

Department of Biotechnology

PROGRAM OUTCOMES

Upon completion of the Biotechnology program, students will achieve the following outcomes:

1. Explain, evaluate & effectively interpret factual claims theories & assumptions in multi-integrated discipline of biotechnology.
2. Students will be able to demonstrate their knowledge of biotechnology concepts.
3. Students will possess the bioanalytical technical knowledge needed to support biotechnology research activity.
4. Students will possess hands-on technical skills in Microscopy, Centrifugation, UV-Visible spectroscopy, Electrophoresis, Colorimetric analysis, PCR, etc.
5. Students will show understanding of their knowledge of fermentation technology through industrial exposure in the biotechnology industry.
6. Students will be able to demonstrate the ability to communicate effectively with appropriate scientific community, industries, clinical health problems with solutions in the field of biotechnology.
7. Students will be able to demonstrate their knowledge in fields of Agriculture Biotechnology, Marine Biotechnology, Environmental Biotechnology, Biosafety, Scientific & Research Area etc.
8. Students will be able to understand the major challenges of limiting earth's resources & a positive attitude to prepare & propose a change in current Indian economy.
9. Respectfully articulate the views of people with diverse perspectives.

PROGRAM SPECIFIC OUTCOMES:

1. Students will be able to understand concepts of basic chemistry, physical chemistry, bio-organic chemistry & biophysical chemistry
2. Understand the principles and the applications of molecular biology methods with an emphasis on the application of recombinant DNA technology to animals, plants and microbial organisms.

3. To gain knowledge about the application of various types of Microscopy.
4. To classify and explain the structure and general characteristics of microorganisms.
5. To explain the microbial degradation of pesticides, bioremediation and biofertilizers.
6. The course describes the use of genetically engineered products to solve environmental problems and cure human diseases.
7. Understand the applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, plant, animal and forensic sciences.
8. Learn the concept and applications of biostatistical analysis & bioinformatics tools with regard to scientific & research study in field of biotechnology.
9. Explain the general principles of transgenic plants, animals and microbes.
10. Students will possess hands-on technical skills necessary to support biotechnology research activity.
11. Have hands-on experience of basic techniques like agarose and poly acrylamide gel electrophoresis, immunological techniques, UV-VIS Spectrophotometer, genetic engineering, microbiological techniques, tissue culturing(PTC).
12. Define and apply bioethics.
13. Ability to comprehend & make oral and written presentations effectively.
14. Respectfully articulate the views of people with diverse perspectives.

Course Outcomes

SEMESTER I

Course Code	Course Title	Course Outcome
USBT 101	Basic Chemistry I	- Students understand concepts of nomenclature and classification of organic and inorganic compounds, chemical bonds - Students learn chemistry of water, buffer and concepts of normality, molality, molarity, etc
USBT 102	Basic Chemistry II	- Students gain knowledge of stereochemistry, titrimetry and gravimetry concepts - Students learn the fundamental theory of instruments along with handling, working principle of separation methods, chromatography and colorimetry.
USBT 103	Basic Life Sciences- I : Biodiversity and Cell Biology	- Students will understand about origin of life and different forms of biodiversity existing on earth - They will learn about the ultrastructure of prokaryotic & eukaryotic cells - Gain the knowledge about classification of bacteria, viruses & their life cycle
USBT 104	Basic Life Sciences- II : Microbial Techniques	- They will learn working principle and uses of different types of microscopes - They will get acquainted with various sterilization techniques - They will learn how to culture microorganisms in laboratory
USBT 105	Basic Biotechnology- I : Introduction to Biotechnology	- Students gain knowledge and implications of Biotechnology in daily life, applications of Biotechnology in Agriculture, Marine Biology, Industry, Environment etc. and ethical issues surrounding Biotechnology. - Students know basic concepts of Food spoilage, preservation, quality testing and regulatory agencies
USBT 106	Basic Biotechnology- II : Molecular Biology	- Students will learn the fundamentals of DNA replication in prokaryotes & Eukaryotes - They will gain knowledge of cloning vectors, enzymes and tools used in rDNA technology

		• They will learn types, causes of gene mutations and repair mechanisms of mutations
USBT 107	Societal Awareness	• They will learn information and knowledge about indian constitution, indian society and culture. • They will learn to sensitize gender inequality. • They will learn to create awareness about various physical disabilities & to overcome them
USBTP101, USBTP102, USBTP103,	Practicals of USBTP101, USBTP102, USBTP103, USBTP104, USBTP105, USBTP106	• Students get hands on techniques on colorimeter, aseptic techniques, microscopy, titrimetric methods, etc. • Students develop analytical skill to conduct experimental work and data interpretation

SEMESTER II

Course Code	Course Title	Course Outcome
USBT 201	Chemistry I- Bio-organic Chemistry	• Students gain knowledge about structure, classification and characteristics of carbohydrate & lipids. • Students will learn basic amino acids, their structure, classification & function of some important proteins. • Students gain knowledge about basic structures, types, properties & functions of nucleic acids.
USBT 202	Chemistry II- Physical Chemistry	• Students gain knowledge of thermodynamics and chemical kinetics principles • Students learn the principles of oxidation and reduction reactions
USBT 203	Basic Life Sciences- I : Physiology & Ecology	• Students gain knowledge about the physiological process of animal like excretory system, respiratory system, digestive & cardiovascular system. • They will learn ecology, ecosystems their types & ecological interaction that balances abiotic & biotic factors of the environment.

USBT 204	Basic Life Sciences- II :Genetics	- Students gain knowledge about basic concept of genetics including mendelian laws of heredity, pedigree analysis etc. - They will learn basic 3 techniques of recombination & gene transfer in bacteria. - They will acquire basic knowledge of alleles ,their frequencies & forces responsible for evolution.
USBT 205	Biotechnology- I : Tissue culture & Scientific writing and Communication Skill	- Students gain knowledge about the history,techniques & application of PTC. - They will learn history of ATC,techniques & applications of ATC. - They will acquire effective means of communication, with preparation of oral & poster presentation & research paper writing.
USBT 206	Biotechnology- II : Enzymology,Immunology and Biostatistics	- Students gain knowledge & impart skills in enzyme kinetics & learn basics of enzyme reaction - They will learn to understand basic immunology & study how immune system fights against infection. - They will acquire knowledge about statistical aspects of data,& its representation, measures of central tendency & dispersion.
USBT 207	Globalization ,Ecology & Sustainable Development	- They will learn knowledge of globalization. - Students will understand various problems of indian society. - They will develop thinking power in overcoming various problems of indian society.
USBTP201, USBTP202, USBTP203,	Practicals of USBTP201, USBTP202, USBTP203, USBTP204, USBTP205, USBTP206	Students gain experience in handling biological samples for analytical procedures

SEMESTER III

Course Code	Course Title	Course Outcome
USBT 301	Biophysics	Students get acquainted with concept of optics and its applications in analytical techniques.

		• Learner understands fundamentals of physical properties like Heat, sound, magnetism, viscosity, surface tension and its applications in biology. • They gain knowledge about protein separation on basis of molecular weight, size and pH by using AGE, PAGE and IEF. They also get hands on training on AGE.
USBT 302	Applied Chemistry -I	• Students gain knowledge about types of organic reactions and metal coordination for effective functioning of different enzymes. • They learn about the different methods of synthesis of organic compounds. • They get introduced to principles of Green chemistry and its significant role in industries.
USBT 303	Immunology	• Students gain knowledge about the cells and organs of the immune system. • They understand the idea of T-cell and B-cell receptors and pathways involving MHC class I & class II molecules for antigen processing. • They understand the principles underlying various immunotechniques.
USBT 304	Cell Biology and Cytogenetics	• Students get acquainted with basic concept of cytoskeleton, its structural composition and its role in cellular activities. • They will learn about cell membrane structure, membrane transport mechanism, cell junctions and cell-cell interactions. • They gain knowledge about chromosome structure, abnormalities and mapping.
USBT 305	Molecular Biology	• Students gain knowledge about the steps of transcription, how information flows from DNA to RNA. • They will understand the steps of translation, protein sorting and post-translational modification of proteins. • Learners understand the concept of regulation of gene expression in bacteria, bacteriophages and eukaryotes including gene silencing and RNA interference.

USBT 306	Bioprocess Technology	- Students will learn the application of bacteria, fungi, algae and Actinomycetes in Industrial process. - They get familiarized with the design of fermentor, media, sterilization and its use at the commercial level. - They gain knowledge about the qualitative and quantitative assays used for industrial products.
USBT 307	Research Methodology	Learner acquires in depth knowledge about research methods, research designs, collection of data, interpretation and research report writing.
USBTP301, USBTP302, USBTP303,	Practicals of USBTP301, USBTP302, USBTP303, USBTP304, USBTP305, USBTP306	Students apply theoretical knowledge in carrying out various techniques like electrophoresis, molecular techniques, fermentation techniques, etc.

SEMESTER IV

Course Code	Course Title	Course Outcome
USBT 401	Biochemistry	- Students gain the knowledge about different metabolic pathways of carbohydrates and their fate in oxidative phosphorylation for production of ATP. - They learn about the catabolism of amino acids and disorders associated with amino acid metabolism. - They learn about the metabolism of dietary lipids, mobilization and digestion of fats, ketone body synthesis, degradation of purines and pyrimidines and genetic defects related to lipid catabolism.
USBT 402	Applied Chemistry –II	- Learners get acquainted with various sampling and separation techniques. - Students get familiar with properties, extraction methods and uses of various natural secondary metabolites and chromatography techniques used for their analysis. - They learn about the types and properties of polymers and uses of nanomaterials.
USBT 403	Medical Microbiology	Students get introduced to different terms involved in medical microbiology, different

		patterns of infectious diseases, routes for introduction of microorganisms in human body. • They get to know the causes, pathogenesis, lab diagnosis and treatment of various skin and respiratory tract infections.. • The students learn about causative organisms of gastrointestinal tract infections.
USBT 404	Environmental Biotechnology	• Students get knowledge about types of pollution, their causes, sources of pollutants, their effects on plants, animals and environment and control measures. • They gain knowledge about global environmental problems and issues, control measures and precautions to be taken to tackle these problems. • They learn about concept of bioremediation and its applications in environmental pollution management.
USBT 405	Biostatistics and Bioinformatics	• Students get acquainted with different computer basics, hardware, software, internet basics and variety of databases used in bioinformatics. • They gain knowledge about different bioinformatics tools and algorithm that help analyze biological data. • They understand use of biostatistics in scientific and research area by the use of t-test, chi square test and Z-test, regression and correlation analysis.
USBT 406	Molecular Diagnostics	• Students become able to explain various molecular analysis methods, in depth working of in vitro DNA amplification. • They acquire knowledge about commercial molecular diagnostics, genetic counseling and its need and legal aspects about genetic testing.
USBT 407	Entrepreneurship Development	• Learners understand the concept, essentials, factors for successful entrepreneur and entrepreneurship. • They get introduced to the steps involved in setting up of an Enterprise and to the concept of business planning.

		Students understand the significance of marketing plan, market research, strategic alliance and promotion mix in the field of marketing.
USBTP401, USBTP402, USBTP403,	Practicals of USBTP401, USBTP402, USBTP403, USBTP404, USBTP405, USBTP406	Students develop skill in various medical microbiology, clinical biochemistry, environmental chemistry, bioinformatics techniques

SEMESTER V

Course Code	Course Title	Course Outcome
USBT 501	Cell Biology	- Students will understand the basics of cell cycle, genetics of cell cycle control, apoptosis and its significance. - They will gain knowledge about cell signaling mechanisms and logic of intracellular signaling from computer based neural network lessons. - Students will understand knowledge of normal developmental processes in multicellular organism's growth, differentiation & morphogenesis. - Students are imparted with basic concepts of cancer biology, its causes diagnosis and chemotherapy.
USBT 502	Medical Microbiology & Instrumentation	- Students will understand the basic properties of viruses, their classification, reproduction and purification assays - Students learn the various classes of antibiotics used against microbial infections. - Students understand working and applications of different bio analytical techniques
USBT 503	Genomics & Molecular Biology	- Students get acquainted with variety of genetic engineering techniques used in plants - They learn about different methodologies used in the production and transgenic animals and their applications - They learn tools and techniques in molecular biology, cloning vectors, screening & expression of cloned DNA molecules. - Students understand in depth gene

		sequencing and editing
USBT 504	Marine biotechnology	- Students get introduced to different marine ecosystems and bioactive compounds from marine organisms - Students get acquainted with bioactive compounds like drugs & enzymes from marine sources & challenges in current use of marine microbial drugs & enzymes. - Students understand potential of marine resources as functional foods and nutraceuticals. - They learn about different marine resources and their use in cosmetic industry
USBT 505 Applied component	Biosafety	- Students understand the importance of biosafety and regulatory measures in Biotechnology and contemporary issues in Bioethics. - Students learn the importance of GLP, SOP and audit reports and its documentation. - They learn the concept of microbial contamination in pharmaceutical products and its quality testing.
USBTP501, USBTP502, USBTP503, USBTP504	Practicals of USBTP501, USBTP502, USBTP503, USBTP504, USBTP505	Students acquire expertise in basic techniques in molecular biology and other analytical techniques

SEMESTER VI

Course Code	Course Title	Course Outcome
USBT 601	Biochemistry	- Students gain knowledge of protein structure and function - Students understand metabolism of carbohydrate and lipids - Students gain knowledge about the structure, synthesis, biochemical functions and disorders associated with endocrine hormones. - They will learn about the bioactive form, dietary sources, biochemical functions of vitamins and minerals and nutritional disorders.
USBT 602	Industrial Microbiology	- Students are imparted with methods used in Dairy technology - They will learn about different processes

		involved in downstream processing - Students will get acquainted with the inoculum development process and fermentation processes for some of the biologically important fermentation products - Students learn the concept of GMP, OC and QA to be used in Industry.
USBT 603	Pharmacology and Neurochemistry	- Students learn about fundamentals of drug, agonists, antagonists, types of drug responses. - Students will gain knowledge about mechanism and factors influencing drug absorption and distribution. - They will get an idea about basic & regulatory toxicology which create awareness about adverse effect of drugs, self & specific poisoning, and nonmedical use of drugs. - They learn about anatomy and physiology of brain and neuronal system.
USBT 604	Environmental Biotechnology	- Students will learn about renewable energy sources, biogas & biofuel technology. - Students get acquainted with the various methods used for treatment of effluent water and biodegradation of xenobiotic compounds. - They get to know the use of bacteria, fungi and algae as packaged organism for biosorption of heavy metal. - Students learn the processes for biodegradation of waste from different industries
USBT 605 Applied component	Agribiotechnology	- Students know about use of green house and precision technique in agriculture - Students gain knowledge about plant stress biology which includes biotic & abiotic factors causing physiological changes in plants, host plant resistance signaling pathways. - Students get introduced to use of molecular markers in plant breeding - They learn about different types of Bio fertilizers and bio pesticides, their production and applications

USBTP601, USBTP602, USBTP603, USBTP604, USBTP605	Practicals of USBTP 601, USBTP 602, USBTP 603, USBTP 604, USBTP 605	• Students acquire expertise analytical techniques • Students gain experience in working out on a practical based research project, make a report on it and present it using power point presentation
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