

DEPARTMENT OF MICROBIOLOGY

B.Sc. Microbiology

Programme outcomes

After completing B. Sc.

Students are expected to develop

Knowledge Outcomes:

PO1: Demonstrate and apply the fundamental knowledge of the basic principles in the fields of Microbiology

PO2: Create awareness and sense of responsibilities towards environment and apply knowledge to solve the issues related to Environmental pollution.

PO3: Apply fundamental knowledge for doing qualitative and quantitative analyses in various fields.

Skill Outcomes:

PO4: Collaborate effectively on team-oriented projects in the field of sciences.

PO5: Communicate scientific information in a clear and concise manner both orally and in writing

PO6: Explain environmental pollution issues and the remedies thereof.

PO7: Apply the knowledge to develop the sustainable and eco-friendly technology in Industry.

Generic Outcomes:

PO10: Ability of critical reasoning and judgment.

PO11: Acquired a basic knowledge and skillset for becoming employable.

PO12: Will enhance the scientific temper so as to develop a research interest.

Programme Specific Outcomes (UG)

Students will be able to-

PSO1: Perform Aseptic techniques.

PSO2: Prepare reagents and nutrient media.

PSO3: Isolate, characterize and maintain bacterial cultures.

PSO4: Carry out Production of biofertilizers.

PSO5: Perform Microbial analysis/ Quality Control testing of samples such as soil, water, milk and injectibles.

PSO6: Do Biochemical and molecular biology techniques, enzyme assays, chromatography, electrophoresis.

PSO7: Perform Antibiotic sensitivity testing and hematological techniques.

PSO8: Gain Basic computer literacy

Course outcomes

First Year (Autonomous)

22-MB-111: Introduction to Microbial World

Course outcomes

Students will be able to

CO1: Describe history of microbiology, contribution of different scientists in microbiology and nobel laureates in the field of immunology, molecular biology and biotechnology.

CO2: Explain concepts of Vaccination and Chemotherapy and their applications.

CO3: Differentiate between different microbial groups like Bacteria, Fungi, Algae, Viruses and algae.

CO4: Explain the basis of classification of bacteria and viruses.

CO5: Explain beneficial and harmful effects of microorganisms in different areas of Microbiology.

22-MB-112: Basic Techniques in Microbiology

COURSE OUTCOMES:

Students will be able to

CO1: Explain the concepts- magnification, resolving power, numerical aperture, aberrations in lenses in bright field microscopy.

CO2: Explain principle and working of compound light microscope, phase contrast microscope, electron microscopes and fluorescent microscope.

CO3: Describe properties and role of fixatives, mordant, decolorizes, accentuators and stains.

CO4: Explain Principles and methodology of monochrome, negative, Gram Staining, acid fast staining and special staining techniques for different components of bacterial cell.

CO5: Describe sterilization and disinfection by physical and chemical agents, their mode of action.

22-MB-113 Practical course based on theory papers 22-MB-111 and 22-MB-112

COURSE OUTCOMES

Students will be able to:

CO1: Describe construction and Working of common instruments used in Microbiology laboratory.

CO2: Explain use of various glassware used in microbiology experiments.

CO3: Handle and use compound microscope to observe microorganisms.

CO4: Prepare and stain the smear and focus the slide to observe bacterial/ fungal specimens or their specific cellular components.

CO5: Observe bacterial motility.

CO6: Evaluate disinfectant efficiency by determining its Phenol Coefficient.

Semester II

22-MB-121: Bacterial Cell and Biochemistry

COURSE OUTCOMES:

Students will be able to

CO1: Describe types of bonds present in biomolecules, structures and roles of biomolecules like Carbohydrates, Proteins, Lipids, Nucleic acids etc.

CO2: Describe basics of bacterial cytology, composition and functions of different bacterial cell components

CO3: Describe bacterial classification based on 16s RNA sequencing.

CO4: Explain significance and applications of Human Microbiome, basics of Nano Biotechnology and Space Microbiology.

22-MB-122: Microbial cultivation and growth

CO1: Explain nutritional requirements, nutritional classification and cultivation of bacteria and different types of microorganisms

CO2: Explain concept of enrichment, pure culture, isolation and maintenance of microbial cultures and role of culture collection centres

CO3: Describe kinetics, different methods of measurement and factors affecting bacterial growth.

22-MB-123 Practical course based on theory papers 22-MB-121 and 22-MB-122

Students will be able to-

CO1: Prepare growth medium for cultivation of bacteria.

CO2: Prepare and stain the smear and focus the slide specific cellular components of bacteria.

CO2: Isolate bacteria from given samples.

CO3: Observe and record colony characteristics of bacterial isolates.

CO4: Study effect of physical & chemical agents like pH, temperature, Salt concentrations, heavy metals etc. on growth of bacteria.

CO5: Learn various methods of culture preservation.

Second Year (Semester I) (2019 pattern)

Course- MB 231: Medical Microbiology and Immunology

Students will be able to-

CO1: Define terms such as -Incubation period, Viability, Susceptibility, Pathogenicity, Virulence, Pathogenesis, Lab diagnosis, Epidemic, Sporadic, Endemic and Pandemic.

CO2: Explain the characteristics, pathogenesis, diagnosis and treatment of bacterial pathogens *E. coli* and *Staphylococcus aureus* and fungal pathogens *Candida* and Dermatophytes.

CO3: Explain chemotherapy concepts MIC, MBC and LD50, antagonism and synergism in drug administration, antibiotic sensitivity

CO4: Describe process of Hematopoiesis, innate immunity and adaptive immunity, concept underlying Antigens and Antibodies.

CO5: Explain the genetics, biochemistry and inheritance of ABO and Rh blood group systems, medicolegal applications of blood groups.

CO6: Differentiate between active and passive immunization, know immunization schedule in India, explain the concept of immunization with examples of types of vaccines.

Course- MB 212: Bacterial Physiology and Fermentation Technology (Paper II)

Students will be able to-

CO1: Describe the components of holoenzyme, nomenclature and classification of enzymes, models of catalysis and effect of various parameters on enzymes.

CO2: Explain various glucose metabolic pathways with details such as structures and names of metabolites, names of enzymes and cofactors

CO3: Describe application of fermentation technology, screening, selection and maintenance of microbial strains, design of fermentation media and fermenters, types of fermentations, working of fermenters, consequences of contamination.

MB-233: Practical Course based on MB-231 MB-231: Diagnostic Microbiology and Immunology and MB-232: Bacterial Physiology and Fermentation Technology

Students will be able to-

CO1: Measure cell dimensions by micrometry

CO2: Identify the blood group of blood sample

CO3: Isolate and identify pathogens *E. coli*, *Staphylococcus aureus* and *Candida* from clinical sample and characterize them by Gram staining, motility, cultural and biochemical tests.

CO4: Demonstrate screening of organic acid/ antibiotic and amylase producing microorganisms.

Second Year (Semester II) (2019 pattern)

Course- MB 221: Bacterial Genetics (Paper I)

Students will be able to-

CO1: Explain how the nature of genetic material was discovered and comprehend the structure of Nucleic acids

CO2: Describe the modes, rules and steps of DNA replication

CO3: Explain various types of mutations, types of mutagenic agents and their mechanism of action

CO4: Describe mechanism of gene expression and and gain knowledge about plasmid biology

Course- MB 222: Air , water and soil Microbiology (Paper II)

Students will be able to-

CO1: Define Droplet, droplet nuclei, aerosols, surface water, ground water, stored, distilled, mineral and de-mineralized water.

CO2: Explain with the help of diagram construction and working of various air samplers and steps in water purification.

CO3: Describe air borne and water borne microbial infections.

CO4: Describe physical and chemical methods of air sanitation, functions of regulatory bodies in deciding drinking water standards, tests for bacteriological analysis of water for potability.

CO5: Explain features microorganisms as indicators of faecal contamination, role of rhizosphere microflora and role of microorganisms in composting, humus formation, Carbon and Nitrogen cycles.

CO6: Describe large scale production biofertilizers and biocontrol agents.

CO7: Explain positive, neutral and negative interactions in soil microorganisms

Course- MB 223: Practical Course

Students will be able to-

CO1: Demonstrate air sampling using an air sampler.

CO2: Estimate the diversity of microorganism by statistical analysis

CO3: Determine potability of drinking water using MPN test and membrane filtration technique.

CO4: Enrich and isolate *Azotobacter* and *Rhizobium* or cyanobacterium and prepare biofertilizer.

CO5: Demonstrate the use of physical and chemical mutagen to isolate mutants.

Third Year (Semester V) (2019 pattern)

Course- MB 351: Medical Microbiology- I (Paper I)

Students will be able to-

CO1: Understand the human anatomy, pathogens associated with diseases

CO2: Acquire knowledge of principles underlying establishment of pathogens in human body.

CO3: Comprehend pathogenesis of specific pathogens causing human diseases.

CO4: Assess epidemiological patterns, mode of transmission, reservoirs, of microbial diseases

Course- MB-352 Immunology- I (Paper II)

Students will be able to-

CO1: Understand immune system structure, composition, function and comparison of different types of immunity

CO2: Acquire knowledge about antigens, immunoglobulins & their reactions, Recognition of pathogens; antigen processing and presentation; Role of immune system in transplantation.

CO3: Learn the Production of monoclonal antibodies & their applications in Immunotherapy

Course- MB 353: Enzymology (Paper III)

Students will be able to-

CO1: Understand methods of active site determination, role of enzymes and its cofactors in various biochemical reactions.

CO2: Learn to perform enzyme assay, purification and quantification of enzymes activity, enzyme kinetics in terms of initial, final velocity and derive mathematical expression of enzyme kinetics

CO3: Explain metabolic regulation mechanisms occurring at enzymatic level and methodology for commercial applications of enzymes

Course- MB 354: Genetics (Paper IV)

Students will be able to-

CO1: Describe steps and components of DNA replication, Transcription and Translation Processes, in prokaryotes and eukaryotes

CO2: Explain gene transfer mechanisms in bacteria with specific examples.

CO3: Construct genetic map of bacteria and fungi

Course- MB 355 Fermentation Technology– I (Paper V)

Students will be able to-

CO1: Impart technical understanding of commercial fermentations.

CO2: Apply classical, advanced strain improvement and isolation techniques for fermentation processes.

CO3: Optimize and sterilize media used in fermentation industry for commercially economical and efficient fermentations.

CO4: Recover the product using suitable methods and Use quality assurance tests for assessing quality of the finished product.

Course- MB 356: Agricultural Microbiology (Paper VI)

Students will be able to-

CO1: Understand plant growth improvement with respect to disease resistance, environment tolerance.

CO2: Explain stages of plant disease development, epidemiology, symptoms based classification and disease control methods.

CO3: State the importance of microorganisms in sustainable agriculture, biotechnological application of biofilms, edible vaccines

CO4: Correlate Soil Micro biome and its role pertaining to soil health

CO5: Learn the use of Microorganisms as tools in plant genetic engineering.

Course- Skilled Base Elective MB 3510 Marine Microbiology

Students will be able to-

CO1: Describe unexplored niches of marine ecosystems

CO2: Explain the steps involved in field research and laboratory research

CO3: Explain various approaches to capture microbial diversity of marine ecosystems

CO4: Describe significance and role of marine microbes in bioremediation.

Course- Skilled Base Elective MB 3511 Dairy Microbiology

Students will be able to-

CO1: Comprehend types of milk, associate microflora, natural preservatives present in milk

CO2: Explain process of milk spoilage and methods of preservation.

CO3: Describe various tests for assessment of milk quality in dairy industry.

Course- MB 357: Practical Course I

Students will be able to-

CO1: Isolate and identify pathogens from various clinical samples like Urine, Stool, Sputum etc.

CO2: Carry out epidemiological survey of diseases

CO3: Study various hematological parameters like haemoglobin, ESR, PCV, Differential WBC count, total WBC & RBC count etc

CO4: Detect blood group of unknown blood samples and study blood group compatibility of donor & recipient

CO5: Study immunological tests and apply them for diagnosis such as Agglutination- Widal test, Precipitation-Ouchterlony method etc.

CO6: Learn collection and storage of blood samples, separation of blood components and their preservation, through visit to Blood bank.

Course- MB 358: Practical Course II- Biochemistry and Molecular Biology

Students will be able to-

CO1: Determine absorption spectra and molar extinction coefficient using colorimeter

CO2: Estimate sugar, urea, cholesterol, proteins and albumin from human blood samples

CO3: Carry out qualitative and quantitative estimation of carbohydrates and proteins

CO4: Prepare buffers

CO5: Perform Paper chromatography for separation of amino acids

CO6: Isolate amylase producing microorganisms and carry out production and purification of amylase

CO7: Isolate and enumerate bacteriophages

CO8: Isolate bacterial plasmid and genomic DNA and carry out transformation of *E. coli*

Course- MB 359: Practical Course III

Students will be able to-

CO1: Learn Process of fermentation and product recovery

CO2: Isolation, identification and use of different bacteria from natural samples such as Nitrogen fixers, plant pathogens, lactic acid bacteria etc.

CO3: Learn bioassay technique and its application

CO4: Know importance of and application of Quality control techniques

Third Year (Semester II) (2019 pattern)

Course- MB 361: Medical Microbiology II (Paper I)

Students will be able to-

CO1: Gain Knowledge principles of chemotherapy of microbial diseases and development of drug resistance among pathogens and strategies to mitigate. □

CO2: Develop identification systems for microbial disease diagnosis, disease treatment and prevention measures.

Course- MB 362 Immunology– II (Paper II)

Students will be able to-

CO1: Understand abnormal working of Immune system in hypersensitivity, auto immune diseases, immune tolerance and transplantation immunology.

CO2: To develop strategies for Diagnosis of diseases based on antigen and antibody reactions with emphasis on prevailing communicable diseases.

Course- MB 363: Metabolism (Paper III)

Students will be able to-

CO1: To learn mechanisms of transport of solutes across the membrane

CO2: To get acquainted with mechanism of biosynthesis and degradation of bio molecules

CO3: To comprehend basic concept of autotrophic mode of metabolism of prokaryotes

Course- MB-364: Molecular Biology (Paper IV)

Students will be able to-

CO1: To get introduced to concept of recombination and bacteriophage Genetics

CO2: To understand the concept cloning in bacteria

CO3: To demonstrate the knowledge of common and advanced laboratory practices in Molecular Biology

Course- MB 365 Fermentation Technology – II (Paper V)

Students will be able to-

CO1: Explain fermentation economics, process patentability, process validation.

CO2: Comprehend the large scale productions of commercially significant fermentation products of classical and recent significance.

Course- MB 366: Food Microbiology (Paper VI)

Students will be able to-

CO1: State food safety problems and solutions in India and global scale.

CO2: Identify and classify types of microorganisms in food processing and compare their Characteristics and behavior

CO3: Describe food classification based on their perishability, intrinsic and extrinsic factors affecting the growth of microbes in foods, role of microorganisms in food fermentation.

CO4: Comprehend food spoilage, food borne diseases, predisposition and preventive and control measures.

CO5: Explain principles of sanitation, heat treatment, irradiation, modified atmosphere, antimicrobial preservatives and combination of method (hurdle concept) to control microbial growth with emphasis on HACCP guidelines.

Course- Skilled Base Elective MB 3610 Waste Management

Students will be able to-

CO1: Understand waste management and its practicable applicability.

CO2: Assess the magnitude and influence of hazardous content of waste, pollution of water and waste water treatment technologies.

CO3: Explain the design and working of treatment plants and methods used for liquid and solid waste treatment.

CO4: Impart the understanding of kinetics of biological systems used in waste treatment.

CO5: Describe the standards of waste management and competent authorities involved at National and international level.

Course-Skilled Base Elective MB 3611 Nano-biotechnology

Students will be able to-

CO1: Describe unexplored niches of marine ecosystems.

CO2: Explain the steps involved in field research and laboratory research.

CO3: Explain various approaches to capture microbial diversity in the marine ecosystem.

CO4: Describe and justify significance and role of marine microbes in bioremediation

Course- DSEC-MB – 367: Practical Course I- Diagnostic Microbiology and Immunology

Students will be able to-

CO1: Identify microbial pathogens using permanent slides and Isolate yeast and fungal pathogens.

CO2: Carry out Antibiotic Sensitivity Tests of bacterial pathogens

CO3: Determine compatibility of blood samples by Cross-matching and presence of Rh factor on foetal RBCs using Coombs test.

CO4: Perform various immunological techniques for detection of antigen/ antibody in the given sample

CO5: Learn collection and storage of blood samples, separation of blood components and their preservation, through visit to Blood bank

Course- MB 368: Practical Course II- Biochemistry and Molecular Biology

Students will be able to-

CO1: Estimate sugar, urea, cholesterol, proteins and albumin from human blood samples

CO2: Isolate amylase producing microorganisms and carry out production and purification of amylase

CO3: Isolate and enumerate bacteriophages

CO4: Isolate bacterial plasmid and genomic DNA and detect it using Agarose Gel electrophoresis

CO5: Observe and identify different stages of mitotic cell division

Course- MB 369: Practical Course III: Fermentation Technology- II and Food Microbiology

Students will be able to-

CO1: Carry out lab scale fermentation and Solid State fermentation of important products

CO2: Isolate, identify Probiotic microorganisms from natural sources or commercial products

CO3: Perform various techniques to determine TDP, TDT, TDR and D value with respect to food preservation.

CO4: Describe SOPs used in Pharmaceutical industry.
