

St. Xavier's College (Autonomous),  
Mumbai



Syllabus of the courses offered by the  
Department of Botany  
(2016-17)

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI**  
**Outline of BSc Botany Syllabus for all 6 Semesters (year 2016-17)**

Course	Course Title	Units	Title
S.BOT. 1.01	Plant Diversity I	I	Microbiology and Algae
		II	Fungi
		III	Bryophyte
S.BOT.1.02	Angiosperms-I	I	Morphology of Angiosperms
		II	Angiosperm Taxonomy
		III	Anatomy- Primary Structures
S.BOT.2.01	Plant physiology and Biochemistry I	I	Water Relations
		II	Transport processes and Enzymes
		III	Plant Biochemistry
S.BOT.2.02	Cytology, Genetics and Ecology	I	Cytology
		II	Genetics
		III	Ecology
S.BOT.3.01	Plant diversity II	I	Microbiology
		II	Algae and Lichens
		III	Fungi and Plant Pathology
S.BOT.3.02	Plant Physiology and Biochemistry- II	I	Respiration
		II	Photosynthesis
		III	Photorespiration and mineral nutrition
S.BOT.3.03	Anatomy, Embryology and Palynology	I	Anatomy
		II	Embryology
		III	Palynology
S.BOT.4.01	Plant Diversity- III	I	Bryophyte
		II	Pteridophyta
		III	Gymnosperms and Angiosperms
S.BOT.4.02	Angiosperms-II	I	Morphology and Economic Botany
		II	Angiosperms families
		III	Taxonomic literature, nomenclature and herbarium
S.BOT.4.03	Medicinal Botany and Tools of Analysis	I	Medicinal Botany
		II	Instrumentation
		III	Biostatistics and Bioinformatics
S.BOT.5.01	Cytogenetics, Molecular Biology and Biotechnology	I	Linkage and Crossing over
		II	Inheritance and Molecular Biology
		III	Mutation
		IV	Biotechnology
S.BOT.5.02	Angiosperms III	I	Economic and Medicinal Botany
		II	Plant systematic-I Classification Systems
		III	Plant systematic-II Angiosperms families
		IV	Biodiversity
S.BOT.6.01	Plant Physiology and Biochemistry III	I	Nitrogen Metabolism and Fruit Ripening
		II	Plant Growth
		III	Plant Growth Substances
		IV	Physiology of seeds, ageing process, and time
S.BOT.6.02	Ecology and Environmental Botany- I	I	Ecological factors (Abiotic)
		II	Ecological factors (Soil & Biotic)
		III	Pollution
		IV	Phytogeography and Forestry

DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
F. Y. B. Sc. Botany Syllabus (2016-2017)

**SEMESTER-I Course: S.BOT.1.01 PLANT DIVERSITY- I**

**LEARNING OBJECTIVES**

The students will be able to-

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

**UNIT I : MICROBIOLOGY AND ALGAE: MICROBIOLOGY: Bacteria:** Size, shape, arrangement, cell structure, Growth and reproduction, Significance of bacteria. **Viruses:** Size, shape, structure, Significance; **ALGAE:** General characters of Algae, Pigments in 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*, *Zygnema*.

**UNIT II: FUNGI:** General characters of Fungi, Classification: Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes, General characters of these classes: Mode of nutrition in Fungi, Economic importance of Fungi, Type studies: Distribution, lifecycle and systematic position of *Rhizopus*, *Agaricus*.

**UNIT III: BRYOPHYTA:** General characters, Classification: Hepataceae, Anthocerotaceae and Musci, General characters of these classes, Type studies: Distribution, life cycle and systematic position of *Riccia*. Economic importance of Bryophytes

**Practicals- Course: S. BOT PR 1.01**

1. Gram staining of Bacteria.
2. Study of Economically important Algae and Fungi.
3. Study of stages in the life cycle of *Nostoc* and *Zygnema*.
4. Study of stages in the life cycle of *Rhizopus* and *Agaricus*.
5. Study of the life cycle of *Riccia*.

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

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**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
F. Y. B. Sc. Botany Syllabus (2016-2017)**

**SEMESTER-I Course: S.BOT.1.02 ANGIOSPERMS- I**

**LEARNING OBJECTIVES**

The students will be able to-

- 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: Root, Stem, Leaf, Inflorescence and Flower.**

**UNIT II: ANGIOSPERMS TAXONOMY: Introduction to Systems of Classification – Artificial, Natural and Phylogenetic, Bentham and Hooker's system of classification, Study of following families, Malvaceae, Leguminosae, Asteraceae, Euphorbiaceae, Amaryllidaceae and Liliaceae.**

**UNIT III - ANATOMY- PRIMARY STRUCTURES: Tissue systems in plants: Epidermal tissue system: Epidermal out growths, stomata (dicot and monocot); Mechanical tissue system: Collenchyma, Sclerenchyma and Lignified tissues; Vascular tissue system: Xylem and Phloem; Study of Primary structures: Dicot and monocot root, stem and leaf.**

**Practicals Course: S.BOT PR1.02**

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

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

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**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
F. Y. B. Sc. Botany Syllabus (2016-2017)**

**SEMESTER-II Course: S.BOT. 2.01 PLANT PHYSIOLOGY AND BIOCHEMISTRY- I**

**LEARNING OBJECTIVES**

The students will be able to understand-

- The transport mechanism in plants and differentiate between 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:** Water as a plant constituent, Functions of water in plants, Water molecule, Physical and chemical properties of water, Imbibition and osmosis, Water potential and its components, Role of turgor pressure in plant cells, Changes in  $\Psi_p$  and  $\Psi_w$  during reversible changes in cell volume. Transpiration and absorption: Water loss by transpiration, Measurements of transpiration rates, Movement of water vapor through stomatal pores, Plant antitranspirants, Stomatal movements, Absorption of water by absorbing plants, Movement of water across roots and through leaves.

**UNIT II : TRANSPORT PROCESSES AND ENZYMES:** **Transport processes:** Movement of solutes in plants, Passive transport, Protoplasmic membrane, Active transport across protoplasmic membranes, Mechanism of active transport, Shuttle systems, Electroosmosis and pinocytosis, Transcellular transport, Translocation in sieve tubes, Anatomy of sieve tubes, Mechanism of sieve tube translocation. **Enzymes:** Nomenclature, Properties, Classification, Specificity, Apoenzyme, prosthetic group, Mode of action, Kinetics (no derivation of Michaelis Menten equation), Enzyme inhibition, Isozymes.

**UNIT III : PLANT BIOCHEMISTRY:** Major Cellular compounds, their classification and functions in plants and \*biosynthesis and degradation of selective compounds\*.; Carbohydrates - \*Starch, \*Cellulose; Proteins; Lipids - \*Triglycerides.

**Practicals- Course: S.BOT PR2.01**

1. Study of activity of amylase.
1. Determination of solute potential by plasmolytic method.
2. Demonstration of transpirational water loss by Ganong's potometer.
3. Determination of stomatal frequency.
4. Determination of stomatal size.
5. Tests for detection of Carbohydrates - Reducing sugars, non-reducing sugars, monosaccharides, non-reducing disaccharides, starch.
6. Tests for detection of proteins and amino acids.
7. Tests for detection of fats and oil.

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

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DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
F. Y. B. Sc. Botany Syllabus (2016-2017)

**SEMESTER-II Course: S.BOT.2.02 CYTOLOGY, GENETICS & 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:** Ultra-structure and functions of the following: Cell wall, Plasma membrane (unit membrane and fluid mosaic model), Mitochondrion and Chloroplast, Nucleus: Chromosomes, Cell division – Mitosis.

**UNIT II : GENETICS:** Mendel's Laws, Allelic and non-allelic interaction, Epistatic interactions, Sex determination in plants.

**UNIT III : ECOLOGY:** 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.

**Practicals- Course: S.BOT PR2.02**

1. Examining various stages of mitosis in root tip cells.
2. Study of external and internal structures of *Hydrilla*, *Eichhornia* / *Nymphaea*, *Nerium*, *Opuntia* and *Avicennia*.
3. Study of pond ecosystem.
4. Study of terrestrial ecosystem.
5. Study of estuarine ecosystem.
6. Problems on Mendelian genetics- Mono hybrid and dihybrid ratios, Allelic and non-allelic interactions, Epistatic interactions.

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

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DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
S. Y. B. Sc. Botany Syllabus (2016-2017)

**SEMESTER-III Course: S.BOT.3.01 PLANT DIVERSITY- II**

**LEARNING OBJECTIVES**

The students will be able to-

- Understand the importance of bacteria and methods of their cultivation.
- Learn about the causal organisms of plant diseases.
- Learn the life cycles of the individuals belonging to Algae, Fungi and Lichens.

**Unit I: MICROBIOLOGY :** Basics principles of staining; culture media preparation; pure culture methods: Classification of bacteria based on mode of nutrition; Biofertilizers and methods of application; Bacteria in sulphur cycle; Bacteria in Phosphate solubilization.

**Unit II: ALGAE AND LICHENS:** Algae- Structure life cycle and systematic position of *Vaucheria* (Xanthophyta), *Sargassum* (Phaeophyta), *Batrachospermum* (Rhodophyta). Lichens- Classification, structure, method of reproduction and ecological significance.

**Unit III: FUNGI AND PLANT PATHOLOGY :** Fungi- Structure life cycle and systematic position of *Erysiphe*, *Fusarium*. Plant pathology- diseases, symptoms, causative organism, disease cycle and control measures of rust of wheat and late blight of potato.

**Practicals- Course: S.BOT PR.3.01**

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

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

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**SEMESTER-III Course: S.BOT.3.02 PLANT PHYSIOLOGY AND BIOCHEMISTRY- II**

**LEARNING OBJECTIVES**

The students will be able to understand-

- The importance of minerals to plants,
- The catabolic process and synthesis of chemical energy in plants, the anabolic process in plants.
- And differentiate between light and dark reactions of photosynthesis.
- The respiratory process in presence of light and differentiate between C<sub>3</sub>, C<sub>4</sub> and CAM plants

**Unit I: RESPIRATION:** Respiratory gas exchange, Respiratory substrates, Nature of biological oxidation, Outline of respiratory substrates, Glycolytic pathway, Oxidative pentose phosphate pathway, Anaerobic respiration, Tricarboxylic Acid Cycle, Respiratory chain, Significance of ATP, The chemiosmotic theory.

**Unit II: PHOTOSYNTHESIS:** Efficiency of plants in converting radiant energy and matter, Light phase of photosynthesis, The chloroplast as the unit of photosynthesis, Reaction scheme for ATP and NADPH formation, Role of ATP and NADPH in CO<sub>2</sub> fixation, The path of carbon in photosynthesis – C<sub>3</sub>, C<sub>4</sub> and CAM, Factors influencing photosynthesis.

**Unit III: PHOTORESPIRATION AND MINERAL NUTRITION:** Photorespiration: Biochemistry of photorespiration in C<sub>3</sub> plants, Photorespiration in C<sub>4</sub> plants, Regulation of photorespiration, Mineral nutrition, Autotrophs and heterotrophs, Criteria of essentiality of elements, Essential elements, Nutritional disorders of plants, Sources of nutrients, Mycorrhiza.

**Practicals- Course: S.BOT PR.3.02**

1. Estimation of Ca<sup>2+</sup> and Mg<sup>2+</sup> in plant sample.
2. Estimation of phosphorous in plants.
3. Colorimetric estimation of total chlorophyll content.
4. Estimation of carotenoids from plant samples.
5. Separation of photosynthetic pigments by paper chromatography.
6. Isolation of chloroplasts and study of Hill Reaction (Demonstration only).
7. To study the Kranz anatomy.

**CIA-** multiple choice questions / test / assignment.

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DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
S. Y. B. Sc. Botany Syllabus (2016-2017)

**SEMESTER-III Course: S.BOT.3.03 ANATOMY, EMBRYOLOGY & PALYNOLOGY**

**LEARNING OBJECTIVES :**

The students will be able to-

- Differentiate between the normal and anomalous secondary growth.
- Learn about the different meristems their locations and functions.
- Learn the developmental stages of micro and megasporangium.
- Understand the pollen morphology and the applications of palynology.

**Unit I: ANATOMY:** Normal secondary growth in Dicotyledonous stem and root, Anomalous secondary growth in the stems of *Bignonia*, *Salvadora*, *Achyranthes* and *Dracaena*; Anomalous secondary growth in the roots of Beet and Radish, Root stem transition, Study of apical, lateral and root meristems.

**Unit II: EMBRYOLOGY :** 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:** 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.

**Practicals- Course: S.BOT PR.3.03**

1. Study of normal secondary growth in sunflower stem and root.
2. Study of anomalous secondary growth in the stems of *Bignonia*, *Salvadora*, *Achyranthus*, and *Dracaena* by double staining technique and preparation of permanent slide using one of the above materials.
3. Study of anomalous secondary growth in the storage roots of Beet and Radish.
4. Study of apical, lateral and root meristem using slides / photomicrographs.
5. Study of various stages of microsporogenesis, megasporogenesis and embryo development with the help of permanent slides / photomicrographs
6. Study of pollen morphology of *Hibiscus*, *Canna*, *Pancreatium* and *Ocimum*.
7. Pollen analysis from honey sample: Unifloral and Multifloral honey.

CIA- assignments / presentation / moodle / test.

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DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
S. Y. B. Sc. Botany Syllabus (2016-2017)

**SEMESTER-IV Course: S.BOT.4.01 PLANT DIVERSITY- III**

**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:** Structure, life cycle and systematic position of *Anthoceros* and *Funaria*; Thallus organization in Bryophyta, Apogamy and apospory in Bryophytes.

**Unit II: PTERIDOPHYTA:** 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 :** 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*.

**Practicals- Course: S.BOT PR.4.01**

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

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

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DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
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**SEMESTER-IV Course: S.BOT.4.02 ANGIOSPERMS- II**

**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:** Morphology of fruits, Economic botany: Fiber yielding plants, Paper yielding plants; Spices and condiments.

**Unit II: ANGIOSPERM FAMILIES:** Study of the following angiosperm families – emphasis to be given to the peculiar structures found in plants and economic importance of these species – as per Bentham and Hooker's System: Anacardiaceae, Rutaceae, Combretaceae, Myrtaceae, Apiaceae, Rubiaceae, Apocynaceae, Arecaceae,.

**Unit III: TAXONOMIC LITERATURE, NOMENCLATURE AND HERBARIUM TECHNIQUES:** 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.

**Practicals- Course: S.BOT PR.4.02**

1. Study of Fruit morphology.
2. Study of two anatomical characters of Taxonomic importance to distinguish any two families.
3. Study of two palynological characters of Taxonomic importance to distinguish any two families.
4. Study of Embryological characters of Taxonomic importance .
5. Study of the following families, their morphological peculiarities and economic importance: Anacardiaceae, Rutaceae, Combretaceae, Myrtaceae, Apiaceae, Rubiaceae, Apocynaceae , Arecaceae.
5. Preparation of 10 herbarium sheets
6. Visit to Blatter Herbarium and preparation of a report on the same.
7. Field excursion.

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

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DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
S. Y. B. Sc. Botany Syllabus (2016-2017)

**SEMESTER-IV Course: S.BOT.4.03 MEDICINAL BOTANY AND TOOLS OF ANALYSIS**

**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:** Classification of crude drugs, Pharmacognosy – definition and scope, Analytical Pharmacognosy – Drug adulteration, methods of drug evaluation, phytochemical investigations. Bio-prospection of plant species in relation to medicinal plants, Plants used in treatments of various ailments – Ginger, Turmeric, Tulsi, Garlic, Cinnamon, Nutmeg, Clove; Herbal cosmetics.

**Unit II: INSTRUMENTATION:** Principle, working and applications of: pH meter, Colorimeter, Light, phase contrast microscopy, Chromatography - Paper, Thin layer and Column chromatography, Gel electrophoresis - techniques of protein staining.

**Unit III: BIOSTATISTICS:** Frequency distribution- graphical representation, distribution of data in Biology; Standard deviation; Testing of hypothesis: Student's t-test (paired and unpaired) and Correlation. **BIOINFORMATICS :** Introduction to bioinformatics, internet and its uses, world wide web, Tools used in bioinformatics related to biotechnology; NCBI data models and other data bases, services offered by NCBI and EBI.

**Practicals- Course: S.BOT PR.4.03**

1. Determination of extractive values of crude drugs.
2. Determination of swelling factor.
3. Organoleptic study, macroscopic and microscopic characters of plant drug- Leaf drug *Adhoda vasica*; Rhizome drug *Zingiber officinale*; Bark drug *Cinnamomum zylanicum*.
4. Preliminary tests for alkaloids, tannins essential oils and glycosides.
5. Study of plants used in various ailments - Vernacular name, Botanical name, Family plant part used of the following plants: Ginger, Turmeric, Tulsi, Garlic, Cinnamon, Nutmeg, Clove.
6. Study of Phase contrast microscope.
7. Separation of curcuminoids by TLC (demonstration)
8. Separation of carotenoids by column chromatography (Demonstration).
9. Measure of central tendency, frequency distribution and Standard deviation.
10. *t* –test analysis.
11. Use of BLAST to identify similar sequences with respect to a query sequence.
12. To retrieve and study nucleotide and protein sequence from NCBI database.

CIA- assignments / presentation / project / test.

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**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.**  
**T. Y. B. Sc. Botany Syllabus (2016-2017)**

**SEMESTER-V Course: S.BOT.5.01 CYTOGENETICS, MOLECULAR BIOLOGY & 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 affects in man and advantages in plant breeding.

**UNIT I: LINKAGE AND CROSSING OVER:** Meiosis, Comparison of Mitosis and Meiosis; Linkage- Coupling and Repulsion Hypothesis; Crossing over- Chromosome mapping, Three point test cross, Interference and coincidence, Tetrad analysis in *Neurospora*; Crossing over between centromere and gene (first and second division segregation)

**UNIT II: INHERITANCE AND MOLECULAR BIOLOGY:** Cytoplasmic Inheritance- Streptomycin sensitivity in *Chlamydomonas*, Kappa particles in *Paramecium*, CO<sub>2</sub> sensitivity in *Drosophila* (sigma factor); Plastid inheritance - variegation in *Mirabilis jalapa*; Male sterility in plants. DNA- Central dogma of protein synthesis, Transcription, Genetic code, Translation.

**UNIT III: MUTATION:** Gene Mutations: Types - somatic / germ line, spontaneous / induced, gross / point - base pair substitutions - transversion, transition; Effect of substitution mutation on the phenotype - Missense, Nonsense, Neutral, Silent mutations. Chromosomal Mutations (Chromosomal Aberrations)- Structural Changes in Chromosomes; Deletion / Deficiency; Duplication, Translocation, Inversion; Numerical Changes in Chromosomes: Aneuploidy- Monosomy, Nullisomy, Trisomy, Tetrasomy, Euploidy- Monoploidy and haploidy, Polyploidy, Autopolyploids, Allopolyploids. Role of mutations in plant breeding and crop improvement.

**UNIT IV: BIOTECHNOLOGY:** Recombinant DNA technology; Transgenic plant production by *Agrobacterium* mediated gene transfer; Transgenic plants used for improving quality of seeds, edible vaccines; Restriction enzymes; Cloning vectors,.

**Practicals- Course: S.BOT PR.5.01**

1. Study of smear preparation for stages of meiosis using any suitable plant material.
2. Tetrad analysis in *Neurospora*.
3. Genetic mapping using 3 point test cross data.
4. Identification of cloning vectors, Ti plasmid for the production of transgenic plants.
5. Study of inheritance pattern with reference to plastid inheritance.
6. Quantitative estimation of plant genomic DNA and plant RNA.
7. DNA sequencing – Sangers method.
8. Determining the sequence of amino acids in the protein molecule synthesized from the given m-RNA strand (prokaryotic and eukaryotic).

**CIA-** multiple choice questions / assignment / presentation / test.

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**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
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**SEMESTER-V Course: S.BOT.5.02 ANGIOSPERMS- III**

**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:** Timber Yielding Plants. Oil Yielding Plants. 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:** 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:** Study of the following families – emphasis to be given on its peculiar characteristics and economic importance, their systematic position as per Bentham and Hooker's system of classification. Current position according to APG III System. Capparidaceae and Cleomaceae, Sterculiaceae and Tiliaceae, Solanaceae, Asclepiadaceae, Acanthaceae, Verbenaceae, Zingiberaceae, Cannaceae, Musaceae and Poaceae.

**UNIT IV: BIODIVERSITY:** Definition, Levels of Biodiversity. Importance and status of biodiversity. Loss of Biodiversity – reasons; measures to conserve the biodiversity. Distribution of Flora found in various forest types of India. Biodiversity Act, 2002.

**Practicals- Course: S.BOT PR.5.02**

1. Morphology and Identification of timber yielding plants.
2. Morphology and Identification of oil yielding plants
3. Morphology and Identification of dye yielding plants.
4. Morphology, Identification, Botanical name, Family and uses of Tea and Coffee plants / products.
5. Study of the following families: Minimum two species each from the families prescribed in theory.
6. Identification of Genus and Species. At least three specimens from any families prescribed in the theory for FYBSc to TYBSc.
7. Field excursion.

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

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**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.**  
**T. Y. B. Sc. Botany Syllabus (2016-2017)**

**SEMESTER-VI Course: S.BOT.6.01 PLANT PHYSIOLOGY AND BIOCHEMISTRY- III**

**LEARNING OBJECTIVES**

The students will be able to understand-

- The biochemical steps involved in nitrogen assimilation in plants and will be able to differentiate 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 of seed germination and know the factors which facilitate the germination and the physiology of fruit ripening.
- The time measuring mechanism in plants.
- The ageing process in plants.

**UNIT I: NITROGEN METABOLISM AND FRUIT RIPENING PROCESS:** Assimilation of inorganic nutrients- N<sub>2</sub> cycle. Reduction of nitrate, Assimilation of ammonia, Biological nitrogen fixation, Biochemistry of biological nitrogen fixation, Effects of nitrogen assimilation on carbohydrate utilization. Physiology of fruit ripening.

**UNIT II: PLANT GROWTH:** 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:** Plant growth substances: biosynthesis, physiological role and practical applications of following: Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid- Growth retarding chemicals.

**UNIT IV: PHYSIOLOGY OF SEEDS, AGING PROCESSES AND TIME MEASURING MECHANISM:** Physiology of seeds- Seed germination, Morphological and biochemical changes accompanying seed germination, Dormancy. Aging and senescence; Biological clock.

**Practicals- Course: S.BOT PR.6.01**

1. To study the activity of nitrate reductase.
2. To estimate the  $\alpha$ -amino nitrogen.
3. To estimate the total protein content by Lowry's method.
4. Separation of amino acids by paper chromatography.
5. Inhibition of seed germination by inhibitors in fruit juices.
6. Mobilization of starch during seed germination by amylases (qualitative)
7. Separation of organic acids by chromatography.

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

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**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.  
T. Y. B. Sc. Botany Syllabus (2016-2017)**

**SEMESTER-VI Course: S.BOT.6.02 ECOLOGY AND ENVIRONMENTAL BOTANY-I**

**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 enforcements imposed by government in preventing the loss to the natural regional flora.

**UNIT I: ECOLOGICAL FACTORS (ABIOTIC):** Light- quality, duration, absorption, intensity, effects on plants; Temperature- variation due to altitude, effects on plants, thermal constant and stratification; Water- Precipitation, moisture, measurement of rainfall. Wind - speed, advantages and damage caused to plants.

**UNIT II: ECOLOGICAL FACTORS (SOIL AND BIOTIC FACTORS):** Soil- soil profile, texture, classification, moisture, water, organic matter, atmosphere, temperature, organisms. Biotic- community relationships- mutualism, mycorrhizae, commensalisms, protocooperation, competition, amensalism and saprophytes.

**Unit III: POLLUTION:** Air pollution- causes and consequences of polluting gases; ozone depletion, greenhouse effect, global warming, acid rain, smog. Water pollution- causes and consequences of eutrophication, sewage, industrial waste, heavy metals, oil in sea. Soil pollution- Organic and inorganic chemicals in the soil, bioagents and toxins; Phytoremediation. Effect of Air, Water and Soil pollution on vegetation.

**UNIT IV: FORESTRY:** Types of forests, destruction of forests, deforestation, afforestation, reforestation; institutions for forest research, education and training; Biosphere reserves. Forest Conservation act, 1980; Indian Forests Act (Revised) 1982; The Indian Wildlife (Protection) Act – 1972 amended 1991.

**Practicals- Course: S.BOT PR.6.02**

1. Study of ecological instruments i.e. lux meter, rain guage, hygrometer, wet and dry bulb thermometer, wind anemometer, maximum and minimum thermometer, barometer.
2. To study the chemical characters (moisture, carbonate, nitrate, base deficiency, pH) of soil by use of rapid tests.
3. Determination of COD in water sample; Determination of BOD in water sample.
4. Determination of salinity and chlorinity of water sample.
5. Estimation of organic matter and organic carbon from soil.
6. Determination of percent leaf area injury of different infected leaf samples.
7. Estimation of nitrates from soil sample.

**CIA- assignment / presentation / field report / open book test.**

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