DEPARTMENT OF BIOTECHNOLOGY

PROGRAMME OUTCOMES AND COURSE OUTCOMES OF UNDER GRADUATE & POST GRADUATE PROGRAMME (2022 ONWARDS)

NAME OF THE PROGRAMME: B. Sc BIOTECHNOLOGY – PROGRAMME OUTCOME	
PO1	Understand the concepts of biotechnology
PO2	Gain knowledge principles of basic biological techniques
PO3	Attain basic laboratory skill sets required for interdisciplinary industry setting
PO4	Utilize computational tools for biological data analysis
PO5	Gain knowledge on ethics and good laboratory practices (GLPs)
PO6	Fit into positions that require basic subject knowledge
PO7	Employ science and technology for the welfare of society
PO8	Establish mini and large scale entrepreneurial startups
PO9	Tackle the challenges arising in present and future of academia/industry
PO10	Apply responsibilities in the acquired position as a professional by demonstratingmodern analytical skills
M.SC BIOTECHNOLOGY	
PO1	Gain an in-depth knowledge of biotechnology
PO2	Understand the principles and mechanisms of basic and advanced analytical techniques
PO3	Acquire scientific skill set for industrial application
PO4	Perform fundamental and applied research works in the less explored and emerging areas
PO5	Utilize computational and other tools to analyse and unravel issues related to biology
PO6	Understand ethics and good lab practices (GLPs)
PO7	Apply science and technology to the betterment of society

PO8	Produce reports and documents in terms of scientific understanding of biological concepts
PO9	Fit to work in interdisciplinary andmultifaceted teams
PO10	Learn and adapt technical advancements in the profession

NAME OF THE PROGRAMME: B.Sc BIOTECHNOLOGY – COURSE OUTCOMES	
SEMESTER I	
CELL AND EVOLUTION BIOLOGY	1. The student will be able to learn cell structure and function 2. The student will be able to understand cell organelles 3. The student will be able to learn cell division 4. The student will be able to understand evolution 5. The student will be able to understand evolutionary process of plant and animal
BIODIVERSITY	1. The students will gain knowledge on the diversity of plant, animal and their importance. 2. The students can comprehend the structure and function of various ecosystems and hotspots. 3. The students can understand and differentiate the various plant ecological adaptations. 4. The students will be able to distinguish plant distribution, vegetation pattern of world, continental, state level, forest biodiversity management and its conservationstrategies. 5. The students will gain knowledge on the importance of bioresources in human welfare
	SEMESTER II
BIOCHEMISTRY	1. The student will be able to identify and interpret the structure, classification, ofcarbohydrates 2. The student will be able to identify and interpret the structure, classification, ofproteins 3. The student will be able to identify and interpret the structure, classification, of lipids 4. The student will be able to identify and interpret the structure, classification, ofnucleic acid 5. The student will be able to identify and interpret the structure, classification, ofvitamins.
	1. The students will be able to understand different functions of food

FOOD AND NUTRITION	and learn aboutbalanced diet. 2. The students will be able to understand the importance of carbohydrates and fibre 3. The students will understand the nutritional value of proteins, lipids and fatty acids 4. The students will be able to gain knowledge on food energy intake 5. The students will be able to learn how vitamins are vital to our body.
SEMESTER III	
MICROBIOLOGY	1. The student will be able to know classification of microorganisms 2. The student will be able to know the structure of various microorganisms 3. The student will be able to know the growth of microorganisms 4. The student will be able to know factors controlling microbial growth 5. The student will be able to know various disease caused by microbes
BIOSTATICS AND COMPUTER APPLICATION	1. The student will be able to know about collection of data and presentation of data 2. The student will be able to study measures of central tendency 3. The student will be able to know the types and methods of correlation analysis 4. The student will be able to implant computer knowledge 5. The student will be able to know how to work with excel
ORGANIC FARMING	1. The students will be able to understand various models of organic farming 2. The students could explain the role of soil health in organic crop production. 3. The students will identify the fundamentals of cultural practices and biologicalprocesses for successful establishment of organic farming. 4. The students could provide consultation and make awareness to the society aboutneeds of organic farming for their routine life. 5. The students will be able to set their own business, marketing and to compete withentrepreneurs.
HERBAL MEDICINE	1. The student will be able to gain knowledge on traditional medicine 2. The student will be able to study some important medicinal plants 3. The student will be able to know the common herbal plants 4. The student will be able to know the preservation of herbal medicine 5. The student will be able to learn cultivation methods of herbal plants

SEMESTER IV	
IMMUNOLOGY	1. The student will be able to learn the basics of immunology. 2. The student will be able to learn about the structure of immunoglobulin's. 3. The student will be able to know about the details of immune cells. 4. The student will be able to learn about the mhc&autoimmune disease. 5. The student will be able to learn the details of blood grouping and itsapplications.
MOLECULAR GENETICS	1. The student will be able to explain Central Dogma and DNA as a Genetic Material 2. The student will be able to understand Replication, Repair and Recombination. 3. The student will be able to know Mutation, Chromosomal Abnormalities 4. The student will be able to understand Genetics of Bacteria and Virus 5. The student will be able to know the Regulation of Gene Expression andTransposable Elements.
MUSHROOM CULTIVATION	1. The student will be able to distinguish the principle differences of mushroom cultivation from the cultivation of plants and animals. 2. The student will be able to determine the most important (ca12) species of cultivated mushrooms and knows the basic ways of the cultivation of each of them. 3. The student will be able to know the most important kinds of substrata formushroom cultivation, belonging to the wastes of agricultural, silvi cultural and forest industry management, and have skills to prepare media for the mushroom cultivation from these wastes. 4. The student will be able to maintain mushroom farmin hygienic and scientificway cultivation. 5. The student will be able to know the disease and problems in mushroom cultivation.
APPLIED BIOTECHNOLOGY	1. The student will be able to know the importance of PCR technique 2. The student will be able to study about vaccines 3. The student will be able to learn about applications of RNA

	technology 4. The student will be able to know about Biosensors and its uses 5. The student will be able to study about blotting techniques
SEMESTER V	
GENETIC ENGINEERING	1. The student will be able to learn about molecular marker 2. The student will be able to study about the important tools in genetic engineering. 3. The student will be able to learn about different type of cloning vectors. 4. The student will be able to study about principle and different types of polymerasechain reaction 5. The student will be able to study about recombinant DNA technology.
INDUSTRIAL BIOTECHNOLOGY	1. The student will be able to know about Introduction to biotechnology and products 2. The student will be able to understand Industrially important microorganisms. 3. The student will be able to know Bioreactors / Fermentor: Types 4. The student will be able to know Downstream processing 5. The student will be able to understand Fermented foods and Agricultural products
BIOINFORMATICS	1. The student will be able to learn the basics of bioinformatics. 2. The student will be able to learn about sequence analysis. 3. The student will be able to bioinformatics tools like Blast and Fasta. 4. The student will be able to learn about protein structure using protein visualizingtools. 5. The student will be able to protein and its prediction.
BIOFERTILIZER TECHNOLOGY	1. The student will be able to understand the Biofertilizers 2. The student will be able to know the Isolation Methods of Biofertilizers . 3. The student will be able to know the Identification Methods of Biofertilizers. 4. The student will be able to know the Large Scale Production Process of Biofertilizers. 5. The student will be able to know the Large Scale Production Process of Biofertilizers.
PUBLIC HEALTH AND HYGIENE	1. The student will be able to learn public health 2. The student will be able to understand health policy 3. The student will be able to know about medical terminology 4. The student will be able to learn communicable diseases

	5. The student will be able to identify safety of working populations
ENZYME TECHNOLOGY	1. The student will be able to study about basics in Enzyme 2. The student will be able to learn about mechanism of Enzyme. 3. The student will be able to Study about principle and regulations of Enzyme. 4. The student will be able to learn about Kinetic activity of Enzyme. 5. The student will be able to Study about applications of enzyme.
MEDICAL LAB TECHNOLOGY	1. The student will be able to know the anatomy oforgans in the human body. 2. The student will be able to understand the blood and blood related diseases. 3. The student will be able to know the cardiac profile and heart diseases. 4. The student will be able to know the gastrointestinal system and hormonesecretion. 5. The student will be able to know the steps in tissue processing and staining.
SEMESTER VI	
PLANT AND ANIMAL BIOTECHNOLOGY	1. The student will be able to know about basic plant tissue media preparation. 2. The student will be able to understand plant tissue culture techniques. 3. The student will be able to know animal cell media preparation and sterilization. 4. The student will be able to know transgenic animals. 5. The student will be able to understand in vitro fertilization.
ENVIRONMENTAL BIOTECHNOLOGY	1. The student will be able to know ecosystem 2. The student will be able to know waste water treatment 3. The student will be able to know biodegradation of xenobiotics 4. The student will be able to know biofuel production 5. The student will be able to know environmental genetics
FORENSIC SCIENCE	1. To understand the techniques for identification of the evidences from the criminal. 2. To study the personal identification aspects, molecular mechanisms and its application in forensic science. 3. It helps to study the sociological aspects, mechanisms and its application in forensicscience 4. To know about personal identification techniques. 5. To understand the molecular identifications.

SERICULTURE	1. To learn about History of silkworm & their life cycle. 2. The students able to understand the propagation methods of mulberry. 3. It will be very useful for studying step by step process in rearing technology. 4. And to identify the useful by products of sericulture. 5. To identify the diseases damage the silkworm.
ENTERPRENEUSHIP	1. Entrepreneurial attitude to the students 2. Opportunities available for the entrepreneurial support 3. IPR related understanding on the developed products 4. Market needs and dynamics both locally and globally
BIOSAFETY, BIOETHICS & IPR	1. The student will be able to understand about biosafety 2. The student will be able to learn about the biosafety guidelines 3. The student will be able to understand about bioethics 4. The student will be able to learn about IPR 5. The student will be able to learn about patents and patent law
PHARMACEUTICAL BIOTECHNOLOGY	1. The student will be able to learn about Drugs and their action in our body 2. The student will be able to learn about Chemotherapeutic drugs, Geneticrecombination and drugs 3. The student will be able to learn about Enzyme immobilization and its applicationin pharmaceutical industry 4. The student will be able to learn about current trending microencapsulationtechnique 5. The student will be able to learn about Designing and Development of Drugs
HORTICULTURE & LANDSCAPING	1. The students will be able to gain knowledge on the horticultural crop propagationtechniques, export, import and marketing value of horticultural crops. 2. The students will understand the principles of plant growth, quality, nutritional value,yield and resistance to insects, diseases, and environmental stresses. 3. The students will be able to elucidate the importance of kitchen garden, horticulturalcrops, gardening and organic farming. 4. The students will acquire knowledge on entrepreneurship related to horticulture. 5. The students will be aware of job opportunities in the fields of horticulture, seedproduction, fertilizers, landscaping and gardening.
INDUSTRIAL WASTE	1. The student will be able to get an insight into the pollution from major industries including the sources and characteristics of

MANAGEMENT	pollutants. 2. The student will be able to understand the plan of waste management approaches andapplications. 3. The student will be able to learn the design facilities for the understand the pollutionfrom major industries 4. The student will get an idea to identify and formulate waste minimization. 5. The student will be able to acquire a knowledge about the develop conceptual schematics required for the treatment of industrial water and industrial waste water treatment.

NAME OF THE PROGRAMME: M.Sc. BIOTECHNOLOGY –COURSE OUTCOME	
SEMESTER - I	
CELL AND DEVELOPMENTAL BIOLOGY	1. The students will be able to understand the cell and its basic functions 2. The students will be able to learn about the cell signaling and different pathways of cell signaling and types of receptors 3. The students will be able to learn the concept of DNA replication and central dogma of molecular biology 4. The students will be able to understand the gametes and its production, fertilization and formation of zygote and embryo 5. The students will be able to understand the morphogenesis and organogenesis in animals
BIOCHEMISTRY	1. The students will be able to understand carbohydrates and their functions. 2. The students will be able to know metabolism of lipids. 3. The students will be able to understand important of proteins. 4. The students will be able to know nucleic acids and their functions. 5. The students will be able to understand enzymes and their functions.
	1. The students will be able to explain DNA as a genetic material and mendelian principle 2. The students will be able to understand replication, genetics of bacteria and virus and gene regulation 3. The students will be able to know mutation, cancer and

GENETICS AND MOLECULAR BIOLOGY	oncogene, tumour supression 4. The students will be able to know allelic variation and gene function 5. The students will be able to explain the human genetics and transposable elements
BIOINSTRUMENTATION	1. The students will be able to acquire knowledge about importance of various chromatographic techniques. 2. The students will be able to understand working principles and application of microscopes. 3. The students will be able to get insight into application of spectroscopy techniques. 4. The student will get knowledge about advanced instruments like qPCR, FACS etc. 5. The students will be able to learn about application of radio isotopes in biomedical sciences.
BIOPROSPECTING	1. The students will be able to gain knowledge of bioreactor. 2. The students will be able to understand the application and functioning of bioreactors. 3. The students will be able to understand the fermentation process growth of cultures in the fermentor. 4. The students will be able to understand the downstream procedure and fermenter waste treatment. 5. The students will be able to know the role of fungi in food and feed industries viz. Edible mushrooms, different cultivation and nutritional aspects of mushrooms.
AQUACULTURE BIOTECHNOLOGY	1. The students will be able to understand the scope of aquatic biotechnology as an emerging field 2. The students will be able to learn feed biotechnology, scp, active compounds and proteins 3. The students will be able to use of technology in environment management 4. The students will be able to understand and biotechnology in aquatic applications 5. The students will be able to molecular diagnostic technologies in aquatic biotechnology
TOOLS IN BIOTECHNOLOGY	1. The students will be able to obtain a comprehensive knowledge about concepts of gene and genomics. 2. The students will be able to gain an in-depth knowledge about vectors used in gene cloning. 3. The students will be able to apprehend about the

	principle tools that are used for gene manipulation. 4. The students will be able to know about the importance of selection and screening of transformants. 5. The students will be aware with the principal applications of gene cloning.
MEDICAL BIOTECHNOLOGY	1. The students will be able to know medical microbiology 2. The students will be able to know bacterial infection 3. The students will be able to know viral infection 4. The students will be able to know parasitology 5. The students will be able to know clinical symptoms of various infections
FOOD BIOTECHNOLOGY	1. The students will be able to acquire knowledge about importance of microbes in food production. 2. The students will be able to understand QC and other safety guidelines related to production of fermented food. 3. The students will be able to get insight into process involved in production of organic acids, amino acids and nutraceuticals. 4. the student will be understanding the important role played by food preservatives in preventing spoilage. 5. The students will be able to learn about recent developments in GM food and related regulatory aspects.
SEMESTER - II	
MICROBIAL TECHNOLOGY	1. The students will able to Explain the principles and fundamentals of microbial technology. 2. The students will able to Elucidate the structure of fermentor. 3. The students will able to Understand the formulation of culture media. 4. The students will able to Describe the microbial processing in food and pharmaceutical industries. 5. The students will able to Summarize the methods used in industrial products such as microbial enzymes, organic acids etc.,
IMMUNOTECHNOLOGY	1. The students will be able to know the detailed description of the immune response made in humans to foreign antigens including microbial pathogens. 2. The students will be able to know about the cells involved in the immune response either innate or

	acquired and how the immune system recognizes self from non-self. 3. The students will be able to know about the b and t cell maturation and specific responses. Other topics covered will include the genetic basis of diversity of immune responses in mammals. 4. The students will be able to describe the cause and treatment for immune system pathologies and dysfunctions. 5. The students will be able to learn the importance techniques of immunodiagnosis.
GENETIC ENGINEERING	1. The students will be able to know gene cloning. 2. The students will be able to understand cloning vectors. 3. The students will be able to know cloning strategies. 4. The students will be able to understand cloned genes. 5. The students will be able to know recombinant DNA technologies.
OMICS TECHNOLOGY	1. The students will be able to get the detailed characteristics of prokaryotes and eukaryotes genome as well as application of forward and reverse genetics. 2. The students will be able to get knowledge and design the experiments using various techniques of genome sequencing as well proper organization of generated biological data. 3. The students will be able to apply structural and functional genomics approaches on newly sequenced genome for functional characterization of genes. 4. The students will be able to develop capacity to pin point the strategies used for crop improvement and development of drug, recombinant proteins or value added crop. 5. The students will be able to handle a proteins and its characterization and demonstrate how various types of mass spectrometers can be used for proteome quantification, structure determination of proteins by various methods.
PHARMACEUTICAL BIOTECHNOLOGY	1. The students will be able to learn about drugs and their action in our body 2. The students will be able to learn about chemotherapeutic drugs, genetic recombination and drugss 3. The students will be able to learn about enzyme immobilization and its application in pharmaceutical

	industry 4. The students will be able to learn about current trending microencapsulation technique 5. The students will be able to learn about designing and development of drugs
NANOTECHNOLOGY	1. The students will be able to acquire knowledge about importance of nanotechnology and nanomaterials. 2. The students will be able to understand application of nanomaterials in day to day life. 3. The students will be able to get insight into process involved in production of metal nanoparticles and its application. 4. The student will be understanding critical factors in synthesis of nanoparticles. 5. The students will be able to learn about recent developments and application of nanoparticles.
MEDICINAL PLANTS	1. The student will be able to gain knowledge on traditional medicine 2. The student will be able to study some important medicinal plants 3. The student will be able to know the common herbal plants 4. The student will be able to know the preservation of herbal medicine 5. The student will be able to learn cultivation methods of herbal plants
TISSUE CULTURE	1. The students will gain knowledge on tissue culture environment 2. The students will be able to learn about the nutritional properties and requirements for tissue culture. 3. The students will learn about the design of a tissue culture laboratory and its requirements 4. The students will be able to grow plants at controlled conditions in laboratory 5. The students will be able to understand plant breeding techniques and transfer lab-grown plants to environmental conditions in hardening facility
MOLECULAR DIAGNOSTICS	1. The students will be able to acquire knowledge about importance of molecular diagnostic methods over conventional methods. 2. The students will be able to understand application of DNA based detection methods.

	3. The students will be able to get insight into application of proteomic diagnostic methods. 4. The student will be understanding critical factors diagnosis of various genetic and immune disorders. 5. The students will be able to learn about recent developments and application of molecular diagnosis in cancer therapy and viral disease.
SEMESTER III	
ECOLOGY & ENVIRONMENTAL BIOTECHNOLOGY	1. The students will be able to acquire a complete knowledge about ecosystem and global environmental problems. 2. The students will be able to understand harmful effects of environmental pollution and its methods of control and management. 3. The students will be able to get insight into process involved in wastewater treatment. 4. The student will be understanding the recent developments in solid waste management. 5. The students will be able to learn about bioremediation and use of recombinant organisms for the process.
PLANT BIOTECHNOLOGY	1. The students will be able to know about genomic interaction 2. The students will be able to understand plant tissue culture techniques 3. The students will be able to know bio chemistry and molecular biology 4. The students will be able to know hybridization technique. 5. The students will be able to understand plant transformation.
ANIMAL BIOTECHNOLOGY	1. The students will be able to study basic needs of cell culture 2. The students will be able to implant knowledge on media 3. The students will be able to describe genetic engineering in animals 4. The students will be able to know ethical concerns over the use of animal biotechnology. 5. The students will be able to know various biotechnologies available to the animal related fields.
CANCER BIOLOGY	1. The students will be able to develop a comprehensive knowledge about basics of cancer biology.

	2. The students will be able to understand an in-depth knowledge about molecular mechanism of cancer. 3. The students will be able to able to relate and understand the role of immune system in cancer. 4. The students will be able to know about the importance of immune process, selection and tolerance of cancer. 5. The students will be able to gain the knowledge about the diagnosis and treatment strategies of cancer.
INDUSTRIAL BIOTECHNOLOGY	1. The students will be able to know about introduction to biotechnology and major classes of commercial products using microorganisms. 2. The students will be able to understand introduction to biotechnology and major classes of commercial products using microorganisms. 3. The students will be able to know the bioreactors / fermentor: types and microbial culture and its types 4. The students will be able to know microbial enzymes in food processing 5. The students will be able to understand plant transform biofertilizers and its types
VIROLOGY	1. The students will be able to gain knowledge about the basic concepts of virology. 2. The students will be able to learn the virological techniques for diagnosis. 3. The students will be able to understand the various viral groups and also about the vaccines to treat that viral groups. 4. The students will be able to learn clinical features, epidemiology, diagnosis and treatment of viral group. 5. The students will be able to get an idea about the various diagnostic techniques such as PCR.
FORENSIC SCIENCE	1. The students will be able to understand various aspects of crimes 2. The students will be able to do forensic examination of body and semen fluids to identify criminals 3. The students will be able to do forensic examination of hair and tissue to identify criminals 4. The students will learn personal identification techniques to determine age and sex 5. The students will be able to gain knowledge about different advanced investigation and instrumentation techniques

DAIRY FARMING	1. The students will be able to develop a comprehensive knowledge about basics of dairy farming 2. The students will be able to understand the physiology and management aspect of dairy farming 3. The students will be able to discuss the chemistry and microbiology of dairy 4. The students will be able to know about the processing technologies of dairy products 5. The students will be able to gain knowledge on quality management of dairy products
WASTE WATER MANAGEMENT	1. The students will be able to get the concepts of industrial scenario in india and major issues on water quality management. 2. The students will be able to understand the methods that are used for the control and prevention of industrial pollution. 3. The students will be able to learn the fundamental scientific processes underlying the design and operation of wastewater treatment. 4. The student will get the knowledge of the management of residues from water and wastewater treatment. 5. The student will understand about the wastewater treatment.
SEMESTER IV	
RESEARCH METHODOLOGY	1. The students will be able to understand the research and its types. 2. The students will be able to understand the collection of reviews from various journals. 3. The students will be able to learn about writing research proposals. 4. The students will be able to know about scientific papers. 5. The students will be able to know about the thesis writing and oral and poster presentation.
BIOSAFETY, BIOETHICS AND IPR	1. The students will be able to understand the basics of biosafety and biodiversity. 2. The students will be able to understand the guidelines of biosafety. 3. The students will be able to learn about bioethics and socio economics. 4. The students will be able to know about patent and intellectual rights. 5. The students will be able to know about the patent and

	patent laws.
SYSTEMS BIOLOGY	1. The students will be able to understand the basic principles of systems biology. 2. The students will be able to understand the metabolism of carbohydrates, proteins and glucose. 3. The students will be able to learn about cell designer and virtual of cells. 4. The students will be able to know about protein interaction and gene cluster and databases. 5. The students will be able to know about the bioinformatics and biological databases.
STEM CELL BIOLOGY	1. The students will be able to know the history of stem cell and its basics. 2. The students will be able to learn about the different types of stem celland how they are derived and extent of their plasticity. 3. The students will be able to learn about Tumor stem cell and telomeres in stem cell biology. 4. The students will be able to understand stem cell culture and ethical issues. 5. The students will be able to learn about stem cell based diseases and assisted reproductive technology.
ORGANIC FARMING	1. The students will able to understand the various models of organic farming 2. The students will able to explain the role of soil health in organic crop production. T 3. he students will able to identify the fundamentals of cultural practices and biological processes for successful establishment of organic farming. 4. The students will able to provide consultation and make awareness to the society about needs of organic farming for their routine life. 5. The students will able to set their own business, marketing and to compete with entrepreneurs.
ENTREPRENEURSHIP	1. The students will be able to develop a basic knowledge of business 2. The students will be able to understand about entrepreneurship concept and management 3. The students will be able to understand the concept of enterprise and market analysis 4. The students will be able to gain technical knowledge about the growth of business

	5. The students will be able to gain the knowledge various government schemes supportingentrepreneurship
POLLUTION CONTROL	1. The students will learn about the sources and different aspects of air pollution 2. The students will gain knowledge on soil pollution and methods to control pollutants 3. The students will learn about water and marine pollution and effective ways to control 4. The students will be able to learn about government policies and find alternative sources for fuels 5. The students will be able to spread awareness among public to reduce pollution