

Program Name: BSc Biomedical Science

Program Outcomes:

1. **Application of Biological Concepts:** Apply domain knowledge in biological sciences to address complex real-world issues across diverse disciplines, demonstrating interdisciplinary perspectives and problem-solving abilities.
2. **Proficiency in Practical Laboratory Skills:** Demonstrate competence in executing laboratory procedures following established protocols, including accurate measurement, sample preparation, instrument operation, and data recording, fostering practical skills essential for hands-on experimentation and scientific inquiry.
3. **Critical Analysis of Experimental Results:** Utilize critical thinking skills to evaluate experimental outcomes rigorously, interpret data accurately, and draw valid conclusions, facilitating evidence-based decision-making and scientific inquiry.
4. **Utilization of Modern Analytical Tools:** Apply advanced statistical, bioinformatics, and computational techniques to collect, refine, and analyze biological data, facilitating comprehensive data analysis and interpretation.
5. **Effective Scientific Communication:** Comprehend and effectively communicate scientific literature and experimental findings to the scientific community and society, demonstrating proficiency in oral and written communication skills.
6. **Research Competence and Innovation:** Apply research-based knowledge and techniques to investigate and solve complex research problems, demonstrating competence in experimental design and data interpretation.
7. **Ethical and Professional Conduct:** Adhere to ethical principles, integrity, and safety guidelines while conducting scientific investigations, ensuring responsible and professional conduct in research and practice.
8. **Continuous Learning and Adaptability:** Demonstrate adaptability and a commitment to life-long learning by constantly updating knowledge and skills to meet evolving scientific challenges and advancements.
9. **Leadership and Collaboration:** Work effectively as an independent researcher and collaborate efficiently with diverse teams, demonstrating leadership qualities and teamwork skills.
10. **Awareness of Societal Impact:** Recognize and understand the societal, environmental, and ethical implications of biological research and its applications, and work towards promoting environmental sustainability and societal well-being.
11. **Integration of Interdisciplinary Perspectives:** Integrate knowledge from diverse biological disciplines to address complex issues in health, environment, and agriculture, fostering interdisciplinary perspectives and solutions.
12. **Adaptation to Emerging Technologies:** Demonstrate the ability to adapt to and effectively utilize emerging technologies and methodologies in biological sciences, staying abreast of advancements and integrating innovative approaches into research and practice.

Program Specific Outcomes (PSOs) of Biological Sciences department

1. **In-depth Understanding of Biological Concepts:** Develop a comprehensive understanding of key concepts across various biological disciplines including Microbiology, Genetics, Cell Biology, and Immunology, fostering advanced cognitive skills for analysis and application.

2. **Research Proficiency and Critical Thinking:** Cultivate research aptitude and critical thinking skills by actively engaging in experimental design, data analysis, and interpretation, and effectively communicating scientific findings, ensuring evidence-based learning and synthesis of knowledge.

3. **Biological Data Analysis and Visualization:** Acquire proficiency in assessing, comprehending, analyzing, and visualizing biological data using statistical, bioinformatics, programming, and data analytics tools, facilitating advanced data-driven insights and scientific discoveries.

Course Outcomes

Semester	Course Name	Course Outcomes	
III	Bioprocess technology	CO-1	Describe the different types of fermentation processes and fermenters
		CO-2	Understand Quality Assurance
		CO-3	Understand Scale-up, Scale-down and downstream processes
	Genetics	CO-1	Explain the Mendelian inheritance of traits
		CO-2	Describe the factors that regulate sex determination
		CO-3	Understand and explain factors that induce mutations
		CO-4	Explain quantitative inheritance
	Immunology	CO-1	To comprehend the concepts and components of innate immunity, including anatomical barriers, phagocytosis, induced cellular responses, inflammation, and natural killer cells
		CO-2	To understand the fundamental concepts of immunology, including antigens, antibodies, and the major histocompatibility complex (MHC), and their roles in immune responses.
		CO-3	To understand the components and activation pathways of the Complement system, the generation of immune responses, and the principles of immunological techniques.
	Biochemistry: Metabolism	CO-1	Understand the catalytic role of enzymes
		CO-2	Understand the metabolism of nutrient molecules in physiological and pathological conditions.

		CO-3	Describe importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
	Biophysics	CO-1	Understand the basic principles of electromagnetic radiation, molecular orbital theory, and the Beer-Lambert law, and their relevance to biophysical methods in spectroscopy.
		CO-2	Understand the principles of viscosity, sedimentation, flow cytometry, biosensors, biological membranes, and radiation biophysics.
	Project management skills	CO-1	Explain and practice project management, which involves various elements, planning, scheduling, qualities of leadership and teamwork.
	Practical S31	CO-1	Screen and isolate antibiotic or vitamin B12 producing bacteria
		CO-2	Enrich and characterize mutant via antibiotic selection technique
		CO-3	Use statistical methods to study pedigree analysis
		CO-4	Predict genetic crosses using probability theory
	Practical S32	CO-1	Identify blood groups, perform total leukocyte count
		CO-2	Perform DOT ELISA
		CO-3	Use spectrophotometer for determining different parameters such as viscosity, structure, concentration and purity of biological macromolecule.
	Sustainability initiative	CO-1	Define sustainability and identify major sustainability challenges.
IV	Medical microbiology	CO-1	Students will understand the principles of microbial transmission, infection, and the body's immune response to various pathogens
		CO-2	To acquire knowledge about the characteristics of pathogenic microorganisms and their interactions with the human host.
		CO-3	Students will gain knowledge about the pathogenesis of specific microbial diseases, including the factors contributing to disease progression, clinical manifestations, and potential treatment options

	Cell Biology	CO-1	Compare and differentiate the cellular organization, Cell cycle regulation, Cell communication
		CO-2	Understand handling of cell lines, cell culturing and characterizing
		CO-3	Interpret underlying principles of various molecular pathways
	Developmental Biology	CO-1	To provide students with a comprehensive understanding of the key processes and mechanisms involved in the development of multicellular organisms.
		CO-2	To enable students to critically evaluate and analyze existing theoretical frameworks and models that explain various aspects of developmental biology.
		CO-3	To critically analyze and discuss the medical implications associated with developmental biology.
	Neurobiology and Clinical Psychology	CO-1	Explain organization and communication mechanism in the nervous system
		CO-2	Understand the mode of signal transduction in sensory nervous system
		CO-3	Describe the various cognitive functions of the brain
		CO-4	Understand and explain the Psychological processes
	Computational tools	CO-1	Do data analysis on MS Excel and have hands on knowledge of the same
		CO-2	Learn tools and techniques for Statistical analysis and Data transformation
		CO-3	Understand Data Mining techniques and their implementation
		CO-4	Analyze Data using Machine Learning algorithms in R
	Alternative Systems of Medicine	CO-1	Describe the historical development of alternative system of medicine in India.
		CO-2	Enlist and describe AYUSH system of medicine and non AYUSH system of medicine.
CO-3		Describe the administrative infrastructure for management of plural systems in medical education and public health.	
Practical S4P1	CO-1	Identify bacteria from colony morphology and biochemical characteristics	
	CO-2	Grow specific bacterial species using differential media	

		CO-3	Study cell cycle in onion root tip
		CO-4	Work using aseptic techniques in biosafety cabinet followed by culture and maintenance, cryopreservation of cell lines
	Practical S4P2	CO-1	Identify different stages of development such as gastrulation, organogenesis, extraembryonic membranes from chick embryo and Drosophila
		CO-2	Dissect and display of nervous system of invertebrates and vertebrates.
V	Parasitology and virology	CO-1	Describe the taxonomic principles for the subdivision of viruses and describe the characteristics of the most important human pathogenic viruses and parasites.
		CO-2	Describe the infection process at the organism level
		CO-3	Describe pathogenesis, epidemiology and life cycle of parasites and viruses.
	Molecular Biology: DNA and replication	CO-1	Understand genome structure, chromatin and nucleosome
		CO-2	Describe processes of DNA mutations and repair
		CO-3	Describe the mechanism of DNA replication process in a cell
	Pathology	CO-1	Understand the cellular adaptations, cell Injury, cell death, acute and chronic Inflammation
		CO-2	Explore the mechanisms of tissue renewal, repair, healing, fibrosis and hemodynamic disorders
		CO-3	Gain knowledge of applications of pathology in understanding diseases
	Pharmacology and Toxicology	CO-1	Understand general principles of pharmacology
		CO-2	Enlist steps involved in drug discovery and development
		CO-3	Explain the different aspects of clinical pharmacology
		CO-4	Describe types of toxins, their metabolism and toxicity testing
	R in Biology	CO-1	Analyze biological data using R program
		CO-1	Perform literature search on research topic

	Research Methods	CO-2	Summarize the various components of Scientific Methods and Research Aptitude
		CO-3	Integrate the Good Laboratory Practices in research
		CO-4	Prepare and present a research topic as a poster
	Practical S5P1	CO-1	Understand and explain life cycle of protozoans, round worms and vectors
		CO-2	Enlist the various detection methods of viruses from serum or blood
		CO-3	Isolate DNA from eukaryotic or prokaryotic cell
	Practical S5P2	CO-1	Perform tissue processing, sectioning, staining, and histopathological observations.
		CO-2	Perform routine diagnostics tests for detection of various pathological conditions.
		CO-3	Perform experimental pharmacological assays using animal simulations
VI	Clinical Biochemistry	CO-1	Understand the mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients.
		CO-2	Define the metabolic role of certain tissues and metabolites in physiological and/or pathological processes
		CO-3	Discuss the impairments in metabolic pathways, including inborn errors of metabolism
		CO-4	Discuss the biochemistry and pathophysiology associated with tests performed in a clinical biochemistry laboratory
	Molecular Biology: Transcription and Translation	CO-1	Understand the mechanism of transcription in prokaryotes, including the role of RNA polymerase and the regulation of gene expression through initiation control (lac and trp operons).
		CO-2	Explore the complex process of transcription in eukaryotes, including RNA modifications, splicing pathways, and mRNA transport.
		CO-3	Comprehend the assembly line of polypeptide synthesis, including ribosome structure, protein synthesis steps, and the regulation of translation.

	Advanced Immunology	CO-1	Describe structural and molecular mechanisms of innate and adaptive immunity
		CO-2	Know structural and molecular aspects of immune regulation including cell signaling and activation
		CO-3	Know cellular and molecular bases of autoimmunity, transplantation reactions, tumours, infectious and immunodeficiency disorders
		CO-4	Know recent developments in vaccine development and techniques in clinical immunology
	Bioinformatics	CO-1	To gain knowledge of the inter-disciplinary nature of Bioinformatics, biological databases its importance, use and applications
		CO-2	To gain knowledge of nucleotide and protein sequence retrieval and analysis.
		CO-3	To gain knowledge of the basics of molecular modeling, protein/RNA structure modeling, and molecular dynamics simulation.
	Pharmaceutical Industry and Clinical Research	CO-1	To introduce students to aspect such as clinical research, clinical trials, pharmacovigilance.
		CO-2	To introduce students to medical writing and clinical trial auditing as well as inspection.
	Research project	CO-1	Develop proficiency in conducting literature studies and research methodology.
		CO-2	Acquire practical skills in conducting laboratory experiments related to the research project.
		CO-3	Produce a comprehensive research report and effectively present and discuss the research findings
	Practical S6P1	CO-1	Perform diagnostic tests and analyze the data related to different pathophysiological conditions of humans
		CO-2	Perform RT PCR to study expression of specific genes
	Practical S6P2	CO-1	Perform immunological assays that are routinely used in the field of immunology
		CO-2	Use bioinformatics tools to search for sequences searching, phylogenetic analysis, primer design.

CO-PO mapping

Se- mes- ter	Course	CO No.	PO- 1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO- 10	PO- 11	PO- 12	PSO- 1	PSO- 2	PSO- 3	
III	Bioprocess technology	CO- 1	H	L	M			H			L			H	M			
		CO- 2	H	H	H	M				M				L	M	L		
		CO- 3	H	H	M				L	M						M		
	Genetics	CO- 1	H		L					M				M	L	H		
		CO- 2	H				L	M		H		L	L		H			
		CO- 3	H	L		L			L					M		H	L	
		CO- 4		M		H			H			L		M		H		
	Immunol- ogy	CO- 1	H	L	L		L	H		M	L			L	H	H		
		CO- 2	H	H	H	M				M					L	H		
		CO- 3		H					M	L		L	M		H	H	M	
	Biochemis- try-metab- olism	CO- 1	H	L	L				L					M		H		
		CO- 2	H				L			L			M	M	H	H		
		CO- 3		M		M				M	L		M	H	H	H		M
	Biophysics	CO- 1	H	M	L	M		M							L	M	H	

		CO-2	H	M	L	M		M	L			H	H	M	M	H	
	Project management skills	CO-1			M		H	M	M	L	H		M			H	L
	Practical S3P1	CO-1	L	H	H			H		L						H	
		CO-2	L	H	H	M		H		L		M				H	M
		CO-3			M	H		M		M	M	M	L	L		M	H
		CO-4		L	M	H		M		M	M	M	L	L		M	H
	Practical S3P2	CO-1		H	H			L	L	M			L		L		
		CO-2		H	H			L	L	M			L		L	M	
		CO-3	M	H	H	M		M		M						M	
	Sustainability initiative	CO-1	L	M	M	M	M	H	H	H		H	H	M	L		M
IV	Medical microbiology	CO-1	H	M	M		L	L					M		H	M	
		CO-2	H	M				L			L	M	M	L			
		CO-3	H	H	H	M		M		H		M	M			M	
	Cell Biology	CO-1	H	M				M		M			M	L	H		
		CO-2	M	M	H	M		H				L		M	H		
		CO-3	H	L		M		L					L	M		M	

	Developmental Biology	CO-1	H	L	M	L		L				L		H			
		CO-2			H	H		M		M			L		H		
		CO-3		H	M	M		M	L	M		H	H	H	H		
	Neurobiology and Clinical Psychology	CO-1	H		L	M		M		L		M	M		H		
		CO-2	H			H		L		M				L	H		
		CO-3	H			L		L		H		H	H	M		M	
		CO-4	M			M	M	L		M		M	H	H		M	
	Computational tools	CO-1		H	H	H	M	M		H	L		M	H			H
		CO-2		H	H	H	L	M	M	M			L	M			H
		CO-3			H	H	H	M		M			H	H			H
		CO-4			H	M	H	M		H			H	H			H
	Alternative Systems of Medicine	CO-1	M				H	L		L			M	L	M		
		CO-2	M		H		L	M		H		H	H	H		L	
		CO-3			L				M		M	H	H	L		L	
	Practical S4P1	CO-1	M	H	H		M			M			L		L	H	
CO-2		M	H	H			M		H			L			H		
CO-3		M	H	H		M			M				L	M	H		

		CO-4	L	H	H	L		L					H		H		
	Practical S4P2	CO-1	M	H	H		L	L			M	L	M	L	M	H	
		CO-2	M	H	H		L	L					L		M	H	
V	Parasitology and virology	CO-1	H		L	L		L					L	L	H		
		CO-2	H				M	L					L		H		
		CO-3	H		L		L	M		H			H	M	H		
	Molecular Biology: DNA and replication	CO-1	H		L	L	L			M			L	L	H		
		CO-2	H		M	M	L			M			H	M	H		
		CO-3	H		H	M	L			H			H	M	H		
	Pathology	CO-1	H							M		M	L	L	H		
		CO-2	H							M		M	L	L	H		
		CO-3	H	L						H		H	H	L	H		L
	Pharmacology and toxicology	CO-1	H		M	L		L		H		M	M	M	H		
		CO-2	M		L	H		M	L	H		H	H	H			L
		CO-3			M	M	M			H	M	H	H	H			L
		CO-4	H									M	M	L	L		L

	R in Biol-ogy	CO-1				H		H		M			H	H			H
	Research methods	CO-1	M			L	H	M	L				L				H
		CO-2	L	M	M		H	H					M			M	H
		CO-3		H	M			H	H			L	M	L		M	L
		CO-4					H	M		L			L		L	M	L
	Practical S5P1	CO-1	H	M	L			M		M			L		H		
		CO-2	L	M	M			M					L			H	
		CO-3	M	H	L			H		M	L					H	
	Practical S5P2	CO-1	L	H	H			H		M			L		L	H	
		CO-2	L	H	M					L	L	H	H			H	
		CO-3	L	M	M	H		H				H	H		L	H	H
VI	Clinical Bi-chemistry	CO-1	H			M				M		H	M	M	H		
		CO-2	H		M	H				M		H	H	M	H		
		CO-3	H		M	L				H		H	H	H	H	M	
		CO-4	L		H	M	H	M				L	L		M	H	
	Molecular Biology:	CO-1	H			M				M		H	M	M	H		

Transcription and Translation	CO-2	H		M	H				M		H	H	M	H		
	CO-3	H		M	L				H		H	H	H	H		
Advanced Immunology	CO-1	H		H					M		L	M		H		
	CO-2	H		H					M		L	M		H		
	CO-3	H				L	M	L	H		H	H	L	H		
	CO-4	M	M		H			L		L	H	M	H	H	M	L
Bioinformatics	CO-1	L			H		M		H			H	H			H
	CO-2	L		L	H		M		H			M	H	M	M	H
	CO-3			M	H		L		M		L	H	H			H
Pharmaceutical Industry and Clinical Research	CO-1				H	L	M	L	M		M	H	M	L	L	H
	CO-2			L	H	H	M	H	H			M	H		M	H
Research project	CO-1	M	M	M	H	H	M	M	M			L	L	M	M	H
	CO-2		H	H	M		H		H	M		M	M		H	
	CO-3			M	M	H		H		H	L			M	H	H
Practical S6P1	CO-1		H	H	M		H					L	L		H	H
	CO-2		H	H	L		M		L			M			H	
Practical S6P2	CO-1		H	H	M		H					L	L	L	H	

