

## **COURSE OUTCOME**

### **SEMESTER I**

#### **CELL BIOLOGY (PSMBTC101)**

Upon completion of the course students will know

**CO101.1:** Introduction about the origins of cells, diversity, structure and function of cell organelles

**CO101.2:** Acquainted with various sophisticated instruments and their implementation in biological research

**CO101.3:** Concept of cell signaling, communication, cell growth, division, cell cycle and its regulations

**CO101.4:** Brief idea of cellular basis of differentiation and development.

#### **BACTERIOLOGY AND VIROLOGY (PSMBTC102)**

Upon the completion of the course students will have knowledge about

**CO102.1:** Various bacteria, their morphology, ultrastructure, growth and multiplications and their role in the life of other organisms like humans and plants

**CO102.2:** Hands on experience on various methods for identification and characterization of bacteria based on cultivation, microscopy, biochemical, molecular and metagenomics approaches.

**CO102.3:** Different viruses, their genome, structure and classification, identification of viral diseases (in humans, plants, animals, cyanobacteria, algae, fungi and bacteria), their pathogenesis, symptoms and life cycle of transmission

**CO102.4:** Prevention of viral infections using Vaccines and treatment using various antiviral drugs.

#### **BIOCHEMISTRY AND METABOLISM (PSMBTC103)**

**CO103.1:** The Course aims to make students familiar with the basics of Biochemistry and determine how the collections of inanimate molecules that constitute living organisms, interact with each other to maintain and perpetuate the living state.

**CO103.2:** Students get to know about various biochemical processes with a special emphasis on various biomolecules like carbohydrates, Proteins, Lipids and Nucleic acids.

**CO103.3:** The students get an overview of various metabolic pathways and cycles involved in cellular metabolism and how an imbalance or anomaly in functioning of these pathways can prove to be of clinical significance.

**CO103.4:** The course aims at priming the students towards understanding deeper concepts of cellular functioning in living systems.

**CO103.5:** This course is to Biochemistry yields important insights and practical application in medicine, agriculture, nutrition and industry.

**MOLECULAR BIOLOGY (PSMBTC104)**

**CO104.1:** Understands the genomic organization of living organisms, study of genes genome, chromosome.

**CO104.2:** Aware of molecular mechanism underlying in the process of prokaryotic DNA replication.

**CO104.3:** Importance of gene expression (transcription & translation) and their regulations.

## **SEMESTER II**

### **GENETIC ENGINEERING (PSMBTC201)**

Upon the completion of the course students will have knowledge about

**CO201.1:** Genetic engineering and its benefits, Basic principles, the tools and techniques of cloning and gene sequencing.

**CO201.2:** Various vectors for transformation, Advantages and limitations of expression vectors, model organism for gene cloning.

**CO201.3:** Skills of applying genetic engineering technologies in various fields of Biotechnology.

### **ENZYMOLGY (PSMBTC202)**

After completion of the course the students are:

**CO202.1:** Able to understand structure, function and mechanism of action of enzymes in living systems

**CO202.2:** Able to acquire knowledge on enzyme classes and nomenclature, kinetics, role of enzymes in regulation and metabolism

**CO202.3:** Able to apply the knowledge for developing application based technological processes in a variety of areas such as food, feed, pharmaceutical, textile, leather, and others.

### **MOLECULAR VIROLOGY (PSMBTC204)**

In the end of the course, the student should be able to:-

**CO204.1:** Outline the process of viral infection and multiplication, principles of viral pathogenesis

**CO204.2:** Familiarity to different type of diseases causing viruses, Discuss virus-host interactions and host response to viral infections

**CO204.3:** Discuss different types of DNA and RNA viruses infecting animals and human.

**CO204.4:** Discuss different aspects of virus control including conventional as well as modern approaches, host antiviral resistance mechanisms

### **IMMUNOLOGY (PSMBTC205)**

By the end of this course, students should be able to:

**CO205.1:** Understand fundamental concepts of human immune system and basic immunology

**CO205.2:** Identify the cellular and molecular basis of immune responsiveness.

**CO205.3:** Distinguish various cell types involved in immune responses and associated functions

**CO205.4:** Describe the roles of the immune system in both maintaining health and contributing to disease.

**CO205.5:** Differentiate and understand immune responses in relation to infection and vaccination

**CO205.6:** Understand Immune tolerance and principles of autoimmunity

**CO205.7:** Demonstrate knowledge and practice of common immunological laboratory procedures used to detect and measure the immune response

**CO205.8:** Demonstrate knowledge of the mechanisms of T Cell and B cell maturation, activation, and differentiation in cell mediated immune responses

**CO205.9:** The students will be able to transfer knowledge of immunology into clinical decision.

### **MICROBIAL GENETICS (PSMBTC208)**

**CO208.1:** Students will able to explain process involved in genetic changes and mutations

**CO208.2:** Students will understand the molecular mechanisms underpinning replication, copy number control of prokaryotic plasmids and their role in evolution.

**CO208.3:** Students will able to understand the molecular mechanism of transformation, conjugation and transformation and to recognize the diverse types and lifestyles of phages.

**CO208.4:** Genetics of animal viruses and fungi will help to understand the regulatory mechanisms in these organisms.

## **SEMESTER III**

### **MYCOLOGY AND PHYCOLOGY (PSMBTC301)**

In the end of the course, the student should be able to:-

**CO301.1:** Outline the higher taxonomy of fungi and algae

**CO301.2:** Discuss the characteristics of the major classes and orders within fungi and algae

**CO301.3:** Discuss the importance of fungi and algae in various ecological niches.

### **FOOD MICROBIOLOGY (PSMBTC302)**

In the end of the course, the student should be able to:-

**CO302.1:** Outline different microbes important in food microbiology

**CO302.2:** Discuss about the principles and application of different types of food preservation techniques.

**CO302.3:** Discuss the role of microbes in food spoilage

**CO302.4:** Discuss HACCP concept and Hurdle technology

**CO302.5:** Discuss different food borne diseases, their testing methods and preventive techniques.

### **BIOPROCESS ENGINEERING AND TECHNOLOGY (PSMBTC303)**

After completion of the course the students are:

**CO303.1:** Able to apply the principles of engineering and natural science in executing and developing bioprocesses for production of bio-based value-added commercial commodities such as materials food, feed, fuels, pharmaceutical, nutraceutical, biomaterials or biochemicals.

**CO303.2:** Able to design bioreactors, formulate and operate scaled-up bioconversion processes

**CO303.3:** Able to develop process control systems, instrumentation, and modeling.

**CO303.4:** Able to conduct practice-based tasks related to bioprocessing in a responsible, safe, voluntary, self-motivated and ethical manner.

### **IPRS, BIOETHICS AND ENTREPRENEURSHIP DEVELOPMENT (PSMBTC308)**

**CO308.1:** Students will gain knowledge about the basics of the primary forms of intellectual property rights, the right of ownership, scope of protection as well as the ways to create and to extract value from IP.

**CO308.2:** Students will able to analyse the effects of intellectual property rights on society as a whole.

**CO308.3:** Students will able to understand different aspects of bioethical issues arises due to advancement in Microbiology.

**CO308.4:** This course encourages students to take up entrepreneur opportunities in the areas of Microbiology/Biotechnology.

### **NANOTECHNOLOGY IN BIOLOGY (PSMBTC309)**

Upon completion of the course students will know

**CO309.1:** Fundamental principles of nanotechnology, types and properties of various nanoparticles

**CO309.2:** Understand different techniques involved in the synthesis and characterization methods of nanomaterials

**CO309.3:** Comprehensive package of knowledge in food, agricultural, environment, pharmaceutical industries and drug delivery

**CO309.4:** Critiquing nanomaterial safety and toxicology

### **BIOINFORMATICS & BIOSTATISTICS (PSMBTC310)**

By the end of this course, students should be able to:

**CO308.1:** Gain broad understanding in Statistics

**CO308.2:** Recognize importance and value of statistical thinking, training, and approach to problem solving on a diverse variety of Biology

**CO308.3:** Develop an understanding of basic theory of computational tools

**CO308.4:** Gain working knowledge of computational tools and methods and how to use them to critically analyse and interpret results of any study.

**CO308.5:** Describe the contents and properties of most important bioinformatics databases

**CO308.6:** Perform text- and sequence-based searches and analyse and discuss the results in light of molecular biological knowledge;

**CO308.7:** Perform pair wise and multiple sequence alignment, explain the principle and execute pairwise sequence alignment by dynamic programming

**CO308.8:** Predict the secondary and tertiary structures of protein sequences.

**CO308.9:** Describe various approaches in genome sequencing like Sanger, NGS etc.

## SEMESTER IV

### MEDICAL MICROBIOLOGY (PSMBTC404)

**CO404.1:** The student will be able to identify common infectious agents and the diseases that they cause.

**CO404.2:** The student will be able to evaluate methods used to identify infectious agents in the clinical microbiology lab.

**CO404.3:** The student will be able to explain general and specific mechanisms by which an infectious agent causes disease.

**CO404.4:** The student will be able to assess treatment strategies including the appropriate use of antimicrobial agents and common mechanisms of antimicrobial action and resistance.

**CO404.5:** The student will be able to explain interventions employed to prevent infectious diseases including infection control measure and vaccines

### ENIRONMENTAL MICROBIOLOGY (PSMBTC406)

In the end of the course, the student should be able to:-

**CO406.1:** Discuss microbiology of different environmental habitats like soil, water and air with the role of microbes in major biogeochemical cycles

**CO406.2:** Outline the methods to analyze air and water quality and how microbes cause diseases.

**CO406.3:** Discuss different types of waste and the role of microbes in solid and liquid waste management.

**CO406.4:** Discuss the role of microbes in biodegradation and bioremediation of major environmental pollutants.

**CO406.5:** Outline the microbes involved in biodeterioration of economically important products.

### DISSERTATION (PSMBDC408)

Course Outcomes at the end of the dissertation the students will be trained in:

**CO408.1:** M. Sc. Dissertation is designed in a way to teach and train the students with practical knowledge in the different areas of microbiology in order to become efficient researchers to start their carrier in research through Ph.D. and R & D programmes.

**CO408.2:** Students would gain training in the research areas selected from different fields like Cell biology, Bacteriology and virology, Biochemistry and metabolism, molecular Biology, genetic engineering, Enzymology, Microbial genetics and virology, immunology, mycology and phycology, Food microbiology, nanotechnology in biology, bioinformatics and statistics, IPR etc.

**CO408.3:** Students can develop understanding about the literature survey, presenting the published research work via journal clubs, review paper and dissertation writing during their Ph.D.

**CO408.4:** Hands on training on various scientific equipment for performing their research work.

#### **4. JOURNAL CLUB (PSMBDC402)**

**CO402.1:** Select, read and understand current research topics which enhance their scientific temperament.

**CO402.2:** Enhance their paper presentation and group discussion skills.

**CO402.3:** Stimulate academic debate which helps in defending their research topics.