



College of Arts,
Science &
Commerce (Autonomous)

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE

**SIES College of Arts, Science and Commerce (Autonomous)
Sion (West) Mumbai: 400022**

Affiliated to Mumbai University

Syllabus under Autonomy - June 2018

Program: T. Y. B.Sc. (6 Units)

Course: Botany

Choice Based Credit System (CBCS)

with effect from the academic year 2018-19

PREAMBLE

In the revised autonomous syllabus, the committee has taken utmost care to maintain the continuity in the flow of information at T.Y.B.Sc. level. Hence, some of the modules of the existing university syllabus have been upgraded with the new modules to introduce the learners to the recent developments in various branches of Botany.

All the papers of theory and practicals (Semester - V & Semester - VI together) are compulsory for the TYBSc Botany (6 Units) students according to their specialization.

Each theory period shall be of 48 minutes duration. Theory component shall have 240 instructional periods per semester. Each practical will be of 4 periods each.

MODALITY OF ASSESSMENT:**Theory Examination Pattern**

A) Internal Assessment – 40M

(20M Class Test + 15M Assignment/Case study/ ppt. + 05 Class participation)

B) External examination – 60M (Semester End Theory Assessment)

- i. Duration - These examinations shall be of two hours duration.
- ii. Theory question paper pattern: attached herewith.

Practical Examination Pattern:

A. Internal Examination: There will not be any internal examination/ evaluation for practicals.

B. External (Semester end practical examination)

The students are required to present a duly certified journal for appearing at practical examination, failing which they will not be allowed to appear for the examination. In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from the Head of the Department/ Co-ordinator of the department; failing which the student will not be allowed to appear for the practical examination.

Overall Examination and Marks Distribution Pattern for Semester V

Course	PAPER I			PAPER II			PAPER III			PAPER IV			Grand Total
	Int	Ext	Total	Int	Ext	Total	Int	Ext	Total	Int	Ext	Total	
Theory	40	60	100	40	60	100	40	60	100	40	60	100	400
Practicals	-	50	50	-	50	50	-	50	50	-	50	50	200

Overall Examination and Marks Distribution Pattern for Semester VI

Course	PAPER I			PAPER II			PAPER III			PAPER IV			Grand Total
	Int	Ext	Total	Int	Ext	Total	Int	Ext	Total	Int	Ext	Total	
Theory	40	60	100	40	60	100	40	60	100	40	60	100	400
Practicals	-	50	50	-	50	50	-	50	50	-	50	50	200

PROGRAMME SPECIFIC OUTCOMES (PSOs)

After completing the graduation (B.Sc.) programme in Botany, the learners would be able to -

- **PSO1:** Identify the different groups of plants and gain the knowledge about plant biodiversity and its conservation.
- **PSO2:** Learn different techniques, protocols, methodologies during study and apply them in future.
- **PSO3:** Utilize the botanical knowledge for problem solving and for taking real time decisions while working with plants.
- **PSO4:** Learn good laboratory practices and acquire research skills required for industrial support services.
- **PSO5:** Inculcate scientific temperament, good reasoning power, technological and analytical skills while designing the experiments.
- **PSO6:** Develop interest in pursuing higher studies in plant sciences and allied fields to develop better future.
- **PSO7:** Understand the scope, current trends, job prospects and career avenues in Botany.
- **PSO8:** Share social and environmental consciousness with the fellow citizens and motivate them towards taking fundamental steps towards environmental conservation.

T.Y.B.Sc. Botany Syllabus (Restructured for Choice-Based Credit System)

To be implemented from the Academic year 2018-2019

SEMESTER V

COURSE CODE	UNIT	TOPICS	CREDITS	L /WEEK
SIUSBOT51	PLANT DIVERSITY III		2.5	
	I	Microbiology		
	II	Algae		
	III	Fungi		
SIUSBOT52	PLANT DIVERSITY IV		2.5	
	I	Paleobotany		
	II	Angiosperms I		
	III	Anatomy I		
SIUSBOT53	FORM AND FUNCTION III		2.5	
	I	Cytology and Molecular biology		
	II	Physiology I		
	III	Environmental Botany		
SIUSBOT54	CURRENT TRENDS IN PLANT SCIENCES II		2.5	
	I	Ethnobotany and Mushroom Industry		
	II	Biotechnology I		
	III	Instrumentation		
IV	Pharmacognosy and medicinal botany	1		
SIUSBOT5.1	Practicals based on course I & II in theory		3	8
SIUSBOT5.2	Practicals based on course III & IV in theory		3	8

SEMESTER VI

COURSE CODE	UNIT	TOPICS	CREDITS	L /WEEK
SIUSBOT61	PLANT DIVERSITY III		2.5	
	I	Bryophyta		
	II	Pteridophyta		
	III	Bryophyta and Pteridophyta: Applied aspects		
SIUSBOT62	PLANT DIVERSITY IV		2.5	
	I	Angiosperms II		
	II	Anatomy II		
	III	Embryology		
SIUSBOT63	FORM AND FUNCTION III		2.5	
	I	Plant Biochemistry		
	II	Physiology II		
	III	Genetics		
SIUSBOT64	CURRENT TRENDS IN PLANT SCIENCES II		2.5	
	I	Plant biotechnology II		
	II	Plant Geography		
	III	Economic Botany		
IV	Post-harvest Technology	1		
SIUSBOT6.1	Practicals based on course I & II in theory		3	8
SIUSBOT6.2	Practicals based on course III & IV in theory		3	8

SEMESTER V THEORY

Course Code	Title	Credits
SIUSBOT51	PLANT DIVERSITY III	2.5 Credits (60 lectures)
<p>Course Outcomes: The students will be able to -</p> <ul style="list-style-type: none"> ❖ CO1: Study different types of microbes. Culturing & fermentation techniques. ❖ CO2: Understand the morphology, general characteristics and economic importance of algae and fungi. ❖ CO3: Learn the different plant diseases w.r.t. symptoms & control measures. <p>CIA – Class Test (20M) + Assignment/ Case Study/ Presentation (15M) + Class Participation (5M)</p>		
<p><u>Unit I: Microbiology</u></p> <ul style="list-style-type: none"> • Types of Microbes – Bacteria, Archaea, Viruses, Fungi, Algae, Rickettsia • Culturing: Sterilization, media, staining, colony characters • Pure cultures • Role of microbes in fermentation: Alcohol and Antibiotics 		(15 lectures)
<p><u>Unit II: Algae</u></p> <ul style="list-style-type: none"> • Division <u>Rhodophyta</u> Classification and General Characters: Distribution, Cell structure, pigments, reserve food, range of thallus, reproduction: asexual and sexual, Alternation of Generations, Economic Importance. • Structure, life cycle and systematic position of <i>Polysiphonia</i>, <i>Batrachospermum</i> • Classification and General Characters of <u>Xanthophyta</u>: Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance. • Structure, life cycle and systematic position of <i>Vaucheria</i> • Classification and General Characters of <u>Bacillariophyta</u>: Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance. • Structure, life cycle and systematic position of <i>Pinnularia</i> 		(15 lectures)
<p><u>Unit III: Fungi</u></p> <ul style="list-style-type: none"> • Basidiomycetes: Classification and General Characters • Life cycle of <i>Agaricus</i> • Life cycle of <i>Puccinia</i> • Deuteromycetae: Classification and General Characters • Life cycle of <i>Alternaria</i> 		(15 lectures)
<p><u>Unit IV: Plant Pathology</u></p> <ul style="list-style-type: none"> • Study of plant diseases: Causative organism, symptoms, predisposing factors, disease cycle and control measures of the following. <ul style="list-style-type: none"> ▪ White Rust – <i>Albugo sp.</i> ▪ Tikka disease of ground nut – <i>Cercospora</i> ▪ Damping off disease – <i>Pythium</i> ▪ Citrus canker – <i>Xanthomonas sp.</i> ▪ Leaf curl – leaf curl virus • Study of Physical, chemical and biological control methods of plant diseases. 		(15 lectures)

Course Code	Title	Credits
SIUSBOT52	PLANT DIVERSITY III	2.5 Credits (60 lectures)
<p>Course Outcomes: The students will be able to-</p> <ul style="list-style-type: none"> ❖ CO1: Study different fossils & contribution of Birbal Sahni in the field of Paleobotany. ❖ CO2: Understand the morphology of fruits & general characteristics and economic importance of angiosperms. ❖ CO3: Learn the different aspects of plant anatomy & palynology. <p>CIA – Class Test (20M) + Assignment/ Case Study/ Presentation (15M) + Class Participation (5M)</p>		
<p><u>Unit I : Paleobotany</u></p> <ul style="list-style-type: none"> • <i>Calamites</i> – All form genera Stem, leaf, male and female fructification • <i>Lepidodendron</i>–All form genera root, stem, bark, leaf, male and female fructification • <i>Lyginopteris</i> – All form genera root, stem, leaf, male and female fructification • <i>Pentoxylon</i> – All form genera • Contribution of Birbal Sahni, Birbal Sahni Institute of Paleobotany, Lucknow 		(15 lectures)
<p><u>Unit II : Angiosperms I</u></p> <ul style="list-style-type: none"> • Morphology of flower and fruit • Complete classification of Bentham and Hooker, Merits and demerits • Hutchinson’s classification – merits and demerits • Bentham and Hooker’s system of classification for flowering plants up to family with respect to the following prescribed families and economic and medicinal importance for members of the families: Capparidaceae • Umbelliferae • Cucurbitaceae • Rubiaceae • Solanaceae • Commelinaceae • Graminae 		(15 lectures)
<p><u>Unit III : Anatomy</u></p> <ul style="list-style-type: none"> • Anomalous secondary growth in the Stems of <i>Bignonia</i>, <i>Salvadora</i>, <i>Achyranthes</i>, <i>Aristolochia</i>, <i>Dracaena</i>. Storage roots of Beet, Radish • Root stem transition • Types of Stomata – Anomocytic, Anisocytic, Diacytic, Paracytic and Graminaceous 		(15 lectures)
<p><u>Unit IV : Palynology</u></p> <ul style="list-style-type: none"> • Pollen Morphology • Pollen viability – Storage • Germination and growth of pollen • Application of Palynology in honey industry, coal and oil exploration, Aerobiology and pollen allergies, forensic science 		(15 lectures)

Course Code	Title	Credits
SIUSBOT53	FORM AND FUNCTIONS - II	2.5 Credits (60 lectures)
<p>Course Outcomes: The students will be able to-</p> <ul style="list-style-type: none"> ❖ CO1: Study structure of nucleus & its function also characteristics of the genetic code, transcription and translation processes. ❖ CO2: Understand different aspects of water relations in plants. Bioremediation & succession. ❖ CO3: Learn the different techniques in Plant tissue culture & its application. <p>CIA – Class Test (20M) + Assignment/ Case Study/ Presentation (15M) + Class Participation (5M)</p>		
<p>Unit I : Cytology And Molecular Biology</p> <ul style="list-style-type: none"> • Structure and function of nucleus • Structure and function of vacuole • Structure and function of giant chromosomes • The genetic code: Characteristics of the genetic code • Transcription and Translation in Eukaryotes 		(15 lectures)
<p>Unit II: Physiology</p> <ul style="list-style-type: none"> • Water relations: Potential, osmosis, transpiration, imbibition • Solute transport: Transport of ions across cell membranes, active and passive transport, carriers, channels and pumps. • Translocation of solutes: Composition of phloem sap, girdling experiment, pressure flow model, phloem loading and unloading, anatomy of sieve tube elements, mechanisms of sieve tube translocation, Munch's hypothesis. 		(15 lectures)
<p>Unit III: Environmental Botany</p> <ul style="list-style-type: none"> • Bioremediation: Principles, factors responsible and microbial population in bioremediation. • Phytoremediation: Metals, Organic pollutants • Plant succession: Hydrosere and Xerosere – Formation of barren space, succession on the land citing different seres leading up to the climax, succession in water, ecesis, poly and monoclinal theories. 		(15 lectures)
<p>Unit IV: Plant Tissue Culture</p> <ul style="list-style-type: none"> • Aspects of micropropagation with reference to Floriculture: Detailed study of Orchid cultivation • Plant cell suspension cultures for the production of secondary metabolites: with special reference to Shikonin production. • Somatic embryogenesis and artificial seeds • Protoplast fusion and Somatic hybridization: i) Concept, definition, and various methods of protoplast fusion ii) Applications of somatic hybridization in agriculture 		(15 lectures)

Course Code	Title	Credits
SIUSBOT54	CURRENT TRENDS IN PLANT SCIENCES I	2.5 Credits (60 lectures)
<p>Course Outcome: The students will be able to-</p> <ul style="list-style-type: none"> ❖ CO1: Study construction of DNA libraries and analysis of genes. ❖ CO2: Understand the basic principles & methods of ethnobotany and medicinal botany. ❖ CO3: Learn Colorimetry and Spectrophotometry. <p>CIA – Class Test (20M) + Assignment/ Case Study/ Presentation (15M) + Class Participation (5M)</p>		
<p>Unit I: Ethnobotany And Mushroom Industry</p> <ul style="list-style-type: none"> • Ethnobotany - Definition, history, sources of data and methods of study. • Applications of Ethnobotany: 1) Ethnomedicines 2) Agriculture 3) Famine related plants 4) Toxic plants and Antidotes, 5) Edible Plants as tribal food • Traditional medicines as used by tribals in Maharashtra towards <ul style="list-style-type: none"> i) Skin ailments: <i>Rubia cordifolia</i>, Sandalwood ii) Liver ailments : <i>Phyllanthus</i> , <i>Andrographis</i> iii) Wound healing and ageing: <i>Centella</i>, <i>Typha</i>, <i>Terminalia</i>, <i>Tridax</i> iv) Fever : <i>Vitex negundo</i>, <i>Tinospora cordifolia</i> leaves v) Diabetes: <i>Momordica charantia</i>, <i>Syzygium cuminii</i> • Mushroom industry: Detail general account of production of mushrooms with respect to methods of Composting, spawning, casing, harvesting of mushroom. Cultivation of <i>Pleurotus</i>, <i>Agaricus</i>, <i>Volvariella</i> Mushroom to be studied in detail. General account of mushrooms: Nutritional value, picking and packaging, economic importance. 		(15 lectures)
<p>Unit II: Biotechnology I</p> <ul style="list-style-type: none"> • Construction of genomic DNA libraries, Chromosome libraries and c-DNA libraries. • Identification of specific cloned sequences in cDNA libraries and Genomic libraries • Analysis of genes and gene transcripts – Restriction enzyme, analysis of cloned DNA sequences. • Hybridization (Southern Hybridization) 		(15 lectures)
<p>Unit III: Instrumentation</p> <ul style="list-style-type: none"> • Colorimetry and Spectrophotometry (Visible, UV and IR) - Instrumentation, working, principle and applications. • Chromatography: General account of Column chromatography. Principle and working of adsorption and partition chromatography, ion exchange chromatography, molecular sieve chromatography. 		(15 lectures)
<p>Unit IV: Pharmacognosy And Medicinal Botany</p> <p>Monographs of following drugs with reference to biological sources, geographical distribution, common varieties, macro and microscopic characters, chemical constituents, therapeutic uses, adulterants – <i>Strychnos</i> seeds, Senna leaves, Clove buds, <i>Allium sativum</i>, <i>Acorus calamus</i>, <i>Curcuma longa</i></p>		(15 lectures)

SEMESTER V PRACTICAL

PRACTICAL I – PLANT DIVERSITY III & PRACTICAL II – PLANT DIVERSITY IV SIUSBOTP5.1	Cr. 1.5
<p>Course Outcomes:</p> <p>After completion of the course, the learners would be able to:</p> <p>CO1: Gain knowledge about various microbiology Experiments.</p> <p>CO2: Understand stages in the life cycle of algae & fungi mentioned in theory.</p> <p>CO3: Identify the pathogens causing crop diseases and damage.</p> <p>CO4: Know the systematics with morphological characteristics of angiosperms.</p> <p>CO5: Explain the adaptations behind anomalous secondary growth</p> <p>CO6: Acquire the knowledge about various palynology Experiments.</p>	
<p>Practical I: Plant Diversity III</p>	
<p>Microbiology</p> <ul style="list-style-type: none"> • Study of aeromicrobiota by petriplate exposed method Fungal culture; Bacterial culture • Determination of Minimum Inhibitory Concentration (MIC) of sucrose against selected microorganism • Study of antimicrobial activity by the disc diffusion method 	
<p>Algae</p> <p>Study of stages in the life cycle of the following Algae from fresh / preserved material and permanent slides</p> <ul style="list-style-type: none"> • <i>Polysiphonia</i> • <i>Batrachospermum</i> • <i>Vaucheria</i> • <i>Pinnularia</i> 	
<p>Fungi</p> <p>Study of stages in the life cycle of the following Fungi from fresh / preserved material and permanent slides</p> <ul style="list-style-type: none"> • <i>Agaricus</i> • <i>Puccinia</i> • <i>Alternaria</i> 	
<p>Plant Pathology</p> <p>Study of the following fungal diseases:</p> <ul style="list-style-type: none"> • White rust • Tikka disease in Groundnut • Damping off disease • Citrus canker • Leaf curl 	
<p>Practical II: Plant Diversity IV</p>	
<p>Paleobotany</p> <p>Study of the following form genera with the help of permanent slides/ photomicrographs.</p> <ul style="list-style-type: none"> • <i>Calamites</i> • <i>Lepidodendron</i> • <i>Lyginopteris</i> • <i>Pentoxylon</i> 	
<p>Angiosperms</p> <ul style="list-style-type: none"> • Morphology of floer • Morphology of fruit • Study of one plant from each of the following Angiosperm families • Capparidaceae • Umbelliferae • Cucurbitaceae • Rubiaceae • Solanaceae • Graminae 	

<ul style="list-style-type: none"> Morphological peculiarities and economic importance of the members of the above mentioned Angiosperm families Identifying the genus and species of a plant with the help of Flora 	
<p>Anatomy I Study of anomalous secondary growth in the stems using double staining technique:</p> <ul style="list-style-type: none"> <i>Bignonia</i> <i>Salvadora</i> <i>Achyranthes</i> <i>Aristolochia</i> <i>Dracaena</i> <p>Study of anomalous secondary growth in the roots of</p> <ul style="list-style-type: none"> Beet Radish <p>Types of Stomata</p> <ul style="list-style-type: none"> Anomocytic Anisocytic Diacytic Paracytic Graminaceous 	
<p>Palynology Study of pollen morphology (NPC Analysis) of the following by Chitale's Method</p> <ul style="list-style-type: none"> <i>Hibiscus</i> <i>Datura</i> <i>Ocimum</i> <i>Crinum</i> <i>Pancreatum</i> <i>Canna</i> <p>Determination of pollen viability Pollen analysis from honey sample – unifloral and multifloral honey Effect of varying concentration of sucrose on <i>In vitro</i> Pollen germination</p>	
<p>PRACTICAL III - FORM AND FUNCTION II & PRACTICAL IV CURRENT TRENDS IN PLANT SCIENCES II (SIUSBOTP5.2)</p>	
<p>Course Outcomes: After completion of the course, the learners would be able to:</p> <p>CO1: Explain the stages of meiosis & structure of giant chromosome. CO2: Assess of water quality & estimation of Phosphate phosphorus and iron. CO3: Acquire the knowledge about techniques involved in plant tissue culture. CO4: Gain the analytical techniques of chromatographic separations. CO5: Acquire the skills of mushroom cultivation as well as traditional knowledge about ethnobotany. CO6: Analyse growth curve of <i>E. coli</i>, DNA isolation & separation of Plasmid DNA with understanding restriction mapping & southern blotting. CO7: Carry out pharmacognostic studies of the plants mentioned in theory.</p>	
<p>Practical III: Form and Function II</p>	
<p>Cytology And Molecular Biology</p> <ul style="list-style-type: none"> Mounting of Giant chromosomes from <i>Chironomous</i> larva Smear preparation from <i>Tradescantia</i> buds Predicting the sequence of amino acids in the polypeptide chain that will be formed following translation (Eukaryotic) 	
<p>Physiology</p> <ul style="list-style-type: none"> Estimation of Phosphate phosphorus (Plant acid extract) Estimation of Iron (Plant acid extract) 	
<p>Environmental Botany</p> <ul style="list-style-type: none"> Dissolved oxygen demand of given water sample Biological oxygen demand of given water sample Hardness, Salinity and Chlorinity of given water sample 	

<p>Micropropagation Plant Tissue culture:</p> <ul style="list-style-type: none"> • Identification – Multiple shoot culture, hairy root culture, somatic embryogenesis • Preparation of stock solutions for preparation of MS medium 	
Practical IV: Current Trends in Plant Sciences II	
<p>Ethnobotany And Mushroom Industry</p> <ul style="list-style-type: none"> • Study of plants mentioned in theory for Ethnobotany • Mushroom cultivation (To be demonstrated) • Identification of various stages involved in mushroom cultivation – Spawn, Pin head stage, Mature/ Harvest stage of <i>Agaricus</i>, <i>Pleurotus</i>, <i>Volvariella</i> 	
<p>Biotechnology I</p> <ul style="list-style-type: none"> • Growth curve of <i>E. coli</i> • Plasmid DNA isolation and Separation of DNA using AGE • Restriction mapping (problems), Southern blotting 	
<p>Instrumentation</p> <ul style="list-style-type: none"> • Demonstration of Beer Lambert's Law • Experiment based on ion exchange chromatography for demonstration • Experiment based on separation of dyes/ plant pigments using silica gel column. 	
<p>Pharmacognosy Macroscopic/ Microscopic characters and Chemical tests for active constituents of following:</p> <ul style="list-style-type: none"> • <i>Allium sativum</i> • <i>Acorus calamus</i> • <i>Curcuma longa</i> • <i>Senna angustifolia</i> • <i>Strychnos nux-vomica</i> • <i>Eugenia caryophyllata</i> 	

SEMESTER VI

Course Code	Title	Credits
SIUSBOT61	PLANT DIVERSITY III	2.5 Credits (60 lectures)
<p>Course Outcomes: The students will be able to-</p> <ul style="list-style-type: none"> ❖ CO1: Study different bryophytes w.r.t. their morphology, general characteristics and ecology as well as economic importance. ❖ CO2: Learn the different pteridophytes w.r.t. their morphology, general characteristics and ecology as well as economic importance. ❖ CO3: life cycles of few coniferophytes and their economic importance. <p>CIA – Class Test (20M) + Assignment/ Case Study/ Presentation (15M) + Class Participation (5M)</p>		
<p><u>Unit I : Bryophyta</u></p> <ul style="list-style-type: none"> • Life cycle of <i>Marchantia</i> • Life cycle of <i>Pellia</i> • Life cycle of <i>Funaria</i> 		(15 lectures)
<p><u>Unit II : Pteridophyta</u></p> <ul style="list-style-type: none"> • Lepidophyta – Classification, general characters; Life cycle of <i>Lycopodium</i> • Calamophyta – Classification, general characters; Life cycle of <i>Equisetum</i> • Pterophyta – Classification and general characters, Life cycle of <i>Adiantum</i> and <i>Marsilea</i> 		(15 lectures)
<p><u>Unit III : Bryophytes and Pteridophytes: Applied aspects</u></p> <ul style="list-style-type: none"> • Ecology of Bryophytes • Economic importance of Bryophytes • Bryophytes as indicators • Evolution of Sporophyte and Gametophyte • Economic importance of Pteridophytes • Diversity and distribution of Indian Pteridophytes • Types of sori and evolution of sori 		(15 lectures)
<p><u>Unit IV : Gymnosperms</u></p> <ul style="list-style-type: none"> • Systematic position and Life cycle of <i>Biota (Thuja)</i> • Systematic position and Life cycle of <i>Gnetum</i> • Systematic position and Life cycle of <i>Ephedra</i> • Economic importance of Gymnosperms 		(15 lectures)

Course Code	Title	Credits
SIUSBOT62	PLANT DIVERSITY IV	2.5 Credits (60 lectures)
<p>Course Outcome: The students will be able to-</p> <ul style="list-style-type: none"> ❖ CO1: Understand the general characteristics and economic importance of angiosperms & Major Botanic gardens of India. ❖ CO2: Learn the different aspects of ecological anatomy & embryology. ❖ CO3: Study different statistical tests & their applications. <p>CIA – Class Test (20M) + Assignment/ Case Study/ Presentation (15M) + Class Participation (5M)</p>		
<p><u>Unit I : Angiosperms II</u></p> <ul style="list-style-type: none"> • Major Botanical gardens of India – Indian Botanical Garden, Howrah; National Botanical Garden (NBRI) Lucknow; Lloyd Botanical Garden, Darjeeling; Lalbaugh or Mysore State Botanical Garden Bangalore • Botanical survey of India and regional branches of India • Hutchinson’s classification – merits and demerits • Study of following plant families <ul style="list-style-type: none"> ○ Rhamnaceae ○ Combretaceae ○ Asclepiadaceae ○ Labiate ○ Euphorbiaceae ○ SF. Cannaceae 		(15 lectures)
<p><u>Unit II : Anatomy II</u> Ecological adaptations and anatomy of:</p> <ul style="list-style-type: none"> • Hydrophytes – submerged, floating, rooted • Hygrophytes - <i>Typha</i> • Mesophytes • Sciophytes • Halophytes • Epiphytes • Xerophytes 		(15 lectures)
<p><u>Unit III : Embryology</u></p> <ul style="list-style-type: none"> • Microsporogenesis • Megasporogenesis - Development of monosporic type, examples of all embryo sacs • Types of ovules • Double fertilization • Development of embryo – <i>Capsella</i> 		(15 lectures)
<p><u>Unit IV : Biostatistics</u></p> <ul style="list-style-type: none"> • Test of significance student’s <i>t</i>-test (paired and unpaired) • Regression • ANOVA (one way) 		(15 lectures)

Course Code	Title	Credits
SIUSBOT63	FORM AND FUNCTION III	2.5 Credits (60 lectures)
<p>Course Outcomes: The students will be able to -</p> <ul style="list-style-type: none"> ❖ CO1: Understand biomolecules and Enzyme kinetics, nitrogen metabolism & PGRs. ❖ CO2: Study Genetic mapping in eukaryotes, Gene mutations & metabolic disorders. ❖ CO3: Learn the Organization, retrieval, analysis and application biological data. <p>CIA – Class Test (20M) + Assignment/ Case Study/ Presentation (15M) + Class Participation (5M)</p>		
<p><u>Unit I: Plant Biochemistry</u></p> <ul style="list-style-type: none"> • Structure of biomolecules: Carbohydrates (sugars, starch, cellulose, pectin, lipids (fatty acids and glycerol), proteins (amino acids) • Enzymes: Nomenclature, classification, mode of action, Enzyme kinetics, Michaelis Menten equation, competitive non-competitive, and uncompetitive inhibitors. 		(15 Lectures)
<p><u>Unit II: Plant Physiology II</u></p> <ul style="list-style-type: none"> • Nitrogen metabolism: Nitrogen cycle, root nodule formation, and leg haemoglobin, nitrogenase activity, assimilation of nitrates, (NR, NiR activity), assimilation of ammonia, (amination and transamination reactions), nitrogen assimilation and carbohydrate utilisation. • Physiological effects and commercial applications of Auxins, Gibberellins, Cytokinins, Ethylene and Abscissic acid. 		(15 Lectures)
<p><u>Unit III: Genetics</u></p> <ul style="list-style-type: none"> • Linkage & crossing over, Gene recombination, Genetic mapping in eukaryotes, Construction of genetic maps, three point crosses and mapping chromosomes, problems based on the same. • Gene mutations: definition, types of mutations, causes of mutations, induced mutations, the Ames's test • Metabolic disorders – enzymatic and non-enzymatic: Gene control of enzyme structure Garrod's hypothesis of inborn errors of metabolism, Phenylketonuria, albinism, sickle cell anaemia. 		(15 Lectures)
<p><u>Unit IV: Bioinformatics</u></p> <ul style="list-style-type: none"> • Organization of biological data, databases • Exploration of data bases, retrieval of desired data, BLAST. • Protein structure analysis and application • Multiple sequence analysis and phylogenetic analysis 		(15 Lectures)

Course Code	Title	Credits
SIUSBOT64	CURRENT TRENDS IN PLANT SCIENCES II	2.5 Credits (60 lectures)
<p>Course Outcomes: The students will be able to-</p> <ul style="list-style-type: none"> ❖ CO1: Understand DNA sequence analysis, PCR and DNA barcoding. ❖ CO2: Study of Economic Botany and Post-Harvest Technology. ❖ CO3: Learn Biodiversity and different Phyto geographical regions of India. <p>CIA – Class Test (20M) + Assignment/ Case Study/ Presentation (15M) + Class Participation (5M)</p>		
<p>Unit I: Plant Biotechnology II</p> <ul style="list-style-type: none"> • DNA sequence analysis – Maxam – Gilbert Method and Sanger’s method • Polymerase Chain reaction • DNA barcoding: Basic features, nuclear genome sequence, chloroplast genome sequence, <i>rbcL</i> gene sequence, <i>matK</i> gene sequence, present status of barcoding in plants. 		(15 Lectures)
<p>Unit II: Plant Geography</p> <ul style="list-style-type: none"> • Phyto geographical regions of India • Biodiversity: <ul style="list-style-type: none"> ▪ Definition, diversity of flora found in various forest types of India ▪ Levels of biodiversity ▪ Importance and status of biodiversity ▪ Loss of biodiversity ▪ Conservation of biodiversity ▪ Genetic diversity- Molecular characteristics 		(15 Lectures)
<p>Unit III: Economic Botany</p> <ul style="list-style-type: none"> • Essential Oils: Extraction, perfumes, perfume oils, oil of rose, sandalwood, patchouli, champa, grass oils: <i>Citronella</i>, Vetiver. • Fatty oils: Drying oil (linseed and soyabean oil), semidrying oils (cotton seed, sesame oil) and non-drying oils (olive oil and peanut oil). • Vegetable Fats: Coconut and Palm oil. 		(15 Lectures)
<p>Unit IV: Post-harvest Technology</p> <ul style="list-style-type: none"> • Storage of Plant Produce - Preservation of Fruits and Vegetables • Drying (Dehydration)- (Natural conditions – Sun drying; Artificial drying- hot air drying, Vacuum drying, Osmotically dried fruits, Crystallized or Candied fruits, Fruit Leather, Freeze Drying) • Freezing (Cold air blast system, Liquid immersion method, Plate freezers, Cryogenic Freezing, Dehydrofreezing) • Canning • Pickling (in brine, in vinegar, Indian pickles) • Sugar Concentrates (Jams, Jellies, Fruit juices) • Food preservatives • Use of antioxidants in preservation 		(15 Lectures)

SEMESTER VI PRACTICAL

PRACTICAL I – PLANT DIVERSITY III & PRACTICAL II – PLANT DIVERSITY IV SIUSBOTP6.1	Cr. 1.5
<p>Course Outcomes: After completion of the course, the learners would be able to:</p> <p>CO1: Know the economic importance of bryophytes and pteridophytes & stages in the life cycle of types mentioned in theory.</p> <p>CO2: Recognize the benefits of gymnosperms with stages in the life cycle of types mentioned in theory.</p> <p>CO3: Study the economic importance of bryophytes and pteridophytes.</p> <p>CO4: Know the systematics with morphological characteristics various angiospermic families mentioned in theory with Identification of the genus and species with the help of flora.</p> <p>CO5: Explain the adaptations exhibited by plants belonging to different ecological groups.</p> <p>CO6: Acquire the knowledge about stages of micro / megasporogenesis & embryo development with In vivo growth of pollen tube.</p> <p>CO7: Apply knowledge of biostatistical principles in problem solving.</p>	
<p>Practical I: Plant Diversity III</p>	
<p>Bryophyta Study of stages in the life cycle of the following Bryophyta from fresh / preserved material and permanent slides</p> <ul style="list-style-type: none"> ▪ <i>Marchantia</i> ▪ <i>Pellia</i> ▪ <i>Funaria</i> 	
<p>Pteridophyta Study of stages in the life cycles of the following Pteridophytes from fresh / preserved material and permanent slides</p> <ul style="list-style-type: none"> ▪ <i>Lycopodium</i> ▪ <i>Equisetum</i> ▪ <i>Adiantum</i> ▪ <i>Marsilea</i> 	
<p>Bryophytes and Pteridophytes: Applied aspects</p> <ul style="list-style-type: none"> • Economic importance of Bryophyta • Economic importance of Pteridophyta • Types of sporophytes in Bryophyta (from Permanent slides) • Types of sori and soral arrangement in Pteridophytes 	
<p>Gymnosperms</p> <ul style="list-style-type: none"> • Study of stages in the life cycles of the following Gymnosperms from fresh / preserved material and permanent slides <ul style="list-style-type: none"> ▪ <i>Biota (Thuja)</i> ▪ <i>Gnetum</i> ▪ <i>Ephedra</i> • Economic importance of Gymnosperms 	
<p>Practical II: Plant Diversity IV</p>	Cr. 1.5
<p>Angiosperms</p> <ul style="list-style-type: none"> • Study of one plant from each of the following Angiosperm families <ul style="list-style-type: none"> ○ Rhamnaceae ○ Combretaceae ○ Asclepiadaceae ○ Labiatae ○ Euphorbiaceae ○ SF. Cannaceae • Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families • Identify the genus and species with the help of flora 	
<p>Anatomy Study of Ecological Anatomy of</p> <ul style="list-style-type: none"> • Hydrophytes: <i>Hydrilla</i> stem, <i>Nymphaea</i> petiole, <i>Eichhornia</i> offset • Epiphytes: Orchid 	

<ul style="list-style-type: none"> • Sciophytes: <i>Peperomia</i> leaf • Xerophytes: <i>Nerium</i> leaf, <i>Opuntia</i> phylloclade • Halophytes: <i>Avicennia</i> leaf and pneumatophore, <i>Sesuvium</i> / <i>Sueda</i> leaf • Mesophytes: <i>Vinca</i> leaf 	
Embryology <ul style="list-style-type: none"> • Study of various stages of Microsporogenesis, Megasporeogenesis and Embryo Development with the help of permanent slides / photomicrographs • Mounting of Monocot (Maize) and Dicot (Castor and Gram) embryo • <i>In vivo</i> growth of pollen tube in <i>Portulaca</i> 	
Biostatistics <ul style="list-style-type: none"> • <i>t</i>-test (paired and unpaired) • Problems based on regression analysis • ANOVA 	
PRACTICAL III – FORM AND FUNCTION III & PRACTICAL IV - CURRENT TRENDS IN PLANT SCIENCES (SIUSBOT6.2)	Cr. 1.5
COURSE OUTCOMES After completion of the course, the learners would be able to: CO1: Assess kinetics of enzyme activity, estimate plants proteins, study effect of GA ₃ and role of alpha- amino nitrogen in plants. CO2: Solve the problems based on chromosome mapping. CO3: Gain the knowledge about types & effects of mutations. CO4: Acquire computational skills on Bioinformatic experiments. CO5: Identify plant material via DNA sequencing and barcoding. CO6: Get the entrepreneurship skills with respect to postharvest technology. CO7: Learn the concepts in plant geography. CO8: Apply knowledge of distillation technology in perfumery.	
Practical III: Form and function III	
Plant Biochemistry <ul style="list-style-type: none"> • Estimation of proteins by Biuret method • Effect of temperature on the activity of amylase • Effect of pH on the activity of amylase • Effect of substrate variation on the activity of amylase 	
Plant Physiology <ul style="list-style-type: none"> • Determination of alpha-amino nitrogen • Effect of GA on seed germination • Estimation of reducing sugars by DNSA method 	
Genetics <ul style="list-style-type: none"> • Problems based on three point crosses, construction of chromosome maps • Identification of types of mutations from given DNA sequences • Study of mitosis using pre-treated root tips of <i>Allium</i> 	
Bioinformatics <ul style="list-style-type: none"> • BLAST: nBLAST, pBLAST • Multiple sequence alignment • Phylogenetic analysis • RASMOL/ SPDBV 	
Practical IV: Current Trend in Plant Sciences II	Cr. 1.5
Plant Biotechnology II <ul style="list-style-type: none"> • DNA sequencing (Sanger's Method) 	

<ul style="list-style-type: none"> DNA barcoding of plant material by using suitable data 	
Plant Geography <ul style="list-style-type: none"> Study of phytogeographic regions of India Preparation of vegetation map using Garmin's GPS Instrument Problems based on Simpson's diversity Index 	
Economic Botany <ul style="list-style-type: none"> Demonstration: Extraction of essential oil using Clevenger Thin layer chromatography of essential oil of patchouli and <i>Citronella</i> Saponification value of palm oil 	
Post-Harvest Technology Preparation of the following: <ul style="list-style-type: none"> Squash Jam Jelly Pickle 	

Note:

- A minimum of four field excursions (with at least one beyond the limits of Mumbai) for habitat studies are compulsory. Field work of not less than eight hours duration is equivalent to one period per week for a batch of fifteen students.
- A candidate will be allowed to appear for the practical examinations only if he/she submits a certified journal of TYBSc Botany and the Field Report or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of TYBSc Botany as per the minimum requirements. In case of loss of journal a candidate must produce a certificate from the Head of the Department/ Institute that the practical for the academic year were completed by the student. However such a candidate will be allowed to appear for the practical examination but the marks allotted for the journal will not be granted.

SIES COLLEGE OF ARTS, SCIENCE & COMMERCE (AUTONOMOUS)
SION (WEST), MUMBAI – 400 022
Fifth/Sixth Semester

Class: T.Y.B.Sc (6 Units)

Sub: Botany

Paper: I/II/III/IV

Day:

Date:

Time:

Marks: 60

N.B.:

- 1) All questions are Compulsory.
- 2) Figures to the right indicate marks.
- 3) Draw neat labelled diagrams wherever necessary.

Q.1 a) Unit I: Long answer question (10)

OR

a) Unit I: Long answer question (10)

b) Write note on **any one** of the following: (05)

i Unit I

ii Unit I

Q.2 a) Unit II: Long answer question (10)

OR

a) Unit II: Long answer question (10)

b) Write note on **any one** of the following: (05)

i Unit II

ii Unit II

Q.3 a) Unit III: Long answer question (10)

OR

a) Unit III: Long answer question (10)

b) Write note on **any one** of the following: (05)

i Unit III

ii Unit III

Q.4 a) Unit IV: Long answer question (10)

OR

a) Unit IV: Long answer question (10)

b) Write note on **any one** of the following: (05)

i Unit IV

ii Unit IV

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