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**St. Xavier's College (Autonomous), Mumbai**

**Programme: B.Sc. Botany – Biochemistry**

**Department of Botany:**

*Programme Specific Outcomes (PSOs) and Course Outcomes (CO) for Botany*

**Department of Life Science and Biochemistry:**

*Programme Specific Outcomes (PSOs) and Course Outcomes (CO) for Biochemistry*



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

**Programme: B.Sc. Botany**

*Programme Specific Outcomes (PSOs) for B.Sc. Botany*

Sr. No.	A student completing B.Sc. Botany will be able to:
PSO 1	Understand the diversity of plants, their economic importance, life cycles, classification, morphology, anatomy, basic physiological functions, embryological processes, genetics and ecology.
PSO 2	Possess basic skills in identification of plants, growing plants, basic microbial techniques, learn the use of instruments, environmental laws and scientific communication.
PSO 3	Perform experiments in the field or the laboratory making use of analytical, interpretation and writing skills.
PSO 4	Understand the relationship between different fields of botany and other sciences.
PSO 5	Appreciate nature, and become socially responsible citizens by using the acquired knowledge to help conserve environment.



## Course Outcomes (COs): B.Sc. Botany

### Semester I

**Course Title: Thallophyta**

**Course Code: SBOT0101**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the basis of classification of algae, fungi and bryophytes.	1	R
CO 2	Distinguish between the four major classes of algae.	1, 4	R, U
CO 3	Elaborate the general characters of the classes phycomycetes, ascomycetes, basidiomycetes and deuteromycetes of fungi.	1	R, U
CO 4	Know the importance of studying life cycles of type specimens of algae, fungi and bryophytes.	1, 5	R
CO 5	Illustrate and understand the important morphological and anatomical features of Nostoc, Spirogyra, Rhizopus, Agaricus and Riccia.	1, 5	R, U

**Course Title: Angiosperms**

**Course Code: SBOT0102**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the morphological differences in leaves, inflorescence, flowers, their different parts, and modifications of structure.	1, 2	U
CO 2	Know the various terms required to technically describe the plant, the use of specific characters in identifying families.	1, 2	R
CO 3	Recall the basis of classification in the artificial, natural and phylogenetic classification systems of angiosperms.	1	R
CO 4	Grasp the basis of the Bentham and Hooker's system of classification, and the knowledge of families leguminosae, asteraceae and amaryllidaceae.	1	R, U
CO 5	Know how anatomy helps to understand the simple and compound tissues in plants.	1, 4	R, U



**Course Title: Botany Practicals – I**  
**Course Code: SBOT01PR**

<b>Sr. No.</b>	<b>On completing the course, the student will be able to:</b>	<b>PSOs addressed</b>
CO 1	Morphologically differentiate between different categories of leaves, stems, inflorescence and flowers, and identify few common plants.	2, 3
CO 2	Know preparation of specimens and slides for observation under compound microscope.	2



## Semester II

**Course Title: Plant Physiology**

**Course Code: SBOT0201**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Associate the components of water potential to the maintenance of turgidity in plants, transpiration and movement of water from root to the leaves.	1, 4	U
CO 2	Measure the transpiration rates, understand stomatal movements, and gain knowledge of plant anti-transpirants.	1, 2	R, U, Ap
CO 3	Picturize and understand passive and active transport, pinocytosis, and phenomenon of sieve-tube translocation.	1, 4	U
CO 4	Understand enzyme nomenclature, properties, classification, mode of action and kinetics, with an emphasis on how enzymes control all cellular metabolic pathways.	1, 4	R, U
CO 5	Know the structure, function, classification, biosynthesis and degradation of major cellular compounds.	1	R

**Course Title: Cytology and Ecology**

**Course Code: SBOT0202**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Correlate the structure and functions of major cell organelles.	1	U
CO 2	Characterize the cell wall, plasma membrane, mitochondrion and chloroplast.	1	R, U
CO 3	Solve problems based on Mendel's laws, allelic and non-allelic gene interactions, and sex determination in plants.	1, 2	R, Ap
CO 4	Describe the components of ecosystem, and understand various interactions in the food chain and the food web.	1	R
CO 5	Elaborate the role of ecological adaptations in hydrophytes, xerophytes and halophytes.	1, 2	R, U



**Course Title: Botany Practicals – II**  
**Course Code: SBOT02PR**

<b>Sr. No.</b>	<b>On completing the course, the student will be able to:</b>	<b>PSOs addressed</b>
CO 1	Learn basic laboratory skills to perform qualitative tests to detect different organic compounds; perform basic enzyme assays.	3
CO 2	Take plant part sections and prepare slides of different ecologically adapted plants, use microscope to observe them and note anatomical differences; solve problems on Mendelian genetics.	1, 2



### Semester III

#### Course Title: Algae and Fungi

Course Code: SBOT0301

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Utilize properties of bacterial cell wall and other characteristics to identify and distinguish different forms of bacteria.	1, 2	U, Ap
CO 2	Demonstrate the techniques of sterilization, culture media preparation for culturing of bacteria and for obtaining pure bacterial cultures.	1, 2	U, Ap
CO 3	Compare, draw and describe the life cycle of algae Vaucheria, Sargassum, and Batrachospermum.	1, 2	U
CO 4	Explain the structure and methods of reproduction in lichens.	1	U
CO 5	Diagnose the symptoms of common fungal plant diseases.	1, 2	U, Ap

#### Course Title: Photosynthesis and Respiration

Course Code: SBOT0302

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Examine and draw glycolysis, pentose phosphate pathway, anaerobic respiration and TCA cycle.	1, 4	R
CO 2	Understand the interactions involving light during photosynthesis, and the role of ATP and NADPH in CO <sub>2</sub> fixation.	1, 4	R, U
CO 3	Identify the path of carbon during photosynthesis in C <sub>3</sub> , C <sub>4</sub> and CAM pathways, and factors influencing photosynthesis.	1, 4	R, U
CO 4	Diagnose nutritional disorders of plants with respect to essentiality of nutrients.	1, 2	U
CO 5	Comprehend the biochemistry of photorespiration in C <sub>3</sub> and C <sub>4</sub> plants.	1, 4	U



**Course Title: Anatomy and Embryology**  
**Course Code: SBOT0303**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Describe the anomalous growth behavior of plant stem and root, and their anatomical differences.	1	U
CO 2	Understand the transformation of vasculature during root to stem transition, and the components and development of apical, lateral and root meristems.	1	R
CO 3	Describe the structures of microsporangium, megasporangium and the development of male and female gametophytes and dicot embryo.	1	R, U
CO 4	Identify and categorize pollen grains based on their exine ornamentation.	1, 2	U, Ap
CO 5	Understand the applications of palynology in honey industry, coal and oil exploration, forensic sciences and allergy.	1, 4	U

**Course Title: Botany Practicals – III**  
**Course Code: SBOT03PR**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Know sterilization of glassware, staining of bacteria and basic microbiological techniques.	2, 3
CO 2	Use laboratory techniques to perform various estimations of plant compounds, handle glassware, chemicals, instruments, note down observations, analyze and interpret results.	2, 3



### Semester IV

#### Course Title: Lower Vascular Plants

Course Code: SBOT0401

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Know the classification and salient features of major groups of bryophytes, pteridophytes, and gymnosperms.	1	R
CO 2	Differentiate between apospory and apogamy, in addition to thallus organization in bryophytes.	1, 4	R, U
CO 3	Recall the structures, life cycles and systematic positions of type specimens of bryophytes, pteridophytes and gymnosperms.	1, 5	R
CO 4	Comprehend the process of fossil formation correlated with the geological time scales.	1, 4	U
CO 5	Analyse and categorize the structures seen in fossil form genera.	1, 4	An

#### Course Title: Angiosperm Families

Course Code: SBOT0402

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Compare the morphology of different fruits.	1	U
CO 2	Know the economic importance of spices, condiments, and paper- and fiber-yielding plants.	1, 5	R
CO 3	Classify the plants into given families according to Bentham and Hooker's system of classification.	1	R, U
CO 4	Use the characters of taxonomic importance in anatomy, palynology and embryology in classification and identification of plants.	1	R, Ap
CO 5	Master the techniques used in preparation of herbarium specimens.	1, 4	Ap



**Course Title: Analytical Tools**  
**Course Code: SBOT0403**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Evaluate the common crude plant drugs and detect adulterants in them.	1, 4	R, E
CO 2	Summarize the basis of development of Kampoh (Chinese) and Ayurvedic system of medicines, and of classification system of crude drugs.	1	R
CO 3	Understand the principle and working of pH meter, colorimeter, light microscope, and paper-, thin layer- and column- chromatography.	1, 3, 4	R, U
CO 4	Solve and explain the common problems using frequency distribution, standard deviation, student's t-test and correlation coefficient.	1, 3, 4	R, U, Ap
CO 5	Be conversant with bioinformatics tools, and be well-versed with the services offered by various online bioinformatics database resources.	1, 3, 4	R, U, Ap

**Course Title: Botany Practicals – IV**  
**Course Code: SBOT04PR**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Collect, treat, label plant specimen and use it to prepare herbarium sheet; carry out pharmacognostic study of common crude drugs from plants.	2, 3
CO 2	Solve basic statistical problems manually as well as by using a computer; use online tools and databases to perform bioinformatics exercises.	2, 3



### Semester V

#### Course Title: Cytogenetics and Biotechnology

Course Code: SBOT0501

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Compare the cytoplasmic inheritance involving sensitivity to drugs and CO <sub>2</sub> .	1	R, U
CO 2	Understand the central dogma of molecular biology, and the transcription and translation processes.	1	R, U
CO 3	Enumerate the types of gene and chromosome mutations.	1	R, U
CO 4	Explain the role of enzymes in gene cloning, and of various DNA vectors used in transferring desired genes using different methods.	1, 2, 4	R, U
CO 5	Use methods to map, identify, amplify and sequence genes.	1, 2, 4	R, U

#### Course Title: Plant Systematics

Course Code: SBOT0502

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Select timber-, oil- and dye-yielding plants, tea, coffee through family and botanical name; and identify the parts used.	1,2,5	R
CO 2	Compare and contrast the various classifications systems of angiosperms: Cronquist, Takhtajan and APG I-III, their merits, demerits and relevance in today's time.	1	R, U
CO 3	Use literature available on BSI website and in IUCN-red data book, and understand the methods of plant conservation, stressing their role in preservation of biodiversity.	1, 2	R, U, Ap
CO 4	Compare and classify selected plant families according to Bentham and Hooker's system, and their current position in APG III system of classification; identify genus and species using floral specimens.	1, 2	R, U
CO 5	Know different levels of biodiversity, reasons for its loss, and different measures to conserve it.	1, 2, 5	R



**Course Title: Botany Practicals – V**  
**Course Code: SBOT05PR**

<b>Sr. No.</b>	<b>On completing the course, the student will be able to:</b>	<b>PSOs addressed</b>
CO 1	Use the laboratory techniques and instruments to perform basic molecular biology experiments.	3
CO 2	Identify genus and species of plant specimen using taxonomic literature; identify plants in the field.	2



## Semester VI

### Course Title: Plant Growth Physiology

Course Code: SBOT0601

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the biochemistry of nitrogen fixation and effects of nitrogen assimilation on carbohydrate utilization in plants, leading to appreciation of how fertilizers are absorbed and used by plants.	1	U, Ap
CO 2	Analyse quantitative aspects of vegetative growth of annual plants, and interpret factors affecting growth.	1	R, U
CO 3	Deduce the role of environment in flower initiation through phenomenon of photoperiodism and vernalization.	1, 2	R, U
CO 4	Use the knowledge of growth hormones and growth-retarding hormones at different stages of plant growth and for various parts of plant to optimise plant growth and yields in practice.	1, 2, 3	R, U, Ap
CO 5	Know morphological and biochemical changes accompanying seed development, seed germination, dormancy, aging and senescence.	1, 4	R, U

### Course Title: Environmental Botany

Course Code: SBOT0602

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the function and importance of biotic and abiotic environmental factors in the sustenance of plant life and the local ecology.	1	U
CO 2	Evaluate the diverse biotic interactions among organisms helping them to survive in an ecosystem.	1, 5	U, E
CO 3	Devise various methods to mitigate pollution caused by light, noise, water, soil and air, and their effects on plants.	1, 2	U
CO 4	Understand deforestation, afforestation, reforestation, and be aware of various existing institutions for forest research, education and training.	1	R
CO 5	Know the different acts of the country which provide the legal framework to protect and conserve forests, environment and the associated wildlife.	1, 2	R



**Course Title: Botany Practicals – VI**  
**Course Code: SBOT06PR**

<b>Sr. No.</b>	<b>On completing the course, the student will be able to:</b>	<b>PSOs addressed</b>
CO 1	Perform plant physiology experiments, and use chromatographic techniques to carry out estimations of phytochemicals.	3
CO 2	Use ecological instruments to detect weather and soil parameters; identify phytogeographical area from a map.	2



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

**Programme: For B.Sc. Botany-Biochemistry / B.Sc. Life Science and Biochemistry /  
B.Sc. Microbiology-Biochemistry / B.Sc. Zoology-Biochemistry**

***Programme Specific Outcomes (PSOs) for T.Y.B.Sc. Biochemistry***

Sr. No.	On completing T.Y.B.Sc. Biochemistry, the student will be able to:
PSO 1	Associate the structure of molecules with their chemical interactions/kinetics and role in the organism and to recognise the operation of fundamental scientific principles in the functioning of the human body.
PSO 2	Comprehend the significance of bio-molecules/nutrients, their metabolic fate, energetics and interconversion, and the integration of biochemical pathways within organisms; and apply this knowledge for a better understanding of nutrition, health and allied fields of biology.
PSO 3	Understand the principle and working of various analytical instruments and methods, and their appropriate selection for biochemical investigations.
PSO 4	Be equipped to perform the calculations required for preparation of reagents, to perform/design simple biochemical experiments, to apply her/his knowledge to solve theoretical and practical problems based on concepts, and to do troubleshooting in the laboratory.
PSO 5	Be able to use search engines and bioinformatics tools for literature surveys, reference citations, and analysis of biological sequence and structural data.
PSO 6	Be capable of working in a heterogeneous group towards a common goal through research projects, and be empowered to present ideas logically and with confidence, in a scientific paper and an oral presentation.

**Biochemistry is offered only in the third year of the UG programme.**



## Course Outcomes (COs): T.Y.B.Sc. Biochemistry

### Semester V

**Course Title: Molecules of Biological Significance**

**Course Code: SBCH0501**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Recall structures of biomolecules like carbohydrates, lipids, proteins, vitamins, nucleic acids, and secondary plant metabolites.	1, 5	R, U
CO 2	Compare biomolecules based on their chemistry and functions.	1, 5	R, U
CO 3	Summarize and evaluate the significance of biomolecules and minerals in health and deficiency conditions.	1, 5	U
CO 4	Explain the structure and function of biocatalysts and evaluate the role of regulators of biochemical pathways.	1, 5	U, E
CO 5	Comprehend the basics of enzyme kinetics and inhibition; solve problems based on the above concepts.	1, 4, 5	R, U



**Course Title: Nutrition and Metabolism**  
**Course Code: SBCH0502**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Describe and discuss fundamental concepts of nutrition, nutritional and eating disorders, food regulation, body composition and energy expenditure.	2, 4, 5	R, U
CO 2	Analyze and assess nutrition panels, design a nutritional plan by extrapolating nutritional information to personal health and disease.	2, 5	Ap, An, E
CO 3	Identify the location of, and describe the pathways that lead to the oxidation (aerobically/anaerobically), synthesis and storage of glucose and fatty acids in the human body.	1, 2, 5	R, U
CO 4	Explain the role of electron transport chain and ATP synthase in using the energy of electrons (extracted from simple sugars and fatty acids) to make ATP in the mitochondria.	2, 4, 5	U, An
CO 5	Describe the role of chloroplast in harnessing energy and analyze the steps involved in the fixation of atmospheric carbon dioxide by a plant.	2, 4, 5	U, An
CO 6	Determine the link between nutrition, metabolism and energy.	2	U, An, E

**Course Title: Biochemistry Practicals – I**  
**Course Code: SBCH05PR**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Acquire the fundamental skill of understanding the concepts of concentration and dilution, and apply these in accurately and efficiently preparing and storing laboratory reagents for use.	3, 4
CO 2	Identify and critically analyze the principle and working of various analytical instruments such as pH meter, colorimeter, spectrophotometer, centrifuge; choose appropriate techniques for biochemical investigations associated with qualitative and quantitative analysis of carbohydrates, proteins, lipids, various inorganic ions and micronutrients, confidently applying this learning to real-life quality assurance situations.	3, 4



## Semester VI

**Course Title: Biophysical and Bio-analytical Chemistry**

**Course Code: SBCH0601**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Derive equations involving terms such as pH, $K_w$ , pI etc., understand the working of a pH meter and interpret the contribution of physiological buffers to homeostasis in humans.	3, 4	U, An
CO 2	Understand the various principles and processes involved in extracting and purifying proteins.	3, 4, 5	U, Ap
CO 3	Correlate and apply basic gas laws and concepts of viscosity and dipoles in living systems.	1	Ap, An, E
CO 4	Comprehend and apply the principles of common analytical techniques like centrifugation, chromatography, electrophoresis and spectrophotometry to the separation and analyses of biomolecules.	3, 4, 5	R, U
CO 5	Apply the knowledge of instrumentation to solve simple problems.	3, 4, 5	Ap



**Course Title: Metabolism, Clinical Biochemistry and Pharmacology**  
**Course Code: SBCH0602**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Describe the steps in the synthesis of a peptide and the role of ubiquitin and proteosomes in its degradation.	2, 4, 5	R, U
CO 2	Provide an overview of: the fates of amino acids, metabolism of purines and pyrimidines, excretion of protein nitrogen as urea and also appreciate the integration of carbohydrate, lipid and amino acid metabolism in the human body.	2, 5	R, U, An
CO 3	Comprehend the importance of signal molecules, with emphasis on hormones and their role in the regulation of metabolism and to understand the etiology of some disorders associated with carbohydrate, protein and lipid metabolism.	2, 5	R, U
CO 4	Relate inborn errors of metabolism to the associated enzymatic and biochemical profiles, to interpret the same in the context of human health and disease, and identify suitable enzymatic and diagnostic techniques.	2, 5	U, An, E
CO 5	Select the right bioinformatics tools to analyse biological molecules and the sequence and structural information they contain.	2, 4, 5	Ap, An
CO 6	Discuss in-depth the concepts of Pharmacodynamics, Pharmacokinetics and Pharmacogenomics, and be able to distinguish between the various allied fields of pharmacology.	2, 5	R, U

**Course Title: Biochemistry Practicals – II**  
**Course Code: SBCH06PR**

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Understand and integrate the principles of protein purification, enzymology, chromatographic and electrophoretic separations, and their appropriate selection for biochemical investigations.	3, 4
CO 2	Plan, design and execute simple biochemistry-based group research projects, defend the verified results before a panel of teachers in an oral presentation, and submit them as scientific research papers.	3, 4