Government Institute of Science, Aurangabad.

Program outcomes, program specific outcomes and course outcomes
Department of Biotechnology

Year M.Sc. I / II	Program/name of the Paper (Theory & practical)	After successful completion of the program the student should be able to know: (Program Outcome)
I	Biostatistics and Biomathematics Theory Course BT1001	• Basic mathematical calculations which are useful for students especially in research and development in industry and academia • All basic methods of sampling, collection and analysis of data. • All statistical methods which are important for every step of R & D. • How to select a specific statistical tool for a particular problem or data analysis
	Biostatistics and Biomathematics Practical Course BTP1001	• Practically solve the problems and learn the preparation of graph and charts by using a data followed by drawing an inference. • To perform a particular statistical method and its significance.
I	Biomolecules and Bioenergetics Theory Course BT1002	• That biomolecules play indispensable roles in all life processes • That these molecules perform or trigger important biochemical reactions in living organisms. • The physiological function that regulates the proper growth and development of a human body.
I	Biomolecules and Bioenergetics Practical course BTP1002	• To perform qualitative and quantitative analysis of the molecules. • Sources of these molecules.
I	Microbiology Theory Course BT1003	• Understanding the core basics and differences between prokaryotes and eukaryotes • Gain theoretical knowledge of different classes of stains and • Understand the principles of different staining procedures. • Learn different biochemical identification techniques in microbiology. • Understand common groups of bacteria and archaea in different ecosystems • Study different approaches used in microbial taxonomy • To get acquainted with genomic-based methods to study microbial diversity in

		nature and for the mechanisms behind it. • To understand microbial adaptation in extreme environmental conditions. • To understand the concept of growth and bacterial cell division. • To get acquainted with different microbial growth curves and related mathematical expression. • To learn microbial growth assessment methods • To gain knowledge about different methods to control microbial growth • To understand the role of nutrients in microbial growth • To learn pure culture techniques • To study metabolism and nutritional requirements in microbes • To classify different nutritional requirements of microbes • Construction method of microbial media, and • Learn preservation methods of microbes • To study the cytological and macromolecular changes during sporulation. • To understand the nature and mode of action of different microbial toxins • To Gain knowledge about microbial stress protein and • To study the two-component microbial system.
I	Microbiology Practical Course BTP1003	• Aseptic and pure culture techniques. • Preparation of and viewing samples for microscopy using different staining procedures, • Use appropriate methods to identify microorganisms, • Estimate the number of microorganisms in a sample, • Use common lab equipment. • Demonstrate key practical skills/competencies in working with microbes • Interpret results from a variety of microbiological methods, and apply these methods to analogous situations, and • Demonstrate and employ practical skills of assay with antibiotics

I	Inheritance Biology Theory Course BT1004	• Understanding the concept of gene • Study Mendelian principles of Inheritance • To learn extensions and variations to Mendel's Law. • To understand biological system of sex Determination • To understand the role of the X and Y chromosomes in determining sex and how they are inherited • Gain knowledge about mutations and its causes • To understand why mutations that occur outside of coding regions of structural genes can influence gene expression. • To get acquainted with mutation detection methods • Gain insight about transposon mediated mutation. • Understanding of fundamental concepts in microbial genetics • Gain Insight into genetic transfer methods. • To learn gene mapping methods • To understand S. Benzer study: on substructure of the gene. • To study Linkage maps and Tetrad analysis, • To learn about molecular markers for gene mapping • Know the methods of development of mapping population in plants. • Mapping by using somatic cell hybrids • To gain better understanding about chromosomal inheritance • To understand and identify Chromosomal Theory of Inheritance • To learn about Inheritance of mitochondrial and chloroplast genes • To study plasmid inheritance.
I	Inheritance Biology Practical Course BTP1004	• Illustrates the standard approach used in linkage analysis. • Study one, two and three factor crosses • Learn the methods of plasmid, mitochondrial and chloroplast DNA isolation, • Design hypothesis and interpret Fluctuation test, • Use common lab equipment. • Study UV induced mutagenesis and

		graphically learn to plot survival curve • Interpret results from a variety of chemical mutagens and analyze respective results • To learn the technique for Isolating antibiotic resistance spontaneous mutant
I	Molecular Biology Theory Course BT2001	• Exhibit an understanding for significance of DNA repair Systems • Gain of clear and concise understanding about microbial DNA repair systems • To learn eukaryotic complex system of DNA repair mechanisms. • Co-relate between defective DNA repair system and genetic abnormalities associated with it. Comprehend the key process of genetic recombination • To reflect the understanding about recombination and genetic diversity. • To get acquainted with the principle proteins involved • To learn the resolution of genetic recombinants. Elucidation of the structure of the double helix and phase of replication process • To understand DNA synthesis and related it to cell cycle. • To learn about the important enzymes involved and its role in replication • To understand different DNA polymerases and its function • To associate Telomerase with End Problem of Linear DNA Replication. • : Understanding about central dogma of molecular biology, • CO2: To gain thorough knowledge about three stages of transcription • CO3: Know about RNAP of Prokaryotes and eukaryotes and its function. • CO4: To understand about Promoter elements for three polymerases • CO5: To learn about RNA editing, splicing, polyadenylation • Understand the “one gene-one protein” hypothesis • Learn the key differences in prokaryotes and eukaryotes translation process • Understand the properties of the genetic code • Understand post-translational

		modifications that occur before a protein becomes fully functional. • Deducing the molecular structure of the ribosome
I	Molecular Biology Practical Course BTP2001	• To implement observational strategies to formulate hypothesis for spontaneous mutations • Learn to apply statistical methods when analyzing their data. • To generate and interpret graphs displaying experimental results., • Study UV induced mutagenesis and graphically learn to plot survival curve • Interpret results from a variety of chemical mutagens and analyze respective results • To learn ampicillin enrichment method for autotrophs • Formulate experiments to learn DNA repair mechanisms in E. coli and Yeast • To study chromosomal aberrations using Physical mutagen • To Isolate different auxotrophic mutants by using selective plate method
I	Enzyme Technology Theory Course BT2002	• Chemical nature, mode of action and types and classes of enzymes. • To measure enzyme activity. • Types and kinetics of enzyme inhibition. • Different methods and advantages of enzyme immobilization. • Name and role of different industrially important enzymes.
I	Enzymology Practical Course BTP2002	• Role of enzymes in catalyzing chemical reaction and their applications
I	Cell Biology Theory Course BT2003	• To understand the concept of cell and its diversity • To learn about intracellular membranous compartments where different cellular functions can take place • Learn the structure and functions of each of organelles and relate to specific known genetic diseases. • To coordinate functions of several organelles that bring about cellular functions such as secretion and flow of genetic information from DNA to protein • To know how the fluid mosaic model of membrane structure explains each experimental finding

		• To understand the fluidity of the components of a cell membrane Distinguish between peripheral and integral membrane proteins • To understand the functioning of different ion pumps and channels. • To Understand that cell division functions in reproduction, growth, renewal and repair. • To understand molecular control of cell division • To learn about Cell differentiation in prokaryotic cells & Morphogenesis • To understand the roles of checkpoints, cyclin, Cdks, and MPF in cell cycle control • To learn about abnormal cell division and apply the principles of genetics to cancer • Predict the possible outcomes of various mistakes in meiosis. • Extract information about genes, alleles, and gene functions, • To gain knowledge about Chromosomal organization • To understand transposons • Learn about histone proteins and its function in chromosomal organization • To acquire understanding about general principles of cell communication • To learn about cell adhesion and roles of different adhesion molecules, • Understand neurotransmitters and its function • To gain an insight about G-protein coupled receptors, signal transduction pathways, • Study bacterial chemotaxis and quorum sensing.
I	Cell Biology Practical Course BTP2003	• Design experimentation to study Transport across membranes. • To study Effect of detergents on membrane permeability. • Learn method for Isolation of cellular organelles • Acquire the skills for preparing liposomes • Understand the effect of Colchicine on Chromosome movements during Mitosis
I	Basic Immunology Theory Course BT2004	• The basic principle of Immunology. • Cells & Organs involved in host immune system • Molecular and cellular mechanism of

		antibody production. • The function of T cells and role of MHC in immune response. • Immunology based diagnostic techniques.
I	Basic Immunology Practical Course BTP2004	• The importance and technique of blood group. • About how to isolate Protein A and what is its importance in industry. • About how to isolate the bacterial antigens • Different methods to quantify antigens.
II	Applied Immunology & Virology Theory Course BT3001	• the specific immune response against different types of pathogen. • How pathogen evolves to cause infection. • Details of vaccine development. It will be useful to them to develop the strategy of vaccine development. • The general cause of cancer and how we can prevent and treat the cancer. • Types of virus and what diseases they cause to human, plants and other organisms.
II	Applied Immunology & Virology Practical Course BTP3001	• the antibody based methods of diagnosis of diseases. • To culture and count the viruses *in vitro*. • the immunodiagnostic assays and virus culture methods and their enumeration.
II	Gene Expression & Genetic engineering Theory Course BT3002	• To explain the basic principles and the tools and techniques of genetic engineering • To describe the applications of genetic engineering in various fields. • About DNA manipulation enzymes, genome and transcriptome analysis and manipulation tools, gene expression regulation, production and characterization of recombinant proteins. • The debate on ethical issues concerned with Genetic engineering • Profiling of gene expression in eukaryotic and prokaryotic organisms. • about advances in biotechnology-healthcare, agriculture and environment cleanup via recombinant DNA technology.
II	Gene Expression & Genetic engineering Practical Course BTP3002	• to perform basic genetic engineering experiments at the end of course. • to become familiar with the tools and techniques of genetic engineering • the applications of genetic engineering in biological research and pharma sector

II	Developmental Biology Theory Course BT3003	• and can use the terminology in genetics and developmental biology • and have an understanding of the main concepts in developmental biology and their mechanisms and principles • the main morphological principles for development and reproduction in classical model organisms • the genetic and molecular mechanisms that operate in development and reproduction • and have insight in and understanding of how connections between genes and genomes play a role in genetics and developmental biology
	Developmental Biology Practical Course BTP3003	• and will be able to identify different stages in the embryo development • and will be able to rear in lab the model organisms and will be able to manipulate different embryos • and will be able to understand the effect of different molecules and environmental conditions on embryo development and morphogenesis
II	Bioinstrumentation Theory Course BT3004	• Mechanism of qualitative and quantitative determination of any reaction product. • To study structural features and other properties of biological samples. •
II	Bioinstrumentation Practical Course BTP3004	• Principal of working of given instrument. • Different important component of given instrument. • Hands on practice of handling the given instrument. •
II	Industrial Technology Theory Course BT4001	• Bioreactor designs and its applications in fermentation process • the best approaches to mass transfer during fermentation • different methods to strain improvement • the kinetics of biomass production • the different types of fermentation carried out industrially
II	Industrial Technology Practical Course BTP4001	• to set up, monitor and carry out downstream processes of different fermentation • methods of media optimization • the culture preservation and revival

		techniques
II	Recombinant DNA Technology Theory Course BT4002	• To understand the steps involved in recombinant DNA technology. • To explain the construction of DNA & c DNA library and their applications, Cloning, GMO • The Principles & applications of Proteomics • About Protein Engineering and site directed Mutagenesis • Explain the basics of NGS.
II	Recombinant DNA Technology Practical Course BTP4002	• Apply the technical skills learnt in pharma sector and research. • Students will be able to perform basic RDT experiments at the end of course.
II	Tissue Technology Theory Course BT4003	• Certain introductory aspects of plant and animal cell culture • media constituents and its role, Assessment of growth, measurement of cell death, totipotecny etc. • Various methods of plant and animal tissue culture. • Plants and animal cell transformation methods. • Application of plant cell Science in various fields such as o Production of biodegradable plastics, o Synthesis of primary and secondary metabolites with desirable properties. o Bio-Pharmaceutical, edible vaccines production, o Enhanced nutrient utilization, o tolerance to abiotic stress and improved disease resistance. o Production of crop plant with enhanced nutrition contents • Application of animal cell science for o Production of vaccines, o Interferons and antibiotics, o embryonic stem cell and gene therapy, o Production transgenic mice, cattle, sheep and fish. • Tissue engineering, Ethical issues related with use of above techniques.
II	Introduction to Bioinformatics Theory	• will have awareness of the basic principles and concepts of molecular biology and

	Course BT4004	information technology • an understanding of the intersection of life and information sciences, the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries • existing software tools effectively to extract information from large biological databases and to use this information in making new discoveries and knowledge
II	Dissertation	• about how to seek guidance from project guide • to identify a problem based on interest and through referenced research articles published in various scientific journals • to set limited clear cut objectives to address the identified problem • the nuances of setting up experiments to address a problem • to record and present the results in form of dissertation thesis • to successfully defend the short research work executed by the student • to meet project goals set mutually by the student and the mentoring project guide