



St. Xavier's College (Autonomous), Mumbai
Department of Life Science and Biochemistry

Programme: M.Sc. Life Science (Applied Medical Science)

Programme Specific Outcomes (PSOs) for M.Sc. Life Science (Applied Medical Science)

Sr. No.	On completing M.Sc. Life Science (Applied Medical Science), the student will be able to:
PSO 1	Understand the fundamentals of different of branches in biology and undertake self study in these fields.
PSO 2	Integrate technical and analytical skills used in modern biology and effectively perform experiments over wide domains such as protein purification, medical microbiology, molecular biology, animal tissue culture and bioinformatics.
PSO 3	Design, plan and engage in guided research in various disciplines of biology.
PSO 4	Process and analyse data to make logical interpretations; demonstrate effective scientific communication skills in writing research work and defending it in oral presentations.
PSO 5	Develop confidence in writing assignments, critically evaluate information, present the learning orally and function effectively in a team.



Course Outcomes (COs): M.Sc. Life Science

Semester I

Course Title: Cell Biology

Course Code: SLSC0701

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Comprehend the detailed structural organization and function of different components of a eukaryotic cell.	1	R, An,
CO 2	Understand and analyse structural aspects and molecular mechanisms of intra- and trans-cellular transport of molecules.	1	R, U, An
CO 3	Acquire fundamental concepts of intercellular communication through different modes of cell signalling; and analyse and explain the structural and functional aspects of intercellular communication machinery.	1, 2	U, An, Ap
CO 4	Understand and explain the fundamental concepts of cell division cycle and cell death, and the molecular mechanisms regulating these processes.	2	U, An, Ap
CO 5	Understand the role of apoptosis in various developmental and physiological processes; comprehend recent molecular and biochemical techniques for detection of apoptosis and use this knowledge to design experiments for analysis of apoptosis and fragmentation.	1, 2, 3	An, Ap



Course Title: Scientific Communication, Research Methodology, Intellectual Property Rights, Entrepreneurship

Course Code: SLSC0702

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Search for, comprehend, evaluate and manage scientific information effectively; critically analyse and review research papers as well as other forms of scientific communication.	1, 4	U, R, Ap, An
CO 2	Communicate and report scientific data findings clearly through oral, written and poster presentations.	3, 4	U, R, Ap, C
CO 3	Comprehend the concepts of IPR, and the significance of patenting.	1, 2	U, R
CO 4	Apply the principles of IPR in setting up entrepreneurial ventures and analyse the socio-economic impact of IPR at national and international levels.	2, 3	U, R, An
CO 5	Understand the basic concepts of entrepreneurship and its significance in economic development.	3, 5	U, R, Ap

Course Title: Biochemistry

Course Code: SLSC0703

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Explain the fundamental physical forces that exist between molecules, and evaluate the thermodynamic parameters that govern the interactions between them.	1, 4	U, Ap, E
CO 2	Discuss the role of protein structure in protein folding and function using various biological examples and protein supramolecular systems.	1, 2, 4	R, Ap
CO 3	Apply the knowledge of enzyme kinetics and inhibition in differentiating between various enzymatic mechanisms; understand the role of cofactors and coenzymes in enzyme function; solve problems based on the above concepts.	1, 4	Ap, An
CO 4	Comprehend and describe the steps in cellular metabolism of key biomolecules (carbohydrates, lipids, proteins), correlate their dysfunction to metabolic disorders, and integrate them with the hormonal regulation of these processes.	1, 2, 3	R, Ap
CO 5	Analyse and critique the above concepts to get a wholesome picture of the biochemical pathways and their interrelation and interdependence in the human body.	1, 3, 4	An, E



Course Title: Laboratory Management and Analytical Techniques
Course Code: SLSC0704

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the basics of laboratory design and the guidelines for safety in national and international laboratories; develop protocols for a safe and effective work environment.	1, 3, 5	U, R, Ap, C
CO 2	Explain the basic principles of separation methods such as chromatography, electrophoresis and centrifugation; identify core areas of application of these techniques in experiments and projects and analyse and troubleshoot the results obtained.	1, 3, 5	U, R, An, AP
CO 3	Understand the workings of various microscopy techniques and critically examine their distinguishing features.	1, 2, 5	U, R, AP, An
CO 4	Explain the significance of Beer-Lambert's law in spectrophotometric analysis of solutions; explain principles of various spectrometric applications to estimate biomolecules, and to apply such techniques in practice.	1, 2, 4, 5	U, R, AP, An, E
CO 5	Explain the principle and application of AAS/AES, ORD/CD, XRD, NMR and mass spectrometry for studying structures and composition of biomolecules; discuss the principles of the next- generation sequencing techniques.	1, 4, 5	U, R, AP, An

Course Title: Protein Biochemistry
Course Code: SLSC07PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Demonstrate good laboratory practices, be aware of laboratory safety, document Standard Operating Procedures for various instruments, work with common instruments and appliances in the laboratory; record observation and results in a scientific manner.	2, 4, 5
CO 2	Display skills of solution preparation, protein purification, enzyme assays and protein separation by electrophoresis that will be useful in careers in research and development, or for employment in laboratories or bioprocess plants.	2, 4, 5



Semester II

Course Title: Human Physiology – I

Course Code: SLSC0801

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the structural organization of the human body, explain the functional segregation into systems and analyse the physiological interdependence of systems for homeostasis.	1, 2	U, An, Ap
CO 2	Describe the anatomical and histological features of organs contributing to the digestive, circulatory, urinary, muscular and respiratory systems.	1, 2	U, An, Ap
CO 3	Comprehend the cellular and molecular mechanisms involved in the physiology of digestion, circulation, excretion, muscle contraction and respiration.	1, 3	U, An, Ap
CO 4	Identify and evaluate the structural and physiological anomalies underlying disorders of each of the above systems.	3, 4	An, Ap
CO 5	Apply the understanding of the physiological principles and disorders in daily life scenarios such as nutrition, obesity control, ensuring cardiac health etc.	1, 3, 4, 5	An, Ap



Course Title: Basic Mathematics and Biostatistics
Course Code: SLSC0802

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the use of mathematics necessary for biology students and to interpret, analyse and discuss these in the realm of biological questions.	1, 2, 3	U, An, Ap
CO 2	Understand, recall and apply various methods of data representation; evaluate the difference between the forms of data distribution and explain methods to quantify these differences; determine simple correlation and regression relations within the given data.	3, 4, 5	U, Ap, E
CO 3	Explain probability and compare and contrast the types of data distribution; inspect positional importance of data points; construct hypotheses and explain the importance of critical regions and types of errors; determine the status of central tendencies within hypotheses testing.	3, 4, 5	U, An, Ap, C
CO 4	Examine and develop ANOVA tests for given data; choose and explain various relevant tests for non-parametric data; identify, design and defend various experimental designs.	3, 4, 5	U, An, Ap, C



Course Title: Immunology
Course Code: SLSC0803

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Exhibit a firm grasp on fundamental immunological concepts; identify the cellular and molecular basis of immune responsiveness and understand the role of the immune system in maintaining health and contributing to disease; develop an insight into some classical and advanced immunological techniques.	1, 2, 4, 5	U, R, Ap
CO 2	Appreciate the wide range of mechanisms and cellular players of innate and adaptive immunity and their coordination in fighting invading pathogens.	1, 4, 5	U, R, Ap
CO 3	Elucidate the molecular basis for antigen recognition; identify and illustrate immune cell receptors and their interaction, and the signal transduction involved; critically discuss the evolution of the adaptive immune response; explain the genetic diversity of the immune receptors.	1, 4, 5	U, R, An, Ap
CO 4	Illustrate and explain the development of adaptive immune response; discuss immunological memory and provide an overview of the mucosal immune response.	1, 4, 5	U, An, Ap
CO 5	Outline key events and cellular players in immune-mediated disorders; describe new advances, new challenges, and newly appreciated connections between the immune system and disease.	1, 4, 5	U, R, Ap
CO 6	Appreciate the pivotal role of immunology in health and disease; and understand its contribution to the discovery, design and application of new techniques and approaches to the diagnosis and treatment of disease.	1, 4, 5	An, Ap



Course Title: Microbial Diseases
Course Code: SLSC0804

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Explain various terms used in study of infectious diseases such as chain of infection, reservoirs etc.; and evaluate the relationship between host and the pathogen in a disease.	1, 4, 5	U, R
CO 2	Discuss the immune response to a variety of pathogens such as fungi, viruses and bacteria, and critically review the evasive mechanisms evolved by microorganisms.	1, 4, 5	U, R, An
CO 3	Discuss and critically review the fundamental principles of infectious diseases, the pathogenesis, clinical features, diagnosis, treatment of selected infectious diseases affecting different systems of the human body (respiratory, gastrointestinal, urogenital tract and connective tissue-skin).	1, 2, 4, 5	U, R, Ap
CO 4	Critically review and discuss the transmission, pathogenesis, treatment, management and control of selected vector borne infection, zoonotic diseases and perinatal infections.	1, 4, 5	U, R, Ap

Course Title: Medical Microbiology and Immunology
Course Code: SLSC08PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Acquire skills to work effectively in a microbiology laboratory; show proficiency in aseptic techniques for working in a BSL-1 or BSL-2 laboratory; be able to identify microorganisms based on cultural and biochemical characteristics; perform antibiotic sensitivity testing of microorganisms.	2, 4, 5
CO 2	Perform basic immunological techniques like blood typing, agglutination reactions etc.	2, 4, 5



Semester III

Course Title: Human Physiology – II

Course Code: SLSC0901

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Describe the anatomical and histological features of organs and structures of the nervous, endocrine and reproductive systems.	1	U, An, Ap
CO 2	Comprehend the cellular, molecular and electrical mechanisms in the nervous system responsible for nerve impulse transmission, synaptic communication and sensory transduction.	1	U, An, Ap
CO 3	Explain the concept of cell signaling, and elaborate on how endocrine hormones regulate target tissue functions to maintain homeostasis.	1, 2	U, An, Ap
CO 4	Apply the understanding of reproductive physiology in daily life scenarios such as contraception and family planning, assisted reproduction, menopause management etc.	1, 2, 3	An, Ap, C
CO 5	Identify and evaluate the structural and physiological anomalies involved in diseases/ disorders of nervous, endocrine and reproductive systems.	1, 3, 4	An, Ap



Course Title: Molecular Biology and Recombinant DNA Technology
Course Code: SLSC0902

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the molecular processes of DNA replication, transcription and translation in prokaryotes and eukaryotes.	1	R, U
CO 2	Understand and explain the various mechanisms leading to DNA damage and the cellular processes involved in repair.	1	U, An
CO 3	Explain the basic concept of a gene, understand the principles of gene regulation and expression in prokaryotes and eukaryotes.	1	U, An
CO 4	Comprehend the fundamental and advanced concepts in recombinant DNA technology – enzymes, techniques and steps involved in gene cloning.	1, 2	U, An
CO 5	Get an insight into an overall approach to prokaryotic and eukaryotic transgenesis based on assimilation of the above concepts; and appreciate the vast applications of gene cloning.	1, 2, 3, 5	U, An, Ap

Course Title: Bioinformatics and Routine Diagnostics
Course Code: SLSC0903

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Identify and use appropriate search engines and bioinformatics tools for bibliographic searches, reference citations, and the analysis of biological sequence, structural and evolutionary data.	1, 2, 3, 4	U, Ap, An
CO 2	Understand the significance of computer programming in bioinformatics, and discuss the applications of bioinformatics and computational biology in various areas including but not limited to systems biology and big data analysis.	1, 4	U, Ap
CO 3	Comprehend and explain the principles of clinical tests routinely used in diagnostic laboratories for analysis of various body fluids and tissues.	1, 3	U, An, Ap
CO 4	Discuss the physiological basis and clinical relevance of various invasive and non-invasive organ function tests.	1	U, An, Ap
CO 5	Analyse and interpret the results of routine diagnostic tests for better understanding of a disease/clinical condition.	1, 3, 5	An, Ap



Course Title: Clinical Microbiology and Public Health
Course Code: SLSC0904

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Explain the principle of various diagnostic procedures including microscopic, cultural, immunological and molecular methods used in the diagnosis and monitoring of infectious diseases; interpret results of such tests and make presumptive diagnosis.	1, 2, 4, 5	U, R, An
CO 2	Classify antimicrobials based on their modes of action; critically review the mechanism of action of different antimicrobial agents; and understand the strategies involved in antibiotic resistance.	1, 2, 4, 5	U, R, Ap
CO 3	Explain the significance of vaccines in preventing disease; review the types of vaccines and critically evaluate their efficacies; discuss novel strategies used in developing new vaccines.	1, 4, 5	U, R, Ap
CO 4	Recall epidemiological terminologies and summarize an overview of public health concepts; critically review success stories in epidemiology and calculate epidemiological proportion and ratios from a given set of data; evaluate disease burden and elaborate on the methods, interpretation and significance of health surveillance.	1, 4, 5	U, R, An, Ap, E
CO 5	Enlist and explain determinants of emerging and re-emerging infectious diseases; outline the goals of various global infectious disease monitoring agencies; discuss the origin, transmission, pathogenesis, diagnosis and epidemiology of representative viral and bacterial emerging or re-emerging diseases.	1, 4	U, R, An, Ap

Course Title: Cell Culture Techniques, Molecular Biology, Physiology and Medical Laboratory Diagnostics
Course Code: SLSC09PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Identify and use appropriate bioinformatics tools for analyses of biological sequence, structural and evolutionary data; perform assays pertaining to diagnostics and pathology using diagnostic kits for lipids, cholesterol, glucose, SGOT, SGPT, etc.	1, 2, 4, 5
CO 2	Design and perform experiments involving different techniques in molecular biology and recombinant DNA technology, along with data analysis and interpretation of observed results.	1, 2, 4, 5



Semester IV

Course Title: Medical Genetics

Course Code: SLSC1001

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand, construct and interpret Mendelian and Non-Mendelian modes of inheritance in humans with the help of pedigree.	1	U, An, Ap
CO 2	Understand the implications of various phenomena that play important roles in phenotype manifestation, and appreciate the role of genetic and environmental factors in multifactorial conditions.	1	U, An, Ap
CO 3	Explain the conventional cytogenetic analysis and advanced molecular methods of genetic testing and screening.	1, 2	An, Ap
CO 4	Understand the importance of genetics in medical practice, namely, recognizing congenital anomalies and syndromes, risk assessment and genetic counselling and plans for management and treatment.	1	U, An, Ap
CO 5	Understand the organization of the human genome and evaluate the outcome, advantages and disadvantages of human genome project.	1	U, An, Ap



Course Title: Pharmacology and Clinical Research
Course Code: SLSC1002

Sr. No.	On completing the course, the student will be able to:	PSO addressed	Cognitive levels
CO 1	Discuss in depth the concepts of pharmacodynamics, pharmacokinetics and pharmacogenomics, and elaborate upon drug-receptor interactions and drug metabolism by the body.	1, 4	U, R
CO 2	Differentiate between and select the best available pharmacotherapy strategy and drug delivery system for the appropriate treatment of diseases of the various organ systems in the body.	1, 4	U, An
CO 3	Determine and propose a strategy for the discovery/development of new drugs or the modification of existing ones based on safety, efficacy, and suitable screen models for therapy and toxicity.	1, 3, 4	Ap, E
CO 4	Associate the above concepts to get an overview of the field of pharmacology and concepts therein.	1, 3, 4	Ap, An
CO 5	Summarize the stages, strategies, ethics and regulations involved in human clinical trials citing appropriate case studies; write and analyse reports related to clinical trials.	1, 4	An, E

Course Title: Cancer Biology and Stem Cell Biology
Course Code: SLSC1003

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Describe the hallmarks of cancer, understand the genetic basis of cancer and the cellular and molecular mechanisms involved in its development.	1	U, An, Ap
CO 2	Explain the fundamental mechanistic principles behind cancer diagnosis and prevention.	1	An, Ap
CO 3	Comprehend the basic principles in embryonic development and cell differentiation therein.	1	U, An, Ap
CO 4	Analyse and evaluate the molecular interplay of proteins in stem cell maintenance, proliferation and differentiation.	1	U, An, Ap
CO 5	Identify and elaborate on the potential researchable areas and the challenges in the field of stem cell biology.	1, 3	An, Ap, C



Course Title: Applied Biology
Course Code: SLSC1004

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the basic concepts and current advances in various fields of applied biology such as animal cell culture, nanoscience, toxicology and nutraceuticals.	1	R, U
CO 2	Gain knowledge about detailed methodologies in cell culture for further research in academics or industry.	1, 3	U, Ap
CO 3	Appreciate the emerging roles and potential health benefits of nutraceuticals and cosmeceuticals.	1, 2	U, An, Ap
CO 4	Get an insight into the fundamentals of nanoscience, its technical aspects and application in medical science and environmental monitoring.	1, 3	U, An, Ap
CO 5	Explain and analyse mechanisms of toxicity caused by different biotic and abiotic agents and design strategies for its prevention and proper management.	1, 3, 5	An, Ap, C

Course Title: Research Project/ Literature Survey
Course Code: SLSC10PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Ideate and execute scientific projects by integrating and performing experimental techniques; analyse and interpret data using various statistical methods, write research articles and grant proposals; defend her/his work through written, oral and visual presentations.	2, 3, 4, 5
CO 2	Equip himself/herself for industrial/ academic jobs; initiate unique start-ups in the realm of life science as an entrepreneur; pursue doctoral studies.	3, 4, 5