5 Year Integrated M.Sc. Biotechnology-
Course/Paper Outcomes

Academic year	Name of the Course/ Paper Title	Course/Paper Code	Name of the Programme	Activities with direct bearing on employment, Entrepreneurship/skill development
2021-2022	**Cell Biology**	**5-T1**	**5 Yr Integrated M.Sc.Biotechnology**	To gain the knowledge of living cells such as prokaryotic and eukaryotic cells. To understand the molecular aspects of of Cell Signaling, Protein sorting Cell Cycle and Cell Division Cell Death Pathways. To understand the basics of cancer biology.
2021-2022	**Microbiology**	**5-T2**	**5 Yr Integrated M.Sc.Biotechnology**	This course will help students to acquire skills and competency in microbiological laboratory practices applicable to microbiological research or clinical methods, including accurately reporting observations and analysis, applications of Microorganisms in various fields.
2021-2022	**Genetics**	**5-T3**	**5 Yr Integrated M.Sc.Biotechnology**	To understand basic principles and exceptions of Mendelian inheritance. To learn the concepts of Linkage, crossing over and recombination. To gain knowledge about the organelle inheritance. To make students understand the role of the X and Y chromosomes in determining sex and how they are inherited. To impart knowledge about DNA damage and Repair mechanism
2021-2022	**Biodiversity & Biostatistics**	**5-T4**	**5 Yr Integrated M.Sc.Biotechnology**	To study various aspects of biodiversity. To understand global biodiversity (plant and animal) and the concept of Bioprospecting, biosafety, biopiracy and biodiversity conservation This course will help students' tools of biostatics in interpretation of biological data. Students will be able to characterize data and understand different sampling methods. To understand the concept of mean, mode, median, range, mean deviation, standard deviation, standard error, correlation & regression, chi square test, t-test.
2021-2022	**Biophysical methods**	6-T1	**5 Yr Integrated M.Sc.Biote**	To understand the safety measures in laboratory, handling and care of instruments and demonstrate a broad understanding of life science technologies. To demonstrate ability to plan and execute experiments, and analyze and interpret outcomes.

			chnology	Demonstrate understanding of selected Basic Principles & Concepts about biological techniques like microscopy, centrifugation, electrophoresis, chromatography and basics of radioactivity.
2021-2022	**Biochemistry**	6-T2	**5 Yr Integrated M.Sc.Biotechnology**	Students will be imparted knowledge about structure and function of different biomolecules (proteins, lipids, nucleic acids, and carbohydrates). Understanding of carbohydrate, protein, lipid, purine and pyrimidine biosynthesis and metabolism.
2021-2022	**Immunology and Immunotechnology**	6-T3	**5 Yr Integrated M.Sc.Biotechnology**	To introduce the basic concepts of cells and organs of the immune system and immunity. To study the structure and function of antigen and antibodies. Study of rearrangement of Ig genes. To learn about Major Histocompatibility Complex, antigen processing and presentation, complement system and cytokines. To provide knowledge about Humoral and Cell Mediated Immune Response: B- cell and T – cell receptor complex. Cell mediated cytotoxicity: T cytotoxic cells, Natural Killer (NK) Cells, Antibody dependent cell cytotoxicity (ADCC). To give an overview of hypersensitivity and autoimmunity. Transplantation: Graft vs. host reaction and rejection; Immunization and Vaccines. To provide knowledge of antigen-anibody interaction and Immunodiagnostic techniques: RIA and ELISA.
2021-2022	**Molecular Biology**	6-T4	**5 Yr Integrated M.Sc.Biotechnology**	To understand the concepts of Molecular Biology. To study the chemical & physical properties of nucleic acids. Learn experimental evidences for nucleic acid as carrier of genetic information. To understand DNA replication, transcription, translation in Prokaryotes and Eukaryotes. To study the basic features of genetic code. To understand the regulation of gene expression in Prokaryotes and Eukaryotes.
2021-2022	**Genetic engineering**	**7-T1**	**5 Yr Integrated M.Sc.Biotechnology**	Learning outcomes of this course are technical know-how on versatile techniques in recombinant DNA technology, application of genetic engineering techniques in basic and applied experimental biology and proficiency in designing and conducting experiments involving genetic manipulation. Development of an ability to design and conduct genetic engineering experiments, as well as to analyze and interpret data and construction of DNA and cDNA libraries. Development of research aptitude and technical skills to

				secure a job in genetic engineering labs. Understand genome complexity, genome organization and genome analysis. Learn Whole genome Sequencing, accessing whole genome sequence databases. Learn the procedures involved in PCR and southern hybridization, etc.
2021-2022	**Plant Biotechnology**	**7-T2**	**5 Yr** **Integrated** **M.Sc.Biotechnology**	Develop skills for application of plant tissue culture techniques. To get the knowledge about the genetic transformation and production of transgenic plants.
2021-2022	**Animal cell culture**	**7-T3**	**5 Yr** **Integrated** **M.Sc.Biotechnology**	To know the basics of animal cell culture and apply the knowledge in the relevant field of interest. Pursuing research related to animal cell and tissue culture at national and international level. To contribute in industries related to animal cell culture as scientists
2021-2022	**Enzymology and Plant Biochemistry**	**7-T4**	**5 Yr** **Integrated** **M.Sc.Biotechnology**	To understand the Mechanisms of enzyme action and Enzymes kinetics.. To study the Regulation of enzyme activity mechanism of some important enzymes. To know the Photosynthetic pigments and photosynthesis in bacteria and higher plants. To study the CO_2 fixation by C3, C4, and CAM pathways and photorespiration. Students will also be imparted knowledge about nitrogen fixation and *nif* and *nod* genes.
2021-2022	**Medical Biotechnology**	**8-T1**	**5 Yr** **Integrated** **M.Sc.Biotechnology**	Development of solid foundation and requisite research aptitude for further higher studies on regenerative medicines. Become competent to secure a job in biopharmaceutical and biomedical industry. Students will be able to understand the classification of genetic diseases, disease diagnosis and drug delivery & designs This course will help the students to acquire skills and competency in Prenatal diagnosis, gene therapy and Animal Cloning
2021-2022	**Microbial Biotechnology**	**8-T2**	**5 Yr** **Integrated** **M.Sc.Biote**	The course will provide technical knowledge applications of industrial microorganisms. The course will also provide the technical knowledge of several industrial products such as amino acids, organic acids, industrial enzymes and beverages. To gain the knowledge about the role of microbes in food

			chnology	industry.
2021-2022	**Environmental Biotechnology**	**8-T3**	**5 Yr** **Integrated** **M.Sc.Biotechnology**	Explain the importance of microbial diversity and of molecular approaches in environmental microbiology. Describe existing and emerging technologies that are important in the area of environmental biotechnology; Describe biotechnological solutions to address environmental issues including pollution, mineral resource winning, renewable energy and water recycling. Learning outcome of Environment Biotechnology is to gain the knowledge of biodiversity, bioremediation, pollution.
2021-2022	**Agricultural Biotechnology**	**8-T4**	**5 Yr** **Integrated** **M.Sc.Biotechnology**	Engineering plants for biotic stress like insect and fungal diseases. Engineering plants for abiotic stress like drought and herbicide tolerance. Engineering plants for shelf life and nutritional quality. Gaining knowledge on biosafety, risk assessment and regulation of transgenic plants in India Understand the historical background, importance and levels of Biosafety at laboratory and industrial scale. Understanding of the relationship between society and science and the justification for biotechnological manipulation of plants, animals, and microorganisms.
2021-2022	**Bioprocess Technology**	**9-T1**	**5 Yr** **Integrated** **M.Sc.Biotechnology**	Plan a research career or to work in the biotechnology industry with strong foundation about bioreactor design and scale-up. Students will be able to explain the steps involved in the production of bioproducts and methods to improve modern biotechnology and can apply basic biotechnological principles, methods and models to solve biotechnological tasks. Graduates gain ability to investigate, design and conduct experiments, analyze and interpret data, and apply the laboratory skills to solve complex bioprocess engineering problems. Able to separate the molecules through chromatography and understand the complexity in scale up of unit operations. Able to choose the downstream steps within the constraints of

				biosafety and process economics
2021-2022	**Advanced Biotechnology**	**9-T2**	**5 Yr** **Integrated** **M.Sc.Biotechnology**	Students will be able to understand the mechanism of Site specific recombination and Advances in transgenic strategies for gene inhibition. The course will provide technical knowledge and applications of ribozyme technology, gene silencing and RNAi technology, genome editing using CRISPR Cas Students will the knowledge about host parasite interaction and genome mapping such as Fluorescent in situ hybridization (FISH) and Sequence tagged site (STS) mapping,
2021-2022	**Bioinformatics**	**9-T3**	**5 Yr** **Integrated** **M.Sc.Biotechnology**	Students will be able to analyze, interpret and study biological data (sequence, structure, etc) stored in various databases available on internet. Using existing software effectively to extract information from large databases and to use this information in computer modeling.
2021-2022	**Nanotechnology**	**9-T4**	**M.Sc.Biotechnology**	To know the preparation and characterization of appropriate nano materials with precision conceptualize the insertion of nano size in the relevant field of interest
2021-2022	**Industrial Project**	**Xth Sem**	**5 Yr** **Integrated** **M.Sc.Biotechnology**	In this course, the student will undergo training in any biotechnology industry/institute for 5-6 months during X semester. This will not only enhance knowledge base of students but also provide them exposure as to how to conduct and carry out a research based task. Students will also learn how to compile and interpret results.