DEPARTMENT OF BIOCHEMISTRY
PROGRAMME OUTCOMES AND COURSE OUTCOMES OF UNDER GRADUATE & POST GRADUATE PROGRAMME (2024 ONWARDS)

NAME OF THE PROGRAMME: BACHELOR OF BIOCHEMISTRY– PROGRAMME OUTCOME	
PO1	**Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study.
PO2	**Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
PO3	**Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
PO4	**Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non- familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
PO5	**Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.
PO6	**Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and- effect relationships; ability to plan, execute and report the results of an experiment or investigation.
PO7	**Cooperation / Teamwork:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.
PO8	**Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence, and experiences from an open-minded and reasoned perspective.
PO9	**PO9: Reflective thinking**: Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.

PO10	**PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
PO11	**PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.
PO12	**PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully withdiverse groups. .
PO13	**PO 13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.
PO14	**PO 14: Leadership readiness/qualities:** Capability for mapping out thetasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.
PO15	**PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

NAME OF THE PROGRAMME: B.Sc BIOCHEMISTRY – COURSE OUTCOMES	
SEMESTER I	
BIOMOLECULES	1. To Understand the structures and functions of carbohydrates 2. To Illustrate the classification, structure, and properties of amino acids and acquire knowledge about the classification of proteins, levels of structural organization of proteins 3. To Gain knowledge on the structure and properties of nucleic acids. 4. To study the importance of various lipids 5. To Gain knowledge on vitamins and minerals
TITRIMETRIC AND QUALITATIVE ANALYSIS - I	1. Quantify glycine by Sorenson's formol titration method 2. Quantify ascorbic acid in lemon by Dichlorophenol indo phenol dye method 3. Quantify glucose by Benedict method 4. Qualitatively analyze the carbohydrates and report the type of carbohydrate-based on specific tests 5. Determine lipid properties of unsaturation and fatty acid content by SAP number and acid number
ALLIED / GENERIC - 1 ALLIED CHEMISTRY	1. Gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications. 2. Evaluate the efficiencies and uses of various fuels and fertilizers 3. Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions. 4. Apply various thermodynamic principles, systems and phase rule. 5. Explain various methods to identify an appropriate method for the separation of chemical components.
CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES - I	1.Demonstrate advanced skills in using laboratory equipment specific to volumetric analysis, such as burettes, pipettes, and volumetric flasks. 2. Explain and perform different types of titrations, including acid-base, redox, complexometric, and precipitation titrations, and understand their applications. 3.Prepare standard solutions and accurately perform standardization procedures to ensure precise concentration measurements. 4. Accurately determine the concentration of unknown solutions through titration and interpret the results using appropriate mathematical and chemical principles. 5.Understand and apply the principles of chemical equilibria and reaction stoichiometry in the context of volumetric analysis

FC – 1 MEDICINAL DIET	1.Possess basic knowledge about diet 2.Sketch diet plan for GI diseases 3.Sketch diet plan for liver diseases 4.Sketch a diet plan for Infectious diseases 5.Prepare diet chart for Diabetes Renal and Cardio-vascular diseases
BIOMOLECULES	1.Classify, illustrate the structure and explain the Physical and Chemical properties of carbohydrates. 2. Indicate the classification, structure, properties and biological functions of amino acids. 3. Explain the classification and elucidate the different levels of structural organization of proteins. 4. Elaborate on classification, structure, properties, functions and characterization of lipids 5. Describe the structure, properties and functions of different types of nucleic acid
PRACTICAL III BIOMOLECULES	1. Qualitatively analyze the carbohydrates and report the type of carbohydrate-based on specific tests 2. Qualitatively analyze amino acids and report the type of amino acids based on specific tests 3. Determine the Saponification, Iodine, and acid number of edible oil 4.Isolate the nucleic acid from biological sources 5. Identify the biomolecules Carbohydrates and Amino acids by Qualitative test

MICROBIOLOGY I	1.Study the historical events that led to the discoveries and inventions and understand the Classification of Microorganisms. 2. Gain Knowledge of detailed structure and functions of prokaryotic cell organelles. 3. Understand the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms. 4. Explain the principles and working mechanism of different microscopes/Microscopes, their function, and the scope of application. 5. Understand the concept of asepsis and modes of sterilization and disinfectants.
MICROBIOLOGY PRACTICAL	1. Practice sterilization methods 2. Learn to prepare different media and their quality control. 3. Learn streak plate, pour plate serial dilution, and pigment production of microbes. 4. Understand Microscopy methods, different Staining techniques, and motility tests. 5. Acquire knowledge to isolate bacteria from the environment
TISSUE CULTURE	1. Introduction to plant tissue culture 2. Brief knowledge on the preparation of tissue culture media 3. Understanding of different methods of gene transfer 4. Gain knowledge on plant and animal cell culture techniques 5. Study of applications of genetically modified plants and animals.
Enzymes and Intermediary Metabolism	1. After studying Unit 1, the student will be able to acquire Fundamental knowledge in relevant principles of enzymes, the mechanism of enzyme kinetics, and enzyme catalysis emphasizes the capability of the students to work in a group and gather information. 2. After studying unit 2, the student will be able to illustrate the reactions of carbohydrate metabolism. Summarize the steps involved in ATP formation. 3. After studying After studied unit-3, the student will be able to identify the steps involved in the oxidation of fatty acids. 4. After studying unit 4, the student will be able to obtain knowledge on the metabolism of amino acids and the formation of urea. 5. After studying unit 5, the student will be able to summarize the steps involved in purine and pyrimidine synthesis.

Molecular Biology	1.After studying unit 1, the student will be able to Infer the central dogma of molecular biology, Show how DNA acts as vehicle of inheritance through experimental evidences, Outline the steps involved in replication and explain the events, enzymology, fidelity and inhibitors of replication in prokaryotes 2. After studying unit 2, the student will be able to Summarize the process of prokaryotic transcription 3. After studying unit 3, the students will be able to Define genetic code and Relate it to translation process and explain protein biosynthesis 4. After studying unit 4, illustrate the regulation of gene expression in prokaryotes using lac and trp operon 5. After studying unit 5 , gain knowledge on gene mutation and DNA Repair mechanisms
Physiology and Nutrition	1. After studying Unit 1, the student will be able to Gain knowledge about the various types of RBC and WBC cells, different types of blood groups, and basic structure and functions of heart. 2. After studying unit 2, the student will be able to Illustrate the Mechanism of digestion and absorption of macromolecules. 3. After studying unit 3, the students will be able to acquire the knowledge about the structure and functions of kidney, nephron and mechanism of urine formation. 4. After studying unit 4, the students will be able to describe the significance of carbohydrates, lipids and proteins and analyze their sources and functions in the body 5. After studying unit 5, the students will be able to analyse the biological importance of vitamins and Minerals
Practical-3 **Colorimetric Estimations 2. Enzyme Assay**	1.Demonstrate the collection of blood sample List the conditions essential for collection of urine and other clinical samples 2. Show the effect of pH, temperature and substrate concentration on the activity of salivary amylase Assay the activity of salivary amylase 3.Estimate creatinine by Jaffe's method, urea by DAM-TSC method, DNA by diphenylamine method and RNA by orcinol method 4. Identify and enumerate the total count of erythrocytes and leukocytes Differentiate leukocytes and calculate their total count 5. Define and determine the erythrocyte sedimentation rate, packed cell volume, and mean corpuscular volume and relate their clinical implications Utilize a sphygmomanometer to determine the blood pressure

Practical-4 **Hematology 2. Microbiology 3. Urine Analysis**	1. Demonstrate the collection of blood sample List the conditions essential for collection of urine and other clinical samples 2. Hands-on training to sterilization and gram staining 3. Identify and enumerate the total count of erythrocytes and leukocytes Differentiate leukocytes and calculate their total count 4.Define and determine the erythrocyte sedimentation rate, packed cell volume and mean corpuscular volume and relate their clinical implications Utilize sphygmomanometer to determine the blood pressure 5. Qualitatively analyze the normal and abnormal constituents of urine sample
MEDICAL LABORATORY TECHNOLOGY	1.After studying unit 1, the student will be able to Follow good laboratory practices and Prepare reagents for experiments 2. After studying unit 2, the student will be able to Examine urine and stool sample for normal and abnormal constituents 3. After studying unit 3, the student will be able to Estimate Hemoglobin and other hematological parameters 4. After studying unit 4, the student will be able to Perform blood grouping 5. After studying unit 5 the student will be able to Acquire knowledge on culturing microorganisms.

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NAME OF THE PROGRAMME: MASTERS IN BIOCHEMISTRY – COURSE OUTCOMES	
SEMESTER –I	
CORE PAPER I **BIOMOLECULES**	**1.**Helps to understand about the polysaccharides and its types 2.A Clear Knowledge regarding amino acids and protein characterization 3. Gives a clear understanding about the lipids and its role. 4. Provides the structure and properties of Nucleic acids 5. Analyse the functions and disorders of Vitamins and Porphyrins.
CORE PAPER II **CELL BIOLOGY**	1. Understand the structural organization and function of intracellular organelles 2. Illustrate the membrane structure and transport 3. Gain knowledge on Organization of Genes and Chromosomes 4. Study the Cell Division and Cell Cycle 5. Gain knowledge on cancer, cell death.
CORE PRACTICAL Isolation, Characterization Techniques and Quantitative Analysis	1.To understand and apply principles behind different quantitative analysis methods. 2. Students will be able to isolate glycogen, DNA, and RNA from biological samples using appropriate extraction and purification methods. 3. Students will successfully separate lipids, amino acids, and sugars using thin-layer chromatography (TLC) and interpret chromatograms effectively. 4. Students will accurately estimate the concentrations of glycogen, DNA, and RNA using spectrophotometric or other suitable techniques. 5. Students will be able to quantitatively analyze ascorbic acid, inorganic phosphorus, pyruvate, tryptophan, and proteins using standard spectrophotometric or colorimetric methods.

ELECTIVE COURSE 1 - HUMAN PHYSIOLOGY	1.Able to describe the composition of blood, including its formed elements and plasma, and explain their functions; comprehend the structure and function of the heart. 2. Able to describe the structure and functions of digestive juices and their role in digestion and absorption of macromolecules; components and functions of the respiratory system 3. Understand the organization of the nervous system and the conduction of nerve impulses. 4. understand the regulation of water balance, blood volume, blood pressure, electrolyte balance, and acid-base balance and physiology of excretion 5. Gain knowledge on - Endocrine glands and reproductive process
ELECTIVE COURSE – 2 PLANT BIOCHEMISTRY	1.Understand the photosynthesis and photoprotective mechanisms. 2 Illustrate the respiration and photorespiration 3 Gain knowledge on Nitrogen metabolism 4 Study the Sensory photobiology 5 Gain knowledge on Secondary metabolites
ABILITY ENHANCEMENT COMPULSORY COURSE 1 - - BIOSTATISTICS AND DATA SCIENCE	1. Concepts of statistical population and sample, variables and attributes. Tabular and graphical representation of data based on variables. 2. Conditions for the consistency' and criteria for the independence of data based on attributes. Measures of central tendency, Dispersion, Skewness and Kurtosis 3. Learning different sampling methods and analysing statistical significance. 4. Understanding students t test, ANOVA, Chi square test to analyse the significance of various research 5. Learning on data science, algorithm for machine learning, artificial intelligence and big data, their applications in clinical and pharma domain
VALUE EDUCATION - 1 **HUMAN RIGHTS**	1.The student will be able to know the nature of human rights its origin, the theories, the movements in the march of human rights and the facets of future of human rights.

	2. The student will be able to know the international dimension of human rights, the role of UN and the global effort in formulating conventions and declarations. 3.The student will be able to Perceive the regional developments of human rights in Europe , Africa and Asia and the enforceable value of human rights in international arena. 4. The student will be able to have knowledge on the human rights perspectives in India, more developed by its constitution and special legislations. 5. The student will be able to know the redressal mechanism made available in case of human rights violation confined to India.

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PO1	To make students understand the importance of biochemistry as a subject that deals with life processes, as well as the concepts, theories and experimental approaches followed in biochemistry, in order to pursue a research career, either in an industry or academic setting.
PO2	To develop analytical and problem-solving skills
PO3	To create an awareness among the students on the interconnection between the interdisciplinary areas of biochemistry.
PO4	To give the necessary practical skills required for biochemical techniques and analysis.
PO5	To develop a communication and writing skills in students.
PO6	To develop leadership and teamwork skills
PO7	To emphasize the importance of good academic and work ethics and their social implications.
PO8	To emphasize the importance of continuous learning and to promote lifelong learning and career development.
PO9	To teach students how to retrieve information from a variety of sources, including libraries, databases and the internet.
PO10	To teach students to identify, design and execute a research problem, analyze and interpret data and learn time and resource management.
PO11	Understand the principles and methods of various techniques in Biochemistry, Immunology, Microbiology, Enzyme kinetics and Molecular Cell Biology
PO12	Insight on the structure-function relationship of biomolecules, their synthesis and breakdown, the regulation of these pathways, and their importance in terms of clinical correlation

PO13	To understand the concepts of cellular signal transduction pathways and the association of aberrant signal processes with various diseases.
PO14	To visualize and appreciatethe central dogma of molecular biology, regulation of gene expression, molecular techniques used in rDNA technology, gene knock-out and knock-in techniques.
PO15	To create awareness in students about the importance ofgood laboratory practices and the importance of ethical and social responsibilities of a researcher.

NAME OF THE PROGRAMME: MASTERS IN BIOCHEMISTRY – COURSE OUTCOMES	
SEMESTER –III	
CORE PAPER I PHYSIOLOGY AND CELL BIOLOGY	**1.** Specifically understand the biological and chemical processes within a human cell **2.** identify and prevent diseases **3.** understand defects in digestion, nutritional deficiencies and intolerances, and gastrointestinal pathologies **4.** identify general characteristics in individuals with imbalances of acid- base, fluid and electrolytes. **5.** process the mechanism: the transmission of biochemical information between cell membrane and nucleus.
CORE PAPER II CLINICAL BIOCHEMISTRY	1. To appreciate the biological significance of sample collection and awareness of the diagnostic/screening tests to detect common noncommunicable diseases so as to understand role of laboratory investigations for biochemical parameters and understand the disorders associated with blood cells 2. To understand the etiology of metabolic diseases like diabetes and atherosclerosis and avoid such lifestyle disorders by healthy eating and correlate the symptoms with underlying pathology based on diagnostic and prognostic markers. 3. To understand the diagnostic application of serum/plasma enzymes to correlate their levels with the organ pathologies associated with specific diseases. 4. To appreciate the role of pre and post-natal diagnosis leading to

	healthy progeny. 5. To link the serum hormone levels and clinical symptoms with underlying hormonal disturbances. To review the onward transmission of signal via downstream signaling molecules from cell surface to the nucleus by different pathways by comparing and contrasting them and critically evaluate the network between them resulting in the biological outcome.
LABORATORY COURSE ON CLINICAL BIOCHEMISTRY	1.The student will be able to acquire knowledge and skill in hematology techniques. They will get familiar with methods and knowledge to interpret the electrolyte concentration in serum 2. The student will be able to assess the Liver Function and interpret the biochemical investigation in a given clinical situation 3.Skill to perform the Renal function test to assess the function of Kidney and report the abnormal parameters with reference range will be achieved by the student 4. To estimate the blood glucose content and lipid profile , to evaluate the alterations and record the observation in accordance to reference range will be acquired by the student 5: The Group Experiments will support them to acquire practical skills to work in health care sector and assist them to understand the automation process in clinical labs
CORE PAPER III MOLECULAR BIOLOGY	1: Comprehend the organization of genomes, the molecular basis of DNA replication, recombination and transposition, the significance of these processes, the various ways in which the DNA can be damaged leading to mutations and lesions and the different ways in which they are repaired. 2: Gain knowledge about how genes are transcribed and translated in prokaryotes and eukaryotes and how these processes are regulated, recognize the nature of the genetic code and the various experimental approaches used to crack the code. 3: Acquire knowledge of the molecular basis of RNA processing and RNA splicing and the various human pathologies that can result from defects of RNA modification. 4: Comprehend the techniques of gene silencing and its applications. 5: Apply the knowledge they have gained in understanding the above vital life processes to enhancing their analytical and problemsolving skills and develop an interest to pursue high quality research.

ELECTIVE COURSE – 1 **BIOCHEMICAL TOXICOLOGY**	1: To appreciate and understand the role of toxicological biomarkers to assess drug toxicities. 2: To conceive the role of disposition of drug in human system and their metabolism and methodologies pertaining to toxicological studies. 3: To understand and evaluate the functions of different organs on drug disposition and associated drug toxicities. 4 :To understand the toxicological response to foreign compounds and their pharmacological, physiological and biochemical effects. 5: To link the mechanism of toxicity and clinical symptoms with underlying physiological disturbances.
SKILL ENHANCEMENT COURSE [SEC] – II **MOLECULAR BASIS OF DISEASES AND THERAPEUTIC STRATEGIES**	1.Overall view about the complications of diabetes mellitus and its management. 2.Comprehensive understanding of the concepts of cancer biology and implicating the theoretical concepts for further research 3.Understand and appreciate the pathophysiology of conditions affecting the nervous system. 4.A thorough knowledge of renal and cardiac diseases with emphasis related to mechanistic aspects and therapeutic interventions. 5. A thorough knowledge on the experimental models of noncommunicable diseases that will be applied for future research or project dissertation. An in-depth knowledge on development of drugs against non-communicable diseases.