

**Dr. V. S. KRISHNA GOVT. DEGREE COLLEGE (AUTONOMOUS)
MADDILAPALEM, VISAKHAPATNAM**

B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F. 2018–19)

FIRST YEAR – SEMESTER- I

PAPER – 1: INTRODUCTORY MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 60

CREDITS: 3

Course outcomes: Upon completion of the course, the student will be able to achieve the following outcomes.

CO1: Gain knowledge about the origins of microbiology discipline, relationship between microorganisms and disease, major contributions of important microbiologists to the field of microbiology and different classification system of bacteria.

CO2: Understand the morphological, physiological and biochemical properties of different groups of microorganisms like bacteria, archaea, cyanobacteria and viruses.

CO3: Able to identify a microorganism as bacteria, fungi, algae and protozoa and operate the microscope independently.

CO4: Apply the principles of staining techniques to distinguish different groups of microorganisms and plan a suitable physical and chemical methods of sterilization in creating the aseptic environment.

CO5: Design suitable methods for isolation of microbes from different environments by applying the principles of pure culture and enrichment methods.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F. 2018–19)

FIRST YEAR – SEMESTER-I

PRACTICAL - 1: INTRODUCTORY MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 45

CREDITS: 2

COURSE OUTCOMES: Upon completion of the practical course, the student will be able to achieve the following outcomes.

CO1: Explain good laboratory practices in microbiology and classify different biosafety levels.

CO2: Learn the principles and procedures of media preparation for cultivation of bacteria and fungi.

CO3: Select suitable method for achieving sterilization of culture media, glassware, antibiotics etc.

CO4: Apply the staining principles for visualizing the gram-positive, gram-negative bacteria, fungi and protozoa.

CO5: Employ suitable pure culture and enrichment techniques for isolation of microorganisms from clinical or environmental samples.

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**B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F. 2018–19)
FIRST YEAR –SEMESTER- II**

PAPER – 2: MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 60

CREDITS: 3

Course outcomes: Upon completion of the course, the student will be able to achieve the following outcomes.

CO1: Describe different classes of macromolecules such as carbohydrates, lipids, proteins and nucleic acids, classify them and understand their functions.

CO2: Understand the principles and instrumentation for colorimetry, spectrophotometry, chromatography, centrifugation and electrophoresis.

CO3: Explain enzyme properties and factors affecting the enzyme activity and role of cofactors in defining the enzymatic activity.

CO4: Illustrate different nutritional groups of microorganisms, growth requirements of microbes, different stages of microbial growth and factors affecting the microbial growth.

CO5: Explain different life processes such as aerobic and anaerobic respiration, fermentation, oxygenic and anoxygenic photosynthesis.

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**B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F. 2018–19)
FIRST YEAR – SEMESTER – II**

PRACTICAL – 2: MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 45

CREDITS: 2

Course outcomes: Upon completion of the practical course, the student will be able to achieve the following outcomes.

CO1: Perform different colorimetry experiments for quantification of macromolecules by methods such as Lowry's, Biuret or diphenylamine method.

CO2: Learn paper chromatography for separation of amino acids, pigments and other biological molecules.

CO3: Undertake experiments to prepare natural and synthetic media and measure microbial growth such as plate count, turbidometry.

CO4: Design an experiment for preparation of microbial growth curve.

CO5: Plan experiments to check the influence the effects of physical parameters on microbial growth.

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**B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F. 2018–19)
SECOND YEAR – SEMESTER- III**

PAPER – 3: MICROBIAL GENETICS AND MOLECULAR BIOLOGY

TOTAL HOURS: 60

CREDITS: 3

Course outcomes: Upon completion of the course, the student will be able to achieve the following outcomes.

CO1: Understand the importance of DNA and RNA in inheritance, DNA organization, replication and extrachromosomal elements.

CO2: Explain mutations, mutation types, different types of mutagens and list out different DNA repair mechanisms.

CO3: Compare and contrast concepts such as gene, cistron, muton, recon, enzyme, polypeptide etc. one gene – enzyme vs one gene – one polypeptide hypothesis.

CO4: Illustrate different classes of genes, outline the steps involved in transcription and translation mechanisms and gene regulatory mechanisms.

CO5: Examine the applications of vectors, DNA modifying enzymes, polymerase chain reaction and creating of genomic and cDNA libraries in gene cloning.

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**B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F. 2018–19)
SECOND YEAR – SEMESTER- III**

PRACTICAL – 3: MICROBIAL GENETICS AND MOLECULAR BIOLOGY

TOTAL HOURS: 45

CREDITS: 2

Course outcomes: Upon completion of the practical course, the student will be able to achieve the following outcomes.

CO1: Create the DNA, RNA models using ball and stick or paper cuttings

CO2: Design a suitable experiment to isolate genomic DNA from microorganisms

CO3: Understand the principles of electrophoresis and DNA staining by dyes for visualization.

CO4: Plan an experiment to induce mutations in microorganisms using physical mutagens such as UV radiation

CO5: Explain the principle and working of instruments such as centrifuge and thermal cycler.

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**B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F. 2018–19)
SECOND YEAR – SEMESTER- IV**

PAPER – 4: IMMUNOLOGY AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 60

CREDITS: 3

Course outcomes: Upon completion of the course, the student will be able to achieve the following outcomes.

CO1: Acquire knowledge about immune system, types of immunity, cells of immune system and role of lymphoid organs in immunity.

CO2: Understand the concepts of antigen, antibody, haptens, and different types of antigen – antibody reactions.

CO3: Explain the concepts in clinical microbiology and use procedures such as sample collection, storage, processing and apply culture based, biochemical, molecular tools for disease diagnosis.

CO4: Apply the principles of antimicrobial resistance and use suitable methods to detect the antimicrobial resistance in microorganisms.

CO5: Describe the epidemiological principles and pathogenesis, symptoms, diagnosis and treatment of various infectious diseases.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F. 2018–19)

SECOND YEAR – SEMESTER- IV

PRACTICAL – 4: IMMUNOLOGY AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 45

CREDITS: 2

Course outcomes: At the end of the course, the student would have achieved the following outcomes.

CO 1: Determine the blood group of any individual by using a commercial blood typing kit using agglutination principle

CO 2: Learn procedures for serum separation from blood and quantification of hemoglobin.

CO 3: Perform procedures for determining total leucocytes and differential leucocytes count by staining procedures.

CO 4: Undertake the biochemical tests for determination of bacterial identity for clinical or environmental isolates.

CO 5: Test the susceptibility or resistance of a microorganism to an antibiotic by Kirby-Bauer disc diffusion test.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018–19)

FINAL YEAR – SEMESTER- V

PAPER – 5: ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

TOTAL HOURS:45

CREDITS: 3

Course outcomes: At the end of the course, the student would have achieved the following outcomes.

CO 1: Understand the dynamics between microorganisms, soil, water, air environments and special adaptations of extremophiles.

CO 2: Gain knowledge on the role of microorganisms in nutrient recycling, methods of determining the water potability and microbial interactions.

CO 3: Explain the methods of solid and liquid waste management and different levels of sewage treatment methods.

CO 4: Identify the plant growth promoting and nitrogen fixing microbes and their utility in agriculture and biofertilizers.

CO 5: Categorize various plant diseases based on symptoms and list out methods for controlling plant diseases.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018–19)

FINAL YEAR – SEMESTER- V

PRACTICAL – 5: ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

TOTAL HOURS: 45

CREDITS: 2

Course Outcomes: At the end of the practical course, the student would have achieved the following outcomes.

CO 1: Become well versed with procedures such as estimation of pH, moisture content, and water holding capacity.

CO 2: Perform isolation of microorganisms from soil and water.

CO 3: Estimate the water potability by adapting various methods such as presumptive and MPN tests.

CO 4: Undertake the isolation of nitrogen fixing microbes or check the mycorrhizal staining and observation by microscope.

CO 5: Observe the symptoms of plant diseases and categorize them as fungal, bacterial and protozoan diseases

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018–19)

FINAL YEAR – SEMESTER- V

PAPER – 6: DIAGNOSTIC MICROBIOLOGY

TOTAL HOURS: 45

CREDITS – 2

Course outcomes: At the end of the course, the student would have achieved the following outcomes.

CO 1: Acquire knowledge about causative agents and the pathogenesis of various bacterial, fungal, viral and protozoan diseases.

CO 2: Understand the procedures used for collection and transport of various clinical samples such as sputum, urine, blood, CSF and stool.

CO 3: Analyze the pathogens from clinical samples by staining and their isolation of selective or enrichment medium.

CO 4: Categorize a diagnostic procedure as serological, molecular or biochemical test. List out the symptoms of endemic diseases.

CO 5: Learn the principles of antibiotic-resistance mechanisms and methods of assessing the resistance or susceptibility of a pathogen to a given antibiotic.

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FINAL YEAR – SEMESTER- V

PRACTICAL – 6: DIAGNOSTIC MICROBIOLOGY

Total hours: 45

Credits: 2

Course outcomes: At the end of the practical course, the student would have achieved the following outcomes.

CO 1: Acquire skills for collection of clinical samples such as sputum, urine, blood and skin swabs.

CO 2: Be able to analyze and process the clinical samples for isolation of microorganisms on selective or enrichment media.

CO 3: Undertake the antibiotic sensitivity testing by broth dilution, or Kirby-Bauer disk diffusion tests.

CO 4: Categorize a diagnostic procedure as serological, molecular or biochemical test. List out the symptoms of endemic diseases.

CO 5: Learn the principles of cryopreservation and various methods of storage of microbial isolated for long term preservation.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018–19)

FINAL YEAR – SEMESTER- VI

Paper – 7A - FOOD AND INDUSTRIAL MICROBIOLOGY

TOTAL HOURS: 45

CREDITS: 3

COURSE OUTCOMES:

CO I: Gain an understanding of the intrinsic and extrinsic factors that influence microbial growth in food, recognize the microbial spoilage of various food items, and comprehend the concepts of food intoxication (botulism) and foodborne diseases (salmonellosis) along with their detection methods.

CO II: Develop knowledge about the principles of food preservation, including physical and chemical methods, and explore the production processes and benefits of fermented dairy foods (cheese and yogurt). Additionally, understand the potential of microorganisms as food sources, such as single-cell proteins (SCP), edible mushrooms (white button, oyster, and paddy straw), and probiotics.

CO III: Familiarize oneself with the microorganisms of industrial importance, including yeasts (*Saccharomyces cerevisiae*), molds (*Aspergillus niger*), bacteria (*E. coli*), and actinomycetes (*Streptomyces griseus*). Additionally, gain an outline of the procedures for isolating, screening, and improving industrially significant microorganisms.

CO IV: Acquire knowledge about different types of fermentation processes (solid state, liquid state, batch, fed-batch, continuous), understand the basic concepts of fermenter design, identify the ingredients of fermentation media, and explore the techniques involved in downstream processing, such as filtration, centrifugation, cell disruption, and solvent extraction.

CO V: Develop an understanding of the microbial production of industrial products, including citric acid, ethanol, amylase, penicillin, glutamic acid, and vitamin B12, focusing on their production processes and applications.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018–19)

FINAL YEAR – SEMESTER- VI

Practical – 7A -FOOD AND INDUSTRIAL MICROBIOLOGY

TOTALHOURS:45

CREDITS: 2

COURSE OUTCOMES:

CO1: Students will be able to isolate bacteria and fungi responsible for the spoilage of bread, fruits, and vegetables.

CO2: Students will learn how to prepare yogurt or dahi using appropriate microbial cultures.

CO3: Students will gain the skills to determine the microbiological quality of milk samples using the Most Probable Number (MPN) technique.

CO4: Students will be able to isolate and identify antagonistic microorganisms using the spread plate technique.

CO5: Students will develop the ability to design a fermenter, including identifying different types of fermenters and labelling their parts.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018–19)

**FINAL YEAR – SEMESTER- VI
Paper – 8A1 - INDUSTRIAL MICROBIOLOGY**

TOTAL HOURS: 45

CREDITS: 2

COURSE OUTCOMES:

CO I: Students will be able to understand the different types of microorganisms used in industry such as yeasts, molds, bacteria, and actinomycetes. They will also learn about primary and secondary microbial metabolites and the techniques involved in screening and selecting industrially important metabolites from microbes.

CO II: Students will have a clear understanding of fermentation and fermenters. They will learn about the concept and discovery of fermentation, the parts and functions of a fermenter, and the different types of fermenters including batch, continuous, and fed batch.

CO III: Students will be familiar with pharmaceutical and therapeutic enzymes. They will learn about the various enzymes used in industries such as detergents, textiles, and leather. Additionally, they will gain knowledge on the production of amylases, therapeutic enzymes, and the role of microorganisms in bioleaching and the textile industry.

CO IV: Students will have a good understanding of industrial microorganisms. They will learn about cell growth, microbial growth kinetics, factors affecting growth, basic nutrition, principles of production media, and the chemical composition of media.

CO V: Students will be able to comprehend the basic structure of a bioreactor and the different types of bioreactors. They will also learn about the kinetics and methodology of batch and continuous bioreactors. Additionally, they will gain knowledge on the sterilization of bioreactors using fibrous filters and the concepts of aeration and agitation in shake flasks and tube rollers.

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**FINAL YEAR – SEMESTER- VI
Practical - 8A1: INDUSTRIAL MICROBIOLOGY**

TOTAL HOURS: 45

CREDITS: 2

COURSE OUTCOMES:

CO I: Students will be able to understand and apply the basics involved in the production of ethanol.

CO II: Students will be able to estimate the concentration of ethanol using appropriate analytical techniques.

CO III: Students will learn how to isolate and identify microorganisms from soil that are capable of producing amylase.

CO IV: Students will gain hands-on experience in producing amylase and assessing its enzymatic activity through assay methods.

CO V: Students will be able to demonstrate the operation and functionality of a fermenter, a key equipment used in industrial fermentation processes.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018–19)

**FINAL YEAR – SEMESTER- VI
Paper – 8A2 - FOOD MICROBIOLOGY**

TOTAL HOURS: 45

CREDITS: 2

COURSE OUTCOMES:

CO I: Understand the sources of microorganisms causing food spoilage and their detection methods.

CO II: Gain knowledge about the microbiological production of fermented foods and the biochemical activities of microbes in milk.

CO III: Comprehend the processes involved in the microbial production of distilled beverages, vinegar, yogurt, and cheese.

CO IV: Familiarize with various methods of food preservation and their application, including aseptic handling, pasteurization, refrigeration, dehydration, and radiation.

CO V: Course Outcome: Develop an understanding of probiotics, their common properties, and examples of probiotic microorganisms, as well as the production processes and uses of vitamins B12 and C.

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**FINAL YEAR – SEMESTER- VI
Practical - 8A2 - FOOD MICROBIOLOGY**

Total Hours: 45

Credits: 2

COURSE OUTCOMES:

CO I: Demonstrate proficiency in identifying pathogens in various formulations, such as syrup, by employing appropriate laboratory techniques and procedures.

CO II: Apply microbiological methods to identify and assess the presence of pathogens in toothpaste samples, ensuring the safety and quality of the product.

CO III: Utilize laboratory techniques to identify and analyze pathogens present in canned food materials, ensuring their suitability for consumption.

CO IV: Implement effective methods and procedures to identify pathogens in tablet formulations, ensuring their safety and efficacy for medical use.

CO V: Perform bioassays to evaluate the potency and effectiveness of vitamin B12, using appropriate techniques and standards.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018–19)

FINAL YEAR – SEMESTER- VI

Paper – 8A3 - MANAGEMENT OF HUMAN MICROBIAL DISEASES

TOTAL HOURS: 45

CREDITS: 2

COURSE OUTCOMES:

CO1: Students will be able to understand the definition and concept of health, disease, infection, and pathogen. They will also be able to identify different types of human microbial diseases, explain their transmission, and recognize the causative agents and symptoms associated with these diseases.

CO2: Students will gain an understanding of the principles of epidemiology and its significance in public health. They will be able to discuss current epidemics, such as AIDS, nosocomial infections, and acute respiratory syndromes. Furthermore, students will learn about various measures for preventing epidemics, including global health considerations, emerging and re-emerging infectious diseases, as well as the concept of biological warfare and biological weapons.

CO3: Students will have a comprehensive understanding of several viral diseases, including AIDS, Hepatitis, Influenza, Rabies, Chikungunya, and Polio. They will be able to describe the history, causative agents, pathogenesis, diagnosis, and available drugs and inhibitors for these diseases. This knowledge will enable students to recognize the impact of viral infections on human health.

CO4: Students will have a clear understanding of how bacterial pathogens enter the human host, their mechanisms of pathogenicity, colonization, growth, and virulence. They will be able to identify different types of bacterial pathogens, including their virulence factors such as exotoxins, enterotoxins, endotoxins, and neurotoxins. Additionally, students will gain insights into the avoidance of host defence mechanisms by bacterial pathogens, the damage caused to host cells, and the host factors for infection and innate resistance to infection.

CO5: Students will be equipped with the knowledge and skills to perform laboratory diagnosis of common infective syndromes and parasitic manifestations. They will understand the methods of transmission and the role of vectors, focusing on the biology of house flies, mosquitoes, and sand flies. Moreover, students will recognize the need and significance of epidemiological studies, including epidemiological investigations to identify diseases, the challenges posed by drug resistance and drug sensitivity, and the emergence of antibiotic resistance in bacteria.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018–19)

FINAL YEAR – SEMESTER- VI

Practical - 8A3 - MANAGEMENT OF HUMAN MICROBIAL DISEASES

TOTAL HOURS: 45

CREDITS: 2

COURSE OUTCOMES:

CO I: Demonstrate proficiency in conducting physical, chemical, and microscopic examinations of clinical samples such as urine, stool, pus, and sputum, and accurately interpret the findings.

CO II: Apply appropriate laboratory techniques for the isolation and identification of specific pathogens, including *E. coli*, *Salmonella*, and *Pseudomonas* from clinical samples.

CO III: Recognize and identify common parasites through the observation of permanent slides, including *Entamoeba histolytica*, *Ascaris* spp., *Plasmodium* spp., *Mycobacterium tuberculosis*, and *Mycobacterium leprae*.

CO IV: Perform accurate hemoglobin estimation using acid hematin and cyan methemoglobin methods and interpret the results to assess a patient's blood status.

CO V: Demonstrate proficiency in determining erythrocyte sedimentation rate (ESR) and packed cell volume (PCV) as indicators of various pathological conditions and understand their clinical significance.

CO VI: Apply immuno-hematology techniques, specifically slide tests and tube tests, for blood group typing in the ABO and Rh systems and interpret the results to provide appropriate transfusion support and compatibility assessment.