



## Department of Biotechnology - Academic Year 2022-23

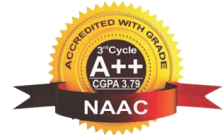
Programme Outcomes (PO) & Course Outcomes (CO) offered by the institution are stated and displayed on websites.

<b>Programme Outcome :M.Sc. Biotechnology</b>	
<b>PO1</b>	<ul style="list-style-type: none"><li>Developing an interdisciplinary approach and a rational thinking.</li></ul>
<b>PO2</b>	<ul style="list-style-type: none"><li>Improvising the technical skills and implying them.</li></ul>
<b>PO3</b>	<ul style="list-style-type: none"><li>Learning about a vast array of new products that are designed to enrich lives, make day-to-day living easier, and make us healthier.</li></ul>
<b>PO4</b>	<ul style="list-style-type: none"><li>Designing of research projects that are cost effective, ecofriendly, potent and beneficial to mankind.</li></ul>
<b>PO5</b>	<ul style="list-style-type: none"><li>Use of scientific reasoning to make evaluative decisions.</li></ul>
<b>PO6</b>	<ul style="list-style-type: none"><li>Handling of sophisticated instrumentations and interpretation and analysis of data.</li></ul>
<b>PO7</b>	<ul style="list-style-type: none"><li>The objective is to prepare long term biotech professionals and researchers for advance research methodologies.</li></ul>



### Course Outcomes : M.Sc. Biotechnology

Class	Semester	Course Title with Sub. Code	Outcome
M. Sc. I Biotechnology	I	MBT 101: Advanced Biological Chemistry	<ul style="list-style-type: none"><li>• Able to discuss the primary, secondary and tertiary protein structure and their function.</li><li>• To understand aspects of protein modification and folding pathways.</li><li>• To gain knowledge of the disorders associated with protein misfolding and aggregate formation</li><li>• Engineering of protein of interest and their applications in fields like medicine and diagnosis</li><li>• To understand the basic concepts related to enzyme structure and enzyme activity</li><li>• Gain the knowledge of enzyme kinetics with respect to single substrate and bisubstrate reactions</li><li>• Understand the enzyme engineering and applications of enzyme in clinical and industrial field</li><li>• Gain the knowledge of different metabolic processes taking place in a cell and energy transductions taking place simultaneously</li><li>• To learn about the metabolome and metabolic flux analysis</li><li>• Learn about the pathways for secondary metabolites synthesis in plants (Mevalonate, Shikimate and Isoprene Unit Pathways)</li><li>• Understand the potential in the field of metabolomics for strain improvement.</li><li>• To discuss about different classes of secondary metabolites in plants.</li></ul>



			<ul style="list-style-type: none"><li>• Study the structure and different applications of phytochemicals like alkaloids, phenolics and terpenoids.</li><li>• Learn the chemical tests for detection and quantitative determination of phytochemicals.</li></ul>
M. Sc. I Biotechnology	I	MBT 102: Cell and Molecular Biology	<ul style="list-style-type: none"><li>• Study Cell structure and cytoplasmic membrane system. Cell structure and function with inter relationship of cell organelles and energy transformation, transport across plasma membrane and intra-cellular transport. Cell membrane – Plasma membrane types (animal, plant and bacterial)</li><li>• Understand the cell signaling: communication between cells and environment, function of second messengers. Signaling at cell surface, signaling molecules, hormones and receptors signaling pathways that control gene activity</li><li>• Understanding the mechanism of cell differentiation, cell death, cell transformation Cell Cycle and its regulation, Cell differentiation in plants and animals including terminal cell differentiation</li><li>• Role of hormones and growth factors Programmed cell death Cell transformation and etiology of cancer.</li><li>• Understand the genome structure and organization in prokaryotes and eukaryotes, histones and their effect on structure and function of chromatin, concept of gene families, clusters, pseudogenes, genome complexity and renaturation kinetics of genome. Understand Transposable elements in bacteria, IS elements composite transposons, replicative and non-replicative transposons and</li></ul>



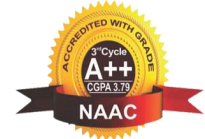
			<p>transposable elements in eukaryotes</p> <ul style="list-style-type: none"> <li>• Understand the process of DNA replication in prokaryotes and eukaryotes and models for replication. Study about Recombination Homologous and site-specific recombination, models for homologous recombination- Holliday junction, NHEJ, Proteins involved in recombination.</li> <li>• To study DNA damage and Repair - types of DNA damage and DNA repair mechanisms- nucleotide excision repair, base excision repair, mismatch repair, recombination repair, double strand break repair.</li> <li>• Study about gene expression in prokaryotes and eukaryotes. Regulation of transcription including transcription factors. Post-transcriptional processing and transport of mRNA. Understanding the concept of Gene Silencing, transcriptional and post transcriptional gene silencing, RNAi pathway (si RNA and mi RNA). To study Co- and post-translational modifications of proteins: Control of translation in eukaryotes (Antisense RNA, Heme and interferon).</li> </ul>
M. Sc. I Biotechnology	I	MBT 103: Genetics and Immunology	<p><b>Genetics:</b></p> <ul style="list-style-type: none"> <li>• To be able to recollect the concepts of Mendelian genetics,</li> <li>• Understand the genetics of Drosophila and Arabidopsis as a model organism.</li> <li>• To understand genetic mosaics, genetic epistasis in context of developmental mechanism.</li> <li>• To acquire knowledge about population genetics and genetics of evolution,</li> </ul>



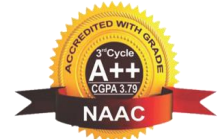
			<ul style="list-style-type: none"><li>• Study the Hardy Weinberg equilibrium, In-breeding depression &amp; mating systems; population bottlenecks, spatial variation &amp; genetic fitness.</li><li>• To be able to understand genetics behind human disorder, Clinical genetics, diagnostic tools and techniques for human genetic disorder Genetic approaches to complex genetic diseases- hypertension, diabetes and Alzheimer's</li><li>• To be able discuss the process of genetic mapping</li><li>• To be able to calculate the distances between two genes on the basis of Genetic recombination and linkage</li><li>• Understand Genetic mapping and physical mapping</li><li>• to understand necessity of Molecular markers &amp; marker based genetic linkage maps know about Linkage Disequilibrium, Genome-wide association study and haplotype mapping, Applications of genetic maps</li></ul> <p><b>Immunology:</b></p> <ul style="list-style-type: none"><li>• Understand the basic concepts of immune system as well as the types of the immune system and the cells and organs playing important roles for the immune system activation.</li><li>• Study the concepts behind the MHC.</li><li>• Study the immune responses generated by the B and T lymphocytes</li><li>• Study the concepts behind the B and T cell responses by various agents like cytokines, ADCC.</li><li>• Understand the concept of antigen and antibody interactions by studying the principles of various immunological</li></ul>
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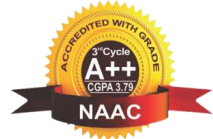
			<p>techniques like RIA, ELISA, Western blotting, Elispot assay, CMI techniques.</p> <ul style="list-style-type: none"><li>• Learn and study the background behind the vaccinology with the help of various vaccine development processes like attenuated vaccines, plant-based vaccines, monoclonal antibodies, gene library, adjuvants and conjugate vaccines.</li></ul>
M. Sc. I Biotechnology	I	MBT 104: Laboratory Course I	<ul style="list-style-type: none"><li>• To extract and purify the enzyme Beta galactosidase by different methods and estimate its enzyme activity</li><li>• To study the enzyme kinetics of enzyme by determining the values of <math>K_m</math>, <math>V_{max}</math> and <math>K_{cat}</math> using LB plot.</li><li>• To study any plant with respect to its secondary metabolites, their extraction and applications.</li><li>• Detect the antigen-antibody interaction qualitatively and quantitatively using immunodiffusion techniques</li><li>• To understand the Complement fixation test.</li><li>• To study the antigen antibody interaction by performing SANDWICH ELISA technique.</li><li>• To understand the technique of Immunoblotting and Dot blot assays.</li><li>• To study the Separation of mononuclear cells by Ficoll-Hypaque method and their cryopreservation</li><li>• Separation of leucocytes by dextran method. To learn the method of Isolation of nuclei from liver tissue using sucrose gradient and chromatin isolation using different buffers and visualizing the Mononucleosome size by agarose gel electrophoresis.</li><li>• To study Extraction of Histone using</li></ul>



			<p>ethanol precipitation method and Analysis of Histones using SDS polyacrylamide gel electrophoresis.</p> <ul style="list-style-type: none"> <li>• To Perform RNA solution of and analysis by agarose gel</li> <li>• To learn working of PCR/RT-PCR using suitable genes</li> <li>• To perform Restriction digestion of DNA using suitable RE and resolution on agarose gel</li> <li>• To understand the technique for Isolation of mitochondria using density gradient centrifugation method, estimation of mitochondria using SDH assay and lysosomes, acid phosphatase activity respectively</li> <li>• To learn about the Programmed cell death during limb development In Chick.</li> <li>• To perform the Staining of animal cells (Histone by Fast green; DNA by Fuelgen; RNA by Methyl green Pyronin).</li> <li>• To perform Karyotyping and Ideogram construction in onion roots using Colchicine treatment</li> <li>• To visit to animal house, or any National Research Institute and Industry Report writing.</li> </ul>
M. Sc. I Biotechnology	I	MBT 105: Environmental Biotechnology	<ul style="list-style-type: none"> <li>• Understand the concept of energy and environment.</li> <li>• Introduction to environmental components, future scenarios of global environment.</li> <li>• Get knowledge about waste management and solid waste management.</li> <li>• Get knowledge about bioremediation, removing pollutants from environment.</li> <li>• Understand concept of remote sensing</li> </ul>



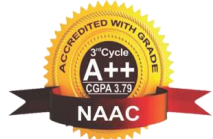
			<p>and GIS, environmental impact assessment.</p> <ul style="list-style-type: none"> <li>• Study environmental laws and policies</li> </ul> <p><b>Practical</b></p> <ul style="list-style-type: none"> <li>• Perform bio stimulation and phytoremediation</li> <li>• Determination of dissolved oxygen, BOD, COD of sewage sample</li> <li>• Learn acquisition of google earth images</li> <li>• Review on EIA case study</li> </ul>
M. Sc. I Biotechnology	II	MBT 201: Genetic Engineering	<ul style="list-style-type: none"> <li>• Understanding various tools in genetic engineering like enzymes, vectors used for preparing a recombinant.</li> <li>• To study various strategies useful to produce high quality and quantity of biomolecules used in industrial prospective.</li> <li>• Study of different techniques and methods useful in genetic engineering for preparing a recombinant.</li> <li>• To study application of various tools and techniques studied in genetic engineering for detection or diagnosis of disease, criminology, preparing vaccines, transgenic models.</li> </ul>
M. Sc. I Biotechnology	II	MBT 202: Bacteriology and Virology	<ul style="list-style-type: none"> <li>• To be able discuss the procaryotic cell structure and its applications in designing drugs.</li> <li>• To isolate and culture any bacteria of interest and identify.</li> <li>• Compare and understand the role of bacteria in public health and biotechnology applications.</li> <li>• Understand the properties of viruses and their morphology.</li> <li>• Discuss the different classification system of viruses.</li> </ul>



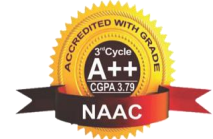
			<ul style="list-style-type: none"><li>• Understand the mechanisms of viral genome replication.</li><li>• Know the methods involved in studying of viruses their cultivation and pathology.</li><li>• Discuss the different antiviral agents with their mode of action.</li><li>• Discuss the types of infective viruses.</li><li>• To understand the field of epidemiology and its applications.</li><li>• To understand the concept of immunopathogenesis.</li><li>• Awareness about the new emerging diseases and how to tackle with them.</li><li>• Able to know different animal and poultry viruses which is of importance in animal husbandry.</li><li>• Study plant viruses with the knowledge of their pathogenesis</li></ul>
M. Sc. I Biotechnology	II	MBT 203: Plant Biotechnology	<ul style="list-style-type: none"><li>• To study algal and fungal biotechnology to get knowledge of micro propagation, in vitro androgenesis, somatic hybridization</li><li>• To study transgenic plant production through various biotechnological techniques</li></ul>
M. Sc. I Biotechnology	II	MBT 204: Laboratory Course II	<ul style="list-style-type: none"><li>• To study techniques for engineering or modification of genetic material by isolating the genetic material, cutting (restricting), joining (ligating), and transforming the genetic material.</li><li>• To study different techniques for amplification, hybridization and analysis of the engineered genetic material</li><li>• To obtain the microbiological skills of handling equipments and microorganisms for identification and applications.</li><li>• To be able to isolate any bacterial</li></ul>



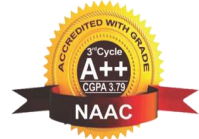
			<p>species and identifying upto genus level.</p> <ul style="list-style-type: none"> <li>To study animal and bacterial viruses by basic techniques</li> <li>To perform the determination of antigen titer by hemagglutination test</li> </ul>
M. Sc. I Biotechnology	II	MBT 206: Medical Biotechnology	<ul style="list-style-type: none"> <li>Introduction to molecular basis of Disease</li> <li>To study Chromosomal Disorders with examples, Classifications of Genetic diseases Single Gene disorders: Sickle cell anaemia and Thalassemia, polygenic diseases like Type I diabetes, Alzheimer Disease, Infectious disorders</li> <li>To study various diagnosis methods like diagnosis using protein and enzyme markers: Enzyme probes (Glucose oxidase, Monoamine oxidase), Diagnosis of hormonal disorders &amp; infectious diseases using Monoclonal antibodies, DNA/RNA based Diagnosis using nucleic acid probes and Microarray Technology for disease diagnosis. To understand Genetic counselling.</li> <li>To understand the gene therapies methods in detail: ex vivo &amp; in vivo gene therapy, Strategies of Gene therapy like Gene augmentation, antisense therapy, ribozymes. To study the Vectors used in gene therapy and Gene therapy trials: ADA deficiency, Cystic fibrosis, HIV. To study Enzyme therapy for Gauchers disease, and Hormone replacement therapy for Diabetes. To understand Subunit Vaccines and Attenuated Vaccines</li> <li>To learn Stem Cell Therapy and Nanotechnology. Stem cells in therapy -embryonic &amp; adult stem cells, Characteristics &amp; properties of stem</li> </ul>



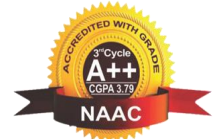
			cells. Potential use of stem cells. To study Cell & Tissue engineering, Bio-artificial organs (liver, Blood cells, skin). To study the application of Nanotechnology in diagnosis
M. Sc. II Biotechnology	III	MBT- 301 Animal and Stem Cell Technology	<ul style="list-style-type: none"> <li>• Learn about animal tissue culture technique, Detection of Mycoplasma and viral contaminants, Prevention of Cross contamination, eradication of contaminants, balanced salt solutions and simple growth medium.</li> <li>• To know about various systems of tissue cultures their Distinguishing features, advantages and limitations.</li> <li>• To understand about Methods of organ culture, behavior of organ explant, and applications of organ culture</li> <li>• To understand the growth studies by Cell proliferation, cell cycle, mitosis in growing cells</li> <li>• To know about the basics of stem cell technology types of stem cells, Cell cycle regulation in stem cells, Concept of Stem cell niche with examples</li> <li>• To understand about techniques to produce transgenic animals</li> <li>• To know about the role of Animal husbandry and reproductive biotechnology, In vitro fertilization and embryo transfer technology, Animal cloning: concept and application in conservation</li> <li>• To know about the Bioethics and Biosafety issues related to animal biotechnology and human cloning</li> </ul>
M. Sc. II Biotechnology	III	MBT- 302 Bioprocess engineering	<ul style="list-style-type: none"> <li>• To learn about types of fermentation, design and types of bioreactors, Kinetics of operation of bioreactor, how industrially important strains can be isolated, screened, strain</li> </ul>



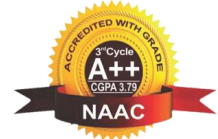
			<p>improvement and inoculum development</p> <ul style="list-style-type: none"> <li>To gain knowledge about media formulation, sterilization, scale up and scale down studies, monitoring of process variables</li> <li>To understand mechanism of mass transfer, aeration and agitation</li> <li>To learn about different techniques for downstream processing</li> <li>Learn industrial production and recovery process of different primary and secondary metabolites</li> <li>To learn different principles, responsibilities of quality control and quality assurance department</li> </ul>
M. Sc. II Biotechnology	III	MBT- 303 Bioinformatics & Biostatistics	<ul style="list-style-type: none"> <li>To understand Major Bioinformatics Resources and Biological databases. To NCBI/EBI/EXPASY, Biological literature databases (PubMed), Nucleic acid sequence databases (NCBI's GenBank + the EuropeanNucleotide Archive [ENA] + the DNA Data Bank of Japan [DDBJ],)Protein sequence databases (UniProtKb,SwissPort, TrEMBL).</li> <li>To learn the biomolecular sequence analysis and Pairwise sequence alignment algorithms (Needleman Wunsch, Smith &amp; Waterman, PAM and BLOSUM matrices, Gap Penalty and Penalty Scheme, Database Similarity Searches (BLAST, FASTA), Multiple sequence alignment algorithms, Methods of MSA(Progressive, Iterative, Block-Based Alignment), CLUSTALW and CLUSTALX,T-Coffee</li> <li>To understand Protein profiles and Hidden Markov Model (HMM). To learn the application of Multiple</li> </ul>



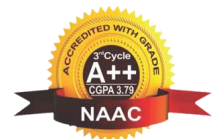
			<p>sequence alignment :Phylogenetic analysis</p> <ul style="list-style-type: none"><li>• To acquire knowledge of Major Structural Resources (PDB and PMDB). To understand the basis of Basic Structure Visualization, Visualization of major secondary structure (helices, beta sheets) and their role in protein structure, Visualization of various interactions :Polar (Hydrogen Bonds), Apolar (Hydrophobic, van der Waals, Pi stacking), Other (Salt Bridges, Coordination with ions) in protein structures and their role. To learn Protein Structure Classification (SCOP and CATH) protein secondary structure and Tertiary structure prediction methods (Homology modeling and Fold Recognition, ab initio methods, Ramchandran Plot</li><li>• To understand the concept Pharmacophore modelling and Chemoinformatics, Chemical Structure representation: 1D, 2D and 3D structures, Molecular file formats (SMILES, WLN, SDF, MOL,PDB etc, Compound library formatting and filtering Physicochemicaland substructure filters</li><li>• To learn the Molecular Modeling strategies</li><li>• Introduction to modelling protein ligand interactions, Pose Prediction Strategies in molecular Docking: Rigid body docking flexible ligand docking (Conformational search method,Fragmentation method, Database method), Scoring Functions: Force field-based, Empirical, Knowledge-based.</li></ul>
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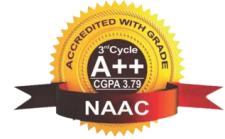
			<ul style="list-style-type: none"> <li>To understand the Application of modelling in Structure Based Drug Designing</li> <li>To understand Biological variables, Sampling methods, Statistical data distribution, Data presentation models.</li> <li>To learn Design, correlation and regression analysis, statistical Methods, Analysis of variance table (ANOVA), Post hoc Tests- Tukey's test for pairwise comparison of treatments, Dunnet's test for comparison of treatment means with control, Duncan's multiple range test, Mann-Whitney U test</li> </ul>
M. Sc. II Biotechnology	III	MBT - 304 Laboratory Course III- Animal Biotechnology, Bioprocess engineering & Bioinformatics & Biostatistics	<p><b>Animal Biotechnology</b></p> <ul style="list-style-type: none"> <li>To study the technique of initiation of primary culturing from chick embryo refers to the stage of the culture after the cells are isolated from the embryo.</li> <li>To be able to subculture the cell from the primary cell culture (multiwell plate), and establishment of cell line by calculating the concentration of cells per ml using hemocytometer.</li> <li>To learn the pattern of Growth of the established cell line by calculation the percentage viability of the cell.</li> <li>To understand the technique of cryopreservation of cell by using glycerol and liquid nitrogen.</li> <li>To study Chromosome spread preparation from cell line</li> </ul> <p><b>Bioprocess Engineering</b></p> <ul style="list-style-type: none"> <li>Students learn the methodology for screening, isolation and identification of a production strain from natural environment and techniques which can</li> </ul>



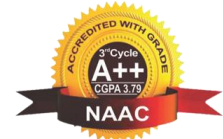
			<p>be used for their preservation.</p> <ul style="list-style-type: none"><li>• Optimization of the production medium for different parameters.</li><li>• Learn the working of lab bench fermenter.</li><li>• Students explore the method of recovery of enzyme and estimate the enzyme activity by enzyme assay.</li><li>• Understand and perform the solid state fermentation technique for laboratory scale production of enzyme.</li><li>• To visit the fermentation industry and report writing</li></ul> <p><b>Bioinformatics and Biostatistics</b></p> <ul style="list-style-type: none"><li>• To explore online resources like NCBI, PubMed (GenBank, UniProtKB, PDB)</li><li>• To perform Database Similarity searching using BLAST</li><li>• To learn Phylogenetic analysis using Phylip or Mega</li><li>• To learn Basic Structure visualization using Deep View</li><li>• To predict protein tertiary structure using any method (CPH, MODELLER, SWISS Model, EasyModeler), Molecular Docking using AutoDock and Molecular visualization of docked complexes (using Pymol or Chimera)</li><li>• To understand the Dtermination of Karl-Pearson's coefficient of correlation/ Spearman's rank</li><li>• To learn examples based on t – test , Chi-square test for goodness of fit and independent attributes.</li><li>• To perform Analysis of variance on the given data (ANOVA)</li><li>• Measures of skewness and measures of Kurtosis (grouped and ungrouped data).</li></ul>
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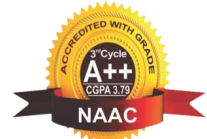
M. Sc. II Biotechnology	III	MBT - 306 Agricultural Biotechnology	<p><b>Agricultural Biotechnology (theory)</b></p> <ul style="list-style-type: none"><li>• To acquire knowledge about Agricultural Biotechnology and advancements in In-Vitro Plant propagation of various crops</li><li>• Understand Use of bioreactors in plant production &amp; Scale-up for Commercialization</li><li>• Learn about the major pest and diseases of horticultural crops and their control by Biotechnological methods</li><li>• Understand about Crop improvement through nuclear (FLAVR SAVER tomato and golden rice) and chloroplast manipulation for therapeutic proteins, vaccines, antibodies and increased production,</li><li>• Able to understand the recent advances in Agricultural biotechnology through plant genotyping, DNA Barcoding and CRISPER technology</li><li>• To learn about the Development and formulation of bioinoculants using nitrogen fixing, siderophore producing growth promoting microorganisms</li><li>• Acquire knowledge about Agricultural biotechnology and agribusiness and various Opportunities in the Agriculture Biotechnology</li></ul> <p><b>Agricultural Biotechnology (practical)</b></p> <ul style="list-style-type: none"><li>• To be able to produce virus free plants by screening using Virus indexing techniques - ELISA and PCR, (Demonstration)</li><li>• To generate Suspension culture and study the parameters to scale-up the production of in-vitro plants through monitoring of growth and differentiation of cells</li></ul>
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			<ul style="list-style-type: none"> <li>To understand the Endosperm culture technique for regeneration of seedless plants.</li> <li>Non gel techniques for plant genotyping and CRISPR based technology (Demonstration using web resources)</li> <li>To understand the Preparation, formulation (using suitable carrier material) and application (pot trials) of bio inoculants using Nitrogen fixing and Phosphate solubilizing Microorganisms)</li> </ul>
M. Sc. II Biotechnology	IV	MBT- 401 Genomics and Proteomic	<ul style="list-style-type: none"> <li>To learn the Genomics and Proteomics overview, Whole Genome sequencing – Methods, Assembly and Analysis, NGS Platforms, Comparative genomics - Goals, bioinformatics of genome annotation, methods and limitations, Structural genomics and Functional genomics Goals, methods, applications. Transcriptomics and Microarray.</li> <li>To understand transcriptomics and expression profiling,</li> <li>To understand the Applications of genomics, Metagenomics, Toxicogenomics and Pharmacogenomics</li> <li>To study concept of proteomics, Protein structure-function relationship, Protein expression proteomics, Structural Proteomics, Functional Proteomics, Protein Isolation and Separation techniques X-ray crystallography, NMR spectroscopy, 2 D electrophoresis, Peptide mapping &amp; sequencing</li> <li>To learn techniques in proteomics like Mass Spectrometry: MALDI_TOF, ESI Tandem, Ion Trap, Peptide mass fingerprinting, LC-MS, (SILAC),</li> </ul>



			<p>Chemical tagging, fluorescence, radio-labeling</p> <ul style="list-style-type: none"> <li>To learn the applications of Proteomics, Protein expression profiling, Protein-protein &amp; Protein-DNA interaction (Chip Technique), Methods for detection of protein-protein interactions, Yeast 1, 2 and 3 `hybrid systems, Phage display and Protein microarray.</li> <li>To study applications, of proteomics in Health care, Biomarkers in disease diagnosis, drug development and their target identification, Identification and characterization of novel proteins</li> </ul>
M. Sc. II Biotechnology	IV	MBT- 402 Advanced Bio analytical Techniques	<ul style="list-style-type: none"> <li>To learn about electron microscopy and different fixation and staining techniques for EM</li> <li>To acquire knowledge about Antibody generation, Detection of antigen using ELISA, RIA, Western blot Immunoprecipitation, Flow cytometry and FACS Detection of antigens in living cells (Stem Cell Markers) in situ localization by techniques such as FISH and GISH</li> <li>To understand Advanced Applications of Spectroscopy through UV visible spectrophotometer, Fluorescence spectroscopy, Circular dichroism, NMR, IR and ESR spectroscopy,</li> <li>Learn about how Molecular structure determination is carried out using X-ray diffraction and X ray crystallography</li> <li>Understand about molecular analysis using light scattering, Mass spectrometry and LC-MS and surface plasma resonance methods</li> </ul>




			<ul style="list-style-type: none"> <li>Acquire knowledge about principle and applications of Advanced Chromatography and Electrophoretic technique such as HPTLC, HPLC, GLC, IF and 2 D electrophoresis, Capillary Electrophoresis, DGGE (Denaturing gradient gel electrophoresis) etc.</li> <li>Learn about advances in PCR, DNA sequencing and Automated DNA microarray systems</li> </ul>
M. Sc. II Biotechnology	IV	MBT- 403 Research Project	<ul style="list-style-type: none"> <li>Research project is the major component in M.Sc IIsyllabus for developing research culture in the students</li> <li>Learn about how to identify problems and find solution to those problems through research</li> <li>Understand about analysis and application of various technique to solve problems concern with different subject areas</li> <li>Understand how to prepare scientific reports and presentations on research work.</li> </ul>
M. Sc. II Biotechnology	IV	MBT - 406 Research Methodology & Scientific Communication	<ul style="list-style-type: none"> <li>To learn different research philosophies, experimental design and deductive-inductive reasoning for scientific research.</li> <li>Understand about the critical thinking and hypothesis formulation</li> <li>To get acquainted about data collection and processing through various data analyzing tools like SPSS,R software and SAS</li> <li>Understand about the concept and importance of review article. To learn about citation index, h index.</li> <li>To learn the concept of research ethics and plagiarism</li> </ul>



			<ul style="list-style-type: none"><li>To understand the important characteristics needed for scientific writing, thesis writing and review writing.</li></ul>
M. Sc. II Biotechnology	IV	MBT - 407 Quality Control, Bio safety & Bioethics	<ul style="list-style-type: none"><li>To learn about the Quality standards, Quality assurance and Quality management in Biotech Industry.</li><li>Development and updates on specifications for essential Documents &amp; Regulatory Submission, Compliance and Audits.</li><li>To understand the Bioethical issues related to Healthcare &amp; medicine Food &amp; agriculture Genetic engineering.</li><li>To be able to experiment with any current ethical issue.</li><li>To learn about Biosafety in Laboratory &amp; Institution, Safety &amp; hazards, Industrial Hygiene &amp; toxicology.</li><li>Learn about the Guideline &amp; regulations (National &amp; International), GMOs &amp; LMOs Guidelines of India.</li></ul>



  
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