छत्रपति शाहू जी महाराज विश्वविद्यालय, कानपुर

CHHATRAPATI SHAHU JI MAHRAJ UNIVERSITY, KANPUR

(पूर्ववर्ती कानपुर विश्वविद्यालय कानपुर)

Formerly Kanpur University, Kanpur – 208024

A Documentary Support

For

Metric No. – 1.1.1

Programme Outcomes & Course Outcomes

Under the

Criteria - I

(Curriculum Design and Development)

Key Indicator - 1.1

In

Metric No. – 1.1.1

B.Sc. (Hons.) Biological Science

Co-ordinator
Internal Quality Assurance Cell
CSJM University, Kanpur

(Registrar)
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REGISTRAR
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B. Sc. (H) Biological Sciences

Program Outcomes (POs)

PO1: In this course, students will learn how to apply sound theoretical, experimental knowledge to jobs in health and bioprocess technology, food technology, nanotechnology, environmental biotechnology and related multidisciplinary areas.

PO2: The program will enhance the subject knowledge of students by using traditional and modern ICT based teaching methods and learning by doing.

PO3: Identify and critically analyse relevant problems in biological sciences, and scientific discipline using appropriate tools and techniques as well as explore and work on approaches to address conclusions/solutions.

PO4: To enrich students' knowledge and train them in various branches of Biological Sciences such as genetics, molecular biology, biochemistry, immunology, fermentation technology, environmental biotechnology and tissue culture techniques.

PO5: To develop the zeal and ability to work safely and effectively in a laboratory. Acquire knowledge in technical and scientific areas to identify research problems, design experiments, use appropriate methodologies, analyse and infer the data and explore the solutions. The program will also enhance the ability of organizational skills and management of time and resources.

PO6: The program will enhance the skills to effectively accomplish tasks independently and as a team member in multidisciplinary areas of research and development.

PO7: Through B.Sc. Biological Sciences program, students will learn how to write dissertations, reports, make effective presentations, and document their findings. In addition to that, the program will teach students how to communicate effectively with both scientists and the general public.

PO9 Program has a very important part to learn and develop professional ethics and responsibility and serve the society.

B. Sc. (H) Biological Sciences

Programme Specific Outcome

At the end of the programme, the student will be able to

PSO1: To provide students with all the research skills they need to work independently.

PSO2: To develop scientific temperament and social responsibilities in the students.

PSO3: To impart knowledge of advanced modern techniques.

PSO4: To empower the students to acquire technical knowledge by connecting disciplinary and interdisciplinary aspects of Biological Sciences.

PSO5: Provide students with knowledge that will enable them to apply their knowledge in industry and research.

PSO6: Development of scientific outlook not only with respect to science subjects but also in all aspects related to life

M.Sc. Biological Sciences (Four-Year)

Course Outcomes

BBS 101 (CC-1) : Cell Biology

Course Outcome (CO)	Description
CO-1	This course introduces the students to the basics of cell and its components.
CO-2	This gives them a strong foundation on the basic unit of life.
CO-3	Through the course, student builds a strong foundation on the functions of the cell.
CO-4	Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
CO-5	Students will understand how these cellular components are used to generate and utilize energy in cells

BBS 102 (CC-2) : General Biochemistry I

Course Outcome (CO)	Description
CO-1	The course will facilitate learning on chemical and molecular foundations of life and the role of energy rich compound in biological systems.
CO-2	The course offers enhanced learning of structure, classification, role and function of macromolecules for example, sugar and polysaccharides, amino acids and proteins, lipids and nucleic acids
CO-3	The course provides enhanced understanding of signaling molecules and pathways.
CO-4	The course provides advance learning on different vitamins, coenzymes and their metabolism

BBS / AECC 101 : English Communication I

Course Outcome (CO)	Description
CO-1	To develop effective communication and vocabulary skills in students.
CO-2	To develop and integrate the use of the four language skills i.e. reading, listening, speaking and writing.

BBS GE-101 A: Development Biology

Course Outcome (CO)	Description
CO-1	To provide a comprehensive understanding of the concepts of gametogenesis and development.
CO-2	to understand the molecular, genetic, cellular, and integrative aspects of building an organism.
CO-3	To understand how gene expression controls the process of development;
CO-4	Fundamental understanding of the processes that control embryonic development, differentiation and organogenesis.

BBS GE-101 B: Plant and Animal Diversity

Course Outcome (CO)	Description
CO-1	To demonstrate knowledge of the principles of plant and animal nomenclature and terminology.
CO-2	The study structural and functional specialization in plants.
CO-3	The study structural and functional specialization in animals.
CO-4	To learn elements of human system physiology by covering alimentary, circulatory, excretory and nervous systems.

Semester 2:

BBS 201 (CC-3): Mammalian Physiology

Course Outcome (CO)	Description

CO-1	The course will cover fundamental mechanisms that operate in a living organism and how they interact.
CO-2	In this course, students will examine basic concepts of mammalian physiology, including membrane biology, protein structure as applied to the structure of transmembrane transport proteins, cellular excitability and neuronal signalling.
CO-3	The course will also cover mechanisms of muscle physiology, sensory-motor integration, blood and fluid mechanics, cardiovascular physiology and regulation, gas transport and control of respiration, digestive system function, renal physiology and electrolyte homeostasis, endocrine function, growth and metabolism.
CO-4	The course will also cover how body maintains conditions within a narrow range of values in the presence of a continually changing environment.

BBS 202 (CC-4): Plant Physiology

Course Outcome (CO)	**Description**
CO-1	This course aims to educate student about the mechanism and physiology life processes in plants
CO-2	The course also focuses on the plant nutrient uptake and translocation, photosynthesis, respiration and nitrogen metabolism. and are able to coordinate the various processes.
CO-3	This course aims at making the students acquainted with the fundamentals and present understanding of the mechanisms associated with development, differentiation and structure of various plant organs, the metabolic and physiological changes occurring in them.
CO-4	The course also covers the studies on plant growth and development.

BBS / AECC 201 : English Communication II

Course Outcome (CO)	**Description**
CO-1	To develop effective and advanced communication and vocabulary skills in the students
CO-2	To develop advanced use of the four language skills i.e., reading, listening, speaking and writing and their use in conducting research, presentations and publications

BBS / GE 201 A: Stress Biology

Course Outcome (CO)	Description
CO-1	The course is designed to provide fundamental insights into the understanding of responses of plants to abiotic and biotic stresses.
CO-2	The course also illustrates knowledge of stress adaptations in biological systems.
CO-3	This course is designed to help students integrate and better understand stress sensing different mechanisms in plants.
CO-4	The course is useful to understand different production of oxidants and learning different scavenging mechanism.

BBS / GE 201 B: Bioprocess technology

Course Outcome (CO)	Description
CO-1	The course outcome is to train the students in understanding of bioprocess technology and its chronological development.
CO-2	The course also provides thorough knowledge of the underlying principles of main bioprocess unit operations like fermentation, and downstream processing
CO-3	The course also develops a critical learning in students to grasp how lab scale methods transform into large scale, and how main unit operations in downstream processing
CO-4	The course will make students acquire advanced knowledge about factorial experimental set up and gradually learn designing of experiments.

Semester 3

BBS 301 (CC5): Intermediary Metabolism

Course Outcome (CO)	Description
CO-1	Intermediary metabolism is the subfield of biological sciences that covers highly integrated network of biochemical reactions that provides cells with forms of energy for immediate use (i.e., metabolic energy), reducing power and biosynthetic intermediates.

CO-2	The course explains the role of catabolic and anabolic pathways in cellular metabolism.
CO-3	Distinguish between exergonic and endergonic reactions in terms of available energy change.
CO-4	Describe the structure of ATP and identify the major class of macromolecules to which ATP belongs.

BBS 302 (CC6): General Microbiology

Course Outcome (CO)	**Description**
CO-1	This fundamental paper discusses the importance of microorganisms.
CO-2	The course throws light on types of microorganisms in and around humans
CO-3	The student will learn the metabolism and mechanism of microbial life
CO-4	The course demonstrates the contribution of the microbiologists and the microbiology laboratory to the diagnosis of infection including specimen collection.
CO-5	To illustrate the characteristic features of microorganisms and the disease they cause. The course also facilitates learning of different methods to control microorganism growth.

BBS 303 (CC7): Fundamentals of Genetics

Course Outcome (CO)	**Description**
CO-1	Through this course, students will gain a basic understanding on human genetics and hereditary. The student will learn Mendelian genetics and deviations from Mendelian analysis.
CO-2	Discussing the progression of discovery from Classical to Modern Genetics.
CO-3	The student will demonstrate knowledge of the mechanisms of genetic change through DNA mutation and repair, methods to detect mutation, variations in chromosome number and structure to phenotypic variations.
CO-4	Relating the chromosomal basis of inheritance, comparing contrasting genes, chromosomes, genome and describing gene linkage.

BBS / SEC 301 A: Fermentation Technology

Course Outcome (CO)	Description
CO-1	This course will help students to acquire basic knowledge of fermentation process and industrial application of microbes for the production of useful products.
CO-2	Students will learn sterilization of air and medium; sterilization of fermenter, thermal death kinetics of microorganisms.
CO-3	The course aims to provide fundamental insights to exploit microbes for manufacturing of products which have huge industrial significance.
CO-4	The course blends science and engineering with various biochemical processes to obtain products such as food, chemicals, vaccines, and medicine.
CO-5	The student will have a better appreciation for the role of microbes in industry using technology.

BBS / SEC 301 B: Enzymology

Course Outcome (CO)	Description
CO-1	To learn about general properties of enzymes like activation energy, active site, etc.; definition of enzyme activity and its various units; classes of enzymes and international nomenclature, the types of enzyme assays; and the various kinds of techniques employed for purification.
CO-2	It helps the students to learn the methodology involved in assessing the enzyme activity and mechanism of enzyme action.
CO-3	It illustrates the enzyme catalysis, kinetics and regulatory aspects.
CO-4	It helps the students to learn the significant features of the biochemical catalysts.
CO-5	Describes multienzyme complexes and isozymes.

Semester 4

BBS-401 (CC8): Environmental Biology

Course Outcome (CO)	Description

CO-1	The students in the course are exposed to the diversity, function, ecological adaptation of microorganisms within the environment.
CO-2	This course gives the importance of microbial life to key ecosystem process and teaches the role of biotechnology to address environmental issues.
CO-3	The course will acquaint the students with the various environmental hazards like environmental pollution, greenhouse effect and ozone layer depletion.
CO-4	Development of understanding on ecology and environmental biology
CO-5	Appreciate the inter-relationship between organism in population and communities.
CO-6	Understand principles of toxicology and the harmful effects of toxic metals on humans and environment.

BBS-402 (CC9): Biophysical Chemistry and Techniques

Course Outcome (CO)	**Description**
CO-1	Students learn about various analytical techniques that are routinely used for separation of biomolecules and their components.
CO-2	The objective of this course is to familiarize students with the basic concepts and applications of modern techniques used in Biochemistry, Biophysics, Cell and Molecular Biology.
CO-3	To learn the application of different techniques and tools in different areas of scientific research.
CO-4	The students will be able to understand the principle and working of different chromatography techniques.
CO-5	To understand the principle and working of different centrifugation techniques.
CO-6	The students will grasp deep understand on the principle and working of different electrophoretic and molecular biology techniques.

BBS-403 (CC10): Biostatistics

Course Outcome (CO)	**Description**
CO-1	This course imparts the knowledge of basic statistical methods to solve problems.
CO-2	Students will learn to operate various statistical software.

CO-3	The students will be better prepared for careers in research by understanding the importance of statistics in research.
CO-4	To construct knowledge about the various applications of software and statistics to the students.
CO-5	Solve mathematical and statistical problems individually and with fellow classmates.

BBS / SEC-401 A: Intellectual Property Rights (IPR)

Course Outcome (CO)	**Description**
CO-1	To recognize the importance of IP and to educate the people on basic concepts of Intellectual Property Rights.
CO-2	To learn the procedure of obtaining patents, copyrights, trademarks and industrial design.
CO-3	This course is aimed at familiarizing researchers with the nuances of IPR so as to help them integrate the IPR process in their research activities.
CO-4	Facilitate the exploration of career options in the field of intellectual property rights.
CO-5	To provide training in literature, including patent search and documentation of research activities that would aid an IPR expert to draft, apply and prosecute IPR applications.

BBS / SEC-401 B: Molecular Diagnosis

Course Outcome (CO)	**Description**
CO-1	The main objective of the course in Molecular Diagnostic is to make the student familiar to the procedures used in a Laboratory of Molecular Diagnostics.
CO-2	The course will describe the techniques commonly used in diagnostics and molecular biology laboratories and the underlying principles and applications, advantages and limitations of each technique.
CO-3	Develop critical thinking skills to trouble shoot problems as they occur and determine possible causes.
CO-4	Learn to utilize appropriate safety equipment and procedures according to established laboratory protocol and regulatory compliance.

Semester 5

BBS- 501 (CC-11) : Molecular Biology

Course Outcome (CO)	Description
CO-1	This course introduces students to molecular biology, which involves interactions between various systems of the cell, including those between DNA, RNA, and proteins.
CO-2	It deals with understanding the molecular aspects of the biology.
CO-3	To gain an understanding of biochemical and molecular processes that occurs in and between cells.
CO-4	To learn and acquire knowledge on tools and techniques related to molecular biology.
CO-5	To develop ability to design and implement experimental procedures using relevant techniques.

BBS- 502 (CC-12) : Immunology

Course Outcome (CO)	Description
CO-1	It trains the students with essentiality of molecules, cells, tissues, and organs involved in the defence mechanism.
CO-2	The course provides information and understanding of immunology and its application to diagnostics.
CO-3	An important aspect of this course is the learning of techniques used in understanding immunological aspects of both physiology and biological samples.
CO-4	As a result of this course, students will be able to describe how the immune system maintains health as well as contributes to disease. Furthermore, students will be able to identify the cellular and molecular basis of immune response and vaccine biology.
CO-5	The students will be able to describe immunological response and how it is triggered and regulated.
CO-6	The students will be able to transfer knowledge of immunology into clinical decision- making through case studies presented in class.

Discipline specific electives:

BBS / DSE 501 A: Bioinformatics

Course Outcome (CO)	Description
CO-1	It provides an introduction to selected important topics in biostatistical concepts and reasoning.
CO-2	This course represents an introduction to the field of data and data types.
CO-3	The students learn specific topics including tools for describing central tendency and variability in data; statistical hypothesis testing and its application to group comparisons; issues of power and sample size in study designs; and random sample and other study types.
CO-4	To understand the alignment between two sequences.
CO-5	To demonstrate the role of bioinformatics in genomics and proteomics

BBS / DSE 501 B: Advanced Genetics

Course Outcome (CO)	Description
CO-1	The course outcome is to train the students in understanding genetics and relate modern genetics technology for disease diagnostics and therapy.
CO-2	To learn the modern epigenetics processes, function and related diseases.
CO-3	To know and assess the social scope of some aspects of research in advanced genetics.
CO-4	Comprehensive and detailed understanding of genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.
CO-5	Understanding the role of genetic mechanisms in evolution.
CO-6	Insight into the mathematical, statistical, and computational basis of genetic analyses that use genome-scale data sets in advanced genetics biology settings.

BBS / DSE 501 C: Genomics and Proteomics

Course Outcome (CO)	Description

CO-1	This course aims to provide students with an overview of the fundamental technological concepts of genomics, functional genomics and proteomics methods using real-world approaches.
CO-2	The course also teaches the techniques used in functional genomics such as microarrays, NGST, mRNA expression and miRNA expression.
CO-3	Students will have the necessary learning to advance techniques and understanding of life and transform medicine.

Semester 6

BBS 601 (CC-13) : Principal and Methods of Genetic Engineering

Course Outcome (CO)	**Description**
CO-1	This core-course introduces students to versatile tools and techniques used in genetic engineering.
CO-2	This course provides theoretical bases to properties and applications of versatile DNA modifying enzymes, cloning strategies, vector types, host genotype specificities for selection and screening of recombinants and/or recombinant transformants.
CO-3	Introduction to various types of vectors viz. cloning, transformation, expression; and also vectors for genomic and cDNA library and whole genome sequencing will be provided
CO-4	A critical appraisal of methods for site-directed mutagenesis and sequencing of cloned genomic fragments will also be covered.
CO-5	The students will be familiarized to software permitting in-silico manipulation and annotation of DNA sequences for efficient design, tracking, and management of cloning experiments in the laboratory.

BBS 602 (CC-14) : Environmental Biotechnology

Course Outcome (CO)	**Description**
CO-1	The students in the course are exposed to the diversity, function, ecological adaptation of microorganisms within the environment.
CO-2	This course gives the importance of microbial life to key ecosystem process and teaches the role of biotechnology to address environmental issues.

CO-3	The students will be able to analyze case studies representatives of key areas of environmental biotechnology.
CO-4	The students will be able to learn treatment of waste and industrial effluents.

BBS / DSE 601 A: Fundamentals of Food Technology

Course Outcome (CO)	**Description**
CO-1	To provide knowledge and skills for better preservation techniques, processing and value addition to different products.
CO-2	To promote research and development for food product and process and guarantee sanitation and safety of processed food items.
CO-3	To gain knowledge about the beneficial role of microorganisms and different types of fermented foods.
CO-4	To know the important genera of microorganisms associated with food and their characteristics. To understand the role of microbes in fermentation, spoilage and food borne diseases
CO-5	To develop knowledge of toxicants that are associated with both plant and animal foodstuffs that occur as natural constituents and contaminants

BBS / DSE 601 B: Basics of Nanotechnology

Course Outcome (CO)	**Description**
CO-1	Understand the use of basic quantum concepts for describing nano systems and processes.
CO-2	Understand basic properties of nanoparticles and learn application of nanomaterials with novel behaviour.
CO-3	Discuss the Nanostructure catalytic materials, colloidal and porous materials and applications.
CO-4	Understand driving forces towards using nanoscale technology in devices and system, the advantages and implications of scaling down devices.

BBS / DSE 601 C: Environment Monitoring and Toxicology

Course Outcome (CO)	Description
CO-1	To study chemicals effects on human health and the environment, applying principles of biology, chemistry and epidemiology.
CO-2	The course is multidisciplinary field of science concerned with the study of the harmful effects of various chemical, biological and physical agents on living organisms.
CO-3	It deals with the study of the harmful actions of chemical substances on biological material.

Semester 7

BBS 701 A (CC-15): Applied Biochemistry

Course Outcome (CO)	Description
CO-1	To acquire the concept of the relationship between structure and function of biomolecules, especially proteins.
CO-2	To learn from the theoretical point of view of the fundamental principles of the main techniques used in a biochemical laboratory, paying particular attention to the techniques used in the purification of proteins, immunochemistry and radiochemistry.
CO-3	To understand the metabolic pathways of catabolic type used to obtain energy from the degradation of biomolecules
CO-4	To learn the principal and usage of new molecular immunology techniques and immunoassays.

BBS 701 B (CC-15): Applied Environmental Science

Course Outcome (CO)	Description
CO-1	Understand and evaluate the global scale of environmental problems.
CO-2	Demonstrate an integrative approach to environmental issues with a focus on sustainability
CO-3	To develop critical thinking on interconnected and interdisciplinary nature of environmental studies.

BBS 701 C (CC-15): Applied Microbiology

Course Outcome (CO)	Description
CO-1	To acquire the concept and roles of microbes in industrial and food processes
CO-2	To gain knowledge of traditional microbiological techniques to the utilization and control of microorganisms.
CO-3	To acquaint students with healthcare, forensic science, environmental, food and drink, pharmaceuticals and many other industries related to applied microbiology.
CO-4	To train and sensitize the students to scope for research in applied Microbiology, Fermentation Technology, Agriculture and Environmental Microbiology.

BBS 701 C (CC-15): Applied Food Technology

Course Outcome (CO)	Description
CO-1	The learner will gain advance knowledge of food and its microbiological aspects in term of quality and spoilage activity along with structural composition, nutrient value and biological value and their mechanisms.
CO-2	To learn symptoms as well as detection of food borne diseases along with fundamental knowledge of toxins.
CO-3	Understand advance technologies and packaging of food.

BBS 702 (CC-16): Research Methodology

Course Outcome (CO)	Description
CO-1	Demonstrate the ability to choose methods appropriate to research aims and objectives.
CO-2	Understand the limitations of particular research methods.
CO-3	Develop skills in qualitative and quantitative data analysis and presentation. Develop critical thinking to troubleshoot research problems.
CO-4	Develop advanced critical thinking skills in research and development.

Semester 8

BBS 801 (CC-17): Research Project and Dissertation

Course Outcome (CO)	Description
CO-1	To develop independent research skills in students.
CO-2	To provide the opportunity to delve deeper into an interested area by students.
CO-3	Demonstrate appropriate referencing and develop skills in other aspects of academic writing.