



**Government Science College, Gandhinagar**  
**FYBSc (CBCS) Microbiology Course Outcomes**  
**(Effective from June 2017)**



<b>Semester-I</b>			
<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Outcomes</b>
1	MI 101	Introduction to Microbial World	<ul style="list-style-type: none"> <li>• Student will learn about development of Microbiology as a new discipline of Biological Science.</li> <li>• Understand different types of microorganism of the Microbiological world.</li> <li>• Gets idea about different branches of microbiology (Applied areas), including genetic engineering and biotechnology.</li> <li>• Able to develop an understanding of various pure culture techniques, staining techniques and microscopic methods to study bacteria.</li> </ul>
2	MI 102	Microbiology Practicals	<ul style="list-style-type: none"> <li>• Students will learn about basic principles and working of various instruments of microbiology laboratory.</li> <li>• Learn techniques for cleaning, preparation and sterilization of laboratory glassware, and gain knowledge of proper methods for disposal of laboratory waste and cultures.</li> <li>• Understand how to observe microbial motility using hay infusion and light microscope.</li> <li>• Through simple staining techniques they will develop a skill to stain and observe bacteria through microscope.</li> <li>• Develop ability to differentiate between Gram-positive and Gram-negative bacteria based on Gram Stain reaction.</li> <li>• Observe different shapes of bacterial cells and cellular morphology of fungi, algae and protozoa.</li> <li>• Students will learn how to prepare nutrient agar and nutrient broth, adjust pH of culture media using pH strips or a pH meter.</li> <li>• Students will able to isolate bacteria from soil, curd and surface of table, by streak plate method.</li> </ul>
<b>Semester-II</b>			
3	MI 103	Basic Bacteriology	<ul style="list-style-type: none"> <li>• Students will learn principles of binomial nomenclature and different systems for classification of microorganisms.</li> <li>• Students will get knowledge of size, shape and arrangements of bacteria and bacterial cell structures.</li> <li>• Understand the nutritional requirements and nutritional diversities of bacteria, principles of media formulation, media ingredients, cultivation methods and growth characteristics of bacteria.</li> <li>• Understanding microbial control by physical and chemical methods.</li> </ul>

4	MI 104	Microbiology Practicals	<ul style="list-style-type: none"> <li>• Students shall learn the cultivation of bacteria in broth and on solidified media.</li> <li>• Cultivation of anaerobic bacteria by using specific media and anaerobic jar.</li> <li>• Understands the concept of preservation of microbial cultures by various methods.</li> <li>• Learns to examine the pigmentation of bacteria and the role of pigments in metabolism, environmental adaptations.</li> <li>• Structural and special staining methods will improve students' knowledge about internal and external structures of bacteria.</li> <li>• Understanding the influence of various physical factors on bacterial growth.</li> </ul>
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**SYBSc (CBCS) Microbiology Course Outcomes**  
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<b>Semester-III</b>			
<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Outcomes</b>
5	MI 201	Microbial Physiology	<ul style="list-style-type: none"> <li>• Students will understand chemical structure, properties, classification and biological significance of different biomolecule.</li> <li>• They will understand the structure, properties, localization, nomenclature, classification, working and inhibition of enzymes.</li> <li>• Students get idea about, how microbes take up nutrients and how bacteria are classified based on their physiology. Additionally they will be introduced to microbial metabolism.</li> <li>• They will come to know about the methods of reproduction, growth rate, generation time, methods of growth measurements and types of growth pattern of microbes.</li> <li>• Students will understand how different chemotherapeutic agents inhibit microbial growth.</li> </ul>
6	MI 202	Soil and Water Microbiology	<ul style="list-style-type: none"> <li>• Students will about soil structure, its composition and various methods to study soil microflora.</li> <li>• They will get idea about microbial interactions in soil.</li> <li>• They will understand about important roles microbe play in various biogeochemical cycles and in soil fertility,</li> <li>• Learn microbiological techniques for water quality assessment and pathogen detection.</li> <li>• Understand waterborne diseases and purification of drinking water, types of waste water and pollution problems.</li> <li>• They will learn about various aerobic and anaerobic microbial processes which are involved in waste water treatment.</li> </ul>
7	MI 203	Microbiology Practicals	<ul style="list-style-type: none"> <li>• Students will learn about composition and preparation of different types of microbiological media and qualitative analysis of carbohydrates and proteins</li> <li>• They will study about effect of antimicrobial compounds on growth of bacteria.</li> <li>• Study biochemical reaction of bacteria based on their source of carbon and nitrogen</li> <li>• Students will learn the isolation of soil microbes including fungi, actinomycetes and nitrogen fixers, and study their characteristics.</li> <li>• They will be introduced to various methods of microbiological analysis of soil and water.</li> <li>• They will learn how to study human skin flora and air flora.</li> </ul>

Semester-IV			
8	MI 204	Diversity of Bacteria	<ul style="list-style-type: none"> <li>• Students will study types of bacteria with respect to their phylogenetic classification,</li> <li>• Learn about general properties and salient features of Archaeobacteria.</li> <li>• Diversity of Eubacteria with respect to their metabolic and morphological characteristics.</li> <li>• Learn about bacteria with complex and unusual morphology.</li> </ul>
9	MI 205	Food and Dairy Microbiology	<ul style="list-style-type: none"> <li>• Students will know how and which microorganisms are associated with different food and cause infections/ diseases.</li> <li>• They will learn about spoilage and preservation of food.</li> <li>• Get knowledge about the use and role of microorganisms in food.</li> <li>• They will get idea about how to examine the quality of food using various techniques</li> <li>• Information on various criteria about the food safety and basic knowledge of agencies will be helpful to them.</li> </ul>
10	MI 206	Microbiology Practicals	<ul style="list-style-type: none"> <li>• Students will learn how to observe bacterial motility and how to measure the size of microbial cell using micrometry.</li> <li>• Understand morphological, cultural and biochemical characters of pure culture of various gram negative and gram positive bacteria.</li> <li>• Understand how to isolate and characterize yeast.</li> <li>• Learn different methods for microbiological analysis of food and milk</li> </ul>



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Semester-V			
Sr. No.	Course Code	Course Title	Course Outcomes
11	MI 301	Molecular Biology and Genetics of Prokaryotes	<ul style="list-style-type: none"><li>• Student will understand the nature of genetic material (DNA), its structure and replication.</li><li>• Students will know the molecular mechanisms of gene expression and its regulation</li><li>• They will get idea about different types of mutation and DNA repair mechanisms.</li><li>• They will understand different modes of gene transfer among bacteria.</li></ul>
12	MI 302	Bacterial Metabolism	<ul style="list-style-type: none"><li>• Students will understand the terms related to chemistry, mathematical modeling for enzymes' reaction rate, principles of biosynthesis and methods to study the biosynthesis.</li><li>• Learn various energy generating metabolic pathways in bacteria through different mechanisms.</li><li>• Learn biosynthetic pathways of important bio-molecules or cellular structures.</li></ul>
13	MI 303	Principles of Immunology	<ul style="list-style-type: none"><li>• Students get the basic knowledge about immune cells, immune organs and their role in immune response.</li><li>• Antigen and antibody structure and its related concepts.</li><li>• Understanding types of antigen-antibody reactions and their applications in diagnosis.</li><li>• Dysfunctional immunities, hematology and blood banking.</li></ul>
14	MI 304	Fermentation Technology	<ul style="list-style-type: none"><li>• Students will get the idea about the scope of microbial products at industrial level and also learn to set profit based processes.</li><li>• Learn to screen microbes with varied production capacities from nature.</li><li>• Formulate an efficient fermentation medium for cheaper production.</li><li>• Understand the concept of sterilization for large scale processes.</li><li>• Design of industrial scale fermenter with specific emphasis on aeration and agitation devices.</li><li>• Learn the concept of special purpose bioreactors and their functioning.</li></ul>
15	MI 305.1	Environmental Microbiology (Elective Course)	<ul style="list-style-type: none"><li>• Student will understand the basics of environmental microbiology.</li><li>• Microbial habitat and role of microorganisms in environmental processes.</li></ul>

			<ul style="list-style-type: none"> <li>• Be able to apply knowledge of environmental microbiology to address global problems such as pollution and waste management.</li> <li>• Understand the principles and application of environmental biotechnology, focusing on microbially enhanced oil recovery, bioremediation and bioleaching.</li> <li>• Learn the potential of microbial processes in producing biofuels, biodegradable plastics and microbial pesticides for sustainable environmental solutions.</li> </ul>
16	MI 306	Microbiology Practicals	<ul style="list-style-type: none"> <li>• Student should able to...</li> <li>• Isolate various types of bacterial mutants.</li> <li>• Estimate glucose, protein and streptomycin by colorimetric methods.</li> <li>• Perform various hematological and serological reactions.</li> <li>• Screening of industrially important microorganisms from soil.</li> <li>• Determine oxygen transfer rate by titrimetric method.</li> <li>• Isolate and identify economically important fungi from soil samples.</li> </ul>



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Semester-VI			
Sr. No.	Course Code	Course Title	Course Outcomes
17	MI 307	Genetic Engineering	<p>Student will be introduced to...</p> <ul style="list-style-type: none"> <li>• Varieties of tools of rDNA technology.</li> <li>• Different molecular techniques of genetic engineering.</li> <li>• Total protocol of rDNA technology.</li> <li>• Applications of rDNA technology in Medical, Agriculture and Environmental science and social impact of rDNA technology.</li> </ul>
18	MI 308	Virology and Mycology	<ul style="list-style-type: none"> <li>• Student will know characteristics of different viruses and fungi</li> <li>• Learn basics of cultivation methods of viruses and fungi.</li> <li>• Types of viral infections and life cycle of different viruses.</li> <li>• Classification schemes of viruses and fungi.</li> <li>• Economic importance of fungi.</li> </ul>
19	MI 309	Medical Microbiology	<ul style="list-style-type: none"> <li>• Students can understand the importance of normal flora and the relationship between host and parasite.</li> <li>• Concepts of epidemiology and vaccines.</li> <li>• Clinical specimen collection and methods useful in diagnosis of pathogens.</li> <li>• Gets an overview of infectious diseases of human being.</li> </ul>
20	MI 310	Bioprocess Technology	<ul style="list-style-type: none"> <li>• Students develop the ability to differentiate varied types of fermentation processes.</li> <li>• Understands the importance of containment.</li> <li>• Masters the steps of product purification and processing.</li> <li>• Physico-chemical and bioassays.</li> <li>• Sterility testing of pharmaceutical products.</li> <li>• Learn the typical fermentation processes of industrially valuable products.</li> </ul>
21	MI 311.1	Biotechnology (Elective Course)	<ul style="list-style-type: none"> <li>• Students will know the status and importance of biotechnology over the years.</li> <li>• They understand the mechanisms and importance of various techniques to estimate, separate and study the bio-molecules</li> <li>• They gain overview of plant and animal tissue culture, RNA separation technique and gene editing techniques.</li> <li>• They will understand the potential of biotechnology by studying various biotechnological applications.</li> </ul>
22	MI 312	Microbiology Practicals	<p>Student should able to perform...</p>

			<ul style="list-style-type: none"> <li>• Chromatographic separation of amino acids.</li> <li>• Estimate blood glucose and blood urea by colorimetric methods.</li> <li>• Isolate bacteriophage from sewage and yeast from grapes/curd.</li> <li>• Isolate, cultivate and identify various gram negative bacteria on the basis of their cultural and biochemical characteristics.</li> <li>• Study of antibiogram and physical &amp; chemical analysis of urine sample.</li> <li>• Fermentative production of amylase and its activity check</li> <li>• Bioassay of penicillin and sterility testing of pharmaceutical products</li> <li>• They will get information about various plant diseases caused by virus and fungi</li> <li>• They will get information about insect vectors and pathogenic microorganisms that transmit or cause infectious diseases to humans.</li> </ul>
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**FYBSc (NEP-2020) Microbiology Course Outcomes**  
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Semester-I			
Sr. No.	Course Code	Course Title	Course Outcomes
1	DSC-C-MIC-111T (Core Theory)	Introduction to Microbiology	<ul style="list-style-type: none"> <li>• It helps students in understanding the significance and classification of microbes, different types of microorganisms and their distribution in various natural environments.</li> <li>• Students can learn the historical context and key figures involved in the discovery of microorganisms and development of microbiology.</li> <li>• Understanding the key discoveries in medical microbiology, agricultural microbiology, microbial genetics and molecular biology.</li> <li>• Students will be able to learn the principles and applications of light microscopy and electron microscopy.</li> <li>• Preparation of smear and staining methods.</li> </ul>
2	DSC-C-MIC-112P (Core Practical)	Microbiology Practicals	<ul style="list-style-type: none"> <li>• Students get aware of the safety protocols and guidelines in the microbiology laboratory, learn good laboratory practices.</li> <li>• Students get to learn the basic principles of laboratory instruments and their working.</li> <li>• Understand the appropriate uses of each type of glassware/plastic ware and their appropriate labeling.</li> <li>• Understand the importance of cleaning and sterilization to prevent contamination in microbiological experiments.</li> <li>• Learn how to adjust pH of media.</li> <li>• Understand proper procedures of disposal of laboratory wastes and cultures.</li> <li>• Students learn how to observe microbial motility by wet mount and hanging drop preparations.</li> <li>• Ability to perform positive and negative staining to understand bacterial cell morphology.</li> <li>• Observe and analyze permanent slides and photomicrographs of various microorganisms.</li> </ul>
3	DSC-M-MIC-113T (Minor Theory)	History and Development of Microbiology	<ul style="list-style-type: none"> <li>• Students can learn the historical context and key figures involved in the discovery of microorganisms and development of microbiology.</li> <li>• Understanding the key discoveries in medical microbiology, agricultural microbiology, microbial genetics and molecular biology</li> </ul>
4	DSC-M-	Microbiology	<ul style="list-style-type: none"> <li>• Students get aware of the safety protocols and guidelines in</li> </ul>

	MIC-113P (Minor Practical)	Practicals	<p>the microbiology laboratory, learn good laboratory practices.</p> <ul style="list-style-type: none"> <li>• Students get to learn the basic principles of laboratory instruments and their working.</li> <li>• Understand the appropriate uses of different types of glassware/plastic ware and their appropriate labeling.</li> <li>• Understand the importance of cleaning and sterilization to prevent contamination in microbiological experiments.</li> <li>• Learn how to adjust pH of media.</li> <li>• Understand proper procedures of disposal of laboratory wastes and cultures.</li> <li>• Students shall learn to prepare nutrient agar and nutrient broth.</li> </ul>
5	MDC- MIC-114T (Multi Disciplinary Theory)	Introduction to Microbial World	<ul style="list-style-type: none"> <li>• It helps students in understanding the significance and classification of microbes, different types of microorganisms and their distribution in various natural environments.</li> <li>• Students will be able to learn the principles and applications of light microscopy and electron microscopy.</li> <li>• Preparation of bacterial smear and methods to stain it.</li> </ul>
6	MDC- MIC-114P (Multi Disciplinary Practical)	Microbiology Practicals	<ul style="list-style-type: none"> <li>• Students learn how to observe microbial motility by wet mount and hanging drop preparations.</li> <li>• Ability to perform positive and negative staining to understand bacterial cell morphology.</li> <li>• Observe and analyze permanent slides and photomicrographs of various microorganisms.</li> </ul>
7	SEC-ICM-116 (Skill Enhancement Course)	Introduction to Compound Microscopy	<ul style="list-style-type: none"> <li>• Students get to understand the basic knowledge of operation and handling of compound microscope.</li> <li>• Helps to learn the structure and morphology of bacteria, fungi, algae and protozoa.</li> </ul>



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Semester-II			
Sr. No.	Course Code	Course Title	Course Outcomes
8	DSC-C-MIC-121T (Core Theory)	Vedic Microbiology and Basic Bacteriology	<ul style="list-style-type: none"> <li>• Students will get the idea about the contributions of ancient Indian scholars, in the field of microbiology.</li> <li>• Explore the prevalence of krimis (microorganisms) in different environments and learn about their morphological characteristics as described in ancient literature.</li> <li>• Understand the structure and function of bacterial cell wall as well as the structures internal and external to the cell wall.</li> <li>• Understanding of the nutritional requirements and nutritional diversities of bacteria.</li> <li>• Ability to understand principles of media formulation, media ingredients, cultivation methods and growth characteristics of bacteria.</li> <li>• Understand the concept of pure culture, mixed culture and selective methods used to obtain pure cultures.</li> <li>• Learn the isolation techniques.</li> <li>• Learn to observe colony characteristics.</li> <li>• Gains knowledge about culture preservation methods and culture collection centers.</li> </ul>
9	DSC-C-MIC-122P (Core Practical)	Microbiology Practicals	<ul style="list-style-type: none"> <li>• Students shall perform Gram staining and learn to differentiate between Gram-positive and Gram-negative bacteria.</li> <li>• Students get trained in preparing slides of various structural components of bacteria, visualizing them by light microscopy.</li> <li>• Students shall learn the preparation of nutrient agar and nutrient broth.</li> <li>• Cultivation of bacteria in broth, agar slant and plating methods.</li> <li>• Understands the concept of preservation of microbial cultures by various methods.</li> <li>• Learns to examine the pigmented bacteria and the role of pigments in metabolism, environmental adaptations.</li> <li>• Cultivation of anaerobic bacteria by using specific media and anaerobic jar.</li> </ul>

10	DSC-M- MIC-123T (Minor Theory)	Cultivation and Isolation of Bacteria	<ul style="list-style-type: none"> <li>• Understanding of the nutritional requirements and nutritional diversities of bacteria.</li> <li>• Ability to understand principles of media formulation, media ingredients, cultivation methods and growth characteristics of bacteria.</li> <li>• Understand the concept of pure culture, mixed culture and selective methods used to obtain pure cultures.</li> <li>• Learn the isolation techniques.</li> <li>• Learn to observe colony characteristics.</li> <li>• Gains knowledge about culture preservation methods and culture collection centers.</li> </ul>
11	DSC-M- MIC-123P (Minor Practical)	Microbiology Practicals	<ul style="list-style-type: none"> <li>• Students shall learn the preparation of nutrient agar and nutrient broth.</li> <li>• Cultivation of bacteria in broth, on solidified media.</li> <li>• Understands the concept of preservation of microbial cultures by various methods.</li> <li>• Learns to examine the pigmented bacteria and the role of pigments in metabolism, environmental adaptations.</li> <li>• Cultivation of anaerobic bacteria by using specific media and anaerobic jar.</li> </ul>
12	MDC- MIC- 124T (Multi Disciplinary Theory)	Vedic Microbiology & Bacterial Cell Structure	<ul style="list-style-type: none"> <li>• Students will get the idea about the contributions of ancient Indian scholars, in the field of microbiology.</li> <li>• Explore the prevalence of krimis (microorganisms) in different environments and learn about their morphological characteristics as described in ancient literature.</li> <li>• Understand the structure and function of bacterial cell wall as well as the structures internal and external to the cell wall.</li> </ul>
13	MDC- MIC- 124P (Multi Disciplinary Practical)	Microbiology Practicals	<ul style="list-style-type: none"> <li>• Students shall perform Gram staining and learn to differentiate between Gram-positive and Gram-negative bacteria.</li> <li>• Students get trained in preparing slides of various structural components of bacteria, visualizing them by light microscopy.</li> </ul>
14	SEC-DAS- 126 (Skill Enhancement Course)	Disinfection and Sterilization	<ul style="list-style-type: none"> <li>• Students shall get the basic understanding of control of microorganisms.</li> <li>• They get to learn the basic skills of disinfection and sterilization.</li> </ul>