

DEPARTMENT OF MICROBIOLOGY

Mrs. K. S. K. College, Beed.

Academic Year: 2026-2027

B.Sc. (NEP)

Course Outcomes (CO's)

After successful completion of this course, students are expected to:

B.Sc. F.Y.

Ist Semester

DSC-I/MBN 111: Fundamentals of Microbiology & DSC-2/MBN 121: Lab based on MBN 111

CO1: Understanding the History of Gain knowledge on Historical perspectives of Microbiology.

CO2: Microscopy Techniques: understand the concepts of Microscopy and get acquainted to various microscopic methods.

CO3: Taxonomy and Classification: Understand the concept of taxonomy, familiarize with classification systems and characteristics of used for classification.

CO4: General Characteristics of Microorganisms: Know general features of various kinds of microorganisms.

SEC -I/MBN 114 Water Analysis & SEC 2/MBN 123: Water Microbiology (Practical Based on MBNI 14)

CO1: Students Will gain knowledge related to water microbiology, properties and standard quality of water. They will also learn the various water borne diseases.

CO2: Will to know various methods used in water sample collection/treatment and the different tests for determining the quality of water.

GE/OE -1/MBN 112: Microbial Biotechnology

CO1: Microbial Diversity and Functionality: Students will gain an understanding of the diverse microorganisms used in biotechnology and their specific functions. This includes knowledge of bacteria, fungi, and viruses and their roles in bioprocessing and bio-product development.

CO2: Engineering: Students will learn the principles of bioprocess engineering, including fermentation techniques and optimization of microbial growth conditions.

CO3: Bioproduct Development: Students will be able to develop and evaluate microbial based products.

IInd Semester

DSC-YMBN 211: Microbial Techniques

CO1: Define and explain the key concepts of sterilization and disinfection, including types of agents, spectrum of activity, mode of action and applications.

CO2: Apply pure culture to isolate, enumerate, and cultivate using a variety of culture media and methods.

CO3: Perform and interpret common staining procedures for the microscopic observation of Microorganisms.

DSC-4/MBN 221: Lab Course based on MBN 211

CO1: Stain the bacterial structures using special staining techniques.

CO2: Able to prepare different cultivation media for microorganisms.

CO3: Enumerate microflora from different ecological samples.

CO4: Validate and evaluate instruments and disinfectant.

VSC -IIMBN 214: Sustainable Agriculture

CO1: Understanding properties of Soil: Gain knowledge on soil fertility, plant nutrition from the perspective of Microbiology.

CO2: Biofertilizers: understand the concepts of various biofertilizers used and get acquainted to various microbes in PGPR.

VSC2/MBN 23: Sustainable Agriculture (practicals Based on MBN214)

CO1: Students will now the various isolation techniques for Nitrogen fixation and phosphate solubilizing bacteria.

CO2: They will get to know the about siderophores in plant growth promotion and biocontrol.

CO3: students will get hands on training for production of biofertilizers and vermicomposting.

GE/OE -2/MBN 212: Food Fermentations

CO1: Understanding Fermentation Principles: Students will develop a comprehensive understanding of the science and principles of fermentation, including the role of microorganisms (bacteria, yeast, and molds) in the fermentation process and the biochemical changes that during fermentation.

CO2: Fermentation Techniques and Practices: Students will learn various fermentation techniques used for different food sources, including vegetables, grains, meat, and in

CO3: Product Development and Quality Control: They will understand how to monitor and control the quality and safety of these products throughout the fermentation process.

CO4: Cultural and Nutritional Significance: Students will gain insights into the cultural and nutritional significance of fermented foods.

B.Sc. S.Y.

IIIrd Semester

MIC/DSC/T/200: Bacterial Cytology and Basic Biochemistry

CO1: Understand procaryotic cell structure

CO2: Study procaryotic cytoplasmic inclusions

CO3: Understand cell-to-cell interaction

CO4: Difference between pro and eucaryotic cell structure

CO5: Understand the structure, properties and significance of macromolecules

MIC/DSC/P/226: Practical Based on Bacterial cytology and Basic Biochemistry

CO1: Study bacterial structures with special staining techniques

CO2: Study reserve food materials in prokaryotes

CO3: Understand cell-to-cell interaction

CO4: Study properties of macromolecules

MIC/DSC/T/201: Immunology

CO1: Define and classify immune system components antibodies, and vaccines and explain the functions of physiological barriers, normal flora, and lymphoid organs.

CO2: Differentiate cellular and humoral immunity, describe antibody structure and function, and explain various vaccine.

CO3: Analyze antigenicity factors (size, chemical nature, enzyme susceptibility, foreignness, specificity) Compare primary and secondary immune responses.

CO4: Explain antigen-antibody reaction mechanisms and the significance of immunological reactions.

CO5: Describe monoclonal antibody.

MIC/DSC/P/227: Immunology – Practical

CO1: Perform and interpret differential blood staining and normal flora isolation.

CO2: Understand and perform Precipitation and Agglutination Tests

CO3: Interpret Precipitation and Agglutination Tests.

CO4: Relate Laboratory Observations to Clinical Applications

MIC/Mn/T/200: Pharmaceutical Microbiology

CO1: Understand the basic concepts of microbiology and microbial contamination.

CO2: Explain the microbial load and its control

CO3: Interpret MLd and LD 50 in the context of pharmaceutical toxicology and microbial potency.

CO4: Apply knowledge of GMP in maintaining microbiological quality in pharmaceutical manufacturing

MIC/Mn/T/201: Microbial Diseases

CO1: Explain the fundamental concepts of probiotics, prebiotics, and their role in human health using non-technical language.

CO2: Identify various traditional Indian fermented foods that act as natural probiotics and describe their health benefits.

CO3: Apply the knowledge of probiotic foods in promoting personal and community well-being, aligned with holistic and preventive healthcare principles of NEP 2020.

MIC/GE/OE/200: Public Health

CO1: Define key public health terms and explain the role of public health in improving community well-being.

CO2: Analyze the causes, prevention, and control measures for major health issues in India.

CO3: Apply basic public health principles to real-life situations, including health education, disease prevention, and health promotion.

MIC/VSC/T/ 200: Microbial Diagnostics

CO1: Learn the basics of infection and the epidemiology of infectious diseases.

CO2: Understand the morphology, pathogenicity, and laboratory diagnosis of Gram-positive and negative organisms.

CO3: Study the morphology, pathogenicity, and laboratory diagnosis of acid-fast bacteria.

CO4: Acquire basic knowledge about the pathogenicity and laboratory diagnosis of fungal and protozoan pathogens.

MIC/DSC/T/250: Environmental Microbiology

CO1: Gain knowledge on the role and infections caused by microbes in air.

CO2: Obtain detailed information on aquatic ecosystems and Assimilate knowledge on Water-borne diseases.

CO3: Get detailed knowledge of Wastewater treatment and its different methods.

CO4: Basic understanding of different types of microbes presents in the environment and their uses.

CO5: Acquire knowledge on Biodegradation, of xenobiotic compounds and Understand Biomagnification and Bioremediation.

MIC/DSC/P/276: Practical - Environmental Microbiology Practical Based on - Environmental Microbiology

CO1: Study various types of microorganisms present in the air

CO2: Study microbial load of indoor and outdoor air

CO3: Study the potability of water

CO4: Study pollution parameters of water and wastewater.

MIC/DSC/T/251: Medical Microbiology

CO1: Apply Koch's postulates to analyze the etiology of microbial diseases.

CO2: Comprehensively describe the representative bacterial disease w.r.t. morphology, classification, pathogenesis, laboratory diagnosis, and treatment.

CO3: Analyze the virological characteristics, pathogenesis, and clinical management of viral diseases.

CO4: Explain the characteristics, pathogenesis, and diagnostic approaches for fungal, protozoal, and rickettsial diseases, focusing on representative species.

CO5: Compare and contrast the epidemiological and prophylactic strategies for the prevention and control of bacterial, viral, fungal, protozoal, and rickettsial infections.

MIC/DSC/P/277: Practical - Medical Microbiology Practical based on- Medical Microbiology

CO1: Prepare and utilize selective and differential media for the cultivation and identification of pathogenic bacteria and fungi.

CO2: Perform and interpret acid-fast staining, hemolysis, and coagulase tests to characterize bacterial pathogens.

CO3: Demonstrate and interpret immunological assays, including ELISA and rapid tests for Chikungunya, Dengue fever, and malaria, for the detection of specific pathogens.

CO4: Identify fungal (*Candida albicans*) and protozoal (*Plasmodium vivax*) pathogens through microscopic observation and rapid diagnostic methods.

CO5: Determine antibiotic resistance patterns in bacteria and understand the principles of PCR based pathogen identification through a pathological laboratory visit.

MIC/Mn/T/250: Microbiology of Indian Traditional foods

CO1: To understand the microbiological basis and health benefits of Indian traditional fermented foods.

CO2: To explore the role of microorganisms in food fermentation and preservation.

CO3: To highlight the cultural and economic importance of Indian fermented foods.

MIC/Mn/T/ 251: Microbiology of Beverages

CO1: Understand microbial roles in beverage production, spoilage, and safety.

CO2: Analyze fermentation processes for alcoholic/non-alcoholic beverages.

CO3: Apply quality control and regulatory standards in beverage microbiology.

MIC/GE/OE/T/250 -: Public Health

CO1: Define key public health terms and explain the role of public health in improving community well-being.

CO2: Analyze the causes, prevention, and control measures for major health issues in India.

CO3: Apply basic public health principles to real-life situations, including health education, disease prevention, and health promotion.

MIC/SEC/T/ 251: Microbiological Analysis of Food and Soil

CO1: To introduce students to the principles and techniques used in microbiological analysis of food and soil.

CO2: To develop skills in detecting and quantifying microbial contaminants.

CO3: To understand the role of microorganisms in soil health and food safety.

MIC/SEC/P/ 277: Practical (Based on Microbiological Analysis of Food and Soil)

CO1: Study microbial load of food and soil

CO2: Study types of pathogens found in street foods

CO3: Study modern and rapid methods of diagnosis

CO4: Study the quality of soil

B.Sc. T.Y.

Vth Semester

MIC/DSC-1/T/300 Enzymology and Microbial Metabolism

CO1: Identify the structure, classification, and catalytic mechanisms of enzymes and the types of enzyme inhibition.

CO 2: Interpret enzyme kinetics and determine enzyme activity parameters such as K_m and V_{max} using enzyme assays.

CO 3: Apply basic thermodynamic principles and concepts in understanding microbial metabolic reactions.

CO 4: Illustrate major carbohydrate metabolic pathways, including glycolysis, pentose phosphate pathway, Entner—Doudoroff pathway, and TCA cycle.

CO5: Analyse the role of the electron chain, proton motive force, and oxidative phosphorylation in microbial energy generation.

CO6: Identify microbial catabolic pathways of lipids, proteins, and nucleic acids, including β -oxidation and amino acid metabolism.

MIC/DSC/P/326 Enzymology and Microbial Metabolism (Lab Course)

CO1: Characterize Enzyme Kinetics

CO2: Evaluate Enzyme Immobilization Efficiency

CO3: Analyze Microbial Metabolic Profiles and Fermentation

CO4: Verify Electron Transport and Oxidative Metabolism

CO5: Assess the metabolic role of microorganisms in chemolithotrophy

MIC/Dsc-2/T/301: Microbial Genetics

CO1: Explain the organization of microbial genomes, DNA replication, and repair mechanisms, including IN-induced damage repair.

CO2: Describe gene regulation models such as the Lac and Trp and their role in microbial adaptation.

CO3: Analyze horizontal gene transfer methods (transformation, transduction, conjugation) and their significance in microbial evolution and antibiotic resistance.

MIC/DSC/P/327: Microbial Genetics (Lab course)

CO1: Explain the organization of microbial genomes, DNA replication, and repair mechanisms, including UV-induced damage repair.

CO2: Describe gene regulation models such as the Lac and Trp and their role in microbial adaptation.

CO3: Analyze horizontal gene transfer (transformation, transduction, conjugation) and their significance in microbial evolution and antibiotic resistance.

CO4: Apply concepts of mutations, recombination, and genetic mapping to design experiments for studying microbial traits.

MIC/DSE/T/300: Agriculture Microbial Biotechnology

CO1: Understand Agricultural Microorganisms.

CO2: Describe types of microorganisms (bacteria, fungi, algae) used in agriculture.

CO3: Explain their role in plant growth and soil health.

CO4: Explain Soil Microbiology & Nutrient Cycles.

CO5: Understand soil microflora and rhizosphere interactions.

CO6: These topics are essential because microbes improve soil fertility and crop yield.

CO7: Important for sustainable and organic farming.

CO8: Includes modern biotech approaches used in agriculture.

MIC/DSE/P/326: Agriculture Microbial Biotechnology (Lab Course)

CO1: Isolate, cultivate, enumerate, and identify agriculturally important microorganisms such as Rhizobium, Azotobacter, Azospirillum, cyanobacteria, and fungi from environmental samples.

CO2: Demonstrate and analyze the role of soil in carbon, nitrogen, phosphorus, and Sulphur cycling processes.

CO3: Perform laboratory techniques for the assessment of rhizosphere microflora, biological nitrogen fixation, and phosphate solubilization.

CO4: Prepare, formulate, and evaluate biofertilizers and understand their application methods in agriculture.

CO5: Study and assess the efficacy of microbial biopesticides and antagonistic microorganisms for crop protection.

CO6: Screen and evaluate agriculturally microorganisms for enzyme production and plant growth- promoting activities.

CO7: Apply microbial biotechnology techniques for composting, vermicomposting, biodegradation, waste management, and bioremediation of contaminated soils.

CO8: Interpret experimental data, maintain laboratory records, and communicate scientific findings effectively.

CO9: Understand the importance of microbial resources in sustainable agriculture and environmental conservation.

CO10: Demonstrate professional laboratory practices, biosafety procedures, and ethical considerations in agricultural microbiology.

MIC/Minor/T/300 Vaccination and its importance

CO1: Explain the basic concepts of vaccination, immunization, and herd immunity.

CO2: Describe different types of vaccines and their mechanisms of action.

CO3: Illustrate the immunological basis of vaccine-induced protection.

CO4: Evaluate the role of national and global immunization programs, including initiatives by the World Health Organization, in disease prevention and public health improvement.

MIC/Min/T/301: Water Microbiology

CO1: Identify key waterborne pathogens and indicators of contamination.

CO2: Perform standard tests like MPN and coliform detection for assessment.

CO3: Understand sustainable water management practices and apply them in real-world contexts.

MIC/VSC-1/T/300 Good Manufacturing Practices- Microbial Aspects

CO1: Explain the principles and importance of Manufacturing Practices (GMP) in pharmaceutical and biotechnology industries.

CO2: Describe sources of microbial contamination and strategies for contamination control in manufacturing environments.

CO3: Discuss cleanroom classification, facility design and environmental control Systems used in GMP- regulated facilities.

CO4: Interpret microbiological quality assurance practices and documentation requirements involved in pharmaceutical production.

MIC/VSC-I/P/ 326 Manufacturing Practices- Microbial Aspects (Lab Course)

CO1: Identify contamination sources and follow good laboratory practices for contamination control.

CO2: Perform basic environmental monitoring methods such as air and surface monitoring.

CO3: Carry Out microbial limit testing and determine microbial load in test.

CO4: Prepare a basic for microbiological following GMP documentation principles.

MIC/RP/P/326: Research Project

CO1: Design and execute a mini research project independently or in a group.

CO2: Analyze experimental/simulation data using scientific tools and methods.

CO3: Demonstrate understanding of advanced concepts beyond the prescribed syllabus.

CO4: Prepare a project report following the scientific format.

CO5: Present and defend the work effectively through a seminar/viva voce.

VIth Semester

MIC/DSC/T/350 Industrial Microbial Technology (Theory)

CO4: Explain principles of fermentation and industrial processes.

CO2: Identify and select industrially important microorganisms.

CO3: Describe types of fermentations and bioreactors used in industries

CO4: Understand industrial production processes of antibiotics, enzymes, Organic acids, etc.

CO5: Apply knowledge of strain improvement and recombinant DNA technology in industries.

CO6: Demonstrate understanding of quality control, GMP, and regulatory standards.

MIC/DSC/P/376 Industrial Microbial Technology (Lab Course)

CO1: Students can isolate and identify industrially important microbes and develop skills in microbial purification and maintenance.

CO2: Identify microorganisms producing industrial enzymes

CO3: Analyze fermentation efficiency

CO4: Perform Kirby-Bauer method effectively.

CO5: Understand importance of product purification.

CO6: Prepare basic documentation records.

MIC/DSC-4/T/351: Molecular Microbiology & Recombinant DNA Technology (Theory)

CO1: Evaluate Microbial Genetic Mechanisms.

CO2: Design and Execute Molecular protocols.

CO3: Appraise Biotechnological & Ethical Frameworks.

MIC/DSC-3/P/377: Molecular Microbiology & Recombinant DNA Technology (Lab Course)

CO1: Evaluate Microbial Genetic Mechanisms.

CO1: Design and Execute Molecular Protocols.

CO3: Appraise Biotechnological & Ethical Frameworks.

MIC/SIKS/T/350 Indian Farming and Role of Microorganisms

CO1: Analyze industrial farming.

CO2: Understand traditional farming.

CO3: Explain role of microorganisms

CO4: Apply biofertilizers and biopesticides

CO5: Promote sustainable agriculture Environmental awareness.

MIC/DSE-3/T/351 Food and Dairy Microbiology (Theory)

CO1: Analyze the role of food and milk as microbial substrates to identify primary sources of contamination and the mechanisms of spoilage.

CO2: Distinguish between infections and intoxications While evaluating the principles and used in food preservation.

CO3: Assess the microbial Composition and industrial significance of fermented foods and probiotic dairy products.

CO4: Execute standard microbiological examinations of milk, including phosphatase and reductase tests, to determine quality and safety.

CO5: Acquire information about national and international regulatory standards, such as FSSAI and CODEX, to ensure quality assurance in the food and dairy industries.

MIC/DSE-3/T/377 Food and Dairy (Lab course)

CO1: Classify foods based on susceptibility to microbial spoilage and explain the chemical and microbiological changes associated with deterioration.

CO2: Differentiate various infections and intoxications, their causative agents, transmission routes, and public health significance.

CO3: Explain the microbiology of milk, sources of microbial contamination, spoilage mechanisms, and preservation techniques used in the dairy industry.

CO4: Analyze the role of in the production of dairy and probiotic and evaluate their industrial significance.

CO5: perform microbiological quality assessment of milk and dairy products using standard laboratory methods.

CO6: Interpret national and international food safety standards and apply quality assurance principles in food and dairy industries.

MIC/Mn/T/350 Biotechnology and Its importance In Life

CO1: Explain the basic concepts and scope of microbial biotechnology.

CO2: Describe microbial biotransformation reactions and the factors influencing these processes.

CO3: Illustrate industrial applications of microorganisms in the production of biotechnological products.

CO4: Discuss environmental applications of microbes in bioremediation and sustainable processes.

MIC/Mn/T/351 Microbial; Diseases and its Control

CO1: Explain the fundamental concepts of microbial diseases, including infection, pathogenicity, and host— pathogen interactions.

CO2: Classify and describe major bacterial, viral, fungal, and protozoal diseases with reference to their causative agents and transmission.

CO3: Illustrate the pathogenesis, clinical manifestations, and diagnosis of important infectious diseases.

CO4: Apply principles of epidemiology to understand the spread and control of infectious diseases.

CO5: Evaluate different preventive and control measures such as sterilization, disinfection, antimicrobial therapy, vaccination, and public health strategies. Analyze the role of national and international health agencies, including the World Health Organization, in disease surveillance and control programs.

MIC/OJT/P/376 OJT: on Job Training

CO1: Demonstrate practical understanding of industrial/research related to Microbiology.

CO2: Apply experimental and analytical skills in real-world applications.

CO3: Prepare a training report documenting observations, work carried out, and learning outcomes.

CO4: Exhibit professional skills, including teamwork, time management, and workplace ethics.