Master of Science (Microbiology)

Program Outcomes (POs)

Program Outcome	Description
PO1	Foster learning through accumulation of knowledge in Science.
PO2	Identify complex problems in the society which can be addressed through science.
PO3	Formulate strategies and design experiments to address the societal problems using first principles of basic sciences and applied sciences.
PO4	Adopt appropriate scientific techniques and resources to solve societal issues with an understanding of the limitations.
PO5	Critically and analytically evaluate and interpret research based data to provide valid conclusions and solutions.
PO6	Demonstrate leadership qualities by working collaboratively in a team, to set goals, communicate scientific information to stakeholders, comprehend and write reports, develop documentation, make presentation and to give and receive clear instructions.
PO7	Apply ethical principles, commit to professional ethics and responsibilities and norms of the scientific practice.
PO8	Engage in life-long learning in the broadest context of scientific advancement.

Program Specific Outcomes (PSOs)

Branch	PSO	Description
Microbiology	PSO1	Communicate and analyze the core concepts and theories in Microbiology and allied sciences (Microbial systematics, Immunology, Biochemistry, Medical Microbiology, Molecular Biology, Genetic Engineering, Biostatistics)
	PSO2	Apply basic concepts/ theories of Life Sciences for solving current scientific and social issues in key fields such as agriculture, environment, human health, transgenic animals, GMOs and plant disease management
	PSO3	Plan and design systematic research activities in the field of Microbiology and allied sciences including necessary skills for collecting, processing and interpreting data and drawing logical inferences

Course Outcomes (COs)

2019-20 Batch

Semester	Course Code	Course Name	Course Outcomes (COs)
I	18MSMB1H01	MICROBIAL SYSTEMATICS AND BACTERIOLOGY	**CO1 :** Describe the morphological features of Bacteria and their types **CO2 :** Explain the systematics for the classification of bacteria by latest approaches **CO3:** illustrate the metagenomic approach for the identification of uncultivable forms of bacteria **CO4:** Explain the ultra structure of bacteria, virus, viriods and Prions **CO5:** Choose different techniques for the isolation of Aerobic and anaerobic microorganisms **CO6:** Choose different sterilization and staining techniques to identify and evaluate the bacteria
I	18MSMB1H02	IMMUNOLOGY	**CO1 :** Name the components of the immune system and their biological functions. **CO2 :** Discuss the concepts behind blood grouping and Rh incompatibilities. **CO3:** Demonstrate the technical know-how of diagnostic techniques in immunology. **CO4:** Distinguish the immunological disorders among human population. **CO5:** Recommend the medical applications of immunology in disease diagnosis and immunotherapy. **CO6:** Assemble the concepts of immunology in vaccine development.
I	18MSMB1H03	MYCOLOGY AND PHYCOLOGY	**CO1 :**Gain knowledge on morphology of fungi and algae **CO2 :** Understand the physiology of fungi and algae **CO3:**Analyse the ecology and classification of fungi and algae **CO4:** Evaluate the fields where fungi and algae can be applied

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I	18MSMB1H04	BIOCHEMISTRY AND MICROBIAL PHYSIOLOGY	**CO1 :** Describe the basic laws of thermodynamics and their role in Biological systems **CO2 :** Explain the fundamentals of Carbohydrate metabolism and lipid metabolism and Mechanism of ATP synthesis. **CO3:** Differentiate the mechanism behind the oxygenic photosynthesis and anooxygenic photosynthesis **CO4:** Access the fundamentals of Amino acid metabolism and nucleic acid metabolism **CO5:** Examine the basic concepts of enzymology which includes the classification and mechanism of action **CO6:** Outline the fundamentals of membrane transport and quorum sensing
I	18MSMB1H12L	BACTERIOLOGY AND IMMUNOLOGY	**CO1 :** State the principles of various sterilization techniques. **CO2 :** Discuss the requirements and skills involved in culture media preparation, pure culturing and staining techniques. **CO3:** Demonstrate the steps involved in different techniques used to identify bacteria based on the biochemical reactions. **CO4:** Examine the measurement of bacterial growth. **CO5:** Assess the application of each serological technique. **CO6:** Assemble the concepts of various techniques for solving a research problem.
I	18MSMB1H3L	MYCOLOGY AND PHYCOLOGY LAB	**CO1 :** Identify morphological characters of fungi **CO2 :** Illustrate saprophytic and pathogenic fungi from different sources **CO3:** Analyse morphology and physiological characters of algae **CO4:** Evaluate the pigments produced by algae

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I	18MSMB1H4L	MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY	**CO1 :** Interpret concentration of carbohydrates, protiens and nucleic acids present in biological sample with the preparation of buffers with appropriate concentrations. **CO2 :** Determine the growth curve and generation time of bacteria as well as determine the concentration of phosphates. **CO3:** Develop protocol to extract and identify IAA from microbial source. **CO4:** Determine the saponification value and iodine number of Lipids and proteins
II II	18MSMB2H01	MOLECULAR BIOLOGY	**CO1 :** Recall the significance of central dogma of gene action **CO2 :** Summarize the structure and properties of DNA and RNA in both prokaryotic and eukaryotic cell. **CO3:** Illustrate the central molecular biological processes and their regulation **CO4:**Compare and contrast the molecular processes between prokaryotic and eukaryotic systems **CO5:** Appraise the differences in the regulation of molecular processes between prokaryotic and eukaryotic systems
II	18MSMB2H02	MICROBIAL AND MOLECULAR GENETICS	**CO1 :** State the fundamentals of microbial genetics, processes behind mutations and other genetic changes. **CO2 :** Discuss the basic structure and function of gene in prokaryotes and bacteriophages. **CO3:** Illustrate the genome organization in prokaryotes and eukaryotes. **CO4:** Differentiate between the process of DNA replication in bacteria and viruses. **CO5:** Recommend the significance of gene transfer techniques in bacteria. **CO6:** Assemble the knowledge of fungal and phage genetics and the structure and function of YACs and YIPs with their applications in genetic engineering.

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II	18MSMB2H03	MEDICAL MICROBIOLOGY	**CO1 :** State the significance of normal human flora, various host-pathogen interactions, and human microbiome project. **CO2 :** Discuss the pathogenicity, epidemiology, laboratory diagnosis, treatment, and prevention of important bacterial diseases. **CO3:** Illustrate the pathogenicity, epidemiology, laboratory diagnosis, treatment, and prevention of significant viral diseases. **CO4:** Compare the features of several human diseases caused by fungi. **CO5:** Assess the mode of action, target organisms, toxicity of antibiotics, antifungals and antiviral drugs. **CO6:** Assemble the concept of collection, transport, and processing of major clinical samples and immunomolecular diagnostic methods.
II	18MSMB2H04	AGRICULTURAL MICROBIOLOGY	**CO1 :** Describe the types of biogeochemical cycles, physical and chemical characteristics of soil **CO2 :** Illustrate the different plant microbe interactions in rhizosphere, Phyllosphere and Spermosphere **CO3:** Describe the mechanism of symbiotic and non symbiotic nitrogen fixation process **CO4:** Illustrate the importance of Bacterial, fungal and Viral biological control agents **CO5:** Outlinethe different types of fungal, bacterial, viral, mycoplasma and viroid diseases caused in plants and control of these diseases **CO6:** Examine different types of post harvest diseases caused during the storage of food commodities
II	18MSMB2H12L	MICROBIAL GENETICS AND MOELCULAR BIOLOGY	**CO1 :** Demonstrate mutation in bacteria and fungi **CO2 :** Compare between the different gene transfer techniques **CO3:** Appraise the regulation of genes in prokaryotes using lac operon model **CO4:** Assess the purity and concentration of the isolated nucleic acids **CO5:** Formulate isolation of nucleic acids: chromosomal and extrachromosomal nucleic acids from bacteria and fungi

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II	18MSMB2H34L	MEDICAL AND AGRICULTURAL MICROBIOLOGY	**CO1 :** Differentiating the different group of microorganisms isolated from soil and rhizosphere **CO2 :** Examining the symbiotic and non symbiotic nitrogen fixing microbes, cellulose, hemicellulose, starch, lignin, pectin degrading microorganisms isolated from different sources and mushroom cultivation. **CO3:** Determining the different features of host parasite relationship of plant pathogens. **CO4:** Examine the results of siderophore production and differential staining **CO5:** Assessthe identification strategies for bacterial pathogens and application of antibiotic sensitivity tests. **CO6:** Assemble the concepts of various techniquesfor solving a research problem.
III	18MSMB3H01	RECOMBINANT DNA TECHNOLOGY	**CO1 : Explain** difference between conventional cloning and modern cloning methods. **CO2 : Interpret** the technical know-how of versatile techniques in recombinant DNA technology. **CO3: Examine** the current applications of RDT in biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, plant, animal, and forensic. **CO4: Appraise** thegenetic engineering techniques and applications with their regulatory and ethical implications in basic and applied experimental biology.
III	18MSMB2H02	MICROBIOLOGICAL TECHNIQUES AND RESEARCH METHODOLOGY	**CO1 :** Gain knowledge on different microscopes and identify microorganisms **CO2 :** Distinguish molecular level detailed structure of cells **CO3:** Compare and contrast different techniques applied in microbiology and allied studies **CO4:** Design research methodology and to create data leading to publications

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III	**18MSMB3S32**	**HOSPITAL INFECTION CONTROL**	**CO1 :** List out the routes of transmission of infections. **CO2 :** Explain the usage of disinfectants and sterilants **CO3:** Interpret the risks involved in a hospital environment and their management practices **CO4:** Examine the methods used in infection surveillance and outbreak control. **CO5:** Select the proper antimicrobial therapy. **CO6:** Propose the correct methods for segregation and disposal of clinical wastes.
III	**18MSMB3S33**	**APPLIED MICROBIOLOGY**	**CO1 :** Enlist the technical know-how of different techniques in preservation of microbial cultures. **CO2 :** Discuss the production and purification of microbial metabolites **CO3:** Illustrate the production and spoilage of different fermented foods **CO4:** Distinguish the features of several food-borne infections and intoxications caused by microorganisms. **CO5:** Recommend the current applications of microorganisms in biodegradation of environmental pollutants, in agriculture as biofertilizers and biopesticides, and in the development of alternate fuels. **CO6:** Assemble the concepts about different bacterial, fungal and protozoal pathogens and preparation standards of different pharmaceutical products.
III	**18MSMB3H01L**	**RECOMBINANT DNA TECHNOLGY**	**CO1 :** Demonstrate the use of enzymes used in cloning **CO2 :** Employ the methods of gene cloning in bacteria **CO3:** Construct a recombinant and screen them **CO4:** Formulate gene amplification by PCR **CO5:** Assess the applications of RDT in DNA fingerprinting

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III	18MSMB3H02L	MICROBIOLOGICAL TECHNIQUES	**CO1 :** State the principles of various microbiological techniques. **CO2 :** Discuss the requirements and skills involved in purification of biomolecules. **CO3:** Demonstrate the steps involved in different techniques used to analyze biomolecules from different sources. **CO4:** Examine the quality/activity of purified biomolecules **CO5:** Assess the application of each technique. **CO6:** Assemble the concepts of various techniques for solving a research problem.
IV	18MSMB4HO1	BIOSTATISTICS AND BIOINFORMATICS	**CO1 :**Gain knowledge on statistical tests that can be conducted for the data **CO2 :** Employ statistical method for data collected **CO3:** Operate various softwares to examine the data collected **CO4:** Assess different biological databases, sequence alignment and phylogenetics
IV	18MSMB4H02	INDUSTRIAL MICROBIOLOGY	**CO1 :** List the isolation and screening of cultures for new microbial products; and features of inoculum development. **CO2 :** Discuss the strategies for various culture preservation techniques, microbial strain improvement methods and industrial media formulation. **CO3:** Illustrate the kinetics of microbial growth and features of different industrial bioreactors. **CO4:** Compare the immobilization techniques and concepts pertaining to the downstream processing of microbial metabolites. **CO5:** Assess the industrial production of microbial metabolites **CO6:** Assemble the knowledge of patent laws, their legal implications, handling and disposal of bio-hazardous materials, good laboratory and manufacturing practices.
IV	18MSMB4H03	ENVIROMENTAL MICROBIOLOGY	**CO1 :** Gain knowledge on the microorganisms present in the environment **CO2 :** Examine the types of microorganisms in the environment **CO3:** Prioritize the methods of making pollution free environment **CO4:** Formulate methods for exploiting microorganisms for human benefit

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IV	18MSMB4S41	DAIRY MICROBIOLOGY	**CO1 :** Name the processing methods used in dairy industry. **CO2 :** Describe the concepts behind microbial examination of milk. **CO3:** Employ techniques to improve the shelf life of dairy products. **CO4:** Examine the role of starter cultures in dairy fermentation. **CO5:** Rate the quality of fermented dairy products **CO6:** Propose the role of regulatory agencies in food safety.
IV	18MSMB4S42	PHARMACEUTICAL MICROBIOLOGY	**CO1 :** State the principles of antimicrobial chemotherapy. **CO2 :** Discuss the mechanism of action of antibiotics. **CO3:** Demonstrate the steps involved in microbial production of enzymes and vaccines. **CO4:** Examine the spoilage of pharmaceutical products. **CO5:** Assess the importance of regulatory aspects of quality control and quality assurance. **CO6:** Propose methods for sterilization of pharmaceutical products.
IV	18MSMB4H23L	INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY LAB	**CO1 :** Describe the fermentative production of alcohol and amylase/protease (SSF). **CO2 :** Discuss the citric acid and penicillin production by SmF andSSF and their respective bioassays. **CO3:** Demonstrate the steps involved in immobilization of whole cells and enzymes. **CO4:** Examine the microbial quality of air and potable water. **CO5:** Assess the DO, BOD and COD of environmental water. **CO6:** Formulate the strategies to isolate microbes from industrial waste water and lethal effect of heavy metals on microbial growth.

Semester	Course Code	Course Name	Course Outcomes (COs)
IV	18MSMB4P6	PROJECT	**CO1 :** Identify a problem in microbiology based industry/ having societal relevance **CO2 :** Select and apply appropriate methodologies and statistical methods for designing experiments **CO3 :** Plan & Design experiments using the knowledge in concepts/principles of microbiology **CO4 :** Graphically present the results using appropriate software to prove the objectives & hypothesis. **CO5 :** Solve scientific problems pertaining to real life situations with originality and write scientific report drawing conclusions, article writing, follow professional ethics **CO 6:** Demonstrate communication and presentation skills through presentation **CO7:** Demonstrate leadership quality such as objectivity, creative imagination/thinking, systematic reasoning, meticulous planning, respect for logic, and acceptance after proof/verification, work in a team/lead the team. **CO8:**Demonstrate life-long learning ability