

M.Sc. Biotechnology (2022-23)

Course Outcome's

SEMESTER 1

1. Cell Biology (PSBTTC101)

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 signalling, communication, cell growth, division, cell cycle and its regulations
- CO101.4: Brief idea of cellular basis of differentiation and development.

2. General and Applied Microbiology (PSBTTC102)

After completing the course, students will able to:

- CO102.1: Know general bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae
- CO102.2: Understand the microbial diversity, taxonomy and nomenclature of microorganisms
- CO102.3: Learn about the morphological and physiological characteristics of different groups of microorganisms
- CO102.4: Understand use of microbial technology in areas of food, medicine, agriculture, environment etc.

3. Biochemistry and Metabolism (PSBTTC103)

- 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.

4. **Molecular Biology (PSBTTC109)**

- CO104.1: Understands the genomic organization of living organisms, study of genes, genome and 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 2

1. **Genetic Engineering (PSBTTC210)**

Upon the completion of the course students will have knowledge about

- CO210.1: Genetic engineering and its benefits, Basic principles, the tools and techniques of cloning and gene sequencing.
- CO210.2: Various vectors for transformation, Advantages and limitations of expression vectors, model organism for gene cloning.
- CO210.3: Skills of applying genetic engineering technologies in various fields of Biotechnology.

2. **Enzymology (PSBTTC202)**

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.

3. **Genetics and Genomics (PSBTTC211)**

- CO211.1: This course will help the students to understand the basic principles of inheritance and gene interaction and also to interpret the inheritance of characters using linkage and crossing over.
- CO211.2: The course will make student understand the reason behind the cause of mutations and transposition which results in altered phenotypes in the population, leading to variations.
- CO211.3: The course provides an understanding of different methods used in cytogenetics along with the concept of maternal inheritance.
- CO211.4: The advanced techniques to be used in molecular biology and genomics which will be utilized by students in genetic and physical mapping of chromosomes, comparative genomics and genome analysis.

4. **Molecular Virology (PSBTTC204)**

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

- CO204.1: Outline the process of viral infection and multiplication
- CO204.2: 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.

5. **Immunology (PSBTTC205)**

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

6. Research methodology and Scientific communications (PSBTTC213)

By the end of this course:

- CO213.1: Understand the various types of tools and techniques used in scientific communications.
- CO213.2: Students will know the various components of research papers.
- CO213.3: Students will know how to do plagiarism check using various plagiarism software like Urkund, Turnitin etc.
- CO213.4: Students will know about the various ethical issues associated scientific writing and communication.

SEMESTER 3

1. Plant Biotechnology (PSBTTC301)

- CO301.1: This course deals with biotechnological aspects of different methods used in plant tissue culture which ensures the production of economically important viable plants on vegetative mode in a less time duration, as compared to the conventional methods.
- CO301.2: The course provides an understanding of different methods used in protoplast isolation and fusion and need for the conservation of germplasm using cryopreservation.
- CO301.3: The course discusses about cloning vectors and genetic transformation using direct and indirect different methods of gene transfer in plants. They will also learn about trans gene stability and gene silencing.
- CO301.4: The course discusses about different applications of genetic transformation in plant productivity and performance. Students will become familiar about the production of sterile seeds using terminator gene technology.
- CO301.5: The course will help the students to acquire knowledge about plant primary and secondary metabolites and regulation of metabolic pathways. Students will become familiar with a broad range of molecular markers and will thus develop platform for molecular breeding experiments.

2. Bioprocess Engineering (PSBTTC302)

After completion of the course the students are:

- CO302.1: 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.

- CO302.2: Able to design bioreactors, formulate and operate scaled-up bioconversion processes
- CO302.3: Able to develop process control systems, instrumentation, and modeling.
- CO302.4: Able to conduct practice-based tasks related to bioprocessing in a responsible, safe, voluntary, self-motivated and ethical manner.

3. **IPRs, Bioethics and Entrepreneurship Development (PSBTTC304)**

- CO304.1: 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.
- CO304.2: Students will be able to analyze the effects of intellectual property rights on society as a whole.
- CO304.3: Students will be able to understand different aspects of bioethical issues arising due to advancement in Biotechnology.
- CO304.4: This course encourages students to take up entrepreneur opportunities in the field of Biotechnology.

4. **Bioinformatics and Biostatistics (PSBTTC308)**

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 analyze 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 analyze 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.

5. **Nano technology (PSBTTC317)**

Upon completion of the course students will know

- CO317.1: Fundamental principles of nanotechnology, types and properties of various nanoparticles
 - CO317.2: Understand different techniques involved in the synthesis and characterization methods of nanomaterials
 - CO317.3: Comprehensive package of knowledge in food, agricultural, environment, pharmaceutical industries and drug delivery
 - CO317.4: Critiquing nanomaterial safety and toxicology
6. Project writing (PSBTTC316):
Upon completion of the course students will understand:
- CO310.1: The process of selection of research topic according to their interest, and expertise and resources available.
 - CO310.2: Ways of devising research questions, goals, approach, methodology, data collection, etc.
 - CO310.3: How to present their research work in form of poster and oral presentation

SEMESTER 4

1. Environmental Biotechnology (PSBTTC404)

Upon the completion of the course students will have knowledge about

- CO404.1: Components of environment, different types environmental pollution and issues related to global environmental change.
- CO404.2: Conventional and non-conventional sources of energy
- CO404.3: Microbiology and methods implemented to carry out waste water treatment
- CO404.4: Solid waste management, concept of composting and soil erosion
- CO404.5: Microbial intervention in mitigating the environmental pollution including the concept of bioremediation, biodegradation, biopollution, biomining.

2. Animal Biotechnology (PSBTTC403)

- CO403.1: This course is designed to give students a perspective on cutting edge biotechnologies that can be used for animal and human health and research.
- CO403.2: Course enable them to develop basic skills for cell culture, maintenance of cell lines and various media used for cell culturing
- CO403.3: Enable to understand the principles of animal cloning, tissue engineering, stem cell technology, animal reproductive biotechnology and their applications

3. Dissertation (PSBTDC406)

- CO408.1: Students will have theoretical and practical knowledge in the different areas of Biotechnology to start their carrier in research through Ph.D. and other R & D programmes.
- CO408.2: students will be able to select Research topics from different fields like animal biotechnology, microbiology, environmental biotechnology, genetic engineering, plant biotechnology, parasitology, virology, nanotechnology and *in-silico* identification and validation of novel proteins.
- CO408.3: Students will be able to develop understanding about the relevant literature search, reading and dissertation writing.
- CO408.4: Students will able to create, analyze and critically evaluate different technical/research solutions.
- CO408.5: Students will able to find the resources needed to perform the research methodology and presenting their findings.

4. **Journal Club (PSBTDC402)**

- 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.