

Program Specific Outcome

Biotechnology

The overall objectives of B.Sc. Biotechnology programme are to provide students with Core courses in Biochemistry, Microbiology, Cell and Molecular Biology, Genetics and Genetic Engineering, Immunology and Industrial Biotechnology and the Elective courses in Molecular Genetics, Plant and Animal diversity, physiology and Cell culture, Biostatistics and Bioinformatics. B.Sc. Biotechnology involves an advanced study of the cellular and biomolecular processes for development of a variety of technologies and products that contribute to improving people's lives and health. Biotechnology is a part of Applied Biology, which simply stated, is the combination of biology with technology so as to alter cells for manipulation. Also, each course has a practical component where students gain hands-on experience of experiments based on concepts learned in theory. Online resources are made available through "Google class room." The students also offered with compulsory job training and field work programme where students visit pathology laboratories, pharma/biopharmaceutical companies and research institutes. In addition to regular lectures, we also organize guest lectures on the latest developments in Biotechnology. As part of this course, students undertake a six-month project which they are encouraged to present at National Seminars and to further publish their data in peer-reviewed journals. The course familiarizes candidates with the usage of living organisms and bio processes in the field of medicine, technology, engineering, and other bio products. Such candidates would possess an analytical mind, have problem-solving skills, and proficiency with the use of computers. Due to its multidisciplinary nature, Biotechnology offers employment opportunities in various fields like research, medicine, healthcare, animal husbandry, and agriculture and environment industry.

COURSE OUTCOME

The Department follows the syllabus and adheres to the curriculum structure as mandated by the affiliating Assam University. During the three years of the B. Sc Biotechnology Honours programme, spread over 6 semesters, 20 theory papers and 14 practical papers are taught. The Semester wise distribution of the Papers and their Course Outcomes are as follows:

SEMESTER 1	
<p>Name of the paper:</p> <p>Biochemistry & Metabolism</p> <p>Paper Code:</p> <p>BIOTECH-C-101</p>	<p>On completion of this course, the students will attain knowledge of various mammalian physiological processes. Students will learn and develop the concepts of:</p> <p>UNIT I: Function of amino acids, protein and their structural organization. Forces stabilizing protein structure and shape. Different Level of structural organization of proteins, Protein Purification.</p> <p>UNIT II: Classification of Carbohydrates and their functions. Study of bacterial cell wall.</p> <p>UNIT III: Lipid and their function.</p> <p>UNIT IV: Properties of enzymes and their functions. Role of: NAD⁺, NADP⁺, FMN/FAD, coenzymes A, Thiamine pyrophosphate, Pyridoxal phosphate, lipoic-acid, Biotin vitamin B12, Tetrahydrofolate and metallic ions.</p> <p>UNIT V: Carbohydrates Metabolism: Reactions, energetics and regulation. Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle, Electron Transport Chain, Oxidative phosphorylation. β-oxidation of fatty acids.</p>
<p>Name of the paper:</p> <p>Biochemistry & Metabolism practical</p> <p>Paper Code:</p> <p>BIOTECH-C-101L</p>	<p>After the completion of the practical course the students will be able to perform the following:</p> <ol style="list-style-type: none"> 1. study the activity of any enzyme under optimum conditions. 2. study the effect of pH, temperature on the activity of salivary amylase enzyme.

	<p>3. Determination of - pH optima, temperature optima, Km value, Vmax value, Effect of inhibitor (Inorganic phosphate) on the enzyme activity.</p> <p>4. Estimation of blood glucose by glucose oxidase method.</p> <p>5. Principles of Colorimetry: (i) Verification of Beer's law, estimation of protein. (ii) study relation between absorbance and % transmission.</p> <p>6. Preparation of buffers.</p> <p>7. Separation of Amino acids by paper chromatography.</p> <p>8. Qualitative tests for Carbohydrates, lipids and proteins</p>
<p>Name of the paper:</p> <p>Biochemistry & Metabolism</p> <p>Paper Code:</p> <p>BIOTECH-C-102</p>	<p>On completion of this course, the students will attain knowledge and develop the concepts of:</p> <p>Unit1: classification of organisms by cell structure</p> <p>Unit2: Cell Membrane and Permeability, cell recognition and membrane transport.</p> <p>UNIT III: Functions of Different cell organelles.</p> <p>UNIT IV: Ribosomes: Structures and function including role in protein synthesis.</p> <p>Nucleus: Structure and function, chromosomes and their structure.</p> <p>UNIT V: Signal transduction. Characteristics and molecular basis of cancer.</p>
<p>Course No.: BIOTECH-C-102-LAB</p> <p>Paper Name: CELL BIOLOGY</p>	<p>After the completion of the practical course the students will be able to:</p> <ol style="list-style-type: none"> 1. Find the effect of temperature and organic solvents on semi permeable membrane. 2. Determine plasmolysis and de-plasmolysis. 3. Determine the structure of any Prokaryotic and Eukaryotic cell. 4. Technique of Microtomy: Fixation, block making, section cutting, double staining of animal tissues like liver, oesophagus, stomach, pancreas, intestine, kidney, ovary, testes. 5. Detailed mechanism of cell division.
SEMESTER 2	

<p>Name of the paper: Mammalian Physiology</p> <p>Paper Code: BIOTECH-C-201</p>	<p>On completion of this course, the students will attain knowledge of various mammalian physiological processes. Students will learn and develop the concepts of:</p> <p>UNIT I: Basic concepts of the digestion process. The mechanism of digestion and absorption of various biomolecules such as carbohydrates, Proteins, Lipids and nucleic acids. Students will also learn the role of various enzymes such as bile, Saliva, Pancreatic, gastric and intestinal juice in the digestion process.</p> <p>UNIT II: Process of respiration and the mechanism of exchange of gases. Concepts of oxygen dissociation curve and chloride shift.</p> <p>UNIT III: Function and composition of blood. Mechanism of coagulation of blood. Mechanism of working of heart and origin & conduction of heart beat. Concept of haemopoiesis, cardiac output, cardiac cycle.</p> <p>UNIT IV: Muscle physiology including structure of cardiac, smooth & skeletal muscle. Mechanism of muscle contraction. Concepts of threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction. Students will also learn the concept of excretion and the mechanism of urine formation.</p> <p>UNIT V: Mechanism of generation & propagation of nerve impulse, along with the structure and function of synapse and neurotransmitters. Students will also learn the role of various hormones (such as insulin and steroids) and endocrine glands (such as hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals)</p>
<p>Name of the paper: Plant Physiology</p> <p>Paper Code: BIOTECH-C-202</p>	<p>Once this course is completed, the students will be able to learn the concepts of</p> <p>UNIT I: Various anatomical and histological organization shoot and root and leaf</p> <p>UNIT II: The importance of water to plant life. Concepts of diffusion, osmosis, plasmolysis, imbibition, guttation, transpiration</p> <p>UNIT III: Role of essential nutrients especially micro & macro nutrients in plant growth and development. Mechanism of uptake of nutrients and food transport</p>

	<p>UNIT IV: Detailed mechanism of photosynthesis. Concept of calvin cycle, CAM plants, photorespiration, compensation point. Detailed mechanism of nitrogen metabolism and fixation by plants.</p> <p>UNIT V: Various growth phases in plants and growth curve. Role of various growth hormone in plant development. Concept of seed dormancy, seed germination, photoperiodism and vernalization</p>
<p>Name of the paper:</p> <p>Mammalian Physiology LAB</p> <p>Paper Code:</p> <p>BIOTECH-C-201-LAB</p>	<p>After the completion of the practical course the students will be able to:</p> <ol style="list-style-type: none"> 1. Find the coagulation time of blood 2. Determine blood group of an individual 3. Count mammalian RBCs 4. Determine the TLC and DLC 5. Learn the concept of enzyme action 6. Determine haemoglobin content in the blood sample
<p>Name of the paper:</p> <p>Plant Physiology LAB</p> <p>Paper Code:</p> <p>BIOTECH-C-202-LAB</p>	<p>After the completion of the practical course the students will be able to:</p> <ol style="list-style-type: none"> 1. Prepare stained mounts of anatomy of monocot and dicot's root, stem & leaf. 2. Learn the concept of plasmolysis by Tradescantia leaf peel. 3. Learn the concept of opening & closing of stomata 4. Learn the concept of guttation on leaf tips of grass and garden nasturtium. 5. Separate of photosynthetic pigments by paper chromatography. 6. Learn the concept of aerobic respiration. 7. Prepare root nodules from a leguminous plant.
SEMESTER 3	
<p>Name of the paper:</p> <p>Genetics</p> <p>Paper Code:</p> <p>BIOTECH-C-301</p>	<p>On completion of this course, the students will attain knowledge of various mammalian physiological processes. Students will learn and develop the concepts of:</p> <p>UNIT I: Basic concepts in genetics, Cell Cycle, Check point. Introduction to Mendelian experimental design, monohybrid, di-hybrid and tri hybrid crosses, Law of segregation & Principle of independent assortment, chromosomal theory of inheritance and allelic interactions</p> <p>UNIT II: Introduction to non allelic interactions. Detailed concepts in chromosome and genomic organization.</p>

	<p>UNIT III: Concept of Genetic organization of prokaryotic and eukaryotic genome. Introduction to genetic code, gene function.</p> <p>UNIT IV: Detailed concept and types of chromosome and gene mutations. Screening procedures for isolation of mutants and uses of mutants, Chromosomal aberrations and abnormalities in human beings. Mechanism of sex determination and sex linkage:</p> <p>UNIT V: Molecular mechanism of genetic linkage, crossing over and chromosome mapping. Concept of extra chromosomal inheritance. Basics in population genetics, evolutionary genetics and natural selection.</p>
<p>Name of the paper: Genetics LAB Paper Code: BIOTECH-C-301-LAB</p>	<p>After the completion of the practical course the students will be able to:</p> <ol style="list-style-type: none"> 1. Prepare permanent and temporary mount of mitosis. 2. Understand Mendelian deviations in dihybrid crosses 3. Understand Barr Body -<i>Rhoeo</i> translocation. 4. Learn karyotyping with the help of photographs 5. Perform pedigree analysis of some common characters like blood group, color blindness and PTC tasting. 6. Perform test to find polyploidy in onion root tip by colchicine treatment
<p>Name of the paper: General Microbiology Paper Code: techniques.-C-302</p>	<p>Once this course is completed, the students will be able to learn the concepts of</p> <p>UNIT I: History and Evolution of Microbiology. Introduction to microbial world, and their classification, taxonomy, phylogeny, diversity and characterization.</p> <p>UNIT II: Methods of isolation, purification and maintenance of microorganisms.</p> <p>UNIT III: Introduction to microbial growth curve, generation time, and various culture techniques. Factors affecting growth of bacteria. Basic concept of microbial metabolism and bacterial reproduction.</p> <p>UNIT IV: Sterilization and disinfection methods for controlling the growth of microorganisms. Introduction to water microbiology and sewage disposal.</p>

	UNIT V: Introduction to food microbiology, microbe involved in food contamination and various food preservation techniques.
Name of the paper: General Microbiology LAB Paper Code: BIOTECH-C-302-LAB	After the completion of the practical course the students will be able to: 1. Understand the morphology of bacteria & their biochemical characterization. 2. Learn various staining methods. 3. Prepare media and isolate bacteria from different sources. 4. Determine bacterial cell size by micrometry. 5. Enumerate total & viable count of microorganism.
Name of the paper: Chemistry-1 Paper Code: BIOTECH-C-303	Once this course is completed, the students will be able to learn the concepts of UNIT I: Introduction to Bohr's theory, de Broglie equation, Heisenberg's uncertainty principle, Schrödinger's wave, Pauli's exclusion principle, Hund's rule, Aufbau's principle. UNIT II: Basic concepts of periodicity of elements. UNIT III: Introduction to the physical properties of liquids and surface tension. UNIT IV: Introduction to viscosity. Basic concepts of cleansing action of detergents. UNIT V: Basic concepts of ionic equilibria , weak acids and bases, pH scale, common ion effect and acid – base indicators.
Name of the paper: Chemistry-1 LAB Paper Code: BIOTECH-C-303-LAB	After the completion of the practical course the students will be able to: 1. Perform acid- base titrations 2. Perform Oxidation- Reduction Titrimetry
Course No.: BIOTECH-C-401	Once this course is completed, the students will be able to learn the concepts of UNIT I: History and Evolution of Microbiology. Introduction to microbial world, and their classification, taxonomy, phylogeny, diversity and characterization. UNIT II: Methods of isolation, purification and maintenance of microorganisms. UNIT III: Introduction to microbial growth curve, generation time, and various culture techniques. Factors affecting growth

	<p>of bacteria. Basic concept of microbial metabolism and bacterial reproduction.</p> <p>UNIT IV: Sterilization and disinfection methods for controlling the growth of microorganisms. Introduction to water microbiology and sewage disposal.</p> <p>UNIT V: Introduction to food microbiology, microbe involved in food contamination and various food preservation techniques.</p>
<p>Course No.: BIOTECH-C-401-LAB Paper Name: MOLECULAR BIOLOGY</p>	<p>After the completion of the practical course the students will be able to perform the following:</p> <ol style="list-style-type: none"> 1. Preparation of solutions for Molecular Biology experiments. 2. Isolation of chromosomal DNA from bacterial cells. 3. Isolation of Plasmid DNA by alkaline lysis method 4. Agarose gel electrophoresis of genomic DNA & plasmid DNA 5. Preparation of restriction enzyme digests of DNA samples 6. Demonstration of AMES test or reverse mutation for carcinogenicity.
<p>Course No.: BIOTECH-C-402 Paper Name: IMMUNOLOGY</p>	<p>On completion of this course, the students will attain knowledge and develop the concepts of:</p> <p>UNIT I: mammalian immune system.</p> <p>UNIT II Regulation of immunoglobulin gene expression.</p> <p>UNIT III Major Histocompatibility complexes.</p> <p>UNIT IV: Autoimmune diseases</p> <p>UNIT V Vaccines & Vaccination.</p>
<p>Course No.: BIOTECH-C-402-LAB Paper Name: IMMUNOLOGY</p>	<p>After the completion of the practical course the students will be able to perform the following:</p> <ol style="list-style-type: none"> 1. Differential leucocytes count 2. Total leucocytes count. 3. Total RBC count

	<p>4. Haemagglutination assay</p> <p>5. Haemagglutination inhibition assay</p> <p>6. Separation of serum from blood</p> <p>7. Double immunodiffusion test using specific antibody and antigen.</p> <p>8. ELISA</p>
<p>Course No.: BIOTECH-C-403 Paper Name: CHEMISTRY-2</p>	<p>UNIT I: Basics of Organic Chemistry</p> <p>UNIT II: Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.</p> <p>UNIT III: Stereochemistry: Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution.</p> <p>UNIT IV: Chemistry of Aliphatic Hydrocarbons : Carbon-Carbon sigma bonds Chemistry of alkanes. Carbon-Carbon pi bonds Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.</p> <p>UNIT V: Aromatic Hydrocarbons and Aromaticity. heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism.</p>
<p>Course No.: BIOTECH-C-403-LAB Paper Name: CHEMISTRY-2</p>	<p>After the completion of the practical course the students will be able to perform the following:</p> <p>1. Checking the calibration of the thermometer.</p> <p>2. Purification of organic compounds by crystallization using the following solvents: a. water b. Alcohol</p> <p>3. Separation of mixture of two amino acids by paper chromatography.</p> <p>4. Separation of mixture of compounds by thin layer chromatography. 5. Separation of plant pigments by paper chromatography.</p> <p>6. Estimation of total free amino acids using plant's material.</p>

	<p>7. Estimation of fat by soxhlet apparatus.</p> <p>8. Estimation of total sugar by anthrone method.</p>
<p>Course No.: BIOTECH-C-501 Paper Name: BIOPROCESS TECHNOLOGY</p>	<p>On completion of this course, the students will attain knowledge and develop the concepts of:</p> <p>UNIT I: Types of microbial culture and its growth kinetics– Batch, Fedbatch and Continuous culture.</p> <p>UNIT II : Design of bioprocess vessels.</p> <p>UNIT III : Principles of upstream processing – Media preparation, Inocula development and sterilization.</p> <p>UNIT IV: oxygen requirement in bioprocess.</p> <p>UNIT V: Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.</p>
<p>Course No.: BIOTECH-C-501-LAB Paper Name: BIOPROCESS TECHNOLOGY</p>	<p>After the completion of the practical course the students will be able to perform the following:</p> <ol style="list-style-type: none"> 1. Bacterial growth curve. 2. Calculation of thermal death point (TDP) of a microbial sample. 3. Production and analysis of ethanol. 4. Production and analysis of amylase. 5. Production and analysis of lactic acid. 6. Isolation of industrially important microorganism from natural resource.
<p>Course No.: BIOTECH-C-502 Paper Name: RECOMBINANT DNA TECHNOLOGY</p>	<p>On completion of this course, the students will attain knowledge and develop the concepts of:</p> <p>UNIT I: Molecular tools and applications.</p> <p>UNIT II Restriction and modification system, restriction mapping.</p> <p>UNIT III Genome mapping, DNA fingerprinting, Applications of Genetic Engineering Genetic engineering in animals</p> <p>UNIT IV Random and site-directed mutagenesis.</p> <p>UNIT V Genetic engineering in plants: Use of Agrobacterium tumefaciens and A. rhizogenes</p>

<p>Course No.: BIOTECH-C-502-LAB Paper Name: RECOMBINANT DNA TECHNOLOGY</p>	<p>After the completion of the practical course the students will be able to perform the following:</p> <ol style="list-style-type: none"> 1. Isolation of chromosomal DNA from plant cells 2. Isolation of chromosomal DNA from E.coli 3. Qualitative and quantitative analysis of DNA using spectrophotometer 4. Plasmid DNA isolation 5. Restriction digestion of DNA 6. Making competent cells 7. Transformation of competent cells.
<p>Name of the paper: Bio Analytical Tools Paper Code: BIOTECH-C-601</p>	<p>On completion of this course, the students will attain knowledge and develop the concepts of:</p> <p>UNIT I: Principle and application of simple microscopy, phase contrast microscopy, florescence and electron microscopy, pH meter, absorption and emission spectroscopy.</p> <p>UNIT II: Principle and application of absorption fluorimetry, colorimetry, visible-, UV- and infrared-spectrophotometry.</p> <p>UNIT III: Principle and application of centrifugation, and concepts of cell fractionation techniques. Isolation of sub-cellular organelles and particles.</p> <p>UNIT IV: Introduction to the principle and applications of various chromatography techniques - paper chromatography, TLC, column chromatography, including HPLC and GC.</p> <p>UNIT V: Principle and application of various electrophoresis techniques - starch-gel, PAGE, agarose-gel electrophoresis, pulse field gel electrophoresis, immuno- electrophoresis, isoelectric focusing, Western blotting. Concepts and applications.</p>
<p>Course No.: BIOTECH-DSE-501 Paper Name: PLANT DIVERSITY I</p>	<p>Once this course is completed, the students will be able to learn the concepts of</p> <p>UNIT I Algae: General character, classification and economic importance.</p> <p>UNIT II Fungi: General characters, classification & economic importance. Life history.</p>

	<p>UNIT III Lichens : Classification, general structure, reproduction and economic importance.</p> <p>UNIT IV Bryophytes: General characters, classification & economic importance. Life histories of following: Marchantia. Funaria</p> <p>UNIT V Applications of algae, fungi, lichens and bryophytes in biotechnology and human welfare.</p>
<p>Course No.: BIOTECH-DSE-501-LAB Paper Name: PLANT DIVERSITY I</p>	<p>Once this course is completed, the students will be able to learn the concepts of</p> <ol style="list-style-type: none"> 1. Comparative study of thallus and reproductive organs of various algae mentioned in theory 2. Comparative study of vegetative and reproductive parts of various fungi mentioned in theory. 3. Study and section cutting and lectophenol mount of plant disease materials studied in theory. 4. Study of various types of lichens. 5. Study of external features & anatomy of vegetative and reproductive parts of Marchantia and Funaria 6. Collection of algae, fungi, plant diseases materials and bryophytes available locally.
<p>Course No.: BIOTECH-DSE-502 Paper Name: ANIMAL BIOTECHNOLOGY</p>	<p>Once this course is completed, the students will be able to learn the concepts of</p> <p>UNIT I Gene transfer methods in Animals – Microinjection, Embryonic Stem cell, gene transfer, Retrovirus & Gene transfer.</p> <p>UNIT II Introduction to transgenesis. Transgenic Animals – Mice, Cow, Pig, Sheep, Goat, Bird, Insect.</p>
<p>Course No.: BIOTECH-DSE-502-LAB Paper Name: ANIMAL BIOTECHNOLOGY</p>	<p>After the completion of the practical course the students will be able to perform the following:</p> <p>Sterilization techniques: Theory and Practical: Glass ware sterilization, Media sterilization, Laboratory sterilization</p> <ol style="list-style-type: none"> 2. Sources of contamination and decontamination measures. 3. Preparation of Hanks Balanced salt solution 4. Preparation of Minimal Essential Growth medium

	<p>5. Isolation of lymphocytes for culturing</p> <p>6. DNA isolation from animal tissue</p> <p>7. Quantification of isolated DNA. 8. Resolving DNA on Agarose Gel.</p>
<p>Name of the paper:</p> <p>Genomics & Proteomics</p> <p>Paper Code:</p> <p>BIOTECH-C-602</p>	<p>Once this course is completed, the students will be able to learn the concepts of</p> <p>UNIT I: Introduction to Genomics and genome sequencing methods. Use of various computer tools and softwares for sequencing projects.</p> <p>UNIT II: Use of various web based servers, databases and softwares for genome analysis.</p> <p>UNIT III: Introduction to protein structure. Chemical properties of proteins and various physical interactions involved in maintaining protein structure stability.</p> <p>UNIT IV: Protein structure and size determination using various techniques such as sedimentation analysis, gel filtration, SDS-PAGE, Native PAGE and Edman degradation.</p> <p>UNIT V: Protein identification using 2D-PAGE. Sample and mass spectrometric.</p>
<p>Name of the paper:</p> <p>Bio Analytical Tools LAB</p> <p>Paper Code:</p> <p>BIOTECH-C-601-LAB</p>	<p>After the completion of the practical course the students will be able to perform the following:</p> <ol style="list-style-type: none"> 1. Native gel electrophoresis of proteins 2. SDS-polyacrylamide slab gel electrophoresis of proteins under reducing conditions. 3. Preparation of protoplasts from leaves. 4. Separation of amino acids by paper chromatography. 5. Identification of lipids in a given sample by TLC
<p>Name of the paper:</p> <p>Genomics & Proteomics LAB</p> <p>Paper Code: BIOTECH-DSE-602</p>	<p>After the completion of the practical course the students will be able to perform the following:</p> <ol style="list-style-type: none"> 1. Use of SNP databases at NCBI and other sites 2. Use of OMIM database 3. Detection of Open Reading Frames using ORF Finder 4. Proteomics 2D PAGE database

<p>Name of the paper:</p> <p>Paper Code:</p> <p>Plant Biotechnology</p> <p>Paper Code:</p> <p>BIOTECH-DSE-601</p>	<p>On completion of this course, the students will attain knowledge and develop the concepts of:</p> <p>UNIT I: Introduction to various techniques of plant tissue culture. Concepts of micropopagation, organogenesis and embryogenesis.</p> <p>UNIT- II: Techniques of in vitro haploid production. Concepts of ploidy level, chromosome doubling and diploidization.</p> <p>UNIT – III: Methods of protoplast isolation, fusion and development. Identification and selection of somatic hybrid cells. Methods and applications in somaclonal variation.</p> <p>UNIT – IV: Introduction to plant Growth Promoting bacteria. Mechanism of nitrogen fixation.</p> <p>UNIT – V: Introduction to Biocontrol. Growth promotion by free-living bacteria.</p>
<p>Name of the paper:</p> <p>Biostatistics</p> <p>Paper Code:</p> <p>BIOTECH-DSE-602</p>	<p>Once this course is completed, the students will be able to learn the concepts of</p> <p>UNIT I: Introduction to the characteristics, capabilities, generations and various parts of computers. Concept of hardware, software, memory, operating systems, programming languages and networking system. Application of computers in Biological Sciences.</p> <p>UNIT II: Data: types and collection procedure. Classification and Graphical representation of Statistical data. Measures of central tendency and Dispersion.</p> <p>UNIT III: Introduction to probability, binomial, poisson and normal distributions.</p> <p>UNIT IV: Concepts of sampling methods and confidence level. Testing of hypothesis, standard error, large sample test and small sample test.</p> <p>UNIT V: Introduction to the test of significance including t-test, chi-square test, ANOVA. Concept of correlation and regression.</p>

Name of the paper: Bioinformatics Paper Code: BIOTECH-DSE-602	<p>Once this course is completed, the students will be able to learn the concepts of</p> <p>UNIT I: Introduction to the history of Bioinformatics. Understanding the structure of Sequence Information Sources like EMBL, GENBANK, Entrez and Unigene.</p> <p>UNIT II: Understanding the structure of Protein Information Sources like PDB, SWISSPROT and TREMBL. Introduction of Data Generating Techniques from Restriction Digestion, Chromatograms, Blots, PCR, Microarrays, Mass Spectrometry.</p> <p>UNIT III: Introduction to Phylogeny analysis. Concept of Open Reading Frames, Sequence Assembly, Mutation/Substitution Matrices and Pairwise Alignments.</p> <p>UNIT IV: Introduction to BLAST and interpreting results. Concept of Multiple Sequence Alignment and Phylogenetic Analysis.</p> <p>UNIT V: Concept of database searching and similarity searches and data Submission.</p>
Name of the paper: Plant Biotechnology LAB Paper Code: BIOTECH-DSE-601-LAB	<p>After the completion of the practical course the students will be able to:</p> <ol style="list-style-type: none"> 1. Prepare of simple growth medium (knop's medium) for plant tissue culture 2. Prepare complex nutrient medium (Murashige & Skoog's medium) for plant tissue culture 3. Select, sterilize and prepare an explant for culture. 4. Understand the significance of growth hormones in culture medium. 5. Understand the various steps of Micropropagation
Name of the paper: Bioinformatics LAB Paper Code: BIOTECH-DSE-602-LAB	<p>After the completion of the practical course the students will be able to:</p> <ol style="list-style-type: none"> 1. Understand the computer hardware devices, installing and handling application software, formatting computers. 2. Handle files and folders. Use of DOS commands and MS Office package. 3. Learn programming languages. 4. Search biological database and able to use basic bioinformatics software 5. Analyze and represent data by graphical Representation 6. Analyze data based on measures of Central Tendency & Dispersion

	<p>7. Analyze data based on Distributions- Binomial Poisson Normal</p> <p>8. Analyze data based on t, f, z and Chi-square test</p>
<p>Name of the paper:</p> <p>Biostatistics LAB</p> <p>Paper Code:</p> <p>BIOTECH-DSE-602-LAB</p>	<p>After the completion of the practical course the students will be able to:</p> <ol style="list-style-type: none"> 1. handle various sequence information resource 2. Understand various web resources: EMBL, Genbank, Entrez, Unigene, PIR 3. Understand PDB, Swissprot, TREMBL 4. Perform BLAST and interpret of results. 5. Retrive information from nucleotide databases. 6. Perform sequence alignment using BLAST. 7. Perform multiple sequence alignment using Clustal W
<p>Course No.: BIOTECH-SEC-301 Paper Name: ENZYMOLOGY</p>	<p>Once this course is completed, the students will be able to learn the concepts of</p> <p>UNIT - I Isolation, crystallization and purification of enzymes, test of homogeneity of enzyme preparation, methods of enzyme analysis.</p> <p>unitII-concept of E-S complex, binding sites, active site, specificity, Kinetics of enzyme activity, Michaelis-Menten equation and its derivation.</p> <p>unitIII- Mechanism of enzyme action: General mechanistic principle, factors associated with catalytic efficiency:</p> <p>UNIT – IV Allosteric enzymes, Protein ligand binding, Multienzyme complexes. Ribozymes. Multifunctional enzyme-eg Fatty Acid synthase.</p> <p>UNIT – V Enzyme Technology: Methods for large scale production of enzymes.</p>
<p>Course No.: BIOTECH-SEC-401 Paper Name: MOLECULAR DIAGNOSTICS</p>	<p>Once this course is completed, the students will be able to learn the concepts of</p> <p>UNIT I Enzyme Immunoassays: Comparison of enzymes available for enzyme immunoassays, conjugation of enzymes. Solid phases used in enzyme immunoassays.</p> <p>UNIT II Molecular methods in clinical microbiology.</p> <p>UNIT III Susceptibility tests: Micro-dilution and macro-dilution broth procedures. Susceptibility tests:Diffusion test procedures.</p>

	<p>Susceptibility tests: Tests for bactericidal activity. Automated procedures for antimicrobial susceptibility tests.</p> <p>UNIT IV Automation in microbial diagnosis, rapid diagnostic approach including technical purification and standardization of antigen and specific antibodies. Concepts and methods in idiotypes. Antiidiotypes and molecular mimicry and receptors. Epitope design and applications. Immunodiagnostic tests. Immuno florescence. Radioimmunoassay</p> <p>UNIT V :GLC, HPLC, Electron microscopy, flowcytometry and cell sorting.</p>
<p>Course No.: BIOTECH-SEC-501 Paper Name: BASICS OF FORENSIC SCIENCE</p>	<p>Once this course is completed, the students will be able to learn the concepts of</p> <p>Unit I Introduction and principles of forensic science, forensic science laboratory and its organization and service, tools and techniques in forensic science, branches of forensic science, causes of crime, role of modus operandi in criminal investigation.</p> <p>Unit II Classification of injuries and their medico-legal aspects, method of assessing various types of deaths.</p> <p>Unit III Classification of fire arms and explosives, introduction to internal, external and terminal ballistics. Chemical evidence for explosives. General and individual characteristics of handwriting, examination and comparison of handwritings and analysis of ink various samples.</p> <p>Unit IV Role of the toxicologist, significance of toxicological findings, Fundamental principles of fingerprinting, classification of fingerprints, development of finger print as science for personal identification</p>

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COURSE OUTCOME (BIOTECHNOLOGY PASS)

Semester I	
<p>Name of the paper: BIOETHICS AND BIOSAFETY</p> <p>Paper code: BIOTECH-DSC-101/BIOTECH -GE-101</p>	<p>On completion of this course the students will learn, have a fair understanding of and develop the concepts of:</p> <p>UNIT I Introduction to Indian Patent Law. World Trade Organization and its related intellectual property provisions. Intellectual/Industrial property and its legal protection in research, design and development. Patenting in Biotechnology, economic, ethical and depository considerations.</p> <p>UNIT II Entrepreneurship: Selection of a product, line, design and development processes, economics on material and energy requirement, stock the product and release the same for making etc.</p> <p>UNIT III The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential etc.</p> <p>UNIT IV Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International. Ethical issues against the molecular technologies.</p> <p>UNIT V Biosafety– Introduction to biosafety and health hazards concerning biotechnology. Introduction to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p>
<p>Name of the paper: BIOETHICS AND BIOSAFETY PRACTICAL</p> <p>Paper code: BIOTECH-DSC-101-LAB/BIO TECH-GE-101-LAB</p>	<p>At the end of this course the students will be able to:</p> <ol style="list-style-type: none"> 1. Proxy filing of Indian Product patent 2. Planning of establishing a hypothetical biotechnology industry in India 3. A case study on clinical trials of drugs in India with emphasis on ethical issues. 4. Case study on women health ethics. 5. Case study on medical errors and negligence. 6. Case study on handling and disposal of radioactive waste
SEMESTER II	
<p>Name of the paper: BIOTECHNOLOGY HUMAN WELFARE</p> <p>Paper code: &</p>	<p>On completion of this course the students will learn, have a fair understanding of and develop the concepts of:</p> <p>UNIT I Industry: protein engineering; enzyme and polysaccharide synthesis, activity and secretion, alcohol and antibiotic formation.</p>

BIOTECH-DSC-201/BIOTEC H-GE-201	<p>UNIT II Agriculture: N₂ fixation: transfer of pest resistance genes to plants; interaction between plants and microbes; qualitative improvement of livestock.</p> <p>UNIT III Environments: e.g. chlorinated and non-chlorinated organ pollutant degradation; degradation of hydrocarbons and agricultural wastes, stress management, development of biodegradable polymers such as PHB..</p> <p>UNIT IV Forensic science: e.g. solving violent crimes such as murder and rape; solving claims of paternity and theft etc. using various methods of DNA finger printing.</p> <p>UNIT V Health: e.g. development of non- toxic therapeutic agents, recombinant live vaccines, gene therapy, diagnostics, monoclonal in <i>E.coli</i>, human genome project.</p>
<p>Name of the paper: BIOTECHNOLOGY & HUMAN WELFARE PRACTICAL Paper code: BIOTECH-DSC-201-LAB/BIO TECH-GE-201-LAB</p>	<p>At the end of this course the students will be able to:</p> <ol style="list-style-type: none"> 1. Perform of ethanolic fermentaion using Baker's yeast 2. Study of a plant part infected with a microbe 3. To perform quantitative estimation of residual chlorine in water samples 4. Isolation and analysis of DNA from minimal available biological samples 5. Case studies on Bioethics
Semester III	
<p>Name of the paper: DEVELOPMENTAL BIOLOGY Paper code: BIOTECH-DSC-301/BIOTEC H-GE-301</p>	<p>On completion of this course the students will learn, have a fair understanding of and develop the concepts of:</p> <p>UNIT I: Gametogenesis and Fertilization Definition, scope & historical perspective of development Biology, Gametogenesis – Spermatogenesis, Oogenesis Fertilization - Definition, mechanism, types of fertilization. Different types of eggs on the basis of yolk.</p> <p>UNIT II: Early embryonic development Cleavage: Definition, types, patterns & mechanism Blastulation: Process, types & mechanism Gastrulation: Morphogenetic movements– epiboly, emboly, extension, invagination, convergence, de-lamination. Formation & differentiation of primary germ layers, Fate Maps in early embryos.</p> <p>UNIT III: Embryonic Differentiation Differentiation: Cell commitment and determination- the epigenetic landscape: a model of determination and differentiation, control of differentiation at the level of genome.</p> <p>UNIT IV: Transcription & Translation Transcription and post-translation level Concept of embryonic induction: Primary, secondary & tertiary embryonic induction, Neural induction and induction of vertebrate lens.</p>

	<p>UNIT V: Organogenesis</p> <p>Neurulation, notogenesis, development of vertebrate eye. Fate of different primary germ layers Development of behaviour: constancy & plasticity, Extra embryonic membranes, placenta in Mammals.</p>
<p>Name of the paper: DEVELOPMENTAL BIOLOGY PRACTICAL Paper code: BIOTECH-DSC-301-LAB/BIO TECH-GE-301-LAB</p>	<p>At the end of this course the students will be able to:</p> <ol style="list-style-type: none"> 1. Identification of developmental stages of chick and frog embryo using permanent mounts 2. Preparation of a temporary stained mount of chick embryo 3. Study of developmental stages of <i>Anopheles</i>. 4. Study of the developmental stages of <i>Drosophila</i> from stock culture/photographs. 5. Study of different types of placenta.
Semester IV	
<p>Name of the paper: ENTREPRENEURSHIP DEVELOPMENT Paper code: BIOTECH-DSC-401/BIO TECH-GE-401</p>	<p>On completion of this course the students will learn, have a fair understanding of and develop the concepts of:</p> <p>UNIT I INTRODUCTION</p> <p>Meaning, Needs and Importance of Entrepreneurship, Promotion of entrepreneurship, Factors influencing entrepreneurship, Features of a successful Entrepreneurship.</p> <p>UNIT II ESTABLISHING AN ENTERPRISE</p> <p>Forms of Business Organization, Project Identification, Selection of the product, Project formulation, Assessment of project feasibility.</p> <p>UNIT III FINANCING THE ENTERPRISE</p> <p>Importance of finance / loans and repayments, Characteristics of Business finance, Fixed capital management: Sources of fixed capital, working capital its sources and how to move for loans, Inventory direct and indirect raw materials and its management.</p> <p>UNIT IV MARKETING MANAGEMENT</p> <p>Meaning and Importance, Marketing-mix, product management – Product line, Product mix, stages of product life cycle, marketing Research and Importance of survey, Physical Distribution and Stock Management.</p> <p>UNIT V ENTREPRENEURSHIP AND INTERNATIONAL BUSINESS</p> <p>Meaning of International business, Selection of a product, Selection of a market for international business, Export financing, Institutional support for exports.</p>
<p>Name of the paper: ENTREPRENEURSHIP DEVELOPMENT PRACTICAL Paper code: BIOTECH-DSC-401-LAB/BIO TECH-GE-401-LAB</p>	<p>At the end of this course the students will be able to make:</p> <p>Project Report on a selected product should be prepared and submitted.</p>

