Department of Microbiology

Course Outcomes - B. Sc. (Microbiology)

Semester I		
Open Elective Course 1: Exploring Microbiology I		**BTL**
After Completion of the course the learner will be able to:		
CO1	Explain importance of Microbes	Understand
CO2	Explain the component of Microscope	Understand
CO3	Differentiate between light microscope and Electron Microscope	Analyze

	Semester I	
Course Name and No.- Mandatory Paper 1: Introduction to Microbiology-I		**BTL**
After Completion of the course the learner will be able to		
CO1	Distinguish between Prokaryotic and Eukaryotic cells	Analyze
CO2	Explain concepts of microscopy	Understand
CO3	Outline the contribution of scientist towards microbiology	Remember

	Semester I	
Course Name and No.- Mandatory Paper 2: Introduction to Microbes and Microbial Growth		**BTL**
After Completion of the course the learner will be able to		
CO1	Explain physiology of virus	Understand
CO2	Differentiate different phases of growth	Analyze
CO3	Obtain pure cultures	Apply

	Semester I	
Course Name and No.- Vocational Skill Course 1: Microbial Analysis of Water		**BTL**
After Completion of the course the learner will be able to		
CO1	Determine pH, TDS, COD, and BOD of waste water	Apply
CO2	Analyze drinking water for presence of indicator organism	Analyze
CO3	Explain treatment methods for waste water.	Remember

	Semester II	
Course Name and No.- Mandatory Paper 1: Microbial control and Microbial interactions		**BTL**
After Completion of the course the learner will be able to		
CO1	Evaluate antimicrobial effectiveness of agent.	Evaluate
CO2	Explain preservation techniques	Remember
CO3	Distinguish between microbial interactions	Analyze

	Semester II	
Course Name and No.- Mandatory Paper 2: Microbes in human health		**BTL**
After Completion of the course the learner will be able to		
CO1	Classify protozoa and fungi	Analyze
CO2	Explain factors responsible for infection	Understand
CO3	Outline host defense against infection	Remember

	Semester II	
Course Name and No.- Open Elective Course 2: Exploring Microbiology II		**BTL**
After Completion of the course the learner will be able to		
CO1	Differentiate phase of bacterial growth curve	Analyze
CO2	Analyze factors affecting growth of bacteria	Analyze
CO3	Explain culture media and sterilization methods	Understand

	Semester II	
Course Name and No.- Vocational Skill Course 2: Microbial Analysis of Food		**BTL**
After Completion of the course the learner will be able to		
CO1	Explain principles and methods of food preservation.	Understand
CO2	Determine number of bacteria from food sample	Apply
CO3	Assess the microbial quality of Milk	Evaluate

Semester II		
Course Name and No.- Minor Course 1: Understanding Biomolecules		**BTL**
After Completion of the course the learner will be able to		
CO1	Classify biomolecules	Understand
CO2	Explain determination of biomolecule concentration	Remember
CO3	Differentiate between qualitative and quantitative analysis	Analyze

	Semester III	
Course Name and No.- I: Estimation of Biomolecules and Introduction to Bioenergetics and Biostatistics		**BTL**
After Completion of the course the learner will be able to		
CO1	Explain the method of extraction and estimation of biomolecules	Understand
CO2	Apply concept of thermodynamics to bioenergetics	Apply
CO3	Solve bio statistical problems related to measurement of central tendency and dispersion	Apply
CO4	Determine concentration of solutions in terms of molarity, normality molality, osmolarity, mole fraction etc.	Evaluate

	Semester III	
Course Name and No.: II: Introduction to fermentation technology and Applied Microbiology		**BTL**
After Completion of the course the learner will be able to		
CO1	Compare primary and secondary screening methods.	Evaluate
CO2	Explain the parts of the fermenter and its type.	Understand
CO3	Apply standard microbiological techniques for the testing and preservation of milk /food.	Apply
CO4	Demonstrate the understanding of techniques used for wastewater management and treatment	Remember

	Semester III	
Course Name and No.: III: Introduction to Microbial Genetics and Molecular Biology		**BTL**
After Completion of the course the learner will be able to		
CO1	Compare the structure and biochemistry of DNA and RNA, nucleotides, and their types	Evaluate
CO2	Explain the methods of DNA sequencing like Maxam & Gilbert and Sanger's method	Understand
CO3	Categorize the different types of mutations which may occur in DNA and their repair mechanisms	Apply
CO4	Enlist the basic steps involved in DNA replication and protein synthesis	Remember

	Semester IV	**BTL**
Course Name and No.: I: Introduction to Metabolism and Enzymology		
After Completion of the course the learner will be able to		
CO1	Explain the concepts of metabolism and metabolic pathways	Understand
CO2	Develop kinetic model of enzyme Inhibition	Apply
CO3	Compare solute uptake mechanisms of bacteria	Evaluate
CO4	Illustrate preparation of vesicles for study of solute uptake	Remember

	Semester IV	**BTL**
Course Name and No.: II: Introduction to Medical Microbiology and immunology		
After Completion of the course the learner will be able to		
CO1	Define various terms associated with Epidemiology	Remember
CO2	Explain the importance of pathogenic bacteria in human disease concerning infections of the respiratory tract, gastrointestinal tract, skin, and nervous system	Understand
CO3	Classify the types of immune system, cells involved in the immune system	Evaluate
CO4	Select the immunological & molecular techniques for disease diagnosis	Understand

	Semester IV	BTL
Course Name and No.: III: Advances Analytical Techniques, Soft Skills and Applications of Microbiology		
After Completion of the course the learner will be able to		
CO1	Define the basic terms involved in Bioinformatics	Remember
CO2	Explain the importance of research work, research planning and interpretation of data	Understand
CO3	Develop the understanding of principle, working and applications of separation and spectrophotometric techniques of Centrifugation, Chromatography and Spectrophotometry	Apply
CO4	Categorize the distinct types of Biosensors and Nanoparticles	Understand

	Semester V	BTL
Course Name and No.: I : Microbial Genetics I		
After Completion of the course the learner will be able to		
CO1	Explain the fundamental principles of Central dogma of life	Understand
CO2	Co–relate between prokaryotic and eukaryotic DNA replication, transcription and translation	Evaluate
CO3	Compare the various gene exchange mechanisms found in microorganisms	Evaluate
CO4	Determine the role of mutagenic agents and their effects onto the growth of living cells	Remember

	Semester V	BTL
Course Name and No.: II: Medical Microbiology & Immunology		
After Completion of the course the learner will be able to		
CO1	Explain mode of transmission, diagnosis, prophylaxis and treatment of respiratory, gastrointestinal skin diseases and virulent factors of pathogen	Understand
CO2	Describe the structure and function of immunoglobulins, cells and organs involved in formation of adaptive immune response	Remember
CO3	Analyze the mechanism of antigen antibody reaction and its application in diagnosis of various infections	Evaluate
CO4	Compare Koch postulates and molecular Koch postulates in identification of pathogen	Evaluate

	Semester V	BTL
Course Name and No.: III: Microbial Biochemistry I		
After Completion of the course the learner will be able to		
CO1	Explain mechanism of generation of electrochemical energy and ATP synthesis	Understand
CO2	Demonstrate EMP, ED, HMP pathways and TCA cycle	Apply
CO3	Differentiate between catabolism and anabolism of lipids	Evaluate
CO4	Deduct fermentation pathways	Remember

	Semester V	BTL
Course Name and No.: IV: Bioprocess Technology Part-I		
After Completion of the course the learner will be able to		
CO1	Explain the techniques of strain improvements in Industrial Microbiology	Understand
CO2	Develop the design of bioreactors and media for fermentation under different conditions	Apply
CO3	Select the procedures and techniques for the upstream and downstream process of fermentation	Remember
CO4	Compare traditional industrial fermentation such as Beer, Wine, Vinegar, etc.	Evaluate

	Semester V	BTL
Course Name and No.: V: Applied component Biotechnology		
After Completion of the course the learner will be able to		
CO1	Apply knowledge to carry out biophysical techniques (electrophoresis, spectrophotometry) in biotechnology	Apply
CO2	Apply techniques for engineering biomolecules industrial and marine organisms for potential applications	Apply
CO3	Compare the mechanisms of generating transgenic animals	Evaluate
CO4	Create strategies for bioremediation of pollutants from soil	Apply

	Semester VI	BTL
Course Name and No.: Microbial Genetics I		
After Completion of the course the learner will be able to		
CO1	Explain basic tools and steps involved in r- DNA technology	Understand
CO2	Find *In - Silico* Analytical techniques used in Bioinformatics and Proteomics	Remember
CO3	Classify viruses based onto their structure, genetic material, and life cycle	Evaluate
CO4	Explain the regulation of genes expression at molecular level	Understand

	Semester VI	BTL
Course Name and No.: II: Medical Microbiology & Immunology		
After Completion of the course the learner will be able to		
CO1	Explain the structure and role of T & B cells in adaptive immune response	Understand
CO2	Differentiate between modes of action of different chemotherapeutic agents in disease treatment	Evaluate
CO3	Evaluate the mode of transmission, pathogenesis and treatment of central nervous system and sexually transmitted diseases	Evaluate
CO4	Describe the role of vaccines in disease prevention, complement system in immune response	Remember

	Semester VI	BTL
Course Name and No.: III: Microbial Biochemistry II		
After Completion of the course the learner will be able to		
CO1	Describe general reactions of amino acid metabolism and amino acid fermentation	Remember
CO2	Summarize factors affecting catalytic efficiency of enzymes.	Understand
CO3	Analyze the regulatory mechanism of a pathway	Evaluate
CO4	Judge the assimilatory and dissimilatory pathways of inorganic metabolism	Apply

	Semester VI	BTL
Course Name and No.: IV: Bioprocess Technology Part II		
After Completion of the course the learner will be able to		
CO1	Explain the industrial production of bio insecticides, bio fertilizers, and biopolymers such as xanthan gum, PHA, alginate, etc.	Understand
CO2	Apply the knowledge of principles and applications of animal and plant tissue culture techniques, and immobilization techniques	Apply
CO3	Build the understanding of IPR, Patent, Criteria for patentability, Indian patent act, Role of the patent in Research and Development	Remember
CO4	Compare industrial fermentation such as Penicillin, Mushroom, Glutamic acid, etc.	Evaluate

	Semester VI	BTL
Course Name and No.: V: Applied component Biotechnology		
After Completion of the course the learner will be able to		
CO1	Explain the role of biotechnology in society	Understand
CO2	Examine the role of biotechnology in healthcare sector (animal & human healthcare, genetic counselling, and forensic medicine)	Remember
CO3	Inspect problems related to genetic engineering in plant biotechnology	Apply
CO4	Interpret the issues of bioenergy and biofuel in the world	Remember

Course Outcomes - M. Sc. (Microbiology)

Semester I		
Course Name and No.: 1 Molecular Genetics -1		**BTL**
After Completion of course, the learner will be able to		
CO1	Explain the importance of DNA recombination and repair	Understand
CO2	Explain the concept of global gene regulation and its importance in bacterial physiology	Understand
CO3	Describe the molecular mechanisms underlying gene regulation in prokaryotes	Remember

Semester I		
Course Name and No.: 2 Biochemistry		**BTL**
After Completion of course, the learner will be able to		
CO1	Correlate the structure and function of bioorganic molecules to their biological roles.	Apply
CO2	Explain the enzymatic mechanisms involved in the breakdown of complex organic molecules.	Understand
CO3	Analyze the role of anaerobic bacteria in biogeochemical cycles and ecosystem functioning.	Analyze

Semester I		
Course Name and No.-3 Medical Microbiology and Microbial Pathogenesis		BTL
After Completion of course, the learner will be able to		
CO1	Analyze the molecular mechanisms of virulence factors employed by pathogens to cause disease	Analyze
CO2	Analyze the virulence factors and mechanisms of transmission for selected emerging pathogens	Analyze
CO3	Apply bacteriological techniques for the isolation, identification, and characterization of clinically relevant bacteria	Apply

Semester I		
Course Name and No.: Elective 1 - Environmental Microbiology & Sustainability		**BTL**
CO1	Evaluate the biotechnological potential of extremophiles and their enzymes (extremozymes) for various applications	Evaluate
CO2	Demonstrate a comprehensive understanding of ecological principles and their application to environmental management	Remember
CO3	Analyze the impacts of human activities on ecosystems and natural resources	Analyze

Semester II		
Course Name and No.: 1 Molecular Genetics -2		**BTL**
After Completion of course, the learner will be able to		
CO1	Explain the role of chromatin structure, epigenetic modifications, and transcription factors in gene regulation	Understand
CO2	Apply population genetics principles to understand genetic variation and evolution	Apply
CO3	Explain the principles and applications of various molecular techniques used in genetics research	Understand

	Semester II	
Course Name and No.: 2 Applied Biochemistry		**BTL**
After Completion of course, the learner will be able to		
CO1	Evaluate the role of enzymes in biochemical processes and industrial activities	Evaluate
CO2	Analyze the cellular responses to different stress conditions (e.g., oxidative stress, heat shock, osmotic stress)	Analyze
CO3	Evaluate the potential applications of unusual biomolecules in medicine, agriculture, and industry	Evaluate

	Semester II	
Course Name and No.: 3 Applied Immunology		**BTL**
After Completion of course, the learner will be able to		
CO1	Analyze the various evasion mechanisms employed by pathogens to subvert host defenses	Analyze
CO2	Classify different types of immunological disorders	Analyze
CO3	Evaluate the diagnostic and therapeutic approaches for immunological disorders	Evaluate

	Semester II	
Course Name and No.: Elective 1 Bioinformatics & Immunodiagnostics		**BTL**
After Completion of course, the learner will be able to		
CO1	Explain the fundamental concepts of biological databases, sequence alignment, and phylogenetic analysis	Understand
CO2	Describe the role of immunodiagnostics in disease prevention, diagnosis, and monitoring	Remember
CO3	Critically evaluate the clinical utility of immunodiagnostic tests	Evaluate

Semester III		
Course Name and No.: Research Methodology		**BTL**
After Completion of course, the learner will be able to		
CO1	Demonstrate understanding of research methodology.	Remember
CO2	Design hypothesis and methods of data collection.	Understand
CO3	Differentiate between different types of sampling and variables.	Analyze
CO4	Demonstrate understanding of data analysis and report writing.	Understand

	Semester III	
Course Name and No.: Food Microbiology		**BTL**
After Completion of course, the learner will be able to		
CO1	Explain the importance and sources of microorganisms in food etc.	Understand
CO2	Analyze qualitative and quantitative microbial testing of food sample	Analyze
CO3	Summarize the food quality parameters by using HAACCP, QA and QC	Remember
CO4	Explain production methods of fermented food like Cheese, Sausage, Pickles	Understand

	Semester III	
Course Name and No.- : Advances in Biotechnology		**BTL**
After Completion of course, the learner will be able to		
CO1	Describe plant tissue culture techniques, for developing transgenic plants by using vectors & selectable markers	Remember
CO2	Explain the concepts of animal tissue culture to construct transgenic animals which has better yielding capacity	Understand
CO3	Differentiate between different methods for synthesis of nanoparticles and application of nanoparticles in the field of diagnostic and medicine	Analyze
CO4	Define concepts of pharmacogenomics, pharmacokinetics, and tissue engineering, prenatal , pre-implantation diagnosis, gene therapy and antisense technology in treatment of genetic diseases	Remember

	Semester III	
Course Name and No.: Elective Course - Applied & Environment Microbiology		**BTL**
After Completion of course, the learner will be able to		
CO1	Illustrate the events of soil, marine and agricultural microbiology	Remember
CO2	Apply physiological and molecular techniques in microbial ecology studies	Apply
CO3	Analyze the water and food samples as a part of quality check	Analyze
CO4	Construct knowledge on biotechnological application of extreme proteins	Understand

	Semester IV	BTL
Course Name and No.: 1 Tools and Techniques: Bio-molecular Analysis		
After Completion of course, the learner will be able to		
CO1	Construct the flow diagrams of spectroscopic techniques	Understand
CO2	Compare between Gas chromatography and High-performance liquid chromatography	Analyze
CO3	Explain molecular biology techniques such as PCR variations, Hybridization array technology, and FISH	Understand
CO4	Demonstrate the use of Microscopy, diffraction techniques and photoluminescence spectroscopy in nanotechnology studies	Remember

	Semester IV	BTL
Course Name and No.: 2 Pharmaceutical Microbiology		
After Completion of course, the learner will be able to		
CO1	Explain the importance of QA, QC, and GMP aspects in the pharmaceutical industry	Understand
CO2	Describe the importance of quality control and documentation in the pharmaceutical industry	Remember
CO3	Analyze various validation and calibration methods used in the cosmetic industry	Analyze
CO4	Apply modern methods to test newly discovered drugs	Apply

	Semester IV	BTL
Course Name and No.: 3 Advances in Biotechnology		
After Completion of course, the learner will be able to		
CO1	Compare different downstream processing techniques for production of therapeutic compounds, and new methods for vaccine production and drug discovery	Analyze
CO2	Describe concepts of IPR and Bioethics in field of biotechnology	Remember
CO3	Develop different methods for extraction of bioactive compounds from marine environment & its application in various fields	Apply
CO4	Explain synthesis of DNA by different chemical and molecular methods, expression of protein in prokaryotic and eukaryotic expression host	Understand

	Semester IV	BTL
Course Name and No.- Applied &Environment Monitoring & Management		
After Completion of course, the learner will be able to		
CO1	Apply knowledge on management of natural resources and safety standards	Apply
CO2	Evaluate the issues related pollution and its management	Evaluate
CO3	Construct strategies to eradicate biofilm from different environments	Understand
CO4	Design strategies of bioremediation for field application	Understand