COURSE OUTCOMES

M.Sc Microbiology (CBCS)

SEMESTER-I

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

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

- Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures
- Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea
- Know various Culture media and their applications and also understand various physical and chemical means of sterilization
- Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae
- Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively
- Comprehend the various methods for identification of unknown microorganisms
- Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy
- Know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

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

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

- Know how viruses are classified
- Understand the architecture of viruses
- Know the methods used in studying viruses
- Discern the replication strategies of representative viruses from the seven Baltimore classes
- Comprehend the intricate interaction between viruses and host cells
- Understand the interactions between viruses and the host immune system
- the terms Oncogenes and tumor suppressor genes, and how tumor viruses interact with these products and their intersecting pathways and cause oncogenesis.
- Explain vaccine strategies and mechanisms of antiviral drugs and interferons
- Know how viruses can be used as tools to study biological processes , as cloning vectors and for gene transfer.

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Code	Course title	Course Type	HPW	Credits
MB 103	Research Methodology	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.
- Provide students with in-depth training on the conduct and management of research from inception to completion using a wide range of techniques.
- The ethical and philosophical issues associated with research in education
- Various modes of presenting and disseminating research findings
- 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.
- Enable students to be reflexive about their role and others' roles as researchers.

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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 electrolytes and electrolytic dissociation, pH and its biological significance, 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 various biochemical studies and reactions.
- Conceptual knowledge of aerobic and anaerobic respiration and various intermediary mechanisms involved, oxidative phosphorylation
- Overview of major biomolecules –carbohydrates, lipids, proteins, aminoacids, nucleic acids, classification, structure, function of the above mentioned biomolecules
- Discuss the biosynthesis and the degradation pathways involved.
- Specify the biological significance of biomolecules in metabolism
- 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

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

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

- Know the terms and terminologies related to molecular biology and microbial
- Understand the properties, structure and function of genes in living organisms at the molecular level
- Explain the significance of central dogma of gene action
- Have a conceptual knowledge about DNA as a genetic material, enzymology, and replication strategies
- Understand the molecular mechanisms involved in transcription and translation
- Describe the importance of genetic code and wobble hypothesis
- Discuss the molecular mechanisms underlying mutations,detection of mutations and 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

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

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

- Appreciate the diversity of microorganism and microbial communities inhabiting a multitude of habitats and occupying a wide range of ecological habitats.
- Learn the occurrence, abundance and distribution of microorganism in the environment and their *role* in the environment and also learn different methods for their detection and characterization
- Competently explain various aspects of environmental microbiology and microbial ecology and to become familiar with current research in environmental microbiology.
- Understand various biogeochemical cycles – Carbon, Nitrogen, Phosphorus cycles etc. and microbes involved
- Understand various plant microbes interactions especially rhizosphere, phyllosphere and mycorrhizae and their applications especially the biofertilizers and their production techniques
- Understand the basic principles of environment microbiology and be able to apply these principles to understanding and solving environmental problems – waste water treatment and bioremediation
- Know the Microorganisms responsible for water pollution especially Water-borne pathogenic microorganisms and their transmission
- Comprehend the various methods to determine the Sanitary quality of water and sewage treatment methods employed in waste water treatment

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

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

- Demonstrate an understanding of key concepts in immunology.
- Understand the overall organization of the immune system
- Conceptualize how the collection of individual clones of lymphocytes (termed the "immune repertoire") arises from rearrangement within two genetic loci: the Ig gene in B cells and the antigen receptor in T cells.
- Learn how "clonal selection" allows for the expansion of a limited number of antigen-recognizing lymphocytes in response to an specific antigenic stimulus
- 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
- Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design, read graphs, and understand and use information from scientific papers. Demonstrate skill in communication of scientific data in standard format.

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

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

- Identify microorganisms of relevance to healthcare and the pharmaceutical industry and their sources.
- Discuss Microbial contamination/product spoilage and antimicrobial preservation of pharmaceutical formulations during production and in products
- Understand various disinfection and sterilization techniques ,evaluate the sterility testing, microbial assays, pharmacopoeial standards of sterilization process
- Discuss Microbial contamination , product spoilage and antimicrobial preservation of Cosmetic products
- Evaluate microbial content testing and sterility testing
- 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.
- Acquire a Knowledge of GMP practices.

SEMESTER-III

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

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

- Understand the beneficial role of microorganisms in fermented foods and in food processing and the microbiology of different types of fermented food products – dairy, pickles, Legume and cereal based food products
- Understand the significance and activities of microorganisms in food and role of intrinsic and extrinsic factors on growth and survival of microorganisms in foods
- Know the spoilage mechanisms in foods and thus identify methods to control deterioration and spoilage
- Recognize and describe the characteristics of important pathogens and spoilage microorganisms in foods.
- Learn various methods for their isolation, detection and identification of microorganisms in food and employ in industries
- Identify ways to control microorganisms in foods and thus know the principles involving various methods of food preservation
- 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
- Acquire, discover, and apply the theories and principles of food microbiology in practical, real-world situations and problems.

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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:

- This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.
- It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora.
- The course provides 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.
- 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.
- Helps to understand the use of lab animals in medical field.
- Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.
- Explain the methods of microorganisms control, e.g. chemotherapy & vaccines. Solve problems in the context of this understanding.

- Demonstrate practical skills in fundamental microbiological techniques.

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

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

- Get equipped with a theoretical and practical understanding of industrial microbiology
- Appreciate how microbiology is applied in manufacture of industrial products
- Know how to source for microorganisms of industrial importance from the environment
- Know about design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer
- Understand the rationale in medium formulation & design for microbial fermentation, sterilization of medium and air
- Appreciate the different types of fermentation processes
- Understand the biochemistry of various fermentations
- Identify techniques applicable for Improvement of microorganisms based on known biochemical pathways and regulatory mechanisms
- Comprehend the techniques and the underlying principles in down stream processing

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

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

- To know the basics and concepts of various biotechnological related terms
- Explain the physiological processes that occur during plant growth and development Describe the methodology involved in plant tissue culture and plant transgenics
- Discuss issues related to plant nutrition, quality improvement, environmental adaptation, transgenic crops and their use in agriculture
- Elucidate the 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
- Understand , conduct and gain a thorough knowledge to perform plant tissue culture experiments
- Explain the basics of animal biotechnology
- Elucidate the molecular techniques involved in gene manipulation and rDNA technology
- Explain the gene transfer methods for the production of transgenic animals
- Address bioethical and biosafety issues related to animal transgenics
- Gain experimental knowledge to perform animal biotechnology related experiments
- Elucidate the concept of nanosize, nanoparticle its structure and properties of nanoparticles
- Connect the concepts of physics, chemistry and engineering principles in the study the nanoscale nature of the particles
- Explain the process protocol for the, synthesis and characterization of nanoparticles
- Discuss the applications of nanoparticles in allied fields

- Acquire knowledge and lab skills to perform nanotechnology experiments in lab
- Explain the application of biotechnology in medical and its allied fields, gene therapy , genetic counseling
- Acquire knowledge about antisence technology, Pharmacogenetics, Toxicigenomics, Tissue engineering, Biomolecular engineering and the impact of these novel stratagies on human population.
- Address the bioethical issues & concerned linked to medical biotechnology