Program Outcome (POs)

(s): Students / graduates will be able to

PO1: Apply knowledge of mathematics and science to solve complex problems.

PO2: Generate solutions by conducting experiments and applying techniques to analyze and interpret data

PO3: Design solutions for problems and system components /processes that address public health, safety, cultural, societal and environmental needs.

PO4: Indentify, formulate, and analyze the problems providing scientific solutions using first principles of applied sciences, mathematics, and research.

PO5: Apply professional ethics and norms of professional practice.

PO6: Ability to communicate effectively with both professionals and society.

PO7: Engage in independent and lifelong learning in the broadest context of the technological change.

PO8: Create, select and apply appropriate techniques, resources and modern tools for design, modeling, simulation and analysis.

PO9: Understand the impact of solutions on society, environment and work for sustainable development.

PO10: Apply contextual knowledge to assess societal, health, safety, legal and cultural issues relevant to the professional practice.

PO11: Function effectively as an individual and as a member or leader in diverse multidisciplinary teams.

PO12: Apply research based knowledge and methods for analysis and interpretation of data and synthesis of information.

PSO: (Dept. of Computer Sci. & IT, Nanded)

Pass out professionals of B.Sc. (CS)/BCA/ M.Sc. (SE) program should be able to:

- Apply and demonstrate skills in emerging area including Computer system security, Cloud Computing, Image Processing, Machine learning
- Apply the Knowledge of modern technologies through learning IoT, Arduino programming.
- Demonstrate competence in programming technologies using open source platforms.

PSOs (Department of Biotechnology and Bioinformatics)

Pass out professionals of B.Sc. (BT) / M.Sc. (BT) program should be able to:

- **PSO 1**: To impart an ability to apply biotechnology skills (including molecular & micro biology, immunology & genetic engineering, bioprocess & fermentation, enzyme & food technology and bioinformatics) and its applications in core and allied fields.
- **PSO 2**: To provide students with the concepts and research approaches for their higher career in the field of biotechnology and develop their scientific interest.
- **PSO 3**: To impart in-depth practical oriented knowledge to students in various thrust areas of biotechnology, so as to meet the demands of industry and academia.

PSOs (Department of Biotechnology and Bioinformatics)

Pass out professionals of B.Sc. (BI) / M.Sc. (BI) program should be able to:

- **PSO 1:** Students will proficiently utilize bioinformatics tools and software to analyze biological data, interpret sequences, and predict protein structures, demonstrating competency in handling bioinformatics databases and computational algorithms.
- **PSO 2:** Students will apply computational techniques such as sequence alignment, phylogenetic analysis, and genome assembly to solve real-world biological problems, showcasing their ability to integrate biological knowledge with computational methods.
- **PSO 3:** Students will demonstrate an understanding of ethical considerations in bioinformatics research and practice, adhering to principles of data privacy, confidentiality, and responsible data sharing in biological research and clinical applications.

Course Outcome statements

FY B.Sc.BT	
Functional English	Apply their knowledge of grammar to communicate effectively.
	Enhance communicative skills in listening, speaking, writing, and reading.
	Analyze the use of English in various real-life situations.
	Demonstrate fluency in conversations and show efficiency in interactional skills.
	Implement grammar in communicative contexts to become effective and efficient English communicators.
INTRODUCTION TO BIOTECHNOLOGY	Define and describe biotechnology as a science and outline significant milestones in its history.
	Explain the applications of recombinant DNA technology in biotechnology.
	Relate the applications of biotechnology in developing novel therapeutics, vaccines, nutritionally enriched crops, and biofuels for various industries.
	Apply recombinant DNA technology to design new vectors and develop innovative processes.
BASIC BIOSCIENCE	Classify and identify organisms and their diversity across the tree of life.
	Explain the relationship between structure and function of organisms and their environment.
	Describe the characteristics and main structures of viruses, prokaryotes, and eukaryotes and identify potential health risks posed to humans
	student will understand biodiversity of living organisms.
MICROBIOLOGY-I	students will be able to summarize the history of microbiology.
	Students will be able to explore the scope of microbiology in various scientific fields.
	Students will be able to explain the detailed cell structure of microbes.
	Students will be able to understand the fundamental concepts of microbiology.
Business Communication	students will be able to apply their knowledge of Basic English usages to fulfill different purposes.
	students will be able to enhance their English skills for entrance examinations and aptitude tests.
	Students will be able to utilize English effectively in real-life situations.
	Students will be able to develop fluency in writing various letters and reports required for professional life.
	Students will be able to compose research papers, emails, and moral stories in English.

Principles of Genetics	Students will be able to explain the principles of Mendelian genetics.
	Students will be able to analyze the scope and significance of genetics by applying hereditary principles and understanding gene-environment interactions.
	Students will be able to identify chromosomal aberrations and understand the structure of chromosomes.
	Students will be able to demonstrate explicit knowledge about the concept of genes and analyze human population genetics.
BIOMOLECULE	Analyze the classification, structure, and function of biomolecules.
	Explain the nature, classification, structure, and function of amino acids, peptides, and proteins.
	Interpret the structures, functions, and properties of nucleic acids (DNA and RNA).
	Apply knowledge of the structures, functions, and properties of lipids, fatty acids, and vitamins.
Microbiology-II	Analyze the growth statistics of microbes.
	Evaluate different physical and chemical methods to control microbes.
	Design artificial nutritional media and develop methods for growing microorganisms in a laboratory.
	Identify various types of microorganisms and assess their applications across different sectors.
SY B.Sc.BT	
Metabolism	**Explain** autotrophic metabolism in detail.
	Investigate the process of energy generation through carbohydrate metabolism.
	Analyze alternative mechanisms of energy generation.
	Describe the process of fatty acid biosynthesis.
Advanced Cell Biology	**Describe** the structural organization and functional aspects of cells.
	Analyze the molecular architecture of cells and cell organelles.
	Examine how cells interact with their environment through the exchange of information and transport of molecules.
	Evaluate the regulation of various cellular mechanisms.
	Assess the regulation of various cellular mechanisms.
Molecular Biology	**Understand** the fundamental molecular aspects of biology.
	Explain the storage and translation of genetic information at the molecular level in both prokaryotic and eukaryotic systems.

Molecular Biology	**Analyze** the concepts of the central dogma of molecular biology, including DNA replication and protein synthesis.
	Extend comprehension of the molecular mechanisms of gene expression, encompassing how genetic information is stored, expressed, and transmitted across generations.
Bioinstrumentation Tech	**Explain** the principles, construction, operation, and types of microscopes.
	Describe the principles and various types of chromatography, along with their operational methods.
	Analyze the application of centrifugal force in biological contexts.
	Understand the principles, operation, types, and applications of electrophoresis.
BASIC ENZYMOLOGY	**Identify** domains and motifs in proteins and **predict** their presence based on structural information.
	Explain the relationship between the structure and function of proteins.
	Understand the principles of enzyme isolation and purification from various sources.
	Comprehend various methods in enzyme technology and **evaluate** their commercial applications.
Applied & Medical Microbiology	**Explain** the concepts of soil and air microbiology.
	Describe the concepts of water and food microbiology.
	Understand the principles of medical microbiology.
	Identify causative agents, symptoms, and control measures for various microbial diseases.
Immunology and Virology	**Describe** the various cells of the immune system and their roles.
	Explain fundamental concepts of immunology and **apply** them in diagnostic and immunological techniques.
	Understand the basics of virology.
	Analyze the biology of viruses, including their life cycles, cultivation, vaccines, and antiviral strategies.
Plant Tissue culture	**Understand** the basics of instrumentation, requirements, and laboratory organization.
	Describe different types of culture techniques.
	Explain the process of in-vitro propagation of plants and their maintenance.
	Gain knowledge of plant modification techniques and their applications in crop improvement.
TY B.Sc.BT	
	Develop an understanding of the concept of blotting and sequencing of biomolecules.

r DNA technology-CCBT-1E	Introduce students to the genomic structure of microbes, techniques pertinent to recombinant DNA technology, and the application of genetic engineering.
	Prepare students' knowledge regarding skills in DNA extraction, purification, and quantification. Additionally, explain the mechanism of transformation.
	Provide information about the basic principles of recombinant DNA technology and demonstrate basic techniques in recombinant DNA technology.
BIOPROCESS TECHNOLOGY	Apply the concept of Bioprocess Engineering to analyze and solve complex problems in biotechnological processes.
	Evaluate the methods and principles of air and media sterilization to ensure optimal conditions for bioprocessing.
	Assess various types of bioprocesses to determine their suitability and efficiency for different applications.
	Analyze the industrial production of enzymes, including the processes involved, factors affecting production, and methods for optimization.
	Apply the concept of scaling up bioprocesses, considering factors such as reactor design, mass transfer limitations, and bioreactor operation parameters.
Medical Biotechnology	Analyze the types of immunization
	Evaluate the functioning and importance of antibodies
	Examine the structure and function of the immune system
	Examine the relationship between carcinogens and cancer,
PHARMACEUTICAL BT	Analyze the production and medicinal applications of secondary metabolites
	Evaluate the role of chemical pharmaceutical products in the treatment of diseases
	Apply the concept of chemical products in the treatment of diseases
	Examine various applications of computational approaches in drug discovery
INDUSTRIAL BT	Understand various fermentation processes, including fermenter design, equipment types, and microbiological processes involved.
	Acquire knowledge concerning equipment and design principles for sterilization cycles of large-scale media in the fermentation industry.
	Apply microorganisms in technological operations, substrate preparation, and control of fermentative processes, including product isolation.
	Analyze the layout of a fermentation unit and the sequential steps involved in bioprocess technology to comprehend the overall process.
Agriculture BT	Comprehend the role of microbes in soil improvement and their impact on agricultural productivity.
	Acquire knowledge regarding the preparation and application of biofertilizers in agricultural practices.
	Analyze various plant diseases and their corresponding solutions, incorporating microbial and biotechnological interventions.
	Understand the significance of biotechnology in agriculture and allied industries.

FY B.Sc BI	
Functional English	**Apply** their knowledge of grammar to communicate effectively.
	Enhance communicative skills in listening, speaking, writing, and reading.
	Analyze the use of English in various real-life situations.
	Demonstrate fluency in conversations and **show** efficiency in interactional skills.
	Implement grammar in communicative contexts to become effective and efficient English communicators.
Introduction to Bioinformatics	**illustrate** bioinformatics as a science, highlighting key milestones in its development.
	Explain the revolutionary impact of the internet on bioinformatics,
	Explainthe objectives, methods, and significance of the Human Genome Project, data mining, identifying its various tasks.
	Identify the principles of sequence , molecular commonly used formats and **exploring** advanced fields within bioinformatics.
Basics of Biological Sciences	**Explore** bacterial life forms and biodiversity to enhance understanding.
	Comprehend fungi life forms to gain insight into their characteristics.
	Describe virus life forms to understand their structure and behavior.
	Acquire knowledge of algae life forms to recognize their diversity and ecological roles.
Business Communication	students will be able to **apply** their knowledge of Basic English usages to fulfill different purposes.
	tudents will be able to **enhance** their English skills for entrance examinations and aptitude tests.
	Students will be able to **utilize** English effectively in real-life situations.
	Students will be able to **develop** fluency in writing various letters and reports required for professional life.
	Students will be able to **compose** research papers, emails, and moral stories in English.
Basics of Biochemistry	**Grasp** the relevance, basic concepts, and theories of chemistry within a biological context.
	Classify and **comprehend** the nature of biomolecules.
	Apply knowledge to analyze the structures, functions, and properties of carbohydrates, lipids, proteins, and enzymes.
	Demonstrate understanding of the structures, functions, and properties of nucleic acids (DNA and RNA).
	Grasp Mendelian genetics inheritance and related concepts.

Basics of Genetics	**Apply** principles of hereditary genetics and diseases to comprehend the scope and significance of genetics.
	Familiarize students with chromosome structure, function, and inheritance patterns in animals and plants.
	Attain explicit knowledge about Population Genetics and Human Genetics concepts.
Basics of Biocomputing	**Explain** the basic architecture of computers and understand their functioning in the modern era.
	Demonstrate various computer hardware peripherals and devices.
	Acquire knowledge about various operating systems, including GUI operating systems and command-line environments.
	Gain proficiency in using MS-Office applications.
SY B.Sc.BI	
Molecular Biology	**Analyze** the basics of molecular biology, including genetic material functioning and transfer.
	Examine the storage and translation of genetic information at the molecular level in prokaryotic and eukaryotic systems.
	Explore the structure, modification, and functioning of elements in the central dogma of biology.
	Investigate the molecular mechanisms of gene expression for understanding genetic information storage, expression, and transmission among generations.
Biodiversity and Phylogenetics	**Identify** concepts such as biodiversity.
	Analyze concepts of species richness in India.
	Examine concepts of phylogenetics.
	Explore various databases for studying biodiversity.
Advanced Bioprogramming	**Master** fundamental Python programming concepts, write scripts for computational tasks, and demonstrate proficiency in using core data types.
	Apply control flow structures, functions, and file I/O operations in Python for effective code organization and execution control.
	Explain basic principles and object-oriented concepts in Python.
	Build a solid foundation in Python programming for further learning in advanced topics and application domains like bioinformatics.
Basics of Immunology	**Classify** Immunoglobulins and **illustrate** their roles within the immune system.
	Explain the functional activities of cells in the immune system.
	Categorize different types of immune responses.
	Differentiate between immunodeficiency diseases and **understand** autoimmunity.

Programming in Perl	**Understand** fundamental Perl programming concepts and **explain** programming strategies.
	demonstrating proficiency in Perl syntax and semantics, and **utilize** Perl's built-in data types effectively.
	Apply control structures like loops and conditional statements, and **implement** subroutines and modules to promote modularity and code readability.
	Develop a solid foundation in Perl programming, preparing for further specialization in Perl-based development for bioinformatics tasks
Immunoinformatics	**Gain** insights into general aspects of the immune system and **understand** key terms in Immunology.
	Examine B-Cell Differentiation, T-Cell Differentiation, and Major Histocompatibility Complex (MHC) in detail.
	Acquire knowledge of terms, techniques, and types in immunology.
	Familiarize with Epitope Types and prediction tools for vaccine designing.
Analytical Techniques for Bioinformatics	**Comprehend** the basics of proteins and the tools and techniques used to analyze them.
	Explain protein sequencing and post-translational modifications (PTMs) of proteins.
	Explain the tools of proteome analysis by utilizing EST, STS, and GSS databases.
	Identify tools for sequence alignment and **describe** gene and protein structure prediction methods.
TY B.Sc.BI	
Genetic engineering	**Analyzes** the concept of blotting and sequencing of biomolecules to develop understanding.
	Synthesizes knowledge of genomic structure of microbes, techniques in recombinant DNA technology, and application of genetic engineering for student familiarity.
	Demonstrates skills in DNA extraction, purification, and quantification, and **explains** the mechanism of transformation to prepare student knowledge.
	Evaluates basic knowledge of genetic engineering and basic techniques in recombinant DNA technology for comprehensive understanding.
Computational structural biology	**Enhance** understanding of computational approaches and applied Bioinformatics in structural biology.
	Acquire knowledge of databases of macromolecules and tools for their visualization.
	Identify domains and motifs in a protein, and understand the basis of their secondary structure prediction.
	Explain methods used in protein 3D structure prediction and **analyze** the relationship between structure and function of a protein.
Chemoinformatics	**Apply** chemical structure representation techniques for drug discovery practices.
	Enhance knowledge of chemoinformatics tools used in drug discovery.
	Comprehend physiochemical properties relevant to drug discovery.

	Acquire knowledge of drugs and drug targets essential for drug discovery.
FY M.Sc BT	
CELL & DEVELOPMENTAL BIOLOGY	**Analyze** the basic concept of cell structure and architecture.
	Explain the characteristics and basic needs of living organisms and ecosystems.
	Integrate the basics of cell biology, developmental biology, and the fundamentals of Cancer.
	Synthesize understanding of the basic concept of cell interaction.
Microbiology & Virology	"Students **analyze** the development (history) of microbiology and microbial classification."
	"Students **synthesize** understanding about nutrition and metabolic strategies of microbes."
	enable to understand growth patterns in microorganisms."
	"Provide **in-depth** understanding about viruses, their cultivation, bacteriophages."
Biochemistry	Students will **comprehend** the nature, characteristics, and classification of proteins/enzymes, as well as the identification of domains and motifs in a protein and the basis of their prediction.
	Students will **analyze** the nature and understand the relationship between the structure and function of a protein.
	Students will **demonstrate** knowledge of the principles for isolation and purification of enzymes from various sources, various methods involved in enzyme technology, and their commercial applications.
	1. Students will **gain** understanding of the rate of reactions and order of reactions, enzyme kinetics and inhibitions, and their kinetics.
TECHNIQUES IN BIOTECHNOLOGY	**Explain** the working principles of biological techniques such as microscopy and electrophoresis.
	Grasp the working principles of biological techniques like chromatography.
	Comprehend the working principles of biological techniques such as spectroscopy.
	Apply these biological techniques in research and development.
Research Methodology	**Grasp** the relevance and basic concepts of research.
	Develop critical thinking abilities to analyze research effectively.
	Learn various research methods to broaden research skills.
	Acquire the tools necessary for designing and executing research projects.
	Explains basic concepts in Mendelian genetics.
	Illustrates the genome organization and gene regulation of prokaryotes and eukaryotes.

MOLECULAR GENETICS	**Demonstrates** laboratory skills for the isolation of genetic material.
	Analyzes the storage of genetic information and its translation at the molecular level in prokaryotic and eukaryotic systems.
	Evaluates the molecular mechanisms of gene expression and how genetic information is stored, expressed, and transmitted among generations.
PROCESS BT	**Demonstrate** understanding of various laboratory methods for isolating and preserving microorganisms.
	Explore the industrial use of bioreactors and **analyze** media optimization techniques.
	Evaluate the production of secondary metabolites and antibiotics.
	Analyze the basic concept of Microbial Growth kinetics.
NANOBIOTECHNOLOGY	**Grasp** the basic fundamentals of nanobiotechnology and the concept of Nanoparticle/nanomaterials.
	Analyze the use of biological molecules like lipids, DNA/RNA, and Proteins as nanoparticles in nanobiotechnology.
	Evaluate the use of Inorganic molecules as nanoparticles in nanobiotechnology.
	Examine the various applications of nanobiotechnology in agriculture, medicine, and the environment.
SY M.Sc BT	
Genetic Engineering BT- IX	**Analyzes** the concepts of rDNA, clone and gene cloning, including cloning strategies, tools, techniques, applications, advantages, and alternatives to transgenic methods.
	Illustrates techniques useful in recombinant DNA technology and the application of genetic engineering.
	Demonstrates knowledge about Molecular cloning, skills in DNA extraction, purification, and quantification, and understanding of the mechanism of transformation.
	Evaluates applications of Genetic Engineering in recombinant vaccines, pharmaceuticals, the concept of Bio-pharming, Gene Therapy, etc.

INDUSTRIAL BIOTECHNOLOGY	**Examine** different methods of Downstream Processing in fermentation.
	Apply analytical techniques for the identification of microbial products and **understand** the microbial production of industrially important compounds.
	Analyze the basic concepts involved and types of bioconversion reactions in Microbial transformations.
	Evaluate the Concept of quality control and quality assessment procedures in industries.
Plant Biotechnology	**Analyze** basic principles and various methods of plant tissue culture to become acquainted with them.
	Evaluate various methods of gene transfer and transgenic plant development to enhance knowledge.
	Examine microbes used for sustainable agriculture to develop understanding.
	Assess basic knowledge about molecular markers and their use in plant breeding to comprehend them.
BT- XIII Intellectual Property Right (OE)	Apply research methodologies to design and conduct studies.
	Analyze and evaluate thesis and manuscript structures.
	Apply procedural steps for patenting biological inventions.
	Analyze legal frameworks for Plant Breeder's and Farmer's Rights.
BT-XV Pharmaceutical Biotechnology	Apply principles of pharmacology to select treatments for diseases.
	Analyze chemotherapeutic agents to assess their effectiveness.
	Apply methods to design and modify proteins for specific applications.
	Analyze drug design processes to evaluate candidates for clinical trials.
ENVIRONMENTAL BIOTECHNOLOGY	Apply biotechnological techniques to develop cleanup solutions for contaminated environments.
	Analyze biodegradation and bioremediation processes to evaluate their effectiveness.
	Apply biotechnological processes to design systems for wastewater and solid waste management.
	Analyze biofuel and bioenergy production systems to evaluate their attributes and assess interventions.
BT- XVII (Elective) Food Biotechnology	Apply knowledge of microorganisms to enhance their roles in food biotechnology.
	Analyze preliminary and post-fermentation processes to evaluate their impact.
	Analyze mechanisms of food spoilage to assess changes and determine prevention strategies.
	Apply knowledge of laws and standards to ensure compliance in food biotechnology.