



St. Xavier's College (Autonomous), Mumbai
Department of Biotechnology

Programme: M.Sc. Biotechnology

Programme Specific Outcomes (PSOs) for M.Sc. Biotechnology

Sr. No.	On completing M.Sc. Biotechnology, the student will be able to:
PSO 1	Understand the fundamental concepts and applications of the core courses in biotechnology (biochemistry, immunology, cell biology, tissue culture, bioinformatics and biostatistics, bioprocess technology, environment biotechnology, drug development, and molecular biology methods with an emphasis on the application of recombinant DNA technology to animals, plants and microbial organisms).
PSO 2	Demonstrate wet laboratory techniques in biotechnology and computational techniques necessary for research activities.
PSO 3	Design, perform, analyse and interpret scientific experiments and projects on various aspects of biotechnology.
PSO 4	Record, represent and communicate scientific data ethically obtained through experimental procedures; critically evaluate and discuss scientific literature with researchers and laypersons.
PSO 5	Ideate and apply entrepreneurial and IPR skills for innovations based on biotechnology.
PSO 6	Be equipped for competitive exams in the field.
PSO 7	Acquire research and development positions in the various fields of biotechnology and competent employment positions in allied fields.



Course Outcomes (COs): M.Sc. Biotechnology

Semester I

Course Title: Biomolecules

Course Code: SBTS0701

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the architecture of structural levels of proteins and associate changes in structural architecture with the disease.	1, 3, 6	U, E
CO 2	Apply fundamental knowledge of biomolecular properties to design strategies for their purification.	1, 3, 6, 7	Ap
CO 3	Understand the interaction between DNA and protein; apply the knowledge to understand the function and purification.	1, 3, 6	U, An
CO 4	Demonstrate the understanding of the biomolecular organization in cellular membranes.	1, 3, 6	U
CO 5	Understand the interaction between lipid and protein; apply the knowledge to develop assays.	1, 3, 6	U, Ap, C

Course Title: Immunology

Course Code: SBTS0702

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Demonstrate basic knowledge of the organization and function of the immune system.	1, 6	U, Ap
CO 2	Differentiate mechanisms that lead to beneficial immune responses and immune disorders.	1, 3, 6	U, Ap
CO 3	Apply key immunologic concepts and methods to diagnose immune disorders.	2, 3, 7	U, Ap, An
CO 4	Explain strategies for manipulating the immune system for therapy.	1, 3, 4	An, Ap, C
CO 5	Apply the knowledge of antigen-antibody interaction in the field of diagnostics and therapeutics.	2, 3, 4	Ap, An, C
CO 6	Analyse immunology-based case studies.	1, 4, 7	An, E, C



Course Title: Genetics

Course Code: SBTS0703

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Elucidate the transfer of genetic information from DNA to RNA to protein.	1, 6	U, An
CO 2	Understand the gene regulation process in prokaryotes and eukaryotes.	1, 6	U
CO 3	Apply the concept of gene regulation to design experiments using model organisms.	1, 3, 6, 7	Ap, An
CO 4	Describe the consequences of mutations and discuss DNA repair systems.	1, 6	U
CO 5	Describe the fundamental molecular principles of genetics.	1, 6	U,
CO 6	Correlate the genotypic expression to the phenotypic behaviour of the selected organisms.	1, 4, 6	An, E

Course Title: Cellular Processes

Course Code: SBTS0704

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Demonstrate in-depth knowledge of membrane transport mechanism and signal transduction.	1, 6	U, An
CO 2	Understand the molecular basis of signal transduction leading to regulation of gene expressions.	1, 3, 6	R, U
CO 3	Identify the key mechanisms in biosignalling leading to favourable and unfavourable responses.	1, 3, 6	Ap
CO 4	Demonstrate knowledge of cell cycle processes and mechanisms of programmed cell death.	1, 6	U, An
CO 5	Understand and analyse the genetic and molecular basis of cancer.	1, 3, 6	An
CO 6	Demonstrate the ability to critically evaluate the established knowledge within cellular processes.	3, 4, 7	Ap, An, E



Course Title: Techniques in Biotechnology and Scientific Communication Skills
Course Code: SBTS07PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Understand the principle and use of basic laboratory instruments, acquire technical competence in biotechnology and computational biology to solve problems in basic research; acquire practical skills to follow written standard laboratory methods and achieve expected outcomes.	2, 3, 4, 7
CO 2	Plan and execute experiments and analyse the data obtained; record experimental procedures and outcomes in a laboratory record book in an ethical manner; carry out laboratory techniques alone or in a group safely and efficiently.	2, 3, 4, 7
CO 3	Read scientific literature and utilise various modalities of scientific communication effectively.	2, 3, 4, 7



Semester II

Course Title: Metabolism

Course Code: SBTS0801

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Demonstrate an understanding of various biochemical pathways in prokaryotes and eukaryotes.	1, 6	R, U
CO 2	Designing strategies for the diagnosis of human diseases and industrial production of favourable metabolites.	1, 3, 6, 7	Ap
CO 3	Discuss and analyse relevant case studies.	1, 4, 6, 7	E, An
CO 4	Design experimental studies to understand metabolic pathways to validate existing and produce new scientific information about the same.	1, 3, 4, 6, 7	Ap, C
CO 5	Utilise the knowledge attained to design and manipulate the metabolic pathways for the overproduction of commercially important products.	3, 4, 7	An, Ap, E

Course Title: Animal Biotechnology

Course Code: SBTS0802

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Demonstrate an understanding of human developmental biology and the molecular mechanisms involved.	1, 6	U
CO 2	Understand the concepts of animal cell culture and demonstrate its application in pre-clinical testing and therapeutics.	1, 3, 4, 6, 7	U, An, Ap
CO 3	Understand the concepts, molecular aspects, and applications of stem cell and tissue engineering.	1, 4, 6, 7	U, An, Ap
CO 4	Demonstrate a systematic understanding of knowledge in the specialised area of Biopharmaceuticals design and synthesis.	1, 3, 4, 6, 7	U, An, Ap
CO 5	Assemble and enhance the knowledge required to understand the techniques and methodologies in the area of biopharmaceuticals.	1, 3, 4, 6, 7	An, Ap, E



Course Title: Molecular Biotechnology
Course Code: SBTS0803

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Interconnect the concepts of genome analysis and manipulation of the genome for beneficial responses.	1, 3, 6, 7	U, An
CO 2	Design strategies for gene manipulation to obtain beneficial products for society.	2, 3, 6, 7	U, An, Ap
CO 3	Discuss and analyse scientific literature from the field of genetic engineering, its validity and applicability for the benefit of society.	4, 6, 7	U, An, Ap
CO 4	Apply the genome analysis and manipulation knowledge in conducting experimental studies in the field of agriculture and health care.	2, 3, 6, 7	An, Ap, E

Course Title: Advanced Analytical Techniques
Course Code: SBTS0804

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the application of various techniques in experimental biology.	1, 2, 6	U, Ap
CO 2	Interpret data generated and its implications.	3, 4, 6, 7	An, Ap
CO 3	Demonstrate knowledge of fundamental concepts of proteomics.	1, 6	U, Ap
CO 4	Explore the available instrumentation-based resources efficiently.	2, 3	An, Ap
CO 5	Design experimental studies for complex biology queries using advanced techniques.	3, 4, 6, 7	An, Ap



Course Title: Biotechnology

Course Code: SBTS08PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Use experimental models for understanding aspects of metabolism; employ recombinant DNA and animal cell culture techniques to address research queries.	1, 2, 3, 7
CO 2	Apply computational techniques to explore, analyse and interpret biological questions; plan, execute experiments and analyse the data obtained.	2, 3, 4,7
CO 2	Acquire knowledge of techniques used in the biotechnology and apply them in research; understand the limitations of techniques and their applications.	3, 4, 6, 7



Semester III

Course Title: Biostatistics and Bioinformatics

Course Code: SBTS0901

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Recognise the importance of statistical thinking and approach to problem-solving in biology.	1, 3, 6, 7	U, An, Ap
CO 2	Understand the working of computational tools and methodologies for investigating specific biological problems.	1, 2, 3, 6, 7	U, An, Ap
CO 3	Apply statistical methods in research.	3, 4, 6, 7	U, An, Ap
CO 4	Critically analyse and interpret the data in research.	3, 4, 7	U, An, Ap
CO 5	Utilise available Bioinformatics software and tools for analysing biological data sets.	2, 3, 4, 7	U, An, Ap



Course Title: Drug Development
Course Code: SBTS0902

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the process of drug discovery.	1, 6	U, R
CO 2	Evaluate the balance between medical benefit, the risk involved, economic reward and risk in the decision-making process of drug development.	1, 4, 6, 7	U, An, Ap
CO 3	Demonstrate competency in biopharmaceutical clinical trial research designs and regulatory affairs management to meet the health and medical needs of current and future.	1, 4, 7	An, Ap, E
CO 4	Use evidence-based approaches to guide decision making in drug discovery and development.	1, 3, 4, 7	An, Ap, E
CO 5	Integrate the 'omics' concept with drug development.	1, 6	U, An, Ap
CO 6	Critically evaluate and discuss scientific literature and key methodologies in drug discovery concerning the validity, reliability, and applicability and present the same to specialised and non-specialised audiences.	4, 7	An, Ap, E
CO 7	Demonstrate a clear understanding of documentation requirements in drug development.	1, 7	An, Ap
CO 8	Demonstrate an awareness of the current approaches to global drug discovery and their advantages and limitations.	1, 4, 7	An, Ap, E



Course Title: Bioprocess Technology
Course Code: SBTS0903

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Appreciate the relevance of microorganisms in industrial biotechnology; understand fundamental principles of methods used in production of bio-based products.	1, 3, 6, 7	U, E
CO 2	Understand relevant calculations of bioprocess engineering.	1	U, An, Ap
CO 3	Discuss and evaluate the operational considerations and relative advantages relating to the choice of techniques used in the downstream processing of biotechnology products.	1, 3, 4, 6, 7	U, An, Ap, E
CO 4	Discuss and critically analyse the upstream and downstream aspects of exemplary industry bioprocesses, spanning biopharmaceutical and industrial biotechnology applications.	1, 3, 4, 6, 7	U, An, Ap, E
CO 5	Apply theoretical knowledge and demonstrate practical know-how to produce, purify and characterize a biomolecule of industrial relevance.	1, 2, 3, 7	U, An, Ap, E
CO 6	Critically analyse any bioprocess from the market point of view.	1, 3, 4, 7	U, An, Ap, E



Course Title: Environmental Biotechnology
Course Code: SBTS0904

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the use of microbiological, molecular and analytical methods for detection and control of pollution.	1, 6, 7	U, Ap, E
CO 2	Strategize sustainable approaches for environmental management.	1, 3, 7	U, An, E
CO 3	Understand concepts of nutraceutical and functional foods and identify strategies related to their production apply the theoretical concepts on an industrial scale.	1, 6, 7	U, Ap
CO 4	Evaluate biosafety and risk assessment of products derived from recombinant DNA and environmental release of genetically modified organisms.	1, 3, 6, 7	U, Ap, E
CO 5	Understand ethical aspects related to biological, biomedical, health care and biotechnology research.	1, 3, 7	U, Ap
CO 6	Integrate scientific literature and environment policies for the benefit of society.	4	An, Ap
CO 7	Integrate knowledge and use it to make judgments in complex situations keeping in mind social and ethical responsibilities and communicate evidence-based knowledge with researchers and laypersons.	4, 7	An, Ap

Course Title: Bioinformatics and Research Methodology
Course Code: SBTS09PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Utilize advanced bioinformatics tools to explore and analyse fundamental questions in biology.	2, 3, 6, 7
CO 2	Design, plan, execute and analyse the data obtained from a research project; document the project using scientific writing principles; integrate the subject knowledge of core courses into a Sustainable Research Project.	3, 4, 6, 7
CO 3	Propose and analyse ad-hoc solutions derived from a research project.	3, 4, 5, 7



Semester IV

Course Title: Entrepreneurship and IPR

Course Code: SBTS1001

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Identify scope for entrepreneurship in biosciences and utilize the schemes promoted through various governmental and non-governmental agencies.	1, 7	U, An
CO 2	Apply intellectual property law principles to biotechnology research and product generation.	1, 5, 7	U, An, Ap
CO 3	Gain entrepreneurial skills to execute a biotech-based start-up.	5	An, Ap
CO 4	Analyse and assess the industrial and commercial viability along with the benefit to risk aspects of Biotech based products/solutions.	1, 5, 7	An, Ap
CO 5	Understand the legal and practical steps needed to ensure that IPR remains valid and enforceable; demonstrate the capacity to identify, apply and assess ownership rights and marketing protection to biotechnology-based products.	1, 5, 7	U, An, E
CO 6	Analyse ethical and professional issues arising in biotechnology research and development about IPR.	1, 5, 7	U, An, E
CO 7	Anticipate and critically evaluate arguments related to biotech product generation.	1, 5, 7	U, An, E

Course Title: Entrepreneurship

Course Code: SBTS1001PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Gain awareness of current research areas and the biotechnology industrial landscape worldwide.	5, 7
CO 2	Develop competencies (leadership, technical and managerial) needed to recognise and explore a biotechnology-based business opportunity; support development of self and the team and articulate skill development through reflective practices.	5, 7
CO 3	Carry out research; produce and present a business plan to venture capitalists and funding agencies; follow ethical practices in a proposed business idea.	5, 7



Course Title: Research Project
Course Code: SBTS1002PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Identify a research query based on the knowledge acquired across the earlier 3 semesters and relevant scientific literature.	3, 4, 6, 7	An, Ap, E
CO 2	Design the research study, plan and execute the research project and validate the methods for reliability and reproducibility.	1, 2, 3, 4, 7	An, Ap, E
CO 3	Apply ethical principles of scientific research in collecting relevant data, analyse and represent it appropriately.	3, 4, 7	An, Ap, E
CO 4	Critically evaluate the data obtained and compare it with existing scientific literature for its validity and applicability.	3, 4, 7	An, Ap, E
CO 5	Proficiently document the research work based on the principles of scientific writing.	4, 7	An, Ap, E