

## **B.Sc BIOTECHNOLOGY**

### **PROGRAM OUTCOMES (POS)**

- PO-1:** Graduates in biotechnology will be eligible for pursuing higher education, M.Sc. programmes in the different field of life science
- PO-2:** Graduates will exhibit contemporary knowledge in Biotechnology and students will be eligible for doing jobs in pharmaceutical and biotechnological Industry
- PO-3:** Graduates will be able to understand the potentials, and impact of biotechnological innovations on environment and their implementation for finding sustainable solution to issues pertaining to environment, health sector, agriculture, etc..
- PO-4:** Graduates will be able to design, conduct experiments, analyze and interpret data for investigating problems in BT and allied fields.
- PO-5:** Graduates will be able to work individually as well as in team to survive in multidisciplinary environment. Graduates will possess oral and written communication skills
- PO-6:** Students will exhibit contemporary knowledge in Biotechnology and students will be eligible for doing jobs in various sectors of pharmaceutical and biotechnological industry.

### **PROGRAM SPECIFIC OUTCOMES (PSOs)**

- PSO-1: Higher education preparedness:** Demonstrate an ability to appear for National level examination to pursue higher studies. Demonstrate practical and theoretical knowledge essential for pursuing higher studies.
- PSO-2: Biotechnology industry oriented preparedness:** Demonstrate an ability to identify careers in biotechnology, domain like Pharmaceutical, Food Industry etc, and skills required to work in a biotechnology laboratory or manufacturing facility.

## COURSE OUTCOMES

**YEAR: I**  
**SUBJECT: CELL BIOLOGY**

**SEMESTER: I**  
**SUBJECT CODE:SAC1A**

### COURSE OBJECTIVE:-

To introduce the students to know the various biological activities occurring at cellular & molecular level.

### COURSE OUTCOMES:-

- CO1:**To Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- CO2:**To understand how these cellular components are used to generate and utilize energy in cells.
- CO3:**To Understand the genetic information flow in the eukaryotic cell; including nucleic acid structures, the definition of a gene, the organisation of the genome, the replication, the formation of RNA (transcription), the processing of pre mRNA and the protein synthesis (translation). Students will understand the cellular components underlying mitotic cell division.
- CO4:** To understand how cells can communicate and the central intracellular signal transduction pathways and intracellular protein transport.
- CO5:**To know the cell cycle and the cell division and account for how these are regulated.

**YEAR: I**  
**SUBJECT: MICROBIOLOGY**

**SEMESTER: I**  
**SUBJECT CODE:SBANA**

### COURSE OBJECTIVE:-

To introduce the student to know the various aspects of basic microbiology.

### COURSE OUTCOMES:-

- CO1:**To know the diversity of microorganisms, bacterial cell structure and function, microbial growth and metabolism, and the ways to control their growth by physical and chemical means
- CO2:**To Understand the classification of microbes, Numerical taxonomy & methods of microbial identification.
- CO3:**To understand the role of microbes in the productivity of ecosystem, Food production, fermented foods, Alcoholic Beverages, SCP & fuel.
- CO4:**To understand pathogenic microorganisms and the mechanisms by which they cause disease, cure, control & prevention in the human body.
- CO5:**To understand the source for microorganisms of industrial importance from the environment Appreciate & how microbiology is applied in manufacture of industrial products.

**YEAR: I**  
**SUBJECT: PLANT PHYSIOLOGY (NME)**

**SEMESTER: I**  
**SUBJECT CODE: SNC1B**

**COURSE OBJECTIVE:-**

Students will have the knowledge of metabolism, physiological function and structure of plants with a better understanding of regulation of growth, development and influence of environment.

**COURSE OUTCOMES:-**

- CO1:** To understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.
- CO2:** To Understand the respiration in higher plants with particular emphasis on aerobic and anaerobic respiration.
- CO3:** To Understand the Symbiotic & Non -Symbiotic Nitrogen fixation and amino acid bio synthesis.
- CO4:** To Understand the types of plant hormones biosynthesis, storage, transport and its physiological function.
- CO5:** To Understand the mechanism of resistance to biotic stress & tolerance to abiotic stress.

**YEAR: I**  
**II**  
**SUBJECT: MOLECULAR DEVELOPMENTAL BIOLOGY**  
**SUBJECT CODE: SAC2A**

**SEMESTER:**

**COURSE OBJECTIVE:-**

Students will learn about the fundamental processes leading to developmental disorders and disease, and the crucial roles that Developmental Biology has played and continues to play in generating key concepts for medical application including stem cells, signalling networks, cancer or wound healing.

**COURSE OUTCOMES:-**

- CO1:** To understand the concept of cell cycle & different kinds of cell signalling pathways.
- CO2:** To understand the basic concepts & development stages of Slime mould.
- CO3:** To know about the molecular basic actions of protoontogenesis & types of Ontogenesis.
- CO4:** To understand about the developmental stages of Neurogenesis and Myogenesis of Drosophila & Mice.
- CO5:** To understand the entire process of Embryogenesis- Gametogenesis, Zygote, Embryo, Cleavage, Blastulation, Gastrulation, Morphogenetic movements, Neurogenesis & Organogenesis of Mammals & Drosophila.

**YEAR: I**  
**SUBJECT: BASICS OF ECOLOGY**  
**SNC2J**

**SEMESTER: II**  
**SUBJECT CODE:**

**COURSE OBJECTIVE:-**

Students to gain better knowledge about this course, which provides an in-depth understanding of ecosystem structures and functions, ecological energetic (primary production, secondary production, and consumer energetic), population, Community ecology, ecological succession, ecosystem-based management, and adaptive management.

**COURSE OUTCOMES:-**

- CO1:** To Develop an appreciation of the modern scope of scientific inquiry in the field of Ecology.
- CO2:** To become familiar with the variety of ways that organisms interact with both the physical and the biological environment.
- CO3:** To develop an understanding of the differences in the structure and function of different types of ecosystems such as Terrestrial, Aquatic, Desert and Marine ecosystem.
- CO4:** To learn techniques of data analysis as well as methods of presenting scientific information in figures and tables of population ecology.
- CO5:** To develop an appreciation of the natural world through direct experience with local ecosystem.

**YEAR: II**  
**SUBJECT: GENETICS**

**SEMESTER: III**  
**SUBJECT CODE: SAC3A**

**COURSE OBJECTIVE:-**

To gain better knowledge about Mendelian laws, linkage, crossing over, Gene Mutation, Repair Mechanisms, Genes and gene numbers, Sex linked inherited disorders and human genome project.

**COURSE OUTCOMES:-**

- CO1:** To Understand about the basic principles of Mendelian inheritance. And acquire the knowledge of chromosome structure, chromatin organization and variation
- CO2:** To understand the concept of sex determination and sex linked inheritance.
- CO3:** To understand the concept of linkage, crossing over and genetic mapping of chromosome
- CO4:** To Understand the concepts of DNA as the genetic material through direct evidence and indirect evidence.
- CO5:** To understand the advanced techniques in genome analysis, management of inherited human diseases and explore the applications of Gene Mutation and Repair.

**YEAR: II**  
**SUBJECT: PLANT BIOTECHNOLOGY**

**SEMESTER: IV**  
**SUBJECT CODE: SAC4A**

**COURSE OBJECTIVE:**

Students will increase understanding and knowledge of basic biological concepts of biotechnology including; molecular biology/genetic engineering, applications of biotechnology, central dogma, recombinant DNA, transgenic organisms, what is a protein.

**COURSE OUTCOMES:-**

- CO1:**To Understand the Nuclear genome, chloroplast genome, mitochondrial genome, transposon, Chloroplast transformation, Agrobacterium mediated transformation.
- CO2:**To understand about structure& function of Ti Plasmid, Ri Plasmid, Gene mediated transfer and its application.
- CO3:**To understand about the different kinds of transgenic Plants, its application and variousSeed storage protein.
- CO4:**To know about the molecular basis action of plant growth regulators such as Auxin, Gibberllic acid, Cytokinin, Ethylene and Abscise acid.
- CO5:**Toknow about the Laboratory organization, culture media, callus culture, suspension culture, Assessment of growth and viability, Micro propagation, Somatic embryogenesis, synthetic seed, Meristem culture, Somaclonal variations, haploid plants, androgenesis, gynogenesis, embryogenesis.

**YEAR: II**  
**SUBJECT: BIOPHYSICS & BIOSTATISTICS**

**SEMESTER: IV**  
**SUBJECT CODE: SBACB**

**COURSE OBJECTIVE:**

The course aims to provide students with a foundation in the basic concepts of Biophysics,Recognize the importance of data collection and its role in determining scope of inference&Demonstrate a solid understanding of interval estimation and hypothesis testing.

**COURSE OUTCOMES:-**

- CO1:** Demonstrate knowledge of the fundamental concepts in physics and chemistry that underlie biological processes
- CO2:** Define the structural characteristics of nucleic acids and proteins and examine parameters that variously determine their stability and function(s).
- CO3:** Select from, use and interpret results of, descriptive statistical methods effectively
- CO4:** Demonstrate an understanding of the central concepts of modern statistical theory and their probabilistic foundation.
- CO5:** Select from, use, and interpret results of, the principal methods of statistical inference and design
- CO6:** Communicate the results of statistical analyses accurately and effectively

**YEAR: II**

**SEMESTER: IV**

**SUBJECT: ENVIRONMENTAL STUDIES**

**SUBJECT CODE: ENV4A**

**COURSE OBJECTIVE:**

Students will increase understanding and knowledge of basic interactions between organisms and their environments drive the dynamics of individuals, populations, communities, and ecosystems.

**COURSE OUTCOMES:-**

- CO1:** Understand the processes and patterns of evolution, and the role of evolution as the central unifying concept in environmental science.
- CO2:** To Understand the historical and social context of environmental science thought and research, and the contributions of environmental science to the resolution of ethical, social, and environmental issues in human affairs
- CO3:** To Develop an in-depth understanding of the interdisciplinary relationship of cultural, ethical, and social aspects of local/global environmental issues
- CO4:** Use quantitative reasoning, observation, technical and analytical skills for scientific problem-solving and interpretation of environmental data.
- CO5:** Design and evaluate strategies, technologies, and methods for assessment and sustainable management of environmental systems and for the remediation or restoration of degraded environments

**YEAR : III**

**SEMESTER : V**

**SUBJECT: ANIMAL & MEDICAL BIOTECHNOLOGY SUBJECT CODE: SAC5A**

**COURSE OBJECTIVE:-**

Student will learn about definitions and scope of basic biotechnology techniques and modern terms and diagnosis tools in medical biotechnology.

**COURSE OUTCOMES:-**

- CO1:** To know about manipulation of reproductive process and Embryo technology and the importance of Assisted Reproductive Technology
- CO2:** To study about medical biotechnology and different types of microbial disease, their prevention measures and diagnosis tools.
- CO3:** To instruct about Health Disease Diagnosis particularly Hybridoma Techniques and Monoclonal antibodies
- CO4:** To learn about Production of recombinant vaccines that bacterial and DNA Vaccines. Synthetic peptide, anti-idiotypic, deletion mutant and vectored vaccine
- CO5:** To learn about Genetic engineering of Microorganisms and molecules and Animal cell culture and its maintenance and applications.

**YEAR: III**  
**SUBJECT: BIO INFORMATICS**

**SEMESTER: V**  
**SUBJECT CODE: SAC5B**

**COURSE OBJECTIVE:**

Students will be able to understand basic tools in bioinformatics and collection of data and producing biological databases and their sequence analysis and alignment

**COURSE OUTCOMES:**

- CO 1:** To know about Genomic, cDNA sequences, gene prediction rules softwares and Human Genome Project.
- CO2:** To study about Gene therapy and Analysis of genomic and proteomic information with respect biological systems and Genome application and Transgenic animals and plants
- CO3:** To instruct about Microarrays, recent developments in expression analysis, Oncogenesis and Classification of Cancer types and Drug toxicity testing
- CO4:** To learn about Sequence analysis Proteins and Nucleic acids and Sequence alignment methods and Proteins analysis and structural comparisons
- CO5:** To learn about and Comparison of Protein sequences and Database searching and its methods for protein structure prediction and conserved patterns in protein sequences and structures and Comparison of protein 3D structures.

**YEAR: III**  
**SUBJECT: IMMUNOLOGY**

**SEMESTER: V**  
**SUBJECT CODE: SAC5C**

**COURSE OBJECTIVE:**

Students will be able to understand the basics of immune system and immune responses of animals and functions and properties of antigens.

**COURSE OUTCOMES:**

- CO1:** To know about Isolation, purification and characterization of various antigens and haptens from pathogens and other biological molecules.
- CO2:** To study about Isolation and Characterization of T cell subsets and B cells and macrophages and Macrophage cultures
- CO3:** To instruct the students about Production and purification of antibodies and Quantification of Immunoglobulins in biomedical research
- CO4:** To learn about In situ and in vivo characterization of cells from tissue and HLA typing and Types of Hypersensitivity
- CO5:** To insist about Biology and assay of cytokines and Immunotechnology and infectious diseases and measures of prevention.

**YEAR: III**  
**SUBJECT: PHARMACEUTICAL BIOTECHNOLOGY**

**SEMESTER: V**  
**SUBJECT CODE: SEC5A**

**COURSE OBJECTIVE:**

Students will be able to understand the new era of Pharmaceutical considerations like Pharmacodynamics and kinetics Proteinengineering, Drug discoveryand delivery.

**COURSE OUTCOMES:**

- CO1:**To know about Formulation of biotech products including biopharmaceutical considerations and Shelf life of protein based pharmaceuticals and Delivery of proteins
- CO2:**To know about Pharmacokinetics and Pharmacodynamics and Chemical modification of protein therapeutics and immunogenicity.
- CO3:**To instruct the students aboutProtein engineering, Peptide chemistry and Peptidomimetics, Glycobiology and biosensors
- CO4:**To learn about Pharmacology and Formulations of Vaccines in Modern vaccine technologies, andpharmaceutical aspects and Monoclonal antibody
- CO5:**To insist about Biotechnology products in pipeline and Nucleic acid therapies and carbohydrate based pharmaceuticals and other products of glycobiology.

**YEAR: III**  
**SUBJECT: GENETIC ENGINEERING**

**SEMESTER: VI**  
**SUBJECT CODE: SAC6A**

**COURSE OBJECTIVE:**

Students will be able to understand recombinant DNA technology and its techniques and cloning strategies of Prokaryotes and Eukaryotes.

**COURSE OUTCOMES:**

- CO1:** To know about Restriction and modification systems in bacteria. Restriction enzymes. &cloning vectors.
- CO2:**To know about Selection and screening for recombinants like RFLP, DNA finger printin&.RAPD
- CO3:**To instruct the students about DNA sequencing techniques Polymerase chain reaction and its types and Ligase chain reaction.
- CO4:**To learn about Expression systems and their applications and Production of protein from cloned genes
- CO5:**To insist about Gene cloning and their manipulation process and their applications in varies fields.



**YEAR: III**  
**SUBJECT: BIOPROCESS TECHNOLOGY**

**SEMESTER: VI**  
**SUBJECT CODE: SAC6B**

**COURSE OBJECTIVE:**

Students will be able to understand introduction to bioprocess technology and upstream downstream processing and design of fermentor and fermentation techniques and waste management system.

**COURSE OUTCOMES:**

- CO1:** To know about overview of traditional and modern applications of biotechnological process and Upstream and downstream unit operations involved in bioprocesses
- CO2:** To know about General requirements of fermentation processes and main parameters to be monitored and controlled in fermentation processes
- CO3:** To instruct the students about, basic design and configuration of immobilized enzyme reactors and applications of immobilized enzyme technology and Media design and sterilization for fermentation processes:
- CO4:** To learn about Stoichiometry of cell growth and product fermentation and elemental balances and degrees of reduction of substrate and biomass
- CO5:** To insist about Kinetics of microbial growth and product formation and Phases of cell growth in batch cultures.

**YEAR: III**  
**SUBJECT: MICROBIAL BIO TECHNOLOGY**

**SEMESTER: VI**  
**SUBJECT CODE: SEC6A**

**COURSE OBJECTIVE:**

Students will know about introduction of Microbial bio technology and classification of microbes and design offer mentor and fermentation techniques and the applications of microbes in production process and sewage treatment.

**COURSE OUTCOME:**

- CO1:** To know about History and scope of microbial biotechnology, microbial diversity and its use microbial biomass
- CO2:** To know about Production of microbial enzymes and applications and production of organic solvents and single cell proteins.
- CO3:** To instruct the students about Beverages Production of beverages and - production of baker yeast, milk products.
- CO4:** To learn about bio fertilizers manufacture, formulation and utilization, biopesticides and the source and applications of biomass
- CO5:** To insist about Microbes in mining and waste water treatment, biodegradation of non cellulose and cellulosic wastes for environmental conservation.

**YEAR: III**

**SEMESTER: VI**

**SUBJECT: ENVIRONMENTAL BIOTECHNOLOGY**

**SUBJECT CODE: SEC6B**

**COURSE OBJECTIVE:**

Students will know about an introduction to environmental biotechnology and focuses on the utilization of microbial processes in waste and water treatment, and basic principles in bioremediation and biological water and industrial waste.

**COURSE OUTCOMES:**

- CO1:** To know about Bio film Kinetics and Reactors types and Reactors with recycle of settled cells.
- CO2:** To know about linking stoichiometric equations to mass balance equations and Engineering design of reactor
- CO3:** To instruct the students about Denitrification and Physiology of denitrifying bacteria and types of denitrification and process of Methanogenic treatment
- CO4:** To learn about Engineering strategies for Evaluating bioremediation and Detoxification of Hazardous chemicals
- CO5:** To insist about Sewage and waste treatment and Pollution control and remediation of various industries

