

## COURSE OUTCOMES OF M.SC. (MICROBIOLOGY)

Students will be able to understand the following:

### Course Outcomes:

#### Course: SLS/MIC/C001: General Microbiology

CO1	Understanding the important milestones in development of microbiology discipline and classification of micro-organisms.
CO2	To understand different types of nutrition in microbes and microbial cultivation techniques.
CO3	Knowledge about classification and ultrastructure of bacteria.
CO4	Knowledge about classification, structure and diagnosis of viruses.
CO5	To know the structural, physiological features and classification of fungi, algae, and protozoa

#### Course: SLS/MIC/C002: Fundamentals of Biochemistry

CO1	Knowledge about Acid- base chemistry and concepts of bioenergetics.
CO2	To understand the structure, and function of Carbohydrates
CO3	Knowledge about structure, function and classification of lipids
CO4	To understand the structure and function of proteins and nucleotides, as well regulation of nucleotide biosynthesis
CO5	Knowledge about general characters, inhibitors and kinetics of enzymes

#### Course: SLS/MIC/C003: Cell biology

CO1	Knowledge about structure and function of cell organelles, cytoskeleton and cell integration
CO2	Understanding various components of cell membrane and transport of metabolites across the membrane
CO3	Knowledge of different cell- cell communication mechanism
CO4	To understand the molecular mechanism of cell cycle control and cell division
CO5	Knowledge about different pathways of cell death

#### Course: SLS/MIC/C004: Molecular biology and Microbial genetics

CO1	Understanding the structure and function of chromosome
CO2	Knowledge about mechanism of replication and transcription of DNA.
CO3	Understanding the translation of genes and regulation of gene expression.
CO4	Knowledge about different mechanism of changes in nucleotide sequences in DNA and its repair
CO5	Understanding the different mechanisms of sexual reproduction in bacterial like Conjugation, Transformation and Transduction

#### Course: SLS/MIC/C005: Lab Course 1

CO1	Hands on training of fundamental microbiological techniques like media preparation, sterilization, cultivation, preservation etc.
CO2	Hands on training for qualitative and quantitative estimation of biomolecules

**Course: SLS/MIC/C006: Lab Course 2**

CO1	Demonstration of various stages of cell division and effect of stress on cells
CO2	Hands on training for isolation of genomic DNA

**Course: SLS/MIC/C007: Microbial Physiology and Metabolism**

CO1	Understanding the phototrophic and chemotrophic nutrition in microorganisms
CO2	Knowledge about nitrogen and sulphur metabolism in microbes
CO3	Understanding the mechanism of respiration and fermentations in bacteria
CO4	Knowledge about metabolite transport across the membrane and communication mechanism in bacteria
CO5	Understanding the microbial responses in different stress conditions.

**Course: SLS/MIC/C008: Immunology**

CO1	Understanding the overview of Immune system and immunity
CO2	Knowledge about antigens, antibodies and the different type of interactions between them
CO3	Knowledge about complement system, cytokines and MHC
CO4	Understanding the mechanism of humoral and cell- mediated immune response
CO5	Knowledge about basics of Immunopathology and Transplantations

**Course: SLS/MIC/C009: Biological Techniques**

CO1	Understanding the principle and applications of Microscopy and Biosensors
CO2	Knowledge about principal and application of different types of Centrifugation
CO3	Understanding the principal and application of different types of Chromatography
CO4	Knowledge about principle and application of various Electrophoretic techniques
CO5	Knowledge about principle of spectroscopic and radiotracer techniques

**Course: SLS/MIC/C010: Recombinant DNA Technology**

CO1	Understanding the basic principles and tools of Gene cloning
CO2	Understanding different Strategies of gene cloning
CO3	Knowledge about basics of cloned gene expression in heterologus system
CO4	Understanding the techniques used for nucleic acid sequence detection, amplification and modification
CO5	Knowledge about the techniques of genome analysis and applications of Gene cloning

**Course: SLS/MIC/C011: Lab Course 1**

CO1	Hands on training for study of various physico-chemicals factors on growth of bacteria
CO2	Hands on training for identification of bacteria on biochemical basis
CO3	Hands on training for determination of blood group
CO4	Demonstration of various antigen-antibody interactions

**Course: SLS/MIC/C012: Lab Course 2**

CO1	Hands on training for various chromatographic and electrophoretic techniques
CO2	Hands on training for various molecular biology techniques

**Course: SLS/MIC/C013: Medical Microbiology**

CO1	Understanding the basics of Medical Microbiology
CO2	Knowledge about basics of microbial pathogenesis and antimicrobial chemotherapy
CO3	Knowledge about clinical features, transmission, causal organism, diagnostics, prevention and control of bacterial diseases
CO4	Knowledge about clinical features, transmission, causal organism, diagnostics, prevention and control of viral diseases
CO5	Knowledge about clinical features, transmission, causal organism, diagnostics, prevention and control of protozoal and fungal diseases

**Course: SLS/MIC/C014: Industrial Microbiology**

CO1	Understanding the basics of Industrial Microbiology
CO2	Knowledge about basic aspects of Fermentation
CO3	Knowledge about the various strategies used for microbial strain development
CO4	Understanding the production aspects of antibiotics, amino acids and biopolymers
CO5	Understanding the production aspects of enzymes, vitamins and beverages

**Course: SLS/MIC/C015: Lab Course 1**

CO1	Hands on training for determination of antimicrobial susceptibility of pathogens using various methods
CO2	Hands on training for microbial production of various materials
CO3	Hands on training for microbial strain development for enhanced enzyme production

**Course: SLS/MIC/E01A: Food and Dairy Microbiology**

CO1	Understanding the principles of Food Preservation
CO2	Knowledge about various types of contamination and microbial spoilage of food
CO3	Knowledge about various foodborne infections and intoxications.
CO4	Knowledge about various food safety measures and Quality Assurance of food stuffs
CO5	Understanding the production process of fermented foods

**Course: SLS/MIC/E01B: Drug Design and Nanobiotechnology**

CO1	Understanding the basics of interaction between drug and cell surface receptor
CO2	Knowledge about strategies for Drug Targeting and Drug Delivery
CO3	Understanding the relationship between structure and activity of chemicals
CO4	Knowledge about molecular modeling technique
CO5	Understanding the basics of Nanobiotechnology

**Course: SLS/MIC/E01C: Genomics and Proteomics**

CO1	Understanding the genome anatomy
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CO2	Knowledge about strategies used for genome mapping
CO3	Understanding the techniques of genome sequence analysis.
CO4	Understanding the basics of proteomics and transcriptomics

**Course: SLS/MIC/E01D: Epidemiology**

CO1	Understanding the basics of Epidemiology
CO2	Knowledge about the various modes of diseases transmission
CO3	Understanding the basics of mathematical modeling of epidemiological studies
CO4	Understanding the various strategies for control of epidemics

**Course: SLS/MIC/E01E: Bioprocess Technology**

CO1	Understanding the various designs of bioreactor
CO2	Understanding of various types of Fermentation process and its kinetics
CO3	Knowledge about transfer and balance of Mass and Energy
CO4	Knowledge about different steps of downstream processing
CO5	Understanding the instrumentation and control mechanism of Fermentation process

**Course: SLS/MIC/E01F: Environmental Microbiology**

CO1	Understanding the fundamentals of Microbial ecology
CO2	Understanding the basics of Air and Aquatic Microbiology
CO3	Knowledge about different microbial interactions
CO4	Knowledge about different types of pollution and its control strategies
CO5	Understanding the impact of various microbes on Environment

**Course: SLS/MIC/E01G: UGC MOOC 01 (Academic Writing)**

CO1	Understanding the need and principles of Academic writing
CO2	Knowledge about different types of Academic writing
CO3	Understanding the writing style of research paper, review, report, research proposal etc.

**Course: SLS/MIC/E02A: Agricultural Microbiology**

CO1	Knowledge about the abiotic and biotic components of Soil
CO2	Knowledge about the rhizospheric and rhizoplane Microorganisms.
CO3	Knowledge about the symptoms, causative organisms, disease cycle and control measures of plant diseases.
CO4	Knowledge about the isolation, purification, mass multiplication and applications of biofertilizers

**Course: SLS/MIC/E02B: Microbial Diversity**

CO1	Understanding the basics of microbial evolution and diversity
CO2	Knowledge about the classification of microbes
CO3	Knowledge about the general features, ecology and physiology of various bacterial and archeal phyla
CO4	Understanding the physiology and molecular adaptations in extremophiles

**Course: SLS/MIC/E02C: Pharmaceutical Microbiology**

CO1	Understanding the basics of drug discovery process
CO2	Understanding the various strategies for development of antimicrobial agents
CO3	Knowledge about microbial production and spoilage of pharmaceutical agents
CO4	Understanding the strategies for quality assurance of pharmaceutical products
CO5	Knowledge about the regulatory practices in pharma industries

**Course: SLS/MIC/E02D: Infection and Immunity**

CO1	Knowledge about various types of Infectious agents
CO2	Understanding the mechanism of Immune regulation of infections
CO3	Understanding the various immune responses to infections
CO4	Understanding the specific immune responses against bacterial, fungal viral and protozoal infections

**Course: SLS/MIC/E02E: Intellectual Property Rights**

CO1	Understanding the basic aspects of Intellectual property rights (IPR)
CO2	Knowledge about the International Treaties for protection of IPR
CO3	Understanding the process of patent filing granting and its significance.
CO4	Knowledge about Patent Acts, and cases of Patent Infringement
CO5	Understanding the strategies for protection of plant varieties and traditional Knowledge

**Course: SLS/MIC/E02F: Research Methodology**

CO1	Understanding the formulation of research problem and experimental planning
CO2	Knowledge about techniques of data collection and analysis
CO3	Understanding the statistical basis of biological assays
CO4	Knowledge about operation and significance of ANOVA
CO5	Understanding basics of Bioinformatics and Technical writing

**Course: SLS/MIC/E02G: UGC MOOC 02 (Biostatistics and Mathematical Biology)**

CO1	Understanding the basics of Biostatistics and data
CO2	Knowledge about various techniques of data presentation and its significance
CO3	Understanding the applications of various statistical tools

**Course: SLS/MIC/E003: Lab Course 2**

CO1	Hands on Training of various experiments related to any two elective papers
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**Course: SLS/MIC/E004: DISSERTATION**

CO1	Awareness and interest towards research
CO2	Develop scientific temperament
CO3	Understanding the practical aspects of research methodology
CO4	Develop writing skills