Department of Microbiology

B.Sc., / PROGRAMME OUTCOME (PO)

After the completion of the program the students are able to

PO-1: Illustrate the basic concepts in biological sciences and their applications in various scientific fields.

PO-2: Attribute the role of microbes in food and dairy manufacturing, ecology, agriculture, drug designing and other human welfare products.

PO-3: Imbibe skills in handling scientific instruments, planning and performing laboratory experiments to find solutions for regional and national health threats like emerging microbial diseases.

PO-4: Articulate good laboratory practices, which provide great carrier opportunities globally.

PO-5: Imbibe ethical, moral and social values in personal and social life leading to highly cultured and civilized personality.

PO-6: Explain microbiology discipline though involvement in experiment.

PROGRAM SPECIFIC OUTCOME

B.SC MICROBIOLOGY

- Annotate scientific information effectively especially relating to microorganisms and role of microbes in ecosystem function and health related issues.

- Exemplify the role of microbes in human disease, in health issues and the immune response.

- Evaluate the needs, identify the potentials and impact of microorganisms relevant to food, soil and agriculture ensure environmental conservation and food safety

COURSE OUTCOME

B.SC MICROBIOLOGY

SEMESTER-I

General Microbiology and Microbial Physiology

- Annotate the developments in Microbiology and list the contributions of various scientists.
- Illustrate the structure and function of Microbial cells. Utilize the principles and applications of different types of Microscope. Apply various staining procedures for visualizing microorganisms under the microscope.
- Exemplify the nutritional requirement of microorganisms and their cultivation techniques under laboratory conditions.
- Evaluate the implication of various sterilization procedures and bio safety measures in clinical labs and industries.
- Assess various metabolic pathways occurring in microorganisms and their significance.
- Acquire knowledge about antibiotics and mode of action

SEMESTER-II

Immunology and Microbial Genetics

- Annotate the key concepts in immunology and overall organization of immune system.
- Illustrate the concepts of antigen and antibody structure
- Comprehend the role of antigen-antibody reaction and its uses in diagnostics and various other studies and explain the structure, properties and functions of antibodies.
- Exemplify the mechanisms of hypersensitivity reactions (I-IV) and auto immune disorders
- Compare primary and secondary immune response, appraise the origin, maturation process, and general function of B and T lymphocytes and analyze graft rejection in transplantation by learning the MHC molecules and their functions.
- Learn about immunization and their preparation and its importance.

SEMESTER-III

Molecular Biology

- Attribute the most significant discoveries and theories through the historical progress of biological scientific discoveries and their impacts on the development of molecular biology.
- Illustrate that fundamental structural units define the function of all living things.
- Explain the fundamental structure, properties and processes in which nucleic acids play a part and understand the DNA replication, repair and recombination in prokaryotes with that of eukaryotes.
- Exemplify RNA synthesis and processing and function of different types of RNA.
- Summarize protein synthesis and inhibition factors of protein synthesis.
- Comprehend prokaryotic and eukaryotic gene expression and control of gene expression.

Bioinstrumentation

- Acquire knowledge on working principle of laboratory instruments.
- Demonstrate the procedure for the pH measurement.
- Design experiments for separation of amino acids and sugars using paper and thin layer chromatography.
- Estimate sugars and amino acids using spectroscopic techniques
- Proficient in using other instruments related to research.
- Construct experiments using instruments from a pH meter to spectroscopy.

SEMESTER-IV

Soil and Agricultural Microbiology

- Attribute types, structure, formation and microbial flora of soil.
- Exemplify the role soil micro flora in biogeochemical cycle in the environments.
- Highlight the mechanism and responsibility of microbial interaction with microbes, plant, animal and insects.

- Examine the role of microorganism in nitrogen fixation and know about the types and mode of action of biopesticides.
- Illustrate the defense mechanism, etiology, epidemiology and management various plant diseases caused by microorganisms.
- Construct protocols to diagnose plant diseases and implement control of microorganisms.

SEMESTER-V

Systemic Medical Bacteriology

- Annotate various techniques of sample collection, transport and processing for laboratory diagnosis of bacterial diseases.
- Explain the basic and general concepts of causation of disease by the pathogenic microorganisms.
- Attribute information for the assessment of their severity including the broad categorization of the methods of diagnosis.
- Highlight the insights practical aspects of antibiotic sensitivity testing.
- Impart knowledge of various zoonotic infections, ways to tackle them and use biosafety precautions.
- Adapt diagnostic skills from sample collection to assess diseases and hormonal disorders.

Medical Mycology and Parasitology

- Attribute information for collection of different clinical samples, transport, culture and microscopic examination, staining and biochemical methods for the diagnosis of fungal and protozoan diseases.
- Summarize basic and general concepts of causation of disease by the pathogenic microorganisms and the various parameters of assessment of their severity including the broad categorization of the methods of diagnosis.
- Highlight the Insights to treatment options of fungal and protozoan diseases.
- Demonstrate the importance of protozoan in the intestine.
- Appraise Nematodes as infectious agent.
- Adapt skills in isolation, identification and diagnosis of fungal and parasitic diseases.

Medical Virology

- Highlight about viruses and the chemical nature of viruses, different types of viruses infecting animals, plants and bacteria – Bacteriophages.
- Exemplify the emerging viral diseases.
- Attribute information about the role of viruses in the causation of the cancer.
- Paraphrase clinical aspects and related implications of viral diseases.
- Examine and experiment viral vaccines and formulate antiviral drugs.
- Execute isolation of viruses, evaluation of viral diseases, produce viral vaccines and formulate antiviral drugs.

Genetic Engineering

- Annotate the history and the development of Genetic Engineering with the contribution of the scientist.
- Demonstrate production methods of the widely used biotechnological products.
- Comprehend the role of the enzymes as a tool in Genetic Engineering.
- Appraise the significance of vector, as a tool in the construction of genetic modification of the organisms.
- Implement Genetic Engineering in health, agriculture and industries.
- Apply the techniques to modify organisms and to produce industrial products.

SEMESTER-VI

Environmental Microbiology

- Attribute the natural ecosystem and role of microorganisms in the ecosystem
- Annotate composition of air, air borne organisms and how the organisms causes the diseases and its preventive measures
- Outstate different types of microorganism in water, causes of water pollution and methods to analyze the quality of water and treatment for purification of drinking water, hygienic practices to control the water borne diseases.
- Summarize the role and application of microorganisms to degrade the environmental contaminants and microbes involved in solid and liquid waste management.

- Comply the role of microbes in biodegradation and bioremediation of heavy metals and hydrocarbon etc.,
- Solve environmental pollution by bioremediation, waste treatment methods.

Food and Diary Microbiology

- Attribute food as a substrate for various microbes, the role of factors and its importance.
- Annotate the principles and application of different types of food preservation technique, chemical preservative and its advantages and disadvantages.
- Describe pragmatic understanding of food spoilage.
- Acquire a thorough understanding of food borne diseases, testing methods, and preventive technique.
- Formulate various fermented product and its various stage spoilage.
- Design experiments related to preservation of food and production of fermented foods.

Industrial and pharmaceutical Microbiology

- Emphasize fermentation process and the requirements of process.
- Annotate designing of fermentation.
- Acquire the knowledge about the production of antibiotic and enzymes.
- Categorize various separation procedures in pharmaceutical industries.
- Infer the principles of raw material used in pharmaceuticals and validation and sterility of pharmaceutical product.
- Illustrate the fermentation process, design of fermentors, production of industrially important products.

Biotechnology

- Attribute Microbial production of industrial enzymes; methods for immobilization of enzymes; kinetics of soluble and immobilized enzymes.
- Annotate principles and application of genetic recombinant technology and strain improvement, production of biotechnological products.
- Illustrate plant genome; plant tissue culture techniques; methods of gene transfer into plant cells

- Categorize various Methods for plant micro propagation; crop improvement and development of transgenic plants.
- Infer the Animal cell metabolism and regulation; cell cycle; primary cell culture; nutritional requirements for animal cell culture; techniques for the mass culture of animal cell lines; transgenic animals.
- Execute biotechnology experiments related to microorganisms, plants and animals.

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COURSE OUTCOME

B.SC MICROBIOLOGY (revised 2020)

SEMESTER-I

General Microbiology and Microbial Physiology

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- Illustrate the structure and function of Microbial cells. Utilize the principles and applications of different types of Microscope. Apply various staining procedures for visualizing microorganisms under the microscope.
- Exemplify the nutritional requirement of microorganisms and their cultivation techniques under laboratory conditions.
- Evaluate the implication of various sterilization procedures and bio safety measures in clinical labs and industries.
- Assess various metabolic pathways occurring in microorganisms and their significance.
- Acquire knowledge about antibiotics and mode of action

SEMESTER-II

Basic and Applied Immunology

- Annotate the key concepts in immunology and overall organization of immune system.

- Illustrate the concepts of antigen and antibody structure
- Comprehend the role of antigen-antibody reaction and its uses in diagnostics and various other studies and explain the structure, properties and functions of antibodies.
- Exemplify the mechanisms of hypersensitivity reactions (I-IV) and auto immune disorders
- Compare primary and secondary immune response, appraise the origin, maturation process, and general function of B and T lymphocytes and analyze graft rejection in transplantation by learning the MHC molecules and their functions.
- Learn about immunization and their preparation and its importance.

Bioinstrumentation

- Acquire knowledge on working principle of laboratory instruments.
- Demonstrate the procedure for the pH measurement.
- Design experiments for separation of amino acids and sugars using paper and thin layer chromatography.
- Estimate sugars and amino acids using spectroscopic techniques
- Proficient in using other instruments related to research.
- Construct experiments using instruments from a pH meter to spectroscopy.

PROGRAMME OUTCOME

M.Sc-Applied Microbiology

After the completion of the program the students are able to

PO-1: Annotate interdisciplinary knowledge to find solutions to the complex biological problems

PO-2: Execute scientific data and carryout the research experiments using microbiological laboratory techniques and safety procedures.

PO-3: Articulate research problems, design and execute experiments to find relevant solutions

PO 4: Implement scientific skills for industrial applications and entrepreneurship

PO-5: Categorize advanced instrumentation tools and execute online resources with an understanding of the troubleshooting and limitations

PO-6: Select both technical and soft skills to qualify for a broad range of positions in research, industry, consultancy and education or for further education in a higher degree program

PROGRAM SPECIFIC OUTCOME

M.SC MICROBIOLOGY

- Categorize different branches of Microbiology such as Bacteriology and Virology.

- Classify various applications of Microbiology such as Environmental Microbiology, Industrial Microbiology, Food Microbiology, and Microbial Pathogenicity.

- Execute experiments related to Basic Microbiology, Immunology, Molecular Biology, Biotechnology and Microbial Genetics

COURSE OUTCOME

M.SC APPLIED MICROBIOLOGY

SEMESTER-I

Microbial Taxonomy

- Annotate the importance of taxonomy and as a tool for researchers who work with new species.
- Implement the application of molecular techniques in identifying new species.
- Categorize the bacterial classification based on 16s rRNA sequencing.
- Emphasize the characteristics features of fungi, algae and protozoa.
- Discriminate the features of plant viruses, animal viruses and bacteriophages.
- Categorize and classify fungi, protozoa and algae.

General Microbiology and Laboratory Animal science

- Illustrate the art of Microscopic techniques and principles. Appraise staining methods, sterilization and disinfection methods and quality control.
- Emphasize various bacterial Anatomy, Structure, properties and biosynthesis cellular components of bacteria, nutritional requirements, kinetics of growth, Measurement of growth, enumeration of cells, pure culture techniques.
- Categorize the distribution of algae, reproduction and life patterns of algae.
- Comprehend modern methods of care, management, breeding and maintenance of laboratory animals and achieve expertise in handling different laboratory animals - rabbits, mice, rats, guinea pigs, monkeys, hamsters, fowl, sheep.
- Demonstrate various breeding and handling of specific pathogen free Gnotobiotic animals and their maintenance and uses. Transgenic animal models – Methodology and uses.
- Evaluate laboratory uses of animals with special reference to microbiology, pathogenicity testing, antibody production

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Immunology

- Summarize the key concepts in immunology and overall organization of immune system.
- Attribute the concepts of antigen and antibody structure and illustrate the role of antigen antibody reaction, its uses in diagnostics and various other studies and to explain the structure, properties and functions of antibodies.
- Describe the mechanisms of hypersensitivity reactions (I-IV) and auto immune disorders
- Compare and contrast primary and secondary immune response, the origin, maturation process, and general function of B and T lymphocytes.
- Analyze graft rejection in transplantation by learning the MHC molecules and their functions.
- Elaborate the immunization and their preparation and its importance.

Metabolic pathways

- Understand the important role of Enzymes in various anabolic and catabolic processes.
- Emphasize the importance of high energy compounds, electron transport chain, and synthesis of ATP under aerobic and anaerobic conditions.
- Illustrate the metabolism of carbohydrates through various anabolic and catabolic pathways like Glycolysis and Kreb's cycle,
- Acquire knowledge related to the role of Glycolysis and TCA cycle in carbohydrate metabolism.
- Demonstrate the insights of biosynthesis lipids and proteins and to understand the catabolism and inter conversion of amino acids.
- Summarize the photosynthetic fixation of CO_2 through Calvin Benson cycle and reductive TCA cycle.

Microbial Diversity

- Categorize the common groups of bacteria and archaea in different ecosystems and their role in environments.
- Demonstrate the commercial aspects and application of thermozymes.
- Appraise idea about different types of extremophiles like acidophiles, barophiles, alklophiles, halophiles etc.

- Illustrate the aim and objectives of space research and missions for life detection experiments conducted in space.
- Identify and characterize the astronaut's microflora and medically important microorganisms in space.
- Explore and isolate microbes in space and medically important microbes.

SEMESTER-II

Medical virology

- Describe viruses and the chemical nature of viruses, different types of viruses infecting animals, plants and bacteria and bacteriophages.
- Articulate with the emerging viral diseases.
- Impart information about the role of viruses in the causation of the cancer.
- Instill wider knowledge on clinical aspects and related implications of viral diseases.
- Comprehend viral vaccines and antiviral drugs.
- Identify the viruses, viral structure and to diagnose emerging viral diseases.

Systemic Medical Bacteriology

- Annotate the basic principles of medical microbiology and infectious disease.
- Illustrate about normal microflora of human and get in depth knowledge in virulence factor of pathogenic bacteria.
- Experiment collection of clinical specimens from the infected patients.
- Proficient in culturing, pathogenicity, pathology and laboratory diagnosis of pathogenic bacteria.
- Summarize the hospital management, ethical committee and its importance.
- Appraise the diagnostic procedure for various pathogens.

Mycology and Parasitology

- Identify different types of fungi and the characteristic of different fungus.
- Attribute the recovery and detection of fungi from clinical specimens.

- Enable students to get knowledge in classification, host-parasite relationships of medically important pathogenic parasite.
- Emphasize clear knowledge in life cycle, pathogenic mechanisms, lab diagnosis and treatment of medically important parasites.
- Categorize and classify parasite to impart knowledge about Epidemiology, life cycle, pathogenic mechanisms, lab diagnosis, treatment for various parasitic diseases.
- Proficient in diagnosis of parasites and focus on other parasites causing infections in immunocompromised hosts and AIDS.

Industrial Microbiology

- Impart knowledge of industrially important microorganisms and strain improvement to increase the production.
- Experiment designing the fermentor and different types of fermentor and its uses in industry.
- Recognize different types of primary and secondary metabolites produced by the industrially important microorganisms and their applications.
- Prioritize immobilisation of enzymes and recombinant protein in therapeutic and diagnostic application.
- Summarize the production protocol for primary and secondary metabolites.
- Proficient in handling all industrial microbiology experiments.

Biostatistics and Bioinformatics

- Annotate theory behind fundamental bioinformatics analysis methods.
- Experiment and articulate widely used bioinformatics databases.
- Summarize the applications and limitations of different bioinformatics and statistical methods
- Discuss basic concepts of probability and statistics in the field of biology.
- Perform and interpret bioinformatics and statistical analyses with real molecular biology data.
- Proficient in the application of bioinformatics tools.

SEMESTER-III

Microbial Genetics

- Exemplify historical perspectives of microbial genetics, Nucleic acid as genetic carriers: experimental evidence, DNA – types, structure and properties.
- Summarize organization of genes and chromosomes: Definition of gene. Operon, Structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons.
- Recognize Plasmids as extrachromosomal genetic elements; types and properties. Structure and replication of different plasmids, Plasmid amplification and curing and Gene transfer mechanisms.
- Prioritize Mutation and Mutagenesis.
- Appraise molecular recombination, Genetic mapping in *E. coli* and Yeast.
- Proficient in handling the plasmids and genes of microorganisms.

Genetic Engineering

- Annotate the principles and application of enzymes in genetic engineering.
- Experiment the methods of cloning techniques in constructing gene libraries.
- Illustrate the analysis of recombinant DNA using molecular methods.
- Describe the applications of genetic engineering tool in agriculture, health and industry including gene therapy.
- Impart knowledge about DNA and protein sequencing, Protein engineering. Protoplast fusion, Hybridoma Technology. DNA finger printing techniques.
- Implement genetic engineering in agriculture, health and industry including gene therapy.

Molecular Biology

- Exemplify the concepts of molecular biology.
- Attribute and identify the function of biomolecules such as carbohydrate, proteins and lipids.
- Distinguish the properties, structure and function of genes in living organisms at the molecular level.

- Explain the significance of central dogma of molecular biology and to a conceptual knowledge about DNA as a genetic material, enzymology and replication steps.
- Inculcate knowledge about the molecular mechanisms involved in transcription and translation and to describe the importance of genetic code and wobble hypothesis
- Proficient independently and to work with molecular biology techniques.

Soil and Agricultural Microbiology

- Attribute soil microorganism and its interaction with the environment.
- Categorize different biogeochemical cycles and its importance.
- Describe the concepts of bio fertilizers, bio pesticides production and their application.
- Validate plant infection and its defence mechanism.
- Identify and recognize Epidemiology and management of the different types plant diseases.
- Familiar with recent advanced techniques in plant pathology and with plant disease broadcasting.

Environmental Biotechnology

- Impart knowledge about basic principles of environmental monitoring.
- Attribute microbial products and inert biomass and its application in biodegradation.
- Explain principles and designing of Bioreactors.
- Summarize the system of waste water treatment and liquid waste management.
- Illustrate the significance of sludge denitrification in the treatment of solid wastes.
- Understand the bioremediation and strategies for bioremediation.

SEMESTER-IV

Food and Diary Microbiology

- Articulate beneficial role of microorganisms in fermented foods and in food processing and the microbiology of different types of fermented food products – dairy, pickles, Legume and cereal based food products.
- Illustrate the significance and activities of microorganisms in food and role of intrinsic and extrinsic factors on growth and survival of microorganisms in foods.
- Exemplify the spoilage mechanisms in foods and to identify methods to control deterioration and spoilage of foods.
- Recognize and describe the characteristics of important pathogens and spoilage microorganisms in foods.
- Discuss various methods for isolation, detection and identification of microorganisms in food and employed in industries.

Research Methodology

- Articulate the principles of quantitative and qualitative research methods.
- Illustrate writing the research report and distinguish the components of research report.
- Describe molecular biology methods, analysis of gene expression.
- Organize histochemical, immunotechniques and biophysical methods
- Experiment and evaluate radiolabeling techniques, Molecular imaging of radioactive material and safety guidelines
- Interpret ethical and philosophical issues associated with research in education and various modes of presenting and disseminating research findings and acquire expertise in the use and application of the methods of data collection and analysis.

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