

## 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 (2019 pattern)**

#### **Course - MB 111: Introduction to Microbial World and**

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: Describe characteristics of different microbial types like Bacteria, Fungi, Algae, Viruses

CO4: Explain beneficial and harmful effects of microorganisms in different areas of Microbiology.

#### **Course- MB 112: Basic Techniques in Microbiology and**

Students will be able to

CO1: Explain Bright field microscopy, magnification, resolving power and numerical aperture, aberrations in lenses, structure and working of compound light microscope, phase contrast microscope, electron microscopes and fluorescent microscope

CO2: Describe properties and role of fixatives, mordant, decolorisers and accentuators, stain and types of stain.

CO3: Explain Principles of Monochrome staining, Negative Staining Differential Staining techniques-Gram Staining and acid fast staining. Learn special staining techniques for different components of bacterial cell

CO4: Describe sterilization and disinfection by physical agents and by chemical agents and their mode of action, checking of efficiency of sterilization phenol coefficient

#### **Practical Course MB113**

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.

### **Course -MB 121 Bacterial Cell and Biochemistry**

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.

### **Course- MB 122 Microbial cultivation and growth**

CO1: Explain cultivation of microorganisms, nutritional requirements and nutritional classification, bacterial media preparation, cultivation of different types of microorganisms

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

CO3: Describe kinetics of bacterial growth, growth curve and generation time, measurement of bacterial growth by different methods, factors affecting bacterial growth, diauxic growth

### **Course- Practical Course MB 123**

**Students will be able to-**

CO1: Prepare growth medium for cultivation of bacteria.

CO2: Use inoculation and isolation techniques for isolation of 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.

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