

St. Xavier's College (Autonomous),
Mumbai



Syllabus of the courses offered by the
Department of Botany
(2019-20)

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
FYBSc Botany Semester-I Syllabus (2019-20)**

Course Code
SBOT0101

Course Title
THALLOPHYTA

LEARNING OBJECTIVES:

The students will be able to learn

- Understand the morphology, structure and importance of the organisms.
- State the meaning of scientific terms.
- Differentiate between various groups of Algae, Fungi, Lichens and Bryophyte.

UNIT I: ALGAE:

(15 Lectures)

General characters of algae, classification of algae into 4 major classes - Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta; general characters of these classes, economic importance of algae. Type studies: Distribution, life cycle and systematic position of *Nostoc* and *Spirogyra*.

UNIT II: FUNGI:

(15 Lectures)

General characters of fungi; Classification and general characters of classes: Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes, mode of nutrition in fungi, economic importance of fungi, Type studies: Distribution, lifecycle and systematic position of *Rhizopus* and *Agaricus*.

UNIT III: BRYOPHYTA:

(15 Lectures)

General characters and classification of Bryophytes: Hepataceae, Anthocerotaceae and Musci; Type studies; Distribution, life cycle and systematic position of *Riccia*. Economic importance of Bryophytes

CIA- multiple choice questions / test / assignments / puzzles / quizzes / field study report.

Practicals- Course: SBOTPR0101

1. Study of Economically Important Algae and Fungi.
2. Study of stages in the life cycle of *Nostoc*, *Spirogyra*.
3. Collection and identification of Algae from the field.
4. Study of stages in the life cycle of *Rhizopus* and *Agaricus*.
5. Study of the life cycle of *Riccia*.

References:

1. Smith, Gilbert M; Cryptogamic Botany Algae & Fungi Volume 1; 2nd edition; McGraw-hill book Comp. Tokyo, 1955.
2. Vasishtha B.R. And A. K. Sinha- Botany for degree students Part 1 ALGAE; S. Chand & Company Ltd, 1st edition, revised 2005.
3. Smith, Gilbert M; Cryptogamic Botany Bryophyta & Pteridophyta Volume 2; 2nd edition; McGraw-hill book Comp. Tokyo, 1955.
4. Vasishtha B.R. And A. K. Sinha- Botany for degree students: Bryophyta; S. Chand & Company Ltd, 1st edition, revised 2005.
5. Dutta, A.C.; A Classbook of Botany; 15th edition; Calcutta: Oxford University Press, 1976.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
FYBSc Botany Semester-I Syllabus (2019-20)**

**Course Code
SBOT0102**

**Paper Title
ANGIOSPERMS**

LEARNING OBJECTIVES:

The students will be able to learn

- Understand the morphology, structure and functions of various parts of plants.
- Learn the taxonomical terminology and understand the meaning of the same.
- Learn anatomical structure and functions of various tissues.

UNIT I: MORPHOLOGY OF ANGIOSPERMS: (15 Lectures)

Leaf: parts, simple and compound leaves, Inflorescence: types; Flower.

UNIT II: ANGIOSPERMS TAXONOMY: (15 Lectures)

Introduction to Systems of Classification – Artificial, Natural and Phylogenetic, Bentham and Hooker's system of classification, Study of following families: Leguminosae, Asteraceae, Amaryllidaceae.

UNIT III - ANATOMY- PRIMARY STRUCTURES: (15 Lectures)

Tissue systems in plants: Epidermal, ground and vascular tissue systems; Simple and compound tissues: Parenchyma, Collenchyma, Sclerenchyma, Xylem and Phloem; Study of Primary structures: Dicot and monocot stem.

CIA- multiple choice questions / test / assignments / puzzles / quizzes / field study report.

Practical Course: SBOTPR0102

1. Study of morphological characters of leaf, inflorescence and flower.
2. Primary structure of typical dicot and monocot stem.
3. Study of families prescribed in theory (any one plant species available from each family).
4. Field excursion.

References:

1. Dutta, A. C.; A Classbook of Botany; 15th edition; Calcutta: Oxford University Press, 1976.
2. Sivarajan, V. V.; Introduction to the principles of plant taxonomy; 2nd edition; Cambridge: Cambridge University Press, 1991.
3. Subrahmanyam, N. S.; Modern plant taxonomy; New Delhi: 1st edition; Vikas Publishing House Pvt. Ltd., 1995.
4. Lawrence, George H. M.; Taxonomy of Vascular Plants; 1st edition; New Delhi: Oxford & IBH Publishing Co., 1967.
5. Fahn, A; Plant anatomy; 4th edition. Indian reprint; New Delhi: Aditya Books (P) Ltd., (1997).
6. Eames, Arthur J.; MacDaniels, Laurence H.; An introduction to plant anatomy; 2nd edition.; New Delhi: Tata Mcgraw-Hill Publishing Company Limited, (1978, 2004)
7. Esau, Katherine; Anatomy of seed plants; 2nd edition; New York: John Wiley & Sons, 1977.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
FYBSc Botany Semester II Syllabus (2019-20)**

**Course Code
SBOT0201**

**Course Title
PLANT PHYSIOLOGY**

LEARNING OBJECTIVES

The students will be able to understand

- The transport mechanism in plants, the physiological processes and their importance.
- The mechanism of enzyme actions.
- The major classes of organic compounds, their synthesis and breakdown in plants.

UNIT I : WATER RELATIONS

(15 Lectures)

Water: plant constituent, functions, molecular structure, physical and chemical properties. Imbibition and osmosis, water potential and its components, role of turgor pressure in plant cells, Transpiration: Water loss by transpiration, measurements of transpiration rates, plant antitranspirants, stomatal movements, movement of water across roots and through leaves.

UNIT II : TRANSPORT PROCESSES

(15 Lectures)

Transport processes: movement of solutes in plants, passive transport, protoplasmic membrane, active transport across membranes and its mechanism, shuttle systems, electroosmosis and pinocytosis, transcellular transport. Anatomy of sieve tubes, mechanism of sieve tube translocation.

UNIT III : PLANT BIOCHEMISTRY

(15 Lectures)

Enzymes: nomenclature, properties, classification, specificity, apoenzyme, prosthetic group, mode of action, kinetics (no derivation), enzyme inhibition, isozymes. Major Cellular compounds: carbohydrates, lipids and proteins, their classification and functions in plants; biosynthesis and degradation of Fats.

CIA- MCQ / test / assignments / puzzles / quizzes / field study report/ Outstation seminar.

Practicals: SBOTPR0201

1. Study of activity of amylase.
2. Determination of solute potential by plasmolytic method.
3. To demonstrate ascent of sap using a dye.
4. Demonstration of transpirational water loss by Ganong's potometer.
5. Determination of stomatal frequency.
6. Qualitative analysis for detection of Carbohydrates.
7. Tests for detection of proteins and amino acids.

References:

1. Noggle, Ray G.;Fritz, George J.; Introductory plant physiology; 2nd edition; New Delhi : Prentice-Hall Of India Private Limited , 1991.
2. Sinha, B.K.;Pandey, S.N.; Plant Physiology; 1st edition; New Delhi : Vikas Publishing House Pvt. Ltd. , 1981.
3. Salisbury, Frank B.;Ross, Cleon W.; Plant physiology; 3rd edition, Reprint; New Delhi : CBS Publishers & Distributors , 1986(2001).
4. Devlin, Robert M.;Witham, Francis H.; Plant Physiology; 4th edition, Indian reprint; Delhi : CBS Publishers & Distributors , 1986(2001).
5. Kochhar, P.L.; A textbook of Plant Physiology; 7th edition; Delhi :Atma Ram & Sons , 1964.
6. Verma S. K. Textbook of Plant physiology and Biochemistry ; 4th editon; S. Chand & Company Ltd, 2003.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
FYBSc Botany Semester II Syllabus (2019-20)**

Course Code
SBOT0202

Course Title
CYTOLOGY AND ECOLOGY

LEARNING OBJECTIVES

The students will be able to understand

- The structure and functions of various cell organelles.
- The phenomenon of inheritance.
- The interactions taking place in the ecosystem and flow of Energy.

UNIT I: CYTOLOGY

(15 Lectures)

Ultra-structure and functions of the following: Cell wall, plasma membrane (unit membrane and fluid mosaic model), mitochondrion, chloroplast. Nucleus: chromosomes, mitosis.

UNIT II : GENETICS

(15 Lectures)

Mendel's laws, allelic and non-allelic interaction, epistatic interactions, sex determination in plants.

UNIT III : ECOLOGY

(15 Lectures)

Concept of Ecosystem: Components and their interactions, Food Chains and food web Ecological pyramids; Ecological adaptations of plants belonging to following ecological groups: Hydrophytes, Xerophytes and Halophytes.

CIA- multiple choice questions / test / assignments / puzzles / quizzes.

Practicals: SBOTPR0202

1. Examining various stages of mitosis in root tip cells.
2. Observation of polytene chromosomes in salivary glands of *Chironomus* larvae.
3. Study of external and internal structures of *Hydrilla*, *Nymphaea*, *Nerium*, *Opuntia* and *Avicennia*.
4. Study of pond, terrestrial and estuarine ecosystem.
5. Problems on mendelian genetics- Mono hybrid and dihybrid ratios, allelic and non-allelic interactions, epistatic interactions

References:

1. Gupta, P.K.; Genetics : A textbook for University students; 3rd edition; Meerut : Rastogi Publications, 2007.
2. Gardner, Eldon J.; Snustad, Peter D.; Principles of genetics; 7th edition; New York : John Wiley & Sons , 1984.
3. De Robertis, E.D.P.; Nowinski, Wiktor W.; Saez, Francisco A.; Cell Biology; Philadelphia : W.B. Saunders Company , 1970.
4. Powar, C.B.; Daginawala, H.F.; General microbiology; vol.I-II; 2nd edition, reprint; Bombay : Himalaya Publishing House , 1986(1993)
5. Subrahmanyam, N.S.; Sambamurty, A.V.S.S.; Ecology; 1st edition; New Delhi : Narosa Publishing House , 2000.
6. Sharma, P.D.; Ecology and Environment; 7th edition; Meerut: Rastogi Publishers, 1998.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
SYBSc Botany Semester III Syllabus (2019-20)**

Course Code
SBOT0301

Course Title
ALGAE AND FUNGI

LEARNING OBJECTIVES:

The students will be able to learn

- Understand the importance of bacteria and their culture methods.
- The causal organisms of plant diseases.
- The life cycles of the individuals belonging to algae, fungi and lichens.

Unit I: MICROBIOLOGY:

(15 Lectures)

Basics principles of staining, culture media preparation, pure culture methods, classification of bacteria based on modes of nutrition, biofertilizers and methods of application; bacteria in sulphur cycle, bacteria in Phosphate solubilization.

Unit II: ALGAE AND LICHENS:

(15 Lectures)

Algae: Structure, life cycle and systematic position of *Vaucheria*, *Sargassum*, *Batrachospermum*. Lichens - Classification, structure, method of reproduction and ecological significance.

Unit III: FUNGI AND PLANT PATHOLOGY:

(15 Lectures)

Fungi- Structure, life cycle and systematic position of *Puccinia* and *Phytophthora*; Diseases, symptoms, disease cycle and control measures of rust of wheat and late blight of potato.

CIA- multiple choice questions / assignments / presentation / field report / test.

Practicals: SBOTPR0301

1. Sterilization techniques, preparation of nutrient agar, Preparation of slants and plates, Study of streak plate method. Gram staining of bacteria.
2. Effect of plant extract (Turmeric / Garlic) on microbial growth by agar diffusion method.
3. Study of stages in the life cycle of *Vaucheria*, *Sargassum*, *Batrachospermum* and diatoms.
4. Structure of crustose, foliose and fruticose lichens and their reproductive structures.
5. Study of diseases, (a) rust of wheat (*Puccinia*) (b) late blight of potato (*Phytophthora*).

References:

1. Gardner, Eldon J.; Snustad, Peter D.; Principles of genetics; 7th edition; New York: John Wiley & Son , 1984.
2. De Robertis, E. D. P.; Nowinski, Wiktor W.; Saez, Francisco A.; Cell Biology; Philadelphia: W.B. Saunders Company, 1970.
3. Powar, C. B.; Dagainawala, H. F.; General microbiology; vol. I-II; 2nd edition, reprint; Bombay: Himalaya Publishing House, 1986 (1993)
4. Subrahmanyam, N. S.; Sambamurty, A. V. S. S.; Ecology; 1st edition; New Delhi: Narosa Publishing House, 2000.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
SYBSc Botany Semester III Syllabus (2019-20)**

Course Code
SBOT0302

Course Title
PHOTOSYNTHESIS AND RESPIRATION

LEARNING OBJECTIVES:

The students will be able to understand;

- The catabolic process and synthesis of chemical energy in plants, the anabolic process in plants.
- Differentiate between light and dark reactions of photosynthesis.
- The respiratory process in presence of light and differentiate between C₃, C₄ and CAM plants, and mineral nutrition.

Unit I: RESPIRATION:

(15 Lectures)

Respiratory substrates, nature of biological oxidation, glycolysis, oxidative pentose phosphate pathway, anaerobic respiration, TCA cycle, respiratory chain, significance of ATP.

Unit II: PHOTOSYNTHESIS:

(15 Lectures)

Efficiency of plants in converting radiant energy and matter, light reaction of photosynthesis, chloroplast as the unit of photosynthesis, reaction scheme for ATP and NADPH formation, role of ATP and NADPH in CO₂ fixation, path of carbon in photosynthesis – C₃, C₄ and CAM, factors influencing photosynthesis.

Unit III: PHOTORESPIRATION AND MINERAL NUTRITION:

(15 Lectures)

Photorespiration: Biochemistry of photorespiration in C₃ and C₄ plants. Mineral nutrition: autotrophs and heterotrophs, essential elements, criteria of essentiality of elements, nutritional disorders of plants, sources of nutrients, mycorrhiza in plant mineral nutrition.

CIA- multiple choice questions / test / assignment.

Practicals: SBOTPR0302

1. Estimation of Ca²⁺ and Mg²⁺ in plant sample. Estimation of phosphorous in plants.
2. Estimation of total chlorophyll content. Estimation of carotenoids from plant samples.
3. Separation of photosynthetic pigments by TLC.
4. Solvent extraction of chlorophyll pigments and study of its absorption spectrum
5. Study of Kranz anatomy.

References:

1. Noggle, Ray G.; Fritz, George J.; Introductory plant physiology; 2nd edition; New Delhi : Prentice-Hall Of India Private Limited , 1991.
2. Sinha, B. K.; Pandey, S. N.; Plant Physiology; 1st edition; New Delhi: Vikas Publishing House Pvt. Ltd., 1981.
3. Salisbury, Frank B.; Ross, Cleon W.; Plant physiology; 3rd edition, Reprint; New Delhi: CBS Publishers & Distributors, 1986 (2001).
4. Devlin, Robert M.; Witham, Francis H.; Plant Physiology; 4th edition, Indian reprint; Delhi: CBS Publishers & Distributors, 1986 (2001).
5. Verma S. K. Textbook of Plant physiology and Biochemistry; 4th editon; S. Chand & Company Ltd, 2003.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
SYBSc Botany Semester III Syllabus (2019-20)**

**Course Code
SBOT0303**

**Course Title
ANATOMY AND EMBRYOLOGY**

LEARNING OBJECTIVES:

The students will be able to learn

- Differentiate between the normal and anomalous secondary growth, and various meristems.
- Learn the developmental stages of micro and megasporangium.
- Understand the pollen morphology and the applications of palynology.

Unit I: ANATOMY:

(15 Lectures)

Normal secondary growth in Dicotyledonous stem and root, anomalous secondary growth in the stems of *Bignonia*, *Salvadora*, *Achyranthes* and *Dracaena* and roots of Beet and Radish; root stem transition, study of apical, lateral and root meristems.

Unit II: EMBRYOLOGY:

(15 Lectures)

Structure of Microsporangium, microsporogenesis and development of male gametophyte, Structure of Megasporangium, megasporogenesis, and development of female gametophyte, Double fertilization and its significance, Development of embryo – Dicotyledonous– *Capsella* type.

Unit III: PALYNOLOGY:

(15 Lectures)

Pollen and spore morphology- size and shape, polarity, apertures, exine stratification, construction of palynogram.; Application of palynology in honey industry, coal and oil exploration, forensic sciences, pollen allergy.

CIA- assignments / presentation / moodle / test.

Practicals: SBOTOPR0303

1. Study of normal secondary growth in sunflower stem and root.
2. Study of anomalous secondary growth in the stems of *Bignonia*, *Salvedora*, *Achyranthus*, *Dracaena*, roots of beet and radish by double staining technique.
3. Study of apical, lateral and root meristem, stages of microsporogenesis, megasporogenesis and embryo development with the help of permanent slides / photomicrographs.
4. Study of pollen morphology of *Hibiscus*, *Canna*, *Pancratium* and *Ocimum*.
5. Pollen analysis from honey sample: Unifloral and Multifloral honey.

References:

1. Eames, Arthur J.; MacDaniels, Laurence H.; An introduction to plant anatomy; 2nd edition. Reprint; New Delhi: Tata Mcgraw-Hill Publishing Company Limited, (1978, 2004)
2. Esau, Katherine; Anatomy of seed plants; 2nd edition; New York: John Wiley & Sons, 1977.
3. Gangulee, Das, and Dutta – College Botany Vol I.
4. Fahn, A; Plant anatomy; 4th edition. Indian reprint; New Delhi: Aditya Books (P) Ltd., 1990(1997)
5. Maheshwari, P.; Introduction to the embryology of angiosperms; 2nd edition, reprint; New Delhi: Tata Mcgraw-Hill Publishing Company Limited, 1971.
6. Bhojwani, S.S.;Bhatnagar, S.P.; The embryology of angiosperms; revised edition; Delhi : Vikas Publishing House Pvt. Ltd. , 1996.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
SYBSc Botany Semester IV Syllabus (2019-20)**

Course Code
SBOT0401

Course Title
LOWER VASCULAR PLANTS

LEARNING OBJECTIVES: The students will learn

- The life cycles of the individuals belonging to Bryophyta, Pteridophyta and Gymnosperms.
- The geological time periods and the plants of past.
- The different methods of fossilization.

Unit I: BRYOPHYTA

(15 Lectures)

Classification of Bryophyta up to class; Salient features of Hepaticae, Anthocerotae and Musci; Structure, life cycle and systematic position of *Marchantia*, *Anthoceros* and *Funaria*; Thallus organization in Bryophyta, Apogamy and apospory in Bryophytes.

Unit II: PTERIDOPHYTA

(15 Lectures)

Classification of Pteridophyta up to class. Salient features of Psilophyta, Lepidophyta, Calamophyta and Pterophyta. Structure, life cycle and systematic position of *Selaginella*, *Equisetum* and *Adiantum*. Heterospory and origin of seed.

Unit III: GYMNOSPERMS AND PALAEOBOTANY

(15 Lectures)

Classification of Gymnosperms up to class. Structure, life cycle and systematic position of *Cycas* and *Gnetum*. Economic importance of gymnosperms. Palaeobotany- geological time scale, fossil formation, Birbal Sahani Institute of Paleobotany, Lucknow; Study of Form Genera- *Lepidodendron*, *Lyginopteris*.

CIA- multiple choice questions / assignments / presentation / test.

Practicals: SBOTPR0401

1. Study of stages in the life cycle of *Anthoceros*, *Marchantia* and *Funaria*.
2. Study of stages in the life cycle of *Selaginella*, *Equisetum* / *Adiantum*.
3. Study of stages in the life cycle of *Cycas* and *Gnetum*.
4. Study of form genus *Lepidodendron*, *Lyginopteris*.

References:

1. Vasishtha B.R. And A. K. Sinha- Botany for degree students: Bryophyta / Pteridophyta; S. Chand & Company Ltd, 1st edition, revised 2005.
2. Smith, Gilbert M; Cryptogamic Botany Bryophyta & Pteridophyta Volume 2; 2nd edition; McGraw hill book Comp. Tokyo, 1955.
3. Kar, Ashok Kumar; Gangulee, Hirendra Chandra; College botany: Volume II; 2nd edition; Kolkata: New Central Book Agency (P) Ltd , 1989, 2006.
4. Dutta, A.C.; A Classbook of Botany; 15th edition; Calcutta: Oxford University Press, 1976.
5. Chamberlain, Charles Joseph; Gymnosperms : structure and evolution; 2nd edition; New York Dover Publications, Inc. , 1966.
6. Rashid, A.; An introduction to pteridophyta : diversity and differentiation; 4th edition; New Delhi: Vikas Publishing House Pvt. Ltd. , 1982.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
SYBSc Botany Semester IV Syllabus (2019-20)**

**Course Code
SBOT0402**

**Course Title
ANGIOSPERMS FAMILIES**

LEARNING OBJECTIVES: The students will learn

- The taxonomical terminology and understand the meaning of the same.
- The various classification systems and understand the reasoning behind the same.
- Basics of Nomenclature

Unit I: MORPHOLOGY AND ECONOMIC BOTANY (15 Lectures)

Morphology of fruits; Economic botany: fiber yielding plants, paper yielding plants, spices and condiments.

Unit II: ANGIOSPERM FAMILIES (15 Lectures)

Study of the following angiosperm families and their economic importance (Bentham and Hooker's System): Anacardiaceae, Rutaceae, Combretaceae, Myrtaceae, Apiaceae, Rubiaceae, Euphorbiaceae, Apocynaceae and Arecaceae.

Unit III: LITERATURE AND HERBARIUM TECHNIQUES (15 Lectures)

Taxonomic structure, major and minor categories, taxonomic literature, characters of taxonomic importance – anatomy, palynology and embryology. Herbarium – Blatter Herbarium; techniques used in preparation of herbarium specimens.

CIA- moodle / assignment / presentation / field report / test.

Practicals: SBOTPR 0402

1. Study of Fruit morphology.
2. Study of two anatomical, palynological and embryological characters of taxonomic importance.
3. Study of the following families: Anacardiaceae, Rutaceae, Combretaceae, Myrtaceae, Apiaceae, Rubiaceae, Euphorbiaceae, Apocynaceae, Arecaceae.
4. Visit to Blatter Herbarium and preparation of a report on the same. Field excursion.

References:

1. Dutta, A.C.; A Classbook of Botany; 15th edition; Calcutta: Oxford University Press, 1976.
2. Sivarajan, V.V.; Introduction to the principles of plant taxonomy; 2nd edition; Cambridge: Cambridge University Press, 1991.
3. Subrahmanyam, N.S.; Modern plant taxonomy; New Delhi : 1st edition; Vikas Publishing House Pvt. Ltd., 1995.
4. Lawrence, George H.M.; Taxonomy of Vascular Plants; 1st edition; New Delhi : Oxford & Ibh Publishing Co., 1967.
5. Naik, V.N.; Taxonomy of angiosperms; 1st edition; New Delhi :
6. Sharma, O.P.; Plant Taxonomy; 1st edition, reprint; New Delhi : Tata Mcgraw-Hill Publishing Co. Ltd., 1993(2002)

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
SYBSc Botany Semester IV Syllabus (2019-20)**

**Course Code
SBOT0403**

**Course Title
ANALYTICAL TOOLS**

LEARNING OBJECTIVES The students will learn

- The methods of evaluation of crude drugs and the adulterants used.
- The working and use of instruments in plant science.
- The important websites and databases available on the internet.
- To compare the significant difference/s in 2 or more samples.

Unit I: MEDICINAL BOTANY

(15 Lectures)

Kampoh and ayurvedic system of medicine, modern classification system of crude drugs, Pharmacognosy- definition, scope, drug adulteration, drug evaluation methods, phytochemical investigations. Bio-prospection for medicinal plants; Crude drugs- Ginger, Turmeric, Tulsi, Garlic, Cinnamon, Nutmeg, Clove; Herbal cosmetics.

Unit II: INSTRUMENTATION

(15 Lectures)

Principle, working and applications of pH meter, colorimeter. Light, phase contrast, scanning and transmission electron microscopy. Paper, thin layer and column chromatography; Gel electrophoresis.

Unit III: BIOSTATISTICS AND BIOINFORMATICS

(15 Lectures)

Distribution of data in Biology. Frequency distribution; Standard deviation; Descriptive statistics, Testing of hypothesis: Student's t-test (paired and unpaired), and Correlation. Bioinformatics- Introduction, tools used, NCBI and other data bases, services offered by NCBI and EBI.

CIA- assignments / presentation / project / test.

Practicals: SBOTPR0403

1. Determination of swelling factor, and extractive values of crude drugs.
2. Pharmacognostic study- *Adhoda vasica*, *Zingiber officinale*, *Cinnamomum zylanicum*.
3. Preliminary tests for alkaloids, tannins and glycosides.
4. Crude drugs- Ginger, Turmeric, Tulsi, Garlic, Cinnamon, Nutmeg, Clove.
5. Separation of carotenoids by column chromatography(Demonstration).
6. Measure of central tendency, frequency distribution, Standard deviation, t –test analysis.
7. Use of BLAST, and MSA.

References:

1. Mahajan, B.K.; Methods in biostatistics; 6th edition; New Delhi: Jaypee Brothers, 1997.
2. Kandavel, D., Pandian, T.T.; Textbook of biotechnology; 1st edition; New Delhi: I.K. International Publishing House Pvt. Ltd , 2008.
3. Kokate, C.K.; Purohit, A.P.; Gokhale, S.B.; Pharmacognosy; 39th edition; Pune : Nirali Prakashan, 2007.
4. Ignacimuthu, S.; Basic bioinformatics; 4th edition; New Delhi: Narosa Publishing House , 2005.
5. Rastogi, Veer Bala.; Fundamentals of Biostatistics; 2nd edition, New Delhi : Ane Books India 2008.
6. Qadry, J.S.; Pharmacognosy; 16th edition; N.A. : Author , 2010.

DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
TYBSc Botany Semester V Syllabus (2019-20)

Course Code
SBOT0501

Course Title
CYTOGENETICS & BIOTECHNOLOGY

LEARNING OBJECTIVES:

- The students will be able to understand;
- The mechanism, role and importance of cell division, linkage and crossing over.
- The various gene mutations, their adverse effects in man and advantages in plant breeding.

UNIT I: INHERITANCE AND MOLECULAR BIOLOGY: (15 Lectures)

Cytoplasmic Inheritance- Streptomycin sensitivity in *Chlamydomonas*, CO₂ sensitivity in *Drosophila* (sigma factor); Plastid inheritance - variegation in *Mirabilis jalapa*, male sterility in plants, petite colonies in yeast. DNA- Central dogma of protein synthesis, Transcription, Genetic code, Translation.

UNIT II: MUTATION: (15 Lectures)

Gene Mutations: Types - somatic / germ line, spontaneous / induced, gross / point - base pair substitutions- transversion, transition; effect on phenotype - missense, nonsense, neutral, silent mutations. Chromosomal Mutations: Structural and Numerical changes in Chromosomes; Role of mutations in plant breeding and crop improvement.

UNIT III: BIOTECHNOLOGY I (15 Lectures)

Nucleic acids modifying enzymes – ligase, restriction endonucleases, polymerases, kinases, phosphatases, reverse transcriptase; Vectors used in gene cloning – plasmids, phages, cosmids, YAC and BAC; Methods of gene transfer - physical, chemical and biological.

UNIT IV: BIOTECHNOLOGY II (15 Lectures)

Methods of gene identification in organisms, gene libraries, restriction mapping, methods of DNA amplification and sequencing, southern hybridization, clonal hybridization.

CIA- MCQ / assignment / presentation / test/ literature review and preparation of project proposal.

Practicals: SBOTPR0501

1. Study Identification of cloning vectors, Ti plasmid for production of transgenic plants.
2. Study of inheritance pattern with reference to plastid inheritance.
3. Quantitative estimation of plant genomic DNA and RNA.
4. Isolation of onion DNA using agarose gel electrophoresis.
5. Determine amino acid sequence in the protein molecule synthesized from given m-RNA strand.

References:

1. Introduction to Genetic Analysis A. J. Griffiths, S. R. Wessler, R. C. Lewontin, S. B. Carroll. 9th Edition, Freeman and Company (2008)
2. Molecular Biology of the Gene J. D. Watson, T. A. Baker, S. P. Bell, A. Gann, M. Levine, R. Losick. 5th Edition, Pearson Education (2004)
3. Genetics: A Conceptual Approach B. Pierce, 3rd Edition, Freeman & Co., (2008)
4. iGenetics Peter Russell, 2nd Edition, Pearson International, (2006)
5. Gupta, P.K. (1990). Genetics. Rastogi Publications
6. Molecular Biotechnology: Principles and Applications of Recombinant DNA by Bernard R. Glick and Jack J. Pasternak

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
TYBSc Botany Semester V Syllabus (2019-20)**

Course Code
SBOT0502

Course Title
PLANT SYSTEMATICS

LEARNING OBJECTIVES:

The students will be able to understand:

- Taxonomic Terminology.
- Various classification systems and the reasoning behind the same.
- Learn various plant families and their economic importance.

UNIT I: ECONOMIC AND MEDICINAL BOTANY: (15 Lectures)

Timber, oil and dye yielding plants, Beverages- tea, coffee. Botanical name, family, part used and uses of plants in these categories.

UNIT II: PLANT SYSTEMATICS-I - CLASSIFICATION SYSTEMS: (15 Lectures)

Study of the various classifications systems: Cronquist, Takhtajan and APG I-III, introduction to botanical nomenclature (ICBN). Conservation: methods of Plant Conservation, Botanical Survey of India – Its role in conservation of Biodiversity, IUCN – Red data book.

UNIT III: PLANT SYSTEMATICS-II - ANGIOSPERM FAMILIES: (15 Lectures)

Study of the following families and their economic importance (Bentham and Hooker's system and current position in APG III System): Capparidaceae, Sterculiaceae, Tiliaceae, Solanaceae, Asclepiadaceae, Acanthaceae, Verbenaceae, Zingiberaceae, Cannaceae, Musaceae and Poaceae.

UNIT IV: BIODIVERSITY: (15 Lectures)

Biodiversity- Definition, levels, importance and status. Loss of Biodiversity – reasons, measures to conserve the biodiversity. Distribution of flora found in various forest types of India. Biodiversity Act, 2002.

CIA- MCQ / assignments / presentation / field excursion / test / literature review and preparation of project proposal.

Practicals: SBOTPR0502

1. Morphology and Identification of timber, oil and dye yielding plants.
2. Morphology, Identification, Botanical name, Family and uses of Tea and Coffee plants / products.
3. Study of families: Minimum two species each from the families prescribed in theory.
4. Identification of Genus and Species.
5. Field excursion.

References:

1. Dutta, A.C., A Class book of Botany. 15th edition. Calcutta. Oxford Univ. Press 1976.
2. Simpson M. G. Plant Systematics 2nd, Academic Press, 2010.
3. Sivarajan, V.V. Introduction to the principles of plant taxonomy 2nd ed. Cambridge Univ. Press. 1995.
4. Stuessy Tod F., Plant Taxonomy: The Systematic Evaluation of Comparative Data. Columbia Univ. Press. 2008.
5. Barry g. Hall, Phylogenetic tree made easy - How to ... Manual 3rd ed.
6. Singh Gurucharan, Plant Systematics – Theory and Practice 3rd edition 2010.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
TYBSc Botany Semester VI Syllabus (2019-20)**

Course Code
SBOT0601

Course Title
PLANT GROWTH PHYSIOLOGY

LEARNING OBJECTIVES

The students will be able to understand

- The biochemical steps of nitrogen assimilation, differences between the process of inorganic and organic nitrogen fixation.
- The phenomenon of transformation of vegetative axis into reproductive axis and the substances responsible for this transformation.
- The process and factors that facilitate seed germination; the physiology of fruit ripening.
- The time measuring mechanism in plants. The aging process in plants.

UNIT I: FERTILIZERS AND NITROGEN METABOLISM (15 Lectures)

Assimilation of inorganic nutrients- NPK fertilizers, N₂ cycle, reduction of nitrate, assimilation of ammonia, Biological nitrogen fixation and its biochemistry, effects of nitrogen assimilation on carbohydrate utilization. Phosphate and cation assimilation.

UNIT II: PLANT GROWTH (15 Lectures)

Vegetative growth- Definition, quantitative aspects of growth of annual plants, factors affecting growth. Reproductive growth- Initiation of flower primordia, environment and flower initiation (photoperiodism and vernalization), florigen.

UNIT III: PLANT GROWTH SUBSTANCES (15 Lectures)

Plant growth substances: biosynthesis, physiological role and practical applications of auxins, gibberellins, cytokinins, and ethylene (fruit ripening). Abscisic acid- Growth retarding chemicals and Brassinosteroids.

UNIT IV: PHYSIOLOGY OF SEEDS, AGING; BIOLOGICAL CLOCK (15 Lectures)

Morphological and biochemical changes accompanying seed development and seed germination, dormancy. Aging and senescence, biological clock.

CIA- short answers question / assignment / presentation / problem solving / project / test.

Practicals: SBOTPR0601

1. To study the activity of nitrate reductase.
2. To estimate the α -amino nitrogen; total protein content by Lowry's method.
3. Separation of amino acids by circular paper chromatography; and Fatty acids by TLC.
4. Inhibition of seed germination by inhibitors in fruit juices.
5. Mobilization of starch during seed germination by amylases (qualitative)

Reference Books:

1. Noggle, Ray G.; Fritz, George J.; Introductory plant physiology; 2nd edition; New Delhi : Prentice-Hall Of India Private Limited , 1991.
2. Devlin, Robert M.; Witham, Francis H.; Plant Physiology; 4th edition, Indian reprint; Delhi : CBS Publishers & Distributors , 1986(2001).
3. Kochhar, P.L.; A textbook of Plant Physiology; 7th edition; Delhi :Atma Ram & Sons , 1964.
4. Verma S. K. Textbook of Plant physiology and Biochemistry ; S. Chand & Company Ltd, 2003.
5. Sinha, R.K.; Modern plant physiology; 2nd edition; New Delhi: Narosa Publishing House , 2004.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.
TYBSc Botany Semester VI Syllabus (2019-20)**

Course Code
SBOT0602

Course Title
ENVIRONMENTAL BOTANY

LEARNING OBJECTIVES:

The students will be able to understand

- The role and importance of biotic and abiotic environmental factors in the sustenance of plant life.
- Causes, consequences, prevention, remediation of pollution and efforts taken in reducing or controlling the pollution causing factor.
- The importance of phytogeography and forestry for man and the legal enforcement imposed by government in preventing the loss to the natural regional flora.

UNIT I: ABIOTIC FACTORS (15 Lectures)

Light- quality, duration, absorption, intensity, effects on plants; Temperature- variation due to altitude, effects on plants, thermal constant, stratification; Water- Precipitation, moisture, rainfall measurement. Wind - speed, advantages and damage caused to plants. Soil- soil profile, texture, classification, moisture, water, organic matter, atmosphere, temperature, organisms.

UNIT II: BIOTIC INTERACTIONS (15 Lectures)

Biotic community relationships- mutualism, mycorrhizae, commensalisms, proto cooperation, competition, amensalism and saprophytism. Prey-predation model equation.

UNIT III: POLLUTION (15 Lectures)

Causes of Pollution: Light, Noise, Water, Soil and Air. Effect of pollution on plants: Light, Noise, Water, Soil and Air. Mitigation of pollution by plants: Noise, Water, Soil and Air.

UNIT IV: FORESTRY (15 Lectures)

Types of forests, destruction of forests, deforestation, afforestation, reforestation, institutions for forest research, education and training; Biosphere reserves. Forest Conservation act, 1980; Environment Protection Act 1986; The Indian Wildlife (Protection) Act – 1972 amended 1991.

CIA- assignment / presentation / field report / open book test/ Case study.

Practicals: SBOTPR0602

1. Study of ecological instruments i.e. lux meter, rain gauge, hygrometer, wet and dry bulb thermometer, wind anemometer, maximum and minimum thermometer, barometer.
2. To study the moisture, carbonate, nitrate, base deficiency, pH of soil by use of rapid tests.
3. Determination: of salinity, chlorinity, BOD of water sample; organic matter and carbon from soil.
5. Determine percent leaf area injury of infected leaf samples.
6. Identification of Phytogeographical area from map w.r.to distribution, rainfall, vegetation.

Reference Books:

1. R.S. Ambasht - A text book of plant ecology.
2. Fundamental of Ecology (1971): EP Odum; WB Saunders Company.
3. Jogdand, SN 1995. Environmental Biotechnology. Himalaya Publishing House, Mumbai.
4. Ecology and environment; PD Sharma, Rastogi publications, Meerut. 7th ed – 2004.
5. Ecology- N.S. Subrahmanyam and A.V.S.S. Sambamurty, Narosa Publishing House, 2000;
6. Environmental Chemistry, A. K. Day, Fourth Edition, New Age International Publishers-2002
7. Environmental Science; by-Santra SC; Central Publ. New Delhi.
