Master of Science (Genetics)

Program Outcomes

PO1 Apply the foundational knowledge in core Genetics, Mathematics, and Statistics to address challenges in biological sciences.

PO2 Conduct experiments independently and acquire proficiency in using instruments.

PO3 Demonstrate the ability to use digital tools, database and software, identify and formulate research literature using principles of life sciences.

PO4 Employ appropriate techniques and scientific resources for solving complex problems in sustainable agriculture, environmental and biomedical Genetics

PO5 Analyze research-based data, comprehend scientific findings, draft reports and documents.

PO6 Incorporate ethical principles into scientific practices to implement value-based inter, multi and trans-disciplinary research.

PO7 Develop effective communication and entrepreneurial skills, and function effectively as a member of a team.

Program Specific Outcomes

PSO1 Understand the Basic concepts of Genetics and apply the same in the field of Developmental Biology, Behavioral Genetics, Human Genetics and Bioinformatics

PSO2 Attain proficiency in techniques specific to Genomics and Proteomics to analyze human diseases and carry out research in related areas

PSO3 Integrate statistical methods and bioinformatic tools to gain biological insights

PSO4 To plan systematic research work in Genetics and applied areas of Biology and to arrive at logical conclusions using reliable data search tools and statistical approaches

Course Outcomes

Semester: 1

Subject	Course Outcomes
CELL AND MOLECULAR BIOLOGY	**CO1** Understand the structure and functions of cell organelles **CO2** Articulate the concepts of cell cycle and cell division **CO3** Learning the basic concepts of Central Dogma of Molecular Biology **CO4** Gain knowledge on DNA replication and repair mechanism
PRINCIPLES OF GENETICS	**CO1** Highlight the importance of Mendelian Genetics concepts and its importance in Genetics **CO2** Compare the ratios of gene interactions in different examples **CO3** Articulate the concepts of Genome organization in eukaryotes and condensation of DNA. **CO4** Correlating the process of Sex determination and sex differentiation and their significance.
PRINCIPLES OF GENETICS, CELL AND MOLECULAR BIOLOGY LAB	**CO1:** Illustrate the preparation of Mitosis and Meiosis **CO2:** Comprehend Genetic problems on Multiple alleles and Gene Interactions **CO3:** Demonstrate proficiency in isolating DNA and RNA and identify proteins present in biological samples. **CO4:** Attain proficiency in demonstrating Cell Viability Assay
PHARMACEUTICAL MICROBIOLOGY LAB	**CO1:** Demonstrate the principles of antimicrobial chemotherapy **CO2:** Examine the sterility and efficacy of pharmaceutical products **CO3:** Assess the production level of therapeutically important microbial enzymes

PROTEIN CHEMISTRY LAB	**CO1:** Discuss scientific problems within the area of protein chemistry that can be tackled and solved by experiments **CO2:** Compare the theories learned about characteristics of protein and obtained experimental results **CO3:** Design experiments and expand the investigation in a project-oriented manner and will be adapted to work in a group
PROTEIN CHEMISTRY **THEORY**	**CO1:** Describe primary, secondary, tertiary and quaternary structures of proteins **CO2:** Demonstrate the fundamental mechanisms of protein folding with a deeper understanding of the factors determining the stability of protein. **CO3:** Examine structural and functional aspects of key proteins and mechanism of transport proteins **CO4:** Recommend data bases for searching information to visualize protein structures and compare amino acid sequences **CO5:** Design methodologies for isolation, purification and characterization of proteins

Semester: 2

Subject	Course Outcomes
DROSOPHILA GENETICS	**CO1** To gain knowledge on Early embryonic development of Drosophila. **CO2** To give an insight into the established and early career opportunities. **CO3** Appraise the latest cutting edge techniques used in Drosophila research **CO4** To educate and inspire the latest advances in Drosophila genetics

MOLECULAR GENETICS	CO1 Differentiate between prokaryotic and eukaryotic gene expression and post transcription al modifications. CO2 Summarize the process of inhibition of transcription and RNA editing CO3 Distinguish the genetic codes and their usage in prokaryotic and eukaryotic translation. CO4 Assess the importance of co and post translational modifications of eukaryotic proteins. CO5 Comment on the process of gene regulation in prokaryotes and eukaryotes, and the mechanisms of gene silencing.
DROSOPHILA GENETICS AND MOLECULAR GENETICS LAB	**CO1: Comprehend culturing, handling physiology and Genome sequence of Drosophila.** **CO2: Illustrate dissection, observation and staining of polytene chromosome.** **CO3:** Demonstrate the skills of isolation and amplification of DNA CO4: Illustrate isolation and quantification of cDNA and transformation of DNA.
APPLIED GENETIC ENGINEERING **THEORY**	**CO1:** Describe the functions, properties and applications of various molecular tools i.e. enzymes; vectors and gene analysis techniques **CO2:** Demonstrate the construction of construction of recombinant clones and gene libraries with their applications. **CO3:** Examine the appropriate molecular tools/approaches employed in gene therapy for treating various diseases (genetic, metabolic, cardiovascular and neurological). **CO4:** Assess the significance and limitations of the applications of gene editing and developments in the field of gene therapy.
APPLIED GENETIC ENGINEERING LAB	**CO1:** Discuss the principle and applications of restriction digestion, plasmid DNA isolation, transformation and cloning **CO2:** Examine the gene analytic techniques such as restriction digestion, southern blotting and transformation and cloning **CO3:** Assess based on the observations and results of the experiments

IMMUNOTECHNOLOGY **THEORY**	**CO1:** Explain the different components of the Immune system, Principles of diagnostic assays and basics of monoclonal antibodies. **CO2:** Discuss the characteristics of immune components and the mechanism of immune response; Basics of immune overactivation, deficiency and disorder **CO3:** Illustrate the mechanism of antibodies, and antigens, in normal and breach of immune responses in diseases like hypersensitivity reactions, immunodeficiency, and autoimmune **CO4:** Distinguish the significance of immune protection, vaccines, and immunizations in humans. **CO5:** Compare the significance and applications of in vitro antigen-antibody reactions in disease diagnosis and the synthesis and use of MoAbs in treating various complex diseases
IMMUNOTECHNOLOGY LAB	antigen and antibody interaction, and diffusion using the kit method. **CO2:** Assess the precipitation of immunoglobulins from serum using electrophoresis and diagnostics of antigens using ELISA **CO3:** Examine the latex agglutination and immune precipitation.
PROJECT 1: REVIEW OF LITERATURE	**CO1:** Plan & Design experiments using the knowledge in concepts/principles of Biotechnology to solve the problem related to the research project. **CO2:** Select and apply appropriate statistical methods for experimental design and result analysis

Semester: 3

Subject	Course Outcomes
Human Genetics	**CO1** Summarize the basic packaging of genetic material and the components involved in genome. **CO2** Exmaine the various phases in cell cycle and the mechanisms involved in M phase regulation, and chromosome instability causes and issues **CO3** Distinguish between the different phases of cancer progression and the underlying mechanisms **CO4** Reflect on the origin and progression of cancers like breast cancer, Lung cancer types and cervical cancer **CO5** Devise appropriate protocols for various samples that are found in a laboratory or clinical setting.
Developmental Genetics and Ethology	**CO1** Explain the process of Development and types **CO2** Apply the knowledge of Gametogenesis and Fertilization in the developmental stages. **CO3** Compare the Developmental stages of Chick, Mouse and other Mammals. **CO4** Appraise the importance of different behavioural traits exhibited by the organisms.
Evolution and Population Genetics	**CO1** Outline the basic concepts of Population Genetics and its importance **CO2** Explain the importance of Mutation, Genetic drift and Natural selection **CO3** Identify the nature of Quantitative traits and their characteristics **CO4** Examine the components of Variations and polymorphism **CO5** Assess the role of Evolution at Speciation and molecular level.
PLANT BIOTECHNOLOGY	**CO1:** Explain the principles, practices and applications of plant tissue culture and plant gene transformation and thereby, describe clear procedures for the maintenance of sterile condition and maintenance of plant tissue cultures and plant transformants

	CO2: Differentiate between various genetic transformation techniques in plants and their commercial application for proteins and vaccine development **CO3:** Demonstrate and relate the diverse purposes and practices of molecular breeding in plants **CO4:** Compare genome engineering in plants and other gene technologies for crop improvement **CO5:** Prioritize among the various strategies for crop improvement including plant molecular breeding and, agricultural practices
PLANT BIOTECHNOLOGY LAB	**CO1:** Demonstrate knowledge of basic techniques involved in plant tissue culture under aseptic conditions and practice GLP in tissue culture laboratory. **CO2:** Experiment different plant cell culture techniques, including preparation and evaluation of media and troubleshoot problems common to routine plant cell cultures. **CO3:** Select a specific method and perform the plant tissue culture and agriculture biotechnology techniques **CO4:** Develop and organize modern approaches to scientific investigation in the field of agriculture.
ELEMENTARY METHODS IN COMPUTATIONAL BIOLOGY	**CO1:** Describe the different types of computer network **CO2:** Discuss the steps for generating phylogenetic tree **CO3:** Explain the principle of sequence alignment and summarize the output generated by the servers (BLAST, Clustal omega, etc) **CO4:** Compare the outputs of different gene prediction servers **CO5:** Demonstrate the application of homology modelling / docking server in generating the 3D model of protein
ELEMENTARY METHODS IN COMPUTATIONAL BIOLOGY LAB	**CO1:** Demonstrate knowledge of basic techniques involved in plant tissue culture under aseptic conditions and practice GLP in tissue culture laboratory. **CO2:** Experiment different plant cell culture techniques, including preparation and evaluation of media and troubleshoot problems common to routine plant cell cultures.

	CO3: Select a specific method and perform the plant tissue culture and agriculture biotechnology techniques **CO4:** Develop and organize modern approaches to scientific investigation in the field of agriculture.
PROJECT 2: EXPERIMENTAL WORK	**CO1:** Application of analytical skills in solving complex problems pertaining to the research project **CO2:** Graphically present the results obtained from the project using appropriate software to prove the objectives & hypothesis. Present a research project proposal in front of subject experts, peer members or any audience and defend their project. Demonstrate communication and oral presentation skills.

Semester: 4

Subject	**Course Outcomes**
Genetics of Crop Improvement	**CO1** **Discuss** the scope and importance of plant genetics, breeding, and crop improvement initiatives. **CO2** **Illustrate** the tools and techniques in plant breeding for crop improvement and crop protection. **CO3** **Assess** the importance of selection techniques in crop improvement programs. **CO4** **Understand** the methodologies involved in seed handling and safeguarding new and native varieties **CO5** **Formulate** strategies for developing improved crop varieties and their validation.
Genetics of Crop Improvement (Practical)	**CO1** Understand the genetic resources of crop plants **CO2** Assess the quality parameters of seeds **CO3** Formulate methods to develop hybrid crop(s)

	CO4 Understanding the concepts of male sterility and self-incompatibility **CO5** Appraise the importance of hybrid seed production and intellectual property rights in crop improvement programs
MEDICAL GENETICS AND PHARMACOGENOMICS	**CO1** Compare between various inheritance patterns and gene flow in pedigrees. **CO2** Determine the causes for disease manifestation and prepare proper counselling measures **CO3** Distinguish between various regulatory mechanisms for gene regulation and their role in disease manifestation **CO4** Debate on the importance of genotype-phenotype correlations and their roles in disease manifestation and progression **CO5** Review the effect of various alleles and their encoded enzyme products on the ADME process of different drug molecules, and reflect on the importance of precision medicine in treating patients.
Medical Genetics and Pharmacogenomics	**CO1** Interpret the mode of inheritance through collected family data by drawing a pedigree. **CO2** Examine samples using molecualar techniques and tools **CO3** Deduce the abnormalities using banding technique and explain the inheritance patterns of the same as a counsellor. **CO4** Predict the structural changes in proteins and their influence on protein structure and function.
RESEARCH METHODOLOGY, SCIENTIFIC COMMUNICATION, AND SCIENTIFIC WRITING SKILLS	**CO1:** Explain the research methods while working on a research project work **CO2:** Select the appropriate research design and the research hypothesis **CO3:** Assess the results, and interpret the research article

	CO4: Assess scientific articles and write a review
PROJECT 3: DESSERTATION AND VIVA	**CO1:** Apply knowledge of scientific technology (Biotechnology) to tackle real life situations. Solve scientific problems with originality and write scientific report drawing conclusions, article writing **CO2:** Demonstrate leadership quality related to science such as objectivity, creative imagination/thinking, systematic reasoning, meticulous planning, respect for logic, and acceptance after proof/verification, consideration of cause and effect, patience, perseverance, work in a team/lead the team. Demonstrate life-long learning ability on scientific advancements