



Department of Biotechnology

B.Sc. Biotechnology

S.No.	Course Code	Course Name	Course Outcomes
SEMESTER - I			
1.	18UBTC11	Core Course – I: Cell Biology	<ol style="list-style-type: none">1. Thorough knowledge about structure and function of Cells, bio molecules and cellular development.2. Knowledge about the role of the major cell organelles.3. Fundamental features of prokaryotic and eukaryotic cells and methods used to examine them.4. Knowledge on the specific processes and proteins involved in membrane transport.5. Understand the major stages of the cell cycle.6. Awareness on the latest advances in cell biology.
2.	18UBTC1P	Core Course - II: Lab in Cell Biology and Genetics	<ol style="list-style-type: none">1. Familiar in basic biochemistry laboratory techniques.2. Understand the basic Biochemical estimations.3. Analyze the methods including graphing and statistical analysis.4. Problem solving skills and analytical thinking skills.5. Familiar with laboratory skills.
3.	18UBTN11	Non Major Elective Course-I: Human Diseases- Communicable Diseases	<ol style="list-style-type: none">1. Understand the ubiquitous nature of pathogens and host - pathogen relationships.2. Awareness on diseases caused by the microorganisms and the prevention methods and vaccination.



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			3. Understand about the diagnosis and treatment of various diseases. 4. Awareness on diseases and ensure the sanitation and hygiene.
4.	18UBTE11	Enrichment Course- I: Fundamentals of Genetics	1. Knowledge in genetics and science. 2. Understand about monohybrid and dihybrid plants. 3. Structure and function of genes, chromosomes and genomes. 4. Understand how traits get passed down through generations. 5. Fundamentals of molecular biology.
5.	18USCEX1	Extra Credit Course (ECC): Nanotechnology	1. Understand the basic concepts and historical aspects of nanotechnology. 2. Understand the different physical, chemical and biological methods of synthesis of nanoparticles. 3. Characteristic analysis of nanoparticles using UV spectrophotometry, microscopic techniques such as SEM, TEM and X-ray diffraction. 4. Applications of nanoparticles in anticancer, antiangiogenic, drug delivery and imaging. 5. Understand the scope of nanomedicine in near future.
SEMESTER - II			
6.	18UBTC21	Core Course- III: Biochemistry	1. Knowledge about structure and function of Cells, bio molecules and cellular development. 2. Awareness on the latest advances in cell biology. 3. Concepts of molecular and functional organization of a cell



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			and its subcellular components. 4. Understand structure and interrelationship of various biomolecules and consequences of deviation from normal. 5. Awareness about digestion and assimilation of nutrients and consequences of malnutrition. 6. Understand the various aspects of metabolism and their regulatory pathways.
7.	18UBTC2P	Core Course – IV: Lab in Biochemistry	1. Familiar in basic biochemistry laboratory techniques. 2. Understand the basic Biochemical estimations. 3. Analyze the methods including graphing and statistical analysis. 4. Problem solving skills and analytical thinking skills 5. Familiar with laboratory skills.
8.	18UBTN21	Non Major Elective Course - II: Human Diseases -Non Communicable Diseases	1. Knowledge about the Health and Diseases. 2. Understand about various metabolic related disorders. 3. Awareness on in borne metabolic disorders. 4. Understand about diagnosis, treatment and prevention method.
9.	18UBTE21	Enrichment Course-II: Human Physiology	1. Understand about nutrition and their values. 2. In depth analysis of the internal organs and their working mechanisms. 3. Understand about important of hormones and their role in health



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			<ol style="list-style-type: none">4. Importance of health and exercise.5. Knowledge about physiology of digestion and absorption of nutrition.6. Awareness on the ultra structure and activities of bones and muscles.
10.	18USCEXP	Extra Credit Course (ECC): Nanotechnology Practicals	<ol style="list-style-type: none">1.Familiar with basic strategy of nanoparticle synthesis and its pros and cons.2.Understand the different physical, chemical and biological methods of synthesis of nanoparticles using various sources.3. Understand the Characterization of nanoparticles using UV spectrophotometry, microscopic techniques such as SEM, TEM and X-ray diffraction.4. Understand the scope of nanomedicine in near future.
SEMESTER – III			
11.	18UBTC31	Core Course – V: Microbiology	<ol style="list-style-type: none">1. Apply appropriate terminology relating to the structure, metabolism, genetics, and ecology of prokaryotic microorganisms, eukaryotic microorganisms, and viruses.2. Understand the nutritional requirement of microorganisms.3. Knowledge about the interactions between pathogenic microorganisms and susceptible hosts that results in infection and disease.4. Knowledge on methods of sterilization used in the control of microorganisms and apply this understanding to the prevention and control of infectious diseases.



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			5. Understand the interaction between the microorganisms and plants, animals.
12.	18UBTC3P	Core Course -VI: Lab in Microbiology	<ol style="list-style-type: none">1. Perform safe practices in a microbiology laboratory.2. Understand the use of culture media.3. Identify unknown bacteria using biochemical testing.4. Perform proper streaking for isolation using the quadrant method.5. Perform appropriate staining technique.6. Interpret biochemical test results properly to determine species identification.
13.	18UBTA31	Allied Course – III: Biological Science	<ol style="list-style-type: none">1. Knowledge about the modern system of classification of plants.2. Analyze the Economic importance and Life history of Algae, Fungi and Bryophytes.3. Understand the Classification and Life history of Pteridophytes, Gymnosperms.4. Salient features of Monocot and Dicot plants.5. Characteristic features of invertebrates and Chordates and their Importance.
14.	18UBTA3P	Allied Course - III: Lab in Biological Sciences	<ol style="list-style-type: none">1. Handling and identification of plants, animals and lower plants.2. Practical knowledge on ecological techniques.3. Basic techniques of cell biology.



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15.	18UBTS31	Skill Based Course - I: Basic Concepts of Biotechnology	<ol style="list-style-type: none">1. Understand the structure, composition and function of various biomolecules.2. Understand the fundamentals of biotechnology.3. Role of biotechnology in <i>Spirulina</i> cultivation and its applications.4. Novel methods for production of antibiotic.5. Importance of mushroom and Vermicompost and its cultivation technique.6. Application of biotechnology in pollution control.
16.	18BTV31	Value Based Course - I: Medicinal Plants	<ol style="list-style-type: none">1. Identify medicinal plant taxa and habitats threatened by non-sustainable harvest.2. Understand the present and future prospectus of the medicinal plants.3. High levels of trade, environmental degradation, and other factors contributing to loss of species and genetic diversity.4. Work with local, regional, national, and global partners to design and implement conservation action plans for priority medicinal plant taxa and habitats.5. Opportunities for consumers, industry, and other beneficiaries to understand and participate more directly in conservation.6. Marketing of Medicinal plants in India and World level.

SEMESTER – IV



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17.	18UBTC41	Core Course-VII: Immunology and Immunotechnology	<ol style="list-style-type: none">1. Understand the cells and organs involved in the immune system of the body.2. Familiar with the body's natural defense (immunity), its mechanism and active immunity by vaccination.3. Understand the mechanisms of humoral and cell mediated immune response.4. Handling skills of different immunotechniques for disease diagnosis and identification.5. Theoretical understanding of transplantation immunology and immunosuppressive agents.6. Understand how to combat the disease and immunotherapies available.7. Highlight the current applications of immunological research in practice.
18.	18UBTC4P	Core Course- VIII: Lab in Immunology and Immunotechnology	<ol style="list-style-type: none">1. Identify the blood groups using antibody specific to each blood group antigens and to study the principle of transfusion.2. Knowledge on different types of antigen, Hapten, adjuvants and immunization methods to elicit polyclonal antibody production in animals.3. Expose to the different immunotechniques for disease diagnosis and identification.4. Isolate and separate B and T lymphocytes from total human blood using nylon wool column. Enumerate WBCs and RBCs



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			from human blood using haemocytometer. 5. Detect the specific protein (antigen) present in the unknown protein sample using western blotting. 6. Detect the presence or absence of antigen/antibody present in the unknown sample using ELISA.
19.	18UBTA41	Allied Course - IV: Food Biotechnology	1. Awareness about the food contamination by microorganisms. 2. Understand the production of cheese, bread, wine. 3. Production of single cell protein and their economic importance. 4. Understanding of food preservation techniques. 5. Awareness on food hazardous and food analysis. 6. Importance of Dairy products and its types.
20.	18UBTA4P	Allied Course - IV: Lab in Food Biotechnology	1. Knowledge about the basic food biotechnology techniques. 2. Knowledge about the isolation and identification of food contaminants. 3. Identify the quality of milk. 4. Identify the water quality analysis. 5. Awareness on microbiological examination of soft drinks.
21.	18UBTO41	Major Elective Course – I: Biostatistics	1. Understand about basic knowledge on biostatistics and their important in applied biology. 2. Understand about history of biostatistics and their role. 3. Knowledge in mean, median and mode and the difference in



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			tabulation. 4. Understand about diagrams and tabulations and their role in experimental studies. 5. Knowledge about ANNOVA and their application in research studies.
22.	18UBTO42	Major Elective Course- I: Fundamentals of Drug Designing	1. Understand the development and discovery of Drugs. 2. Innovative approaches of drug discovery. 3. Understand the role of enzymes and receptors during drug design. 4. Role of Pro drug and their applications.
23.	18UBTO43	Major Elective Course I: Consumer Affairs	1. The learners know about the need for consumer protection and the areas covered by consumer protection law 2. Learners will have a clear idea on legislative controls on unconscionable conduct, misleading or deceptive conduct, false or misleading representations and other unfair practices 3. The learners know the legal obligations of a supplier of goods or services 4. The learners know the obligations of manufacturers and the rights of consumers to compensation 5. The learners know the bodies available to protect the rights of the consumer and discuss their operations.
SEMESTER - V			
24.	18UBTC51	Core Course - IX: Plant Biotechnology	1. Knowledge of Plant Genome Organization organelles organization.



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			<ol style="list-style-type: none">2. Perception of Plant Tissue Culture and the techniques involved.3. Knowledge on the regulation of gene expression in plant development.4. Basic concepts of plant genetic engineering and its application such as edible vaccines, plantibodies, improved nutritional content resistance to bacterial, fungal and viral infections5. Influence of plant hormones in plant tissue culture.6. Understand the molecular mechanism of Agrobacterium mediated gene transfer and to study the plant-pathogen interaction.7. Basic knowledge on gene silencing using RNAi technology.
25.	18UBTC52	Core Course - X: Industrial Biotechnology	<ol style="list-style-type: none">1. Understand the scope and applications of Industrial Biotechnology.2. Basic knowledge about fermentor and its types for the production of recombinant bio molecules.3. Knowledge about the innovative microbial food products.4. Explore the methods of potential improvement of efficient strains to increase the yield of microbial products.5. Knowledge on immobilization of enzymes and cells and downstream processing of biological Products.6. Knowledge of mechanism for the production of primary and



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			secondary metabolites. 7. Understand the importance of single cell protein and single cell oils. 8. Know about separation techniques using in industrial biotechnology.
26.	18UBTC53	Core Course - XI: Animal Biotechnology	1. Explore diagnostic method and therapy for mortal diseases. 2. Expose to genetic engineering for the production of regulatory proteins, vaccines and hormones. 3. Understand the basic principles of animal tissue culture and handling procedures 4. Knowledge on the concept of transgenesis and methods of transferring genes using various vectors into the host. 5. Understand the fundamentals of animal genomics. 6. Basic understanding about genetically modified organisms. 7. Understand the ethical issues related to animal biotechnology and to introduce the concepts and importance of intellectual property rights- patents, copyright, tradesecrets and trademark. 8. Understand human genome project and gene therapy.
27.	18UBTC5P	Core Course - XII: Lab in Plant, Animal and Industrial Biotechnology	1. Basic knowledge of plant tissue culture such as surface sterilization, media preparation, contamination and other handling procedures. 2. Understand the techniques involved in plant tissue culture



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			and to generate <i>in vitro</i> propagated plants. 3. Knowledge on hardening techniques. 4. Handling skills for agrobacterium mediated gene transfer and host-plant pathogen interactions. 5. Isolation and purification of protoplasts. 6. Hands on experience to all students.
28.	18UBT051	Major Elective Course - II: Bioinformatics	1. Practical and the theoretical knowledge of DNA sequences, genomes, protein sequences and protein structure information that will prepare them for careers in bioinformatics, academia, industry and research. 2. Understand the vast quantities of data generated in the fields of Molecular and Biological Sciences (databases available for different organisms). 3. Problem-solving skills and gain experience in understanding, handling and developing important software used in pharmaceutical, chemical and biotechnology industries. 4. Understand the basic algorithms of bioinformatics and to learn with the fundamentals of sequence retrieval and alignment and to study the phylogenetic relationship between the different organisms. 5. Understand with application of structural biology and molecular docking and to impart knowledge on drug designing.
29.	18UBT052	Major Elective Course-II:	1. Knowledge on Transgenic Plant.



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		Genetically Modified Crops	<ol style="list-style-type: none">2. Knowledge on the pharmaceutically useful proteins from plants.3. Basic concepts of plant genetic engineering and its application such as improved nutritional content, resistance to bacterial, fungal and viral infections, plantibodies.4. Ensuring the biosafety concerns of genetically modified crops.5. Understand the molecular mechanism of Agrobacterium mediated gene transfer and cultivation.
30.	18UBT053	Major Elective Course-II: Natural Products (Secondary Metabolites)	<ol style="list-style-type: none">1. Understand the scope and applications of metabolites produced by various plants.2. Explore the methods of potential improvement of efficient plant species to increase the yield of plant products.3. Knowledge on biotechnological applications of metabolites in various industries.4. Knowledge on mechanism for the production of primary and secondary metabolites.5. Know about metabolic engineering for the production of plant products.
31.	18UBTS51	Skill Based Course-II: IPR, Bioethics and Biosafety	<ol style="list-style-type: none">1. Importance of Intellectual Property Rights and productions.2. Awareness on Patenting, Bioethics and its importance.3. Operation of Biosafety and hazards of environmental management.4. Understand about the ethics of Cloning and Stem cell



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			research. 5. Knowledge on guidelines of DBT.
32.	18UBTS52	Skill Based Course - III: Cancer Biology	1. Mechanisms of transformation of normal cell into cancerous cell. 2. Understand the physical, chemical and biological agents that causes cancer. 3. Understand the genes (oncogenes and tumor suppressor genes) involved in cancer progression and termination. 4. Knowledge on the classical and advance methods of diagnosis of cancer. 5. Explore the current trends of cancer research such as nanomedicine and therapies available. 6. Understand the gene silencing process using RNAi technology of cancerous cells.
SEMESTER – VI			
33.	18UBTC61	Core Course- XIII: Recombinant DNA Technology	1. Basic principles of recombinant DNA technology and its pros and cons. 2. Knowledge on the bacterial vectors, viral vectors for the construction of recombinant molecule. 3. Knowledge on the construction of recombinant molecule and how to transform the recombinant molecule into the desire host.



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			<ol style="list-style-type: none">4. Knowledge on methods of gene transfer into bacteria, plant, animal.5. Knowledge on molecular techniques such as PCR, genomic library and to highlight the methods of gene sequencing.6. Detect DNA, RNA and Protein by blotting techniques.7. Understand the application of rDNA in industrial enzyme production.
34.	18UBTC62	Core course-XIV: Molecular Biology and Molecular Genetics	<ol style="list-style-type: none">1. Knowledge about the bacterial and eukaryotic DNA replication, transcription, translation and post translational modification.2. Regulation of gene expression in prokaryotes and eukaryotes.3. Knowledge about genetic diseases and causes of genetic diseases.4. Knowledge on mutation and various aspects of DNA repair mechanism.5. Knowledge about the types of mutation and its causative agents.6. To ensure the students understand about transposable elements and transposition mechanism.
35.	18UBTC6P	Core course- XV: Lab in Recombinant DNA technology	<ol style="list-style-type: none">1. To perform DNA/RNA isolation from different organisms such as plant, bacteria and human blood.2. To study the transformation of recombinant DNA into Bacteria.3. To amplify the gene of interest by Polymerase Chain Reaction



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			(PCR). 4. To perform the cloning of the gene of interest in vector and screening of the recombinants and non recombinants. 5. To identify the gene of interest by Southern hybridization. 6. To identify the protein of interest by Western blotting. 7. To provide hands on experience on molecular techniques to every students.
36.	18UBTC6Q	Core Course-XVI: Lab in Molecular Biology and Molecular Genetics	1. Understand the principle of bacterial conjugation and transformation. 2. Isolation of bacteriophage and their titration. 3. Understanding the mechanism of mutation. 4. Knowledge about the differentiation of auxotrophic and prototrophic mutants. 5. Isolate the genomic DNA and plasmid DNA from plants, animals and bacteria.
37.	18UBTO61	Major Elective Course-III: Stem Cell Biology	1. Understand the properties and types of stem cell. 2. Knowledge about the techniques used for studying stem cell. 3. Application of stem cell biology in medicine. 4. Justify the ethical consideration of stem cell research.
38.	18UBTO62	Major Elective Course- III: Biochemical Techniques	1. Basic principles of biological instruments such as microscopy, flow cytometry. 2. Knowledge on chromatographic, electrophoretic, spectroscopic and radioisotopic techniques for analysis of biological compounds.



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			<ol style="list-style-type: none">3. Application of instruments for the biological research.4. Techniques of two dimensional gel electrophoresis and MALDI-TOF.5. Information on immunotechniques for disease diagnosis and identification.
39.	18UBTO63	Major Elective Course-III: DNA Fingerprinting	<ol style="list-style-type: none">1. Basic principles of DNA Fingerprinting and its pros and cons.2. Knowledge on the identification of paternity, criminals and ancestors.3. Knowledge on the molecular analysis tools such as RFLP, AFLP and PCR.4. Knowledge on its role in agricultural genetics and plant breeding.5. Understand the case studies.
40.	18UBTS61	Skill Based Course- IV: Functional Genomics	<ol style="list-style-type: none">1. Theoretical knowledge of Proteome and genomes.2. Understand the various proteomic and genomic analysis techniques.3. Understand the principle of DNA sequencing and mapping of the genome.4. Acquire problem-solving skills and gain experience used in biotechnology, pharmaceutical, chemical and industries.5. Applications of DNA array and protein array.6. Basic concepts of Pharmacogenomics in the identification of drug targets.
41.	18UBTV61	Value based course-II: Nano Biotechnology	<ol style="list-style-type: none">1. Understand the basic concepts and historical aspects of nanotechnology.



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			<ol style="list-style-type: none">2. Understand the different physical, chemical and biological methods of synthesis of nanoparticles.3. Characteristic analysis of nanoparticles using UV spectrophotometry, microscopic techniques such as SEM, TEM and X-ray diffraction.4. Applications of nanoparticles in anticancer, antiangiogenic, drug delivery and imaging.5. Understand the scope of nanomedicine in near future.
42.	18UESR61	Part IV: Environmental Studies	<ol style="list-style-type: none">1. Understand that living and non living things are interlinked from micro to macro level as an unbroken chain from sun to soil2. Knowledge about the general aspects of eco system and their structure3. Details of diversity of animals and plants and their conservation4. Core concepts and methods from ecological and physical sciences and their application in environmental problem solving.5. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.6. Address the lethal impact of global warming and control measures.