

St. Xavier's College

Burdwan

Department of Biotechnology



Program Specific Outcomes

Program Outcomes

Course Outcomes

(CBCS)

Name of the Programme: Biotechnology

Programme Specific Outcomes; Programme Outcomes; Course Outcomes

The Department of Biotechnology at St. Xavier's College, Burdwan, started its journey in 2014, with the opening of the college. This department is one of the leading departments of the college in teaching and learning of advances in biological science. The department provides well equipped infrastructures and sophisticated instrumentation facilities to the students to conduct their experiments.

Vision and Mission:

VISION

- To nurture outstanding young minds for advancing Biotechnology's emerging sectors.

MISSION

- Develop future-ready professionals in Biotechnology through customized learning and experiential training.
- Educate skilled personnel proficient in Biotechnological methods to undertake
diverse research challenges in the field.
- Foster an academic environment that encourages intellectual inquiry and research curiosity.

Programme Specific Outcomes (PSOs)

PSO1- Provides students with the concepts and research approaches for their higher career in the field of biotechnology and develops their scientific interest.

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PS02- Imparts in-depth practical oriented knowledge to students in various thrust areas of biotechnology, so as to meet the demands of industry and academia.

Program Outcomes (POs)

The graduates of this degree programme will be able to:

PO1- Demonstrate their knowledge of biotechnology concepts

PO2- Familiar with the technologies through an interdisciplinary learning habit.

PO3- Develop an independent thinking ability on the subject.

PO4- Possess technical knowledge and hands-on skills necessary for biotechnology research activity.

PO5- Meet the needs of the thrust areas of future bioscience.

PO6- Enable the students to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes

CC1 - Biochemistry and metabolism:

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Students who successfully complete this course will be able to:

CO1: Realize about the biological significance of the major biomolecules such as amino acids, proteins, carbohydrates, lipids and nucleic acids.

CO2: Understand the structural and functional aspects of the biomolecules and their interactions that will enable them for better understanding of the physiological processes of our body.

CO3: Develop the understanding of the process of metabolism and its intricacies.

CO4: Characterize the features of various biomolecules and identify their presence in the samples using different biochemical assays.

CC-2 - Cell Biology

Students who successfully complete this course will be able to:

CO1: Understand various biological processes become deeper and inclusive.

CO2: Describe the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.

CO3: Understand and explain the entire cell cycle.

CO4: Describe the basis of carcinogenesis and characteristics and molecules basis of cancer

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CC3 - Mammalian Physiology:

Students who successfully complete this course will be able to:

CO1: Understand the basic physiological processes such as nutrition, respiration, circulation, hormonal function, stimulation and muscle activation.

CO2: Learn in depth the structure and function of tissue and organ system and understand their interactions and interrelationship.

CO3: Realize the mechanism of synchronization of the biological functions of different systems and their interrelationship and interdependence.

CO4: Describe the mechanism of maintenance of integrity of the skeletal system, endocrine system and nervous system.

CC4 - Plant anatomy and physiology:

Students who successfully complete this course will be able to:

CO1: Understand plant anatomical structures at root and shoot levels and their functioning.

CO2: Show their interest in topics related to interactions of water and micronutrients in plants and their physiological significance.

CO3: Understand the plant metabolic regulation and cycles that control plant energy generation and utilization.

CO4: Demonstrate the experiments on photosynthesis, mechanism of stomatal opening and closing, checking the viability of seeds etc.

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CC5 - Genetics:

Students who successfully complete this course will be able to:

CO1: Understand the hereditary material and its significance in the modern biological science.

CO2: Realize how the concept evolved from the chromosome to gene and the process of control of different metabolic features

CO3: Know the factors involved in the process of heredity regulation and understand the concept of allele, phenotype, genotype etc. which are the prerequisite for understanding molecular biology

CO4: Grasp some knowledge on Chromosome and gene mutations, Genetic linkage, crossing over and chromosome mapping.

CC6 - General Microbiology:

Students who successfully complete this course will be able to:

CO1- Gain detailed knowledge on the history of microbiology and the importance of microorganisms in different fields, in day to day life.

CO2- Provide the students an insight into the structure and function of various microbial structural details and their significance in microbial systems.

CO3- Sensitize the students on topics related to microbial growth, their control, metabolism and their regulation for utilization and generation of cellular energy.

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C04- Provide hands on training on microbial laboratory related techniques for their isolation, characterization and growth related studies.

CC7- Chemistry -I:

Students who successfully complete this course will be able to:

CO1: Apply various laws of thermodynamics to various processes and real systems.

CO2: Understand and evaluate fundamentals of electrochemistry, the electrochemical processes, electrodes and cells, express the electrodes materials, explains electrode materials, discuss electrode potentials and cell thermodynamics, explain the type of electrodes.

CO3: Understand the concept of rate of change associated with chemical reaction, recognizing that the rate of change and how it can be measured.

CO4: Define radioactive decay processes and nuclear radiation and know the principles of utilizing radioactivity applied to chemistry, chemical processes and adjacent fields where chemistry is an integral part.

CC 8 - Molecular Biology

Students who successfully complete this course will be able to:

CO1: Possess the various concepts of modern biology in the recent status at the molecular level.

CO2: Understand the genetic materials such as DNA and RNA of the living beings and their structure, configuration and role within the living cell.

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CO3: Help the students to know the process of Central dogma comprising DNA replication, Transcription and Translation all of which are critical for cell survival and existence.

CO4: Know the process of post transcriptional and post translational modification of RNA and protein.

CC 9 - Immunology:

Students who successfully complete this course will be able to:

CO1: Describe the basic concept of immunology, immunogen, antigen and antibody and other related terms.

CO2: Explain the how the immune systems works to protect our body from various infectious diseases.

CO3: Discuss about differences in immune response in cellular and humoral immunity.

CO4: Develop the concept on vaccination and several immunoassays for disease diagnosis and implement the theoretical knowledge in practical approach.

CC 10 - Chemistry-II

Students who successfully complete this course will be able to:

CO1: Explain the importance of hydrocarbons and the reason for their diversity, IUPAC nomenclature, saturated and unsaturated hydrocarbons, and molecules derived from them.

CO2: Understand the general structure for an alcohol, identify the structural feature that classifies alcohols as primary, secondary or tertiary and name alcohols with both common names and IUPAC names.

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CO3: Prepare alcohol, phenol and ethers along with their chemical properties.

CO4: Identify stereogenic centres in organic molecules and distinguish between different types of isomers, including enantiomers and diastereomers.

CO5: Predict and account for the most commonly encountered reaction mechanisms in organic chemistry and able to differentiate between aliphatic and aromatic compounds along with their various properties and reaction mechanism.

CC 11 – Bioprocess technology

Upon completion of the course, the student will be able to:

CO1: Acquire strong theoretical knowledge on upstream and down-stream process of fermentation technique.

CO2: Clear idea about the design and the various components of Bioreactors.

CO3: Understanding on various types of fermenters and their uses.

CO4: Gain knowledge on type of microbial culture and its growth kinetics.

CC 12 – Recombinant DNA Technology

Upon completion of the course, the student will possess:

CO1: The idea on different sophisticated tools involved in molecular biology, detailed overview of PCR and its different types.

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CO2: Knowledge on various steps involved in gene manipulation and cloning using restriction modification systems.

CO3: The concept of mutation, mutagenesis and basic genetic engineering methods for generation of genetically modified organisms. **CO4:** Strong knowledge on gel electrophoresis techniques

CC 13 - Bio-analytical Tools

Students who successfully complete this course will be able to:

CO1: Understand the principle and application of various instruments.

CO2: Perform selected analytical techniques.

CO3: Understand the operation of the compound microscope and the transmission and scanning electron microscopes.

CO4: Describe the basic components of the various spectrophotometers and discuss some use of each using appropriate terminology.

CC-14- Genomics & Proteomics

After successful completion of the paper, the students will be able to

CO1: Understand the various concepts associated with Genomics.

CO2: Comprehend the applications of genomics and proteomics in varied fields.

CO3: Understand the characteristics of various genes & genomes.

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CO4: Explain the importance of using mass spectrometry in genomics and proteomics.

DSE1- Animal Biotechnology

Students who successfully complete this course will be able to:

CO1: Know the modern developments and concept of Zoology highlighting their applications aiming for the benefit of human being.

CO2: Understand the modern tools and techniques and their specific application for a particular purpose in the field of industrial and pharmaceutical domain.

CO3: Know the new domain of transgenic biology where they will show their approaches and attempts of cloning which is one of the most recent developments of biology.

CO4: Know the practical difficulties, hazards, and ethical issues concerned with the process of transgenic biology and cloning.

DSE1- Plant Biotechnology

Students who successfully complete this course will be able to:

CO1: Understand the role of plants in human welfare and know about the utility of plant resources with a holistic approach

CO2: Have clear idea on plant tissue culture techniques which will further help them in future research on plant biotech.

CO3: Get a detailed insight about different microbial plant symbiosis that helps in plant growth promotion that has vast agricultural implications.

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CO4: Conduct experiments on plant tissue culture in various aspect such as *In-vitro* propagation, cell culture, protoplast culture and somatic hybridization etc.

DSE-2- Bioinformatics

After successful completion of the paper, the students will be able to

CO1: Understand the importance and significance of DNA sequencing.

CO2: Comprehend the applications of homology in bioinformatics.

CO3: Analyse the use of bioinformatics in Human genome.

CO4: Explain the importance of studying the structure of proteins in drug designing.

DSE3- Medical Microbiology

After successful completion of the paper, the students will be able to

CO1: Learn about different microorganisms that are useful to us (Normal flora) as well the pathogenic microbe that harms the population.

CO2: Provide proper insight about different pathogens, their morphology and mechanism of action and symptoms of diseases.

CO3: Sensitise on specific viral, bacterial and fungal diseases that has enthralled the human population, their basic understanding and cure.

CO4: Provide hands on practice to microscopically identify different pathogens by staining and other lab scale procedures.

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DSE3- Environmental Biotechnology:

After successful completion of the paper, the students will be able to

CO1: Enlighten about the various causes and consequences of environmental pollution caused by anthropogenic activities and possible green technologies as their alternatives.

CO2: Educate others about the different waste treatment strategies by biological means that would clean environment and lead towards a sustainable future.

CO3: Gain knowledge on use of different microorganisms as a part of green approaches in order to find bio- based alternatives such as bio energy, bio pesticides, bio fertilizers etc. for avoiding environmental pollution and biomagnifications.

CO4: Give hands on training in laboratory measures to assess quality of water, determining their chemical, biological and solid waste contaminations and their eradication by bio treatments.

DSE4- Evolutionary Biology

After successful completion of the paper, the students will be able to

CO1: Get an idea about primitive condition of the living and non- living world in the remote past and will also develop a notion about the origin of life.

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CO2: Acquainted with about the atmospheric condition, its composition and contents and the gradual process through which it gets altered during the course of time.

CO3: Understand about how did the bio molecule turned from simple to complex and then finally to compound structure.

CO4: Comprehend the paleobiology and build a discrete knowledge about the way the fossils serve as potent evidence for evolution serve as important archaeological tool.

DSE 4- IPR

After successful completion of the paper, the students will be able to

CO1: Understand the importance and Significance of Intellectual property rights.

CO2: Comprehend the applications of trademark in varied fields.

CO3: Analyse the use of Geographical Indicators.

CO4: Explain the importance of using patenting and copyright in varied fields.

GE-1- Human Welfare

After successful completion of the paper, the students will be able to:

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CO1: Understand the various concepts associated to Gene therapy and its applications.

CO2: Comprehend the applications of DNA fingerprinting.

CO3: Understand the characteristics of symbiotic relationships in plants.

CO4: Explain the commercial importance of using alcohol in biotechnology based industry.

GE1- DEVELOPMENTAL BIOLOGY

Students who successfully complete this course will be able to:

CO1: Understand the basic and fundamental processes of development at the prenatal stage; the process of fertilization and the inevitable prerequisite of formation of life in animal kingdom

CO2: Understand the morphology and development of gametes i.e. spermatocytes & oocytes and the process of their formation i.e. spermatogenesis and oogenesis.

CO3: Develop complete knowledge and better understanding of the prenatal developmental phases like Cleavage, Blastulation, Gastrulation, Morphogenetic movements and also the regulatory factors of development

CO4: Learn the process of development of specific organs such as vertebrate eye, Extra embryonic membranes, placenta in Mammals.

GE2- Microbial Physiology

After successful completion of the paper, the students will be able to

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CO1: Understand the classification and nomenclature of microbes.

CO2: Understand the microbial growth and its significance.

CO3: Apply biophysical knowledge for microbial metabolism.

CO4: Apprehend the various concepts associated with physiological cycles of the microbes.

GE2- Biophysics & Instrumentation

After successful completion of the paper, the students will be able to

CO1: Enable application of the theories and laws of physics to biological structure and functioning.

CO2: Understand the principles and working of instruments commonly used to study biological material.

CO3: Apply biophysical knowledge for human health care and basic functioning and application of instruments.

CO4: Understand the various concepts associated with Ph meter and radiology.

GE3- Entrepreneurship Development:

After successful completion of the paper, the students will be able to

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CO1: Acquainted with foundation and conceptual theories of entrepreneurship

CO2: Explore entrepreneurial skills and management, innovative marketing strategies and the contemporary trends in the market.

CO3: Foster new ideas, self-efficacy and self-advocacy with improved communication and problem-solving skills.

CO4: Design and develop a venture in a globalised and competitive environment with being cognizant of the social, ethical and cultural issues.

GE4- HUMAN GENETICS

Students who successfully complete this course will be able to:

CO1: Compare and study about genome complexity, their evolution and relationship among the animal kingdom.

CO2: Understand specific structure, complexity and peculiarity of the human genome.

CO3: Distinguish the process of development of sex in human and other vertebrate groups. They will realize the biochemical pathway that is involved in the process and also acquire the knowledge of the foundation of male and female sex development through the study of dosage compensation.

CO4: Determine the allelic and genotype frequencies in an infinitely large population free from evolutionary forces.

GE4- Immunotechnology

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After successful completion of the paper, the students will be able to

C01: Gain knowledge on basic concepts of immunology. technologies used to detect disease and related terms.

C02: Develop the basic understanding of how immunity defends our body from potential infectious agents like bacteria, viruses, allergens etc. in different ways.

C03: Comprehend the stages of disease development, pathophysiology, vaccination and diagnostic tools and techniques.

C04: Perform experiments such as ELISA, immunoassays, immunoprecipitation etc. and analyse and interpret experimental data based on practical experiences.

C05: Establish their career in both academia as well as pharmacological industries.

SEC-1- Molecular Diagnostics

After successful completion of the paper, the students will be able to

C01: Describe the fundamentals of immunology and the functions of various components of the immune system.

C02: develop the knowledge of basic concepts of various immunoassays.

C03: Understand the working principle of the ELISA and other molecular diagnostic techniques.

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CO4: Execute the experiments using molecular biology techniques such as PCR, Gel electrophoresis etc. and interpret the experimental results.

SEC1- Industrial Fermentation

Students who successfully complete this course will be able to:

CO1: Integrate the knowledge of microbial growth kinetics, microbial assays, design of fermenters and its types; sterilization processors etc.

CO2: Analyse kinetics of cell and product formation in batch, continuous and fed-batch cultures and applications;

CO3: Develop the basic understanding of industrially important microorganisms, media formulation and inoculum preparation for industrial fermentation

CO4: Differentiate the rheological changes during fermentation process and various Scale up and Downstream processes used in fermentation industries.

SEC2- Enzymology

After successful completion of the paper, the students will be able to

CO1: Understand the basic properties of enzyme and its catalytic ability and the dynamics of enzyme-substrate complex formation

CO2: Comprehend the mechanism of enzyme catalysis, enzyme kinetics and the factors that affect the enzyme activity

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C03: Differentiate between the competitive, non-competitive and uncompetitive inhibition with reference to graph and equation

C04: Apply the theoretical concept of enzyme catalysis and its inhibitors in drug designing and various industries.

SEC-2- Forensic science

After successful completion of the paper, the students will be able to:

C01: Describe the fundamental principles and functions of Forensic science and its significance to human society.

C02: Illustrate the divisions in a Forensic Science Laboratory.

C03: Understand the working of the Forensic establishments.

C04: Explain the importance of criminology and causes of criminal behaviour.

C05: Analyse the significance of criminal profiling in alleviating crimes.

C06: Demonstrate an understanding of the elements of criminal justice system and the consequences of crime in society.

AECC1- ENVS

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Students who successfully complete this course will be able to:

CO1: Understand the core concepts of ecological and physical science with the first-hand knowledge of local and regional ecosystems.

CO2: Master the concept and methodologies and their application in environmental problem solving across local to global scale.

CO3: Design the environmental policies in economic, political and social aspect and understand their responsibility as consumer for maintaining environmental sustainability.

CO4: Impart theoretical knowledge in quantitative and qualitative analysis to measure the interactions between social and environmental processes.

AECC2- English/ MIL Communication

After successful completion of the paper, the students will be able to:

CO1: Develop the basic understandings of media production, interpersonal communication skills, media laws and ethics.

CO2: Become more productive and effective communicators, broadcasters, writers, reporters and researchers.

CO3: Appreciate the appropriate use of information and communication technology that includes mass media, Internet, mobile phone, and social media for media consumers.

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CO4: Possess the proficiency in English that will help them in communicating and delivering the good contents at global level.