

COURSE OUTCOMES

M.SC MICROBIOLOGY (CBCS)

Semester-I

General Microbiology

Code	Course title	Course Type	HPW	Credits
MB 101	General Microbiology	Core	4	4

This focuses on general principles of microbiology, microbial cell structure and function and their growth and metabolism.

Upon successful completion of this course the students will be able to

- ✚ Understand the basic microbial structure and functions of various physiological groups of prokaryotes and eukaryotes and also learn the theory and practical skills in microscopy handling and staining techniques

- ✚ Know various Culture media and their applications and understand various physical and chemical means of sterilization and also learn various techniques for isolation of pure cultures

- ✚ Comprehend the various methods for identification of unknown microorganisms and study microbial metabolism – Autotrophy and heterotrophy modes of nutrition

- ✚ Understand the microbial physiology and know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement

Virology

Code	Course title	Course Type	HPW	Credits
MB 102	Virology	Core	4	4

This course explores Virology- the study of Viruses that infect all types of living organisms on earth.

Upon successful completion of this course the student will be able to

- ✚ Understand the architecture of viruses, their classification and the methods used in their study.
- ✚ Discern the replication strategies of representative viruses from the seven Baltimore classes and comprehend the intricate interaction between viruses and host cells
- ✚ Comprehend the role of viruses in oncogenesis, and ways of preventing/ treating viral infections.
- ✚ Know how viruses can be used as tools to study biological processes, as cloning vectors and for gene transfer.

Research Methodology & Techniques

Code	Course title	Course Type	HPW	Credits
MB 103	Research Methodology & Techniques	Core	4	4

This paper provides students with an introduction to quantitative and qualitative research methods and to the types of skills necessary for the planning and data gathering

- ✚ To equip students with a basic understanding of the underlying principles of quantitative and qualitative research methods and to provide students with in-depth training on the conduct and management of research.
- ✚ The ethical and philosophical issues associated with research in education.
- ✚ Enable students to acquire expertise in the use and application of the methods of data collection and analysis.
- ✚ Provide learning opportunities to critically evaluate research methodology and findings and to enable students to be reflexive about their role and others' roles as researchers.

Microbial Biochemistry

Code	Course title	Course Type	HPW	Credits
MB 104	Microbial Biochemistry	Core	4	4

Microbial Biochemistry is a branch of science which combines biological, chemical and physical principles and its application to living systems pertaining to both macro and micro organisms.

Upon successful completion of the course, students are expected to be able to:

- ✚ Describe the concepts of pH, buffers, Henderson-Hasselbalch equation, biological buffer systems and their importance.
- ✚ Understanding the laws of thermodynamics, concepts of entropy, enthalpy and free energy changes and their application to biological systems and about various biochemical reactions and metabolic pathways.
- ✚ Overview of major biomolecules –carbohydrates, lipids, proteins, aminoacids, nucleic acids, classification, structure, function, significance and biosynthesis and the degradation pathways of the above mentioned biomolecules
- ✚ Conceptual knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation, enzyme engineering, Application of enzymes in large scale industrial processes.

Semester-II

Microbial Biology and Microbial Genetics

Code	Course title	Course Type	HPW	Credits
MB 201	Molecular Biology and Microbial Genetics	Core	4	4

- ✚ Molecular Biology basically deals with study of DNA and other biomolecules essential for sustenance of life and varied mechanisms involved at molecular level.
- ✚ Upon successful completion of the course, students are expected to be able to:
- ✚ Understand the structure, properties and function of genes in living organisms at the molecular level and knowledge about DNA as a genetic material, enzymology, and replication strategies molecular mechanisms involved in transcription and translation.
- ✚ Describe the importance of genetic code and wobble hypothesis and discuss the molecular mechanisms underlying mutations, detection of mutations, DNA damage and repair mechanisms Explain the concept of recombination, linkage mapping and elucidate the gene transfer mechanisms in prokaryotes and eukaryotes
- ✚ Handle and independently work on lab protocols involving molecular techniques

Environmental microbiology

Code	Course title	Course Type	HPW	Credits
MB 202	Environmental & Agriculture Microbiology	Core	4	4

Environmental microbiology is the study of the composition, physiology and significance of microbial communities in the environment (soil, water, air) and **Agriculture Microbiology** deals with plant microbe interactions and the microbiology of soil fertility, such as microbial degradation of organic matter and soil nutrient transformations.

Upon successful completion of the course, students are expected to be able to:

- ✚ Competently explain various aspects of environmental microbiology –water, air and soil and Comprehend about water pollution, Water-borne diseases and their transmission, methods of determination of sanitary quality of water and sewage treatment methods employed in waste water treatment
- ✚ Appreciate the diversity of microorganisms and learn the abundance, distribution and significance of microorganism in the environment such as bioremediation and plant microbe interactions
- ✚ Understand the various biogeochemical cycles - microbes involved and biochemical mechanisms of Carbon, Nitrogen, Phosphorus cycles etc.
- ✚ Learn in detail the types and mechanisms of nitrogen fixation and applications of diazotrophs as biofertilizers and their production techniques.

Immunology

Code	Course title	Course Type	HPW	Credits
MB 203	Immunology	Core	4	4

- ✚ Demonstrate and understanding of key concepts in immunology along with overall organization of the immune system.
- ✚ Begin to appreciate the significance of maintaining a state of immune tolerance sufficient to prevent the emergence of autoimmunity.
- ✚ To understand about Tumor Immunology and help the students to understand its immune prophylaxis and immune therapy.
- ✚ To make them understand the salient features of antigen antibody reaction & its uses in diagnostics and various other studies.
- ✚ Learn about immunization and their preparation and its importance

Pharmaceutical Microbiology

Code	Course title	Course Type	HPW	Credits
MB 204	Pharmaceutical Microbiology	Core	4	4

Pharmaceutical Microbiology is an applied field of microbiology which deals with the role of microorganisms in pharmaceutical industry.

Upon successful completion of this course the student will be able to

- ✚ Understand the role of microorganisms in pharmaceutical /cosmetic industry , their sources, methods of disinfection, sterilization and preservation of pharmaceutical formulations.
- ✚ Evaluate methods of sterility testing, microbial content testing and gain Knowledge of GMP practices.
- ✚ Describe and understand the mechanism of action of Non-therapeutic antimicrobial and therapeutic antimicrobial agents.
- ✚ Recognize the biochemical and genetic basis for antibiotic resistance and ways of controlling spread of antibiotic resistance.
- ✚ Demonstrate a knowledge and understanding of microbiological assays of growth promoting and growth inhibiting substances.

Semester-III

Food microbial Technology

Code	Course title	Course Type	HPW	Credits
MB 301	Food Microbial Technology	Core	4	4

Food microbial Technology is the scientific study of microorganisms both in food and used for production of food. This course also deals with microbiological analysis of food to determine the safety and quality of food

Upon successful completion of the course, students are expected to be able to:

- ✚ Understand the beneficial role of microorganisms in food processing and the microbiology of different types of fermented foods – pickles, bread, Idli, Tempeh etc.
- ✚ Study the different types of microorganisms in milk and their activities - fermented dairy products and spoilage and their applications as probiotics
- ✚ Understand the significance and activities of microorganisms in various food and role of intrinsic and extrinsic factors on microbial growth in foods leading to spoilage, and understand the principles underlying the preservation methods
- ✚ Recognize and describe the characteristics of important food borne pathogens and Learn various methods for their isolation, detection and identification
- ✚ Understand of the basis of food safety regulations and discuss the rationale for the use of standard methods and procedures for the microbiological analysis of food.

Medical Bacteriology

Code	Course title	Course Type	HPW	Credits
MB 302	Medical Bacteriology	Core	4	4

Upon successful completion of this course the student will be able to

- ✚ Course provides learning opportunities in the basic principles of medical microbiology and infectious disease.
- ✚ Know the conceptual basis for understanding pathogenic microorganisms and the mechanisms by which they cause disease in the human body.
- ✚ It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases and use of lab animals in medical field.
- ✚ To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue and explain the methods of microorganisms control, e.g. chemotherapy & vaccines. Solve problems in the context of this understanding.
- ✚ Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.

Industrial Microbiology

Code	Course title	Course Type	HPW	Credits
MB 303	Industrial Microbiology	DSE	4	4

Industrial microbiology is a part of microbiology that focuses on the production of products and services by microorganisms.

Upon successful completion of this course the student will be able to

- ✚ Appreciate how microbiology is applied in manufacture of industrial products , learn methods in discovery of new useful microorganisms and acquire knowledge of the design of Fermentors and process controls .
- ✚ Develop an understanding of fermentation & inoculum media, their formulation and principles & techniques of sterilization.
- ✚ Appreciate the different types of fermentation processes & understand the biochemistry of various fermentations and product recovery methods.
- ✚ Get acquainted with techniques applicable for Improvement of microorganisms based on known biochemical pathways and regulatory mechanisms and learn the methods of immobilization of enzymes and cells.

Advances in Biotechnology

Code	Course title	Course Type	HPW	Credits
MB 304	Advances in Biotechnology	DSE	4	4

Advances in Biotechnology deals with principles and new trends in biotechnology and its application in allied fields.

After completion of the course the students will be able to:

- ✚ To know the basics and concepts of various biotechnological related terms and explain the physiological processes and discuss issues related to plant transgenics, significance of transgenic plants as bioreactors for the production of enzymes, plantibodies, edible vaccines and therapeutic proteins.
- ✚ Address bioethical and biosafety issues related to plant transgenics and understand, conduct and gain a thorough knowledge to perform plant tissue culture experiments
- ✚ Explain and elucidate the molecular techniques, gene transfer methods for the production of transgenic animals and techniques involved in gene manipulation and rDNA technology and address bioethical and biosafety issues related to animal transgenics
- ✚ Elucidate the concept of nanosize, nanoparticle its structure and properties and connect the concepts of physics, chemistry and engineering principles in the study the nanoscale nature of the particles, synthesis and characterization of nanoparticles and its applications of nanoparticles in allied fields.
- ✚ Explain the application of biotechnology in medical and its allied fields, gene therapy, genetic counseling, acquire knowledge about antisense technology, Pharmacogenetics, Toxicogenomics, Tissue engineering, Biomolecular engineering and the impact of these novel strategies on human population, Address the bioethical issues & concerns linked to medical biotechnology

Semester- IV

Cell and Molecular Biotechnology

Code	Course title	Course Type	HPW	Credits
MB 401	Cell and Molecular Biotechnology	Core	4	4

Cell and Molecular Biotechnology is an application oriented field which mainly deals with the study of molecular mechanisms, exploitation of microorganisms and rDNA technology integrating with the omics technology

After completion of the course the students will be able to:

- To know the concepts of Cell Biology and Molecular Biotechnology and explain the molecular mechanism of cell cycle and role of kinases in cell cycle regulation, understand the underlying principles of cell signaling, second messengers and signal transduction and to know the importance of molecular chaperons and their role in protein folding.
- Elucidate the molecular techniques involved in gene manipulation and rDNA technology, explain the significance of gene transfer methods for the production of transgenics.
- Connect the concepts of computational and molecular principles and their application in biological sciences and discuss the applications of Bioinformatics in related fields and acquire knowledge about omics technology, drug discovery, ADME and toxicological assays.
- Apply their lab skills and experimental knowledge to perform varied Biotechnology, Bioinformatics experiments in labs.

Medical Virology & Parasitology

Code	Course title	Course Type	HPW	Credits
MB 402	Medical Virology & parasitology	Core	4	4

Upon successful completion of this course the student will be able to

- ✚ To understand the essential concepts of virology which include the structure of different viruses, properties, replication, types of infection, how viruses cause disease, immune response to infection, treatment and the inhibitory action of the antiviral chemotherapy and laboratory diagnosis.
- ✚ Acquire knowledge to take required measurements for prevention and control of viral diseases ie., virus vaccines and antiviral drugs.
- ✚ To comprehend and appreciate the major and varied laboratory techniques and research approaches employed in the field of virology.
- ✚ Understand transmission strategies, immune evasion and host responses contribute to viral pathogenesis
- ✚ Acquire knowledge about pathogenesis and epidemiology in relation to the properties of a virus and the function of the immune system.

Microbial Biotechnology

Code	Course title	Course Type	HPW	Credits
MB 403	Microbial Biotechnology	GE (IDSE)	4	4

Microbial Biotechnology is a branch of microbiology that includes the theory and experimental knowledge of production of diverse products using microorganisms.

Upon successful completion of this course the student will be able to

- ✚ Know the principles involved in preparation of Beverage and industrial Alcohols
- ✚ Understand the methods followed in the production of industrially important microbial Primary metabolites (Citric acid, Glutamic acid, Vit B12) , secondary metabolites (antibiotics) , and the physical and chemical conditions influencing their production.
- ✚ Comprehend the importance of GMO in producing heterologous proteins and the technology used
- ✚ Understand the importance of microbial enzymes, their applications , production process and relate biotransformation principles to biotransformation of steroids
- ✚ Conceptualize the principles and production process of different types of Vaccines and Biopesticides

Applied microbiology

Code	Course title	Course Type	HPW	Credits
MB 404	Applied Microbiology	DSE (Elective1)	4	4

Applied microbiology is the study of the way the microbes can be utilized in various processes such as relevant enzymes and proteins

After successful completion of this course students are expected to be able to:

- ✚ Ability to categorize the metabolic pathways in microorganisms and understand their roles in central metabolism and analyze the growth kinetics employed in industrial fermentation processes and employ in strain improvement
- ✚ Learn the Processes involved in production of microbial metabolites like lipases, proteases and bacteriocins and enhance the efficiency of microorganisms to produce particular metabolite and produce the same at large scale
- ✚ Understand the background of concepts and theories in plant pathology, its principles and practical applications to disease management especially cultural, chemical and biological control methods.
- ✚ Gain a working knowledge in nanobiotechnology techniques and acquire the ability to use them to solve problems in bioengineering, biomedicine and agricultural/environmental issues