovigilance. Vaccine failure. Communication in pharmacovigilance: Effective communication in pharmacovigilance. Communication in drug safety crisis management. Communication with regulatory agencies, business partners, healthcare facilities and media.	3 Hours
Module 5	Safety data generation: Preclinical phase. Clinical phase. Post-approval phase (PMS). ICH guidelines for pharmacovigilance: organization and objectives of ICH. Good clinical practice in pharmacovigilance studies.	6 Hours
Module 6	Pharmacovigilance Regulatory effects: CDSCO (India) and pharmacovigilance: D&C Act and Schedule Y. Differences in Indian and global pharmacovigilance requirements.	3 Hours
Module 7	Benefits assessment of medicines in pharmacovigilance: Targeted Clinical Investigations and Descriptive studies.	3 Hours
Module 8	Practical 1. Case study analysis of Adverse Drug reaction reports 2. Form for Adverse event reporting 3. Vaccine Adverse event reporting	6 Hours
Module 9	1. Adverse Drug Reaction (ADR) Reporting practice 2. Causality Assessment of ADRs	6 Hours

Module 10	1. Review of Clinical Trial Safety Data 2. Applying ICH Guidelines in Pharmacovigilance	6 Hours
		45 Hours

Book(s) for Study	
1	Pharmacovigilance: Principles and Practice (2021) by Patrick Waller & Mira HarrisonWoolrych.
2	Detecting Adverse Drug Reactions: Pharmacovigilance in Action by Andrew Bate.
3	FDA Pharmacovigilance: Postmarketing Drug Safety & Risk Management by Mark P. Mathieu. (2023)
Book(s) for reference	
1	Meyler's Side Effects of Drugs 2016, (16th Edition) – Elsevier Edited by Jeffrey K. Aronson.
2	Davies's Textbook of Adverse Drug Reactions - 1998, (5th Edition) By D.M. Davies, R.E. Ferner, H. de Glanvil le.
3	Herbal-Drug Interactions and Adverse Effects: An Evidence-Based Quick Reference Guide by <i>Richard B. Philp</i> .
Related Online Contents	
1	https://gpatindia.com/pharmacovigilance-methods-classification-of-pharmacovigilancemethods/
2	WHO Policy Perspectives on Medicines. Geneva: WHO; 2004. Geneva: World Health Organization.Looking at the Pharmacovigilance: ensuring the safe use of medicines.
3	Klepper MJ. The periodic safety updates report as a Pharmacovigilance tool. Drug Saf, 2004; 27: 569-78.
4	WHO, Safety of medicines in public health programmes: Pharmacovigilance an essential tool, WHO, 2006.
5	Livio F, Renard D, Buclin T. Pharmacovigilance. Rev Med Suisse, 2012; 8: 116-9.
6	Skalli S, Soulaymani Bencheikh R. Safety monitoring of herb-drug interactions: acomponent ofpharmacovigilance. Drug Saf, 2012; 35: 785-91.

Job Oriented Certificate Course

Job-oriented Certificate courses

MEDICAL LABORATORY TECHNICIAN	
Name of the Department	BIOCHEMISTRY
Name of the Faculty Member i/c With Complete Address with Phone and e-mail	Dr. S. Suja, Professor and Head, Department of Biochemistry, Bharathiar University, Coimbatore-641 046.
Inter / Intra Department Course	Intra Department Course
Duration of the Course	45 hours
Eligibility	B.Sc
Number of Candidates to be Admitted	25
Mode of the Course	Regular
Collaboration if any with Companies (if Yes, Full Address of the Company Address, Name of the Contact Person, Phone, e-mail etc.)	NG Hospital and Research Centre 577, Trichy Road, Near Singanallur signal, Singanallur, Coimbatore-641005
Registration Procedure	Application will be issued by the department office. Filled in applications will be evaluated based on their Undergraduate percentage.
Job Opportunities:	
Students who complete medical laboratory technology program can pursue employment in settings such as hospitals, clinics, commercial laboratories, public health facilities, or diagnostic laboratories.	
The objectives of the Course are:	
The main objectives of this course are to:	
1	Perform complex tests for diagnosis, treatment, and prevention of disease
2	Know what is implied by the presence of abnormal constituents in body fluid
3	Provide technical information about test results
4	Prepare and document medical tests and clinical results
5	Have sound knowledge of the functioning of lab equipment's and protocols for their cleaning and Calibration
Course Content	Lecture / Practical / Project / Internship

Module 1	Healthcare Systems, Laboratory and Delivery; Role of the Medical Laboratory Technician, Introduction to Laboratory related Medical Terminology	4 Hours
Module 2	Introduction to Biochemistry, Haematology and Clinical Pathology	4 Hours
Module 3	Introduction Clinical Biochemistry	4 Hours
Module 4	Analytical Laboratory Testing Process and Personnel Hygiene; Safety & First Aid, Bio Medical Waste Management	4 Hours
Module 5	Biochemistry Practical – 1	4 Hours
Module 6	Biochemistry Practical – 2	5 Hours
Module 7	Haematology Practical	5 Hours
Module 8	Clinical Pathology Practical	5 Hours
Module 9	Clinical Biochemistry Practical - 1	5 Hours
Module 10	Clinical Biochemistry Practical - 2	5 Hours
		45 hours

Book(s) for Study	
1	Textbook of Medical Laboratory Technology , Praful B. Godkar, Darshan P. Godkar, Edition 3, Bhalani Publishing House, 2014.
2	Textbook of Biochemistry for Medical Students , DM Vasudevan, Sreekumari S, KannanVaidyanathan, Edition 8, Jaypee Brothers Medical Publishers (P) Ltd, 2016.
3	Basic Pathology , Robbins Saunders, Edition 10, An imprint of Elsevier Inc.,2017.
4	Hematology: Basic Principles and Practice , Ronald Hoffman, Edition 7, Elsevier, 2017.
5	Clinical Biochemistry , Maheshwari Nanda, Edition 2, Jaypee Brothers Medical Publishers, 2016.
Book(s) for reference	
1	Harpers Illustrated Biochemistry , Rodwell, Edition 31, Overruns publisher, 2018
2	Clinical Chemistry: Principles, Techniques, Correlations , Michael Bishop, Edition 8, Lippincott Williams and Wilkins publishing, 2017
3	Clinical Hematology: Theory & Procedures , <u>Mary Lou Turgeon</u> , Edition 6, Jones & Bartlett Learning, 2017.
4	https://www.pdfdrive.com/medical-laboratory-technology-e34330445.html
Related Online Contents	
1	https://www.youtube.com/c/MedicalLaboratoryTechnologistVideos/featured

Quality Control Biologist	
Name of the Department	BIOCHEMISTRY
Name of the Faculty Member i/c With Complete Address with Phone and e-mail	Dr. K. M. Saradhadevi Assistant Professor Department of Biochemistry Bharathiar University Email: saradhadevi@buc.edu.in Phone: 9445285328
Inter / Intra Department Course	Intra Department Course
Duration of the Course	45 hours
Eligibility	B. Pharma / Graduation in Biotechnology/ B. Sc with Chemistry/ Biology/Microbiology/ Biochemistry as major subject (Preferable)
Collaboration if any with Companies (if Yes, Full Address of the Company Address, Name of the Contact Person, Phone, e-mail etc.)	Pasteur Institute of India, Coonoor-643103
Number of Candidates to be Admitted	25
Registration Procedure	
Job Description:	
To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “LFS/Q2301, V1.0”.	
The objectives of the Course are:	
The main objectives of this course are to:	
1	Define life sciences industry, legal and regulatory framework and pharmacopeia to enable him/herself for establishing the industry standards in his/her performance.
2	Maintain a healthy, safe and secure working environment at the pharmaceutical manufacturing shop floor, laboratory and area around in conformance with environmental health and safety (EHS) rules.
3	Apply scientific knowledge about biological product and process in quality control analysis of bio-pharmaceutical products.
4	Prepare, preserve and ensure stability of biological samples as per good laboratory practices (GLP) and good manufacturing practices (GMP).

5	Operate analytical equipment and instruments as per standard operating procedures (SOP) and good laboratory practices (GLP).
6	Perform routine analysis of biopharmaceuticals in lab in compliance manufacturing practices (GMP) and good laboratory practices (GLP).
7	Conduct quality check for bio-pharmaceutical samples in conformance of acceptance limits as per standard operating procedures (SOP).
8	Apply good documentation practice (GDP) and data integrity while reporting and documentation as per standard operating procedures (SOP) and good laboratory practices (GLP).
9	Work effectively in a team.
10	Respond to audit queries by citing evidence of work done.
11	Apply core communication skills and professional skills such as planning and organizing, problem solving, analytical and critical skills, decision making and customer centricity at work.

Course Content		Lecture / Practical /
Lecture / Practical		
Module 1	Life Sciences Industry and Quality related regulations	3 hours
Module 2	GLP guidelines and production overview	4 hours
Module 3	Health and safety	3 hours
Module 4	Workplace cleanliness	2 hours
Module 5	Sample Preparation, preservation and Storage	4 hours
Module 6	Test and analysis of biological samples for Plant/ Animal/Human cell culture	6 hours
Module 7	Inspection of samples	3 hours
Module 8	Instrumentation in Biological Analysis	5 hours
Module 9	Quality Analysis	4 hours
Module 10	Reporting and Documentation	3 hours
Module 11	Coordinate with Supervisor, within team and cross functional the teams	2 hours
Module 12	Information Technology Skills at work	2 hours
Module 13	On the Job Training	4 hours
		45 Hours

Book(s) for Study	
1	Bisen P. S. (2016) Life Science In Tools and Tecniques, CBS Publishers.
2	R. Scott Stricoff and Douglas B. Walters (1995) Handbook of Laboratory Health and Safety 2nd Edition, Wiley-Interscience.
3	G. Barrie Wetherill (1969) Sampling Inspection and Quality Control, Methuenyoung books.
Book(s) for reference	
1	Aashka Jain, Hina Bagada, Priya Patel (2019) Good Manufacturing Practises and Good Laboratory Practises, Vallabh prakashan publisers.
2	Shubhangi Tambwekar (2015) Handbook of Quality Assurance in Laboratory Medicine, Wolters Kluwer Lippincott Williams and Wilkins publications.
3	PK Bajpai (2006) Biological Instrumentation and Methodology, S Chand & Company.
4	Pamposh Kumar and V.P.S. Tomar (2005) Laboratory Manual Quality Systems Standardization Quality Assurance Accreditation Quality Management, CBS publication.
Related Online Contents	
1	Hand book good laboratory practice – World Health Organization https://www.who.int/tdr/publications/documents/glp-handbook.pdf
2	<u>Importance of cleanliness in laboratories</u> https://lab-training.com/2017/08/21/importance-cleanliness-laboratories/
3	<u>Cell Culture Basics Handbook</u> https://www.vanderbilt.edu/viibre/CellCultureBasicsEU.pdf
4	<u>Biological sample collection, processing, storage and infomtion management</u> https://publications.iarc.fr/publications/media/download/1398/68b153f74693289ae66d767a8cbe1ca667df4f1b.pdf
5	<u>Lab Safety Rules and Guidelines</u> https://www.labmanager.com/lab-health-and-safety/science-laboratory-safety-rulesguidelines-5727

Health and Wellness

---- 23 - 886*

AUDIT

HEALTH & WELLNESS

L	T	P	C**
0	0	4	1

*(First four digits in the subject code is branch code and Seventh digit is Semester)

** Health & Wellness has one credit for the third semester only and it has no credits for other semesters.

Skill Areas:

Physical Fitness, Nutrition, Mental Health, Awareness on Drug addiction and its effects

Purpose:

The Health & Wellness course focuses on teaching the elements of physical, mental, emotional, social, intellectual, environmental well-being which are essential for overall development of an individual. The course also addresses the dangers of substance abuse and online risks to promote emotional and mental health.

Learning Outcomes:

Upon completion of the Health & Wellness course, students will be able to:

1. Demonstrate proficiency in sports training and physical fitness practices.
2. Improve their mental and emotional well-being, fostering a positive outlook on health and life.
3. Develop competence and commitment as professionals in the field of health and wellness.
4. Awareness on drug addiction and its ill effects

Focus:

During the conduct of the Health & Wellness course, the students will benefit from the following focus areas:

1. Stress Management.
2. Breaking Bad Habits.
3. Improving Interpersonal Relationships.
4. Building Physical Strength & Inner Strength.

Role of the Facilitator:

The faculty plays a crucial role in effectively engaging with students and guiding them towards achieving learning outcomes. Faculty participation involves the following areas:

1. **Mentorship & Motivation:** The Facilitator mentors students in wellness and self-discipline while inspiring a positive outlook on health. Faculty teach stress management, fitness, and daily well-being.
2. **Promoting a Safe and Inclusive Environment:** The facilitator ensures a safe, inclusive, and respectful learning environment for active student participation and benefit.
3. **Individualised Support and Monitoring Progress:** The facilitator plays a crucial role in providing personalized support, monitoring and guidance to students.

Guided Activities:

In this course, several general guided activities have been suggested to facilitate the achievement of desired learning outcomes. They are as follows:

1. Introduction to Holistic Well-being.
2. Holistic Wellness Program- Nurturing Body and Mind
3. Breaking Bad Habits Workshop.
4. Improving the elements of physical, emotional, social, intellectual, environmental and mental well-being.
5. Creating situational awareness, digital awareness.
6. Understanding substance abuse, consequences and the way out.

Period Distribution

The following are the guided activities suggested for this Audit course.

The Physical Director should plan the activities by the students.

Arrange the suitable Mentor / Guide for the wellness activities.

Additional activities and programs can be planned for Health and Wellness.

S.No	Guided Activities	Period
1	Introduction to Holistic Well-being 1. Introduce the core components of Health & Well-being namely Physical, mental and emotional well-being 2. Provide worksheets on all the four components individually and explain the interconnectedness to give an overall understanding.	
2	Wellness Wheel Exercise (Overall Analysis)	

Guide students to assess their well-being in various life dimensions through exercises on various aspects of well-being, and explain the benefits of applying wellness wheel.

- Introduce Tech Tools:
- Explore the use of technology to support well-being.
- Introduce students to apps for meditation, sleep tracking, or healthy recipe inspiration.

3 **Breaking Bad Habits (Overall Analysis)**

- Open a discussion on bad habits and their harmful effects.
- Provide a worksheet to the students to identify their personal bad habits.
- Discuss the trigger, cause, consequence and solution with examples.
- Guide them to replace the bad habits with good ones through worksheets.

4 **Physical Well-being**

1. Fitness

Introduce the different types of fitness activities such as basic exercises, cardiovascular exercises, strength training exercises, flexibility exercises, so on and so forth.

(Include theoretical explanations and outdoor activity).

2. Nutrition

Facilitate students to reflect on their eating habits, their body type, and to test their knowledge on nutrition, its sources and the benefits.

3. Yoga & Meditation

Discuss the benefits of Yoga and Meditation for one's overall health.

Demonstrate different yoga postures and their benefits on the body through visuals (pictures or videos)

4. Brain Health

Discuss the importance of brain health for daily life.

Habits that affect brain health (irregular sleep, eating, screen time).

Habits that help for healthy brains (reading, proper sleep, exercises).

Benefits of breathing exercises and meditation for healthy lungs.

5. Healthy Lungs

Discuss the importance of lung health for daily life.

Habits that affect lung health (smoking, lack of exercises).

Benefits of breathing exercises for healthy lungs.

6. Hygiene and Grooming

Discuss the importance of hygienic habits for good oral, vision, hearing and skin health.

Discuss the positive effects of grooming on one's confidence level and professional growth.

Nutrition:

Invite a nutritionist to talk among the students on the importance of nutrition to the body or show similar videos shared by experts on social media. Organize a 'Stove less/fireless cooking competition' for students where they are expected to prepare a nutritious dish and explain the nutritive values in parallel.

5 Emotional Well-being

1. Stress Management

Trigger a conversation or provide self-reflective worksheets to identify the stress factors in daily life and their impact on students' performance.

Introduce different relaxation techniques like deep breathing, progressive muscle relaxation, or guided imagery.

(use audio recordings or visuals to guide them through these techniques).

After practicing the techniques, have them reflect on how these methods can help manage stress in daily life.

2. Importance of saying 'NO'.

Explain the students that saying 'NO' is important for their Physical and mental well-being, Academic Performance, Growth and Future, Confidence, Self-respect, Strong and Healthy Relationships, building reputation for self and their family (avoid earning a bad name).

Factors that prevent them from saying 'NO'.

How to practice saying 'NO'.

3. Body Positivity and self-acceptance

Discuss the following with the students.

- What is body positivity and self-acceptance?
- Why is it important?
- Be kind to yourself.
- Understand that everyone's unique.

(Importance of saying 'NO')

Provide worksheets to self-reflect on...

...how they feel when others say 'no' to them

...the situations where they should say 'no'

Challenge students to write a song or rap about the importance of saying no and how to do it effectively.

Students can perform their creations for the class.

6 Social Well-Being

1. Practicing Gratitude

Discuss the importance of practicing gratitude for building relationships with family, friends, relatives, mentors and colleagues

Discuss how one can show gratitude through words and deeds.

Explain how practicing gratitude can create 'ripple effect'.

2. Cultivating Kindness and Compassion

Define and differentiate between kindness and compassion.

Explore practices that cultivate these positive emotions.

Self-Compassion as the Foundation.

The power of small gestures.

Understanding another's perspective.

The fruits of compassion.

3. Practising Forgiveness

Discuss the concept of forgiveness and its benefits.

Forgiveness: What is it? and What it isn't?

Benefits of forgiveness.

Finding forgiveness practices.

4. Celebrating Differences

Appreciate the value of individual differences and foster inclusivity.

The World: A Tapestry of Differences (cultures, backgrounds, beliefs, abilities, and appearances).

Finding strength in differences (diverse perspectives and experiences lead to better problem-solving and innovation).

Celebrating differences, not ignoring them (respecting and appreciating the unique qualities).

Activities for celebrating differences (share culture, learn about others, embrace new experiences).

5. Digital Detox

Introduce the students to:

The concept of a digital detox and its benefits for social well-being.

How to disconnect from devices more often to strengthen real-world connections.

:

(Practicing Gratitude)

Provide worksheets to choose the right ways to express gratitude.

Celebrate 'gratitude day' in the college and encourage the students to honour the house keeping staff in some way to express gratitude for their service.

7

Intellectual Well-being

1. Being a lifelong Learner

Give students an understanding on:

The relevance of intellectual well-being in this 21st century to meet

the expectations in personal and professional well-being

The Importance of enhancing problem-solving skills

Cultivating habits to enhance the intellectual well-being (using the library extensively, participating in extra-curricular activities, reading newspaper etc.)

2. Digital Literacy

Discuss:

The key aspects of digital literacy and its importance in today's world.

It is more than just liking and sharing on social media.

The four major components of digital literacy (critical thinking, communication, problem-solving, digital citizenship).

Why is digital literacy important?

Boosting one's digital skills.

3. Transfer of Learning

Connections between different subjects – How knowledge gained in one area can be applied to others.

Intellectual Well-being.

Provide worksheets to students for teaching them how to boost intellectual well-being.

Ask the students to identify a long-standing problem in their locality, and come up with a solution and present it in the classroom. Also organize an event like 'Idea Expo' to display the designs, ideas, and suggestions, to motivate the students to improve their intellectual well-being.

8 Environmental Well-being

1.The Importance of initiating a change in the environment.

The session could be around:

Defining Environmental well-being (physical, chemical, biological, social, and psychosocial factors) – People's behaviour, crime, pollution, political activities, infra-structure, family situation etc.

Suggesting different ways of initiating changes in the environment (taking responsibility, creating awareness, volunteering,

approaching administration).

Providing worksheets to self-reflect on how the environment affects their life, and the ways to initiate a change.

Dedicate a bulletin board or wall space (or chart work) in the classroom for students to share their ideas for improving environmental well-being.

Creating a volunteers' club in the college and carrying out monthly activities like campus cleaning, awareness campaigns against noise pollution, (loud speakers in public places), addressing anti-social behaviour on the campus or in their locality.

9 Mental Well-being

1. Importance of self-reflection

Discuss:

Steps involved in achieving mental well-being (self-reflection, self-awareness, applying actions, achieving mental well-being).

Different ways to achieve mental well-being (finding purpose, coping with stress, moral compass, connecting for a common cause).

The role of journaling in mental well-being.

2. Mindfulness and Meditation Practices

Benefits of practicing mindful habits and meditation for overall well-being.

1. Connecting with nature

Practising to be in the present moment – Nature walk, feeling the sun, listening to the natural sounds.

Exploring with intention – Hiking, gardening to observe the nature.

Reflecting on the emotions, and feeling kindled by nature.

2. Serving people

Identifying the needs of others.

Helping others.

Volunteering your time, skills and listening ear.

Finding joy in giving.

3. Creative Expressions

Indulging in writing poems, stories, music making/listening, creating visual arts to connect with inner selves.

(Mindfulness and Meditation) – Conducting guided meditation every day for 10 minutes and directing the students to record the changes they observe.

10 Situational Awareness (Developing Life skills)

1. Being street smart

Discuss:

Who are street smart?

Why is it important to be street smart?

Characteristics of a street smart person: Importance of acquiring life skills to become street smart – (General First-aid procedure, CPR Procedure, Handling emergency situations like fire, flood etc).

2. Digital Awareness

Discuss:

Cyber Security

Information Literacy

Digital Privacy

Fraud Detection

(sample):

(Street Smart) Inviting professionals to demonstrate the CPR Procedure

Conducting a quiz on Emergency Numbers

11 Understanding Addiction

Plan this session around:

Identifying the environmental cues, triggers that lead to picking up this habit.

Knowing the impact of substance abuse – Adverse health conditions, social isolation, ruined future, hidden financial loss and damaging the family reputation.

Seeking help to get out of this addiction.

:

Provide Worksheets to check the students' level of understanding about substance addiction and their impacts.

Share case studies with students from real-life.

Play/share awareness videos on addiction/de-addiction, experts talk.

*Conduct awareness programmes on Drugs and its ill effects. (Arrange Experts from the concerned government departments and NGOs working in drug addiction issues) and maintain the documents of the program.

Closure:

Each student should submit a Handwritten Summary of their Learnings & Action Plan for the future.

Assessments:

Use Self-reflective worksheets to assess their understanding.

- Submit the worksheets to internal audit/external audit.
- Every student's activities report should be documented and the same have to be assessed by the Physical Director with the mentor. The evaluation should be for 100 marks. No examination is required.

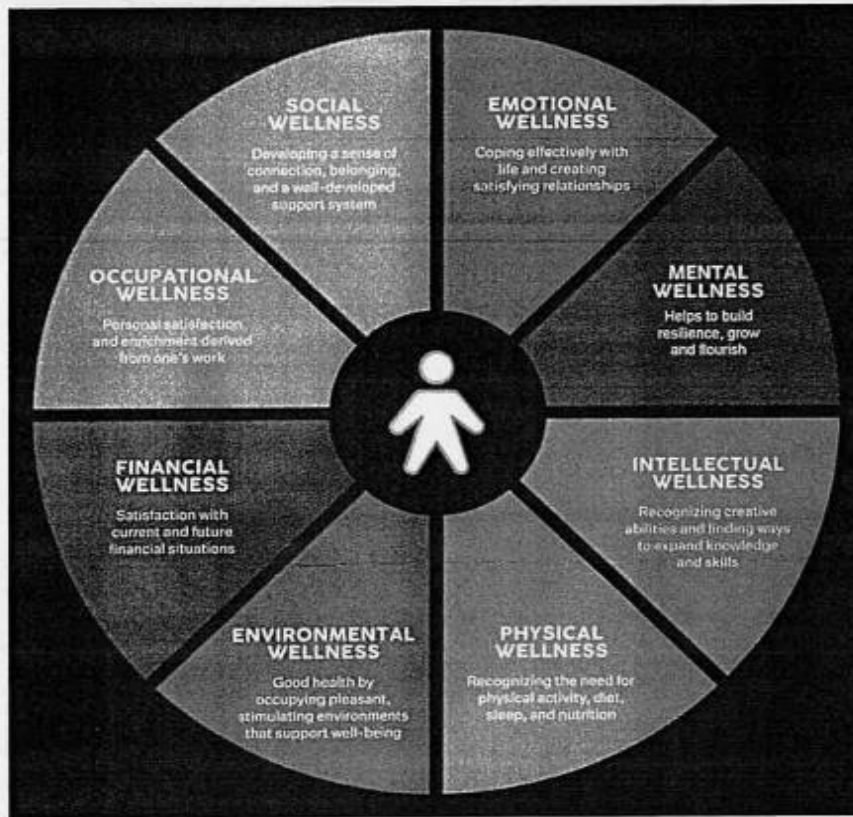
Scheme of Evaluation

Part	Description	Marks
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
Total		100

References/Resource Materials:

The course acknowledges that individual needs for references and resources may vary. However, here are some general reference materials and resources that may be helpful:

1. The Well-Being Wheel:



2. Facilities & Spaces: Some activities may require access to specific facilities, resources or spaces. Students may need to coordinate with the college administration to reserve these as required.

3. Online Resources:

1. United Nations Sustainable Development Goals - Goal 3 - Good Health & Well-Being: <https://www.un.org/sustainabledevelopment/health/>
2. Mindfulness and Meditation: Stanford Health Library offers mindfulness and meditation resources: <https://healthlibrary.stanford.edu/books-resources/mindfulness-meditation.html>

3. Breaking Bad Habits: James Clear provides a guide on how to build good habits and break bad ones: <https://jamesclear.com/habits>
4. 6 Ways to Keep Your Brain Sharp
<https://www.lorman.com/blog/post/how-to-keep-your-brain-sharp>
5. What Is Social Wellbeing? 12+ Activities for Social Wellness
<https://positivepsychology.com/social-wellbeing/>
6. How Does Your Environment Affect Your Mental Health?
<https://www.verywellmind.com/how-your-environment-affects-your-mental-health-5093687>
7. How to say no to others (and why you shouldn't feel guilty)
<https://www.betterup.com/blog/how-to-say-no>

Annexure

M. Sc., BIOCHEMISTRY

Syllabus

(With effect from 2026-2027)



(A State University, Accredited with “A++” Grade by NAAC and 26th Rank among Indian Universities by MHRD-NIRF)

DEPARTMENT OF BIOCHEMISTRY

BHARATHIAR UNIVERSITY

Coimbatore - 641 046, INDIA

MISSION

To educate and inspire the young minds from the basics to the latest innovations in science. To inculcate the traditional culture of ethics. To captivate unexplored sectors in research. Develop and enhance conservation of optimum academic environment to prepare professional graduates in the field of Biochemistry. To identify the local and global issues that need intervention by a Biochemist, and develop intelligent strategies and biochemical approaches in problem solving methods. Providing aspiring molecular life scientists with the opportunity to obtain a world-class education by engaging in a program of instruction that emphasizes: Quantitative analysis, Critical thinking, Rigorous and effective application of the scientific method, Fundamental chemical, biological and physical principles.

Candidate who has presented the work as “Not qualified as per CBCS” must resubmit the project again in the ensuing academic year.

SUPPORTIVE PAPERS OFFERED FOR OTHER DEPARTMENT STUDENTS

Paper I : Tools and techniques in bioscience

Paper II : Medical lab technology

Paper III : Clinical diagnosis in health and disease

CO-SCHOLASTIC COURSES

VALUE ADDED COURSES

Paper	Subject	Hrs Per week	University examination	
			Duration in Hrs.	Max. Marks
20BCVAC1	Animal Cell Culture Techniques	2	2	50
20BCVAC2	Pharmacovigilance	2	2	50

JOB ORIENTED COURSES

Paper	Subject	Hrs Per week	University examination	
			Duration in Hrs	Max Marks
20BCJOC1	Medical Laboratory Technologist	2	2	50
20BCJOC2	Quality control Biologist	2	2	50

Offered in collaboration with industries.

CO-SCHOLASTIC COURSES						
Certification Course in AI in Life Science ###	1	4	4	50	-	50
Health & Wellness	1	4	4	100	-	100
ONLINE COURSES						
Online Course for a period of 4 weeks duration: Swayam, MOOC Course etc.,	2	-	-	50	-	50
The scholastic courses are only counted for the final grading and ranking. However, for the award of the degree, the completion of co-scholastic courses is also mandatory.						

PRACTICAL COMPONENTS:

The M.Sc., Biochemistry Core Practical Examination having the following Marks:

INTERNAL MARKS: 25

Major Practical	10 marks
Minor Practical	5 marks
Spotters (A, B, C, D and E)	5 x 2 =10 marks
Total	25 Marks

EXTERNAL MARKS: 75

Major Practical	30 marks
Minor Practical	20 marks
Spotters (A, B, C, D and E)	5 x 2 =10 marks
Record and Viva	10 + 5 =15 marks
Total	75 Marks

THEORY COMPONENTS:

K1 - Remember	K2 - Understand	K3 - Apply	K4 - Analyze	K5 - Evaluate	K6 - Create
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The M.Sc. Biochemistry Core and Elective theory Examination having the following Marks.

CORE AND ELECTIVE PAPERS - MAXIMUM MARKS: 100

INTERNAL MARKS: 25

Test	15 marks
Assignment	5 marks
Seminar	5 marks
Total	25 Marks

EXTERNAL MARKS: 75
(Mapping with Co & knowledge level)

SECTION – A: 10x1=10 Marks (Question No. 1 to 10)

Choose the best Answer type. Answer all questions. All questions carry equal marks.

SECTION – B: 5x5=25 Marks (Either or type– Question No. 11 to 15)

Answer all questions. All question carries equal marks. Each answer should not exceed 2 pages.

SECTION – C: 5x8=40 Marks (Either or type– Question No. 16 to 20) Answer all questions. All Question carry equal marks. Each answer should not exceed 4 pages.

SUPPORTIVE PAPERS - MAXIMUM MARKS: 50

INTERNAL MARKS: 12

Test	6 marks
Assignment	3 marks
Seminar	3 marks
Total	12 Marks

EXTERNAL MARKS: 38

SECTION – A: 5 x 1 = 5 Marks (Question No. 1 to 5)

Short answer type questions. Answer all questions. All questions carry equal marks.

SECTION – B: 3 x 3 = 9 Marks (Either or type - Question No. 6 to 8)

Answer all questions. Each question carries 5 marks.

SECTION – C: 4 x 6 = 24 Marks (Either or type - Question No. 9 to 12)

Answer all questions. All question carries equal marks. Each answer should not exceed 2 pages.