

Bharatiya Vidya Bhavan's

**M. M. College of Arts, N.M. Institute of Science, H.R.J.
College of Commerce. (Bhavan's College) Autonomous.**

(Affiliated to University of Mumbai)



Syllabus for: T.Y.B.Sc.-Botany

Program: B.Sc.

Program Code: BH. B.Sc. (SEM-V and SEM-VI)

Choice Based Credit System (CBCS)

With effect from academic year 2023-24

SEMESTER V

Course Code	UNIT	TOPICS	Credit	L / Weeks
BH.USBO501	PLANT DIVERSITY III			
	I	Microbiology	2.5	1
	II	Algae		1
	III	Fungi		1
	IV	Plant Pathology		1
BH.USBO502	PLANT DIVERSITY IV			
	I	Paleobotany	2.5	1
	II	Angiosperms I		1
	III	Anatomy I		1
	IV	Palynology		1
BH.USBO503	FORM AND FUNCTION III			
	I	Cytology and Molecular Biology	2.5	1
	II	Plant Physiology I		1
	III	Environmental Botany		1
	IV	Plant Tissue Culture		1
BH.USBO504	CURRENT TRENDS IN PLANT SCIENCES II			
	I	Ethnobotany and Mushroom Industry	2.5	1
	II	Plant Biotechnology I		1
	III	Instrumentation		1
	IV	Pharmacognosy and medicinal botany		1
BH USBOP5	Practicals based on Two Courses in Theory (501 & 502) – For 6 Units		3	8
BH USBOP6	Practicals based on Two Courses in Theory (503 & 504) – For 6 Units		3	8
			16	32 + 8 (3 Units)

SEMESTER VI

Course Code	UNIT	TOPICS	Credit	L / Weeks
BH.USBO601	PLANT DIVERSITY III			
	I	Bryophyta	2.5	1
	II	Pteridophyta		1
	III	Bryophyta and Pteridophyta: Applied Aspects		1
	IV	Gymnosperms		1
BH.USBO602	PLANT DIVERSITY IV			
	I	Angiosperms II	2.5	1
	II	Anatomy II		1
	III	Embryology		1
	IV	Plant Geography		1
BH.USBO603	FORM AND FUNCTION III			
	I	Plant Biochemistry	2.5	1
	II	Plant Physiology II		1
	III	Genetics		1
	IV	Biostatistics		1
BH.USBO604	CURRENT TRENDS IN PLANT SCIENCES II			
	I	Plant Biotechnology II	2.5	1
	II	Bioinformatics		1
	III	Economic Botany		1
	IV	IV: Plant Breeding		1
BH.USBOP7	Practicals based on Two Courses in theory (601 & 602) – For 6 Units		3	8
BH.USBOP8	Practicals based on Two Courses in theory (603 & 604) – For 6 Units		3	8
			16	32 + 8 (3 Units)

BSc BOTANY: PROGRAM OUTCOMES

Specific core discipline knowledge

- Students can recall details and information about the evolution, anatomy, morphology, systematics, genetics, physiology, ecology, and conservation of plants and all other forms of life.
- Students can recall details of the unique ecological and evolutionary features of the local and Indian flora.

Communication skills

- Students can communicate effectively using oral and written communication skills

Problem solving and research skills

- Students can generate and test hypotheses, make observations, collect data, analyze and interpret results, derive conclusions, and evaluate their significance within a broad scientific context

BSc BOTANY: PROGRAM SPECIFIC OUTCOMES

- To recognize and identify major groups of non-vascular and vascular plants and their phylogenetic relationships.
- To understand the phylogeny of plants and study various systems of classification.
- To explore the morphological, anatomical, embryological details as well as economic importance of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.
- To understand physiological processes and adaptations of plants.
- To provide knowledge about environmental factors and natural resources and their importance in sustainable development.
- To be able to carry out phytochemical analysis of plant extracts and application of the isolated compounds for treatment of diseases.
- To be able to deal with all microbes and the technologies for their effective uses in industry and mitigation of environmental concerns.
- To explain how current medicinal practices are often based on indigenous plant knowledge and to get introduced to different perspectives on treating ailments according to ethnomedicinal principles.
- To understand patterns of heredity and variation among individuals, species and populations and apply principles for improvement of quality and yield.
- To be able to apply statistical tools to gain insights into significantly different data from different sources.
- To acquire recently published knowledge in molecular biology, such as rDNA technology; PTC and bioinformatics and their applications.

**SEMESTER V
THEORY**

Course Code	Title	Credits
BH.USBO501	PLANT DIVERSITY – III	2.5 Credits (60 Lectures)
<p>Course outcomes:</p> <p>The students would be able :</p> <ul style="list-style-type: none"> • To gain knowledge about microbial diversity and techniques for culturing and visualization. • To understand the salient features of three major groups of algae, their life cycle patterns with a suitable example; to be able to identify them. • To learn the general characteristics and classification of two major groups of fungi along with life cycles of each group; to be able to identify them. • To understand the scope and importance of Plant Pathology and apply the concepts of various control measures of commonly widespread plant diseases. 		
<p>Unit I: Microbiology</p> <ul style="list-style-type: none"> • Introduction of Types of Microbes: Viruses, Bacteria, Algae, Fungi, Protozoa, Mycoplasma and Actinomycetes. • Culturing: Sterilization, media, Isolation staining, colony characters. • Pure cultures/ Axenic Culture • Aeromicrobiology and its Application 		15L
<p>Unit –II: Algae (G.M. Smith Classification System to be followed)</p> <ul style="list-style-type: none"> • Division Rhodophyta: 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>Batrachospermum</i>. • Classification and General Characters of Xanthophyta: (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 Bacillariophyta: 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>. 		15L
<p>Unit III: Fungi (Alexaupolous Classification System to be followed)</p> <ul style="list-style-type: none"> • Basidiomycetes: Classification and General characters <ul style="list-style-type: none"> ➤ Life cycle of <i>Agaricus</i> ➤ Life cycle of <i>Puccinia</i> • Deuteromycetae: Classification and General Characters • Life cycle of <i>Alternaria</i> 		15L
<p>Unit IV: Plant Pathology</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 candida</i> ➤ Tikka disease of ground nut: <i>Cercospora</i> ➤ Damping off disease: <i>Pythium</i> ➤ Citrus canker –<i>Xanthomonas axonopodis</i> pv. citri ➤ Leaf curl – leaf curl virus in <i>Papaya</i>. • Study of Physical, chemical and biological control methods of plant diseases. 		15L

Course Code	Title	Credits
BH.USBO502	PLANT DIVERSITY – IV	2.5 Credits (60 lectures)
<p>Course outcomes: The students would be able :</p> <ul style="list-style-type: none"> To acquire knowledge of different fossil forms and understand their role in evolution. To provide plant description, describe the morphological and reproductive structures of seven families and also identify and classify according to Bentham and Hooker's system. To gain proficiency in the use of keys and identification manuals for identifying any unknown plants to species level. To relate anomalies in internal stem structure with function and appreciate the salient features of the root stem transition zone. To get exposure to pollen study and learn to apply it in various fields. . 		
<p>Unit I: Paleobotany</p> <ul style="list-style-type: none"> Significance of Paleobotany <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 		15L
<p>Unit II: Angiosperms I</p> <ul style="list-style-type: none"> Morphology of flower – All Parts of Flower. Complete classification of Bentham and Hooker (only for prescribed families), 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. (Special stress on fruit morphology to be given) <ul style="list-style-type: none"> ➤ Capparidaceae ➤ Umbelliferae ➤ Cucurbitaceae ➤ Rubiaceae ➤ Solanaceae ➤ Commelinaceae ➤ Graminae Systems of classification(Artificial, Natural,Phylogenetic), Merits and Demerits 		15L
<p>Unit III: Anatomy I</p> <ul style="list-style-type: none"> Anomalous secondary growth in the Stems of <i>Bignonia</i>, <i>Aristolochia</i>, <i>Salvadora</i>, <i>Achyranthes</i>, <i>Dracaena</i>. Storage roots of Beet, Radish Root stem transition Types of Stomata– Anomocytic, Anisocytic, Diacytic, Paracytic, and Graminaceous 		15L

<p>Unit IV: Palynology</p> <ul style="list-style-type: none"> • Pollen Pistil Interaction • Pollen Morphology • Pollen viability and Pollen storage • Germination and growth of pollen • Application of Palynology in honey industry, Aerobiology. 	15L

Course Code	Title	Credits
BH.USBO503	FORM AND FUNCTIONS- II	2.5 Credits (60 Lectures)
<p>Course outcomes:</p> <p>The students would be able :</p> <ul style="list-style-type: none"> To acquire knowledge about two important organelles and molecular mechanisms of translation To understand water relations of plants, inorganic and organic solute transport, and apply the knowledge to manage mineral nutrition and survival in challenging abiotic stresses. To understand succession in plant communities and study remediation technologies in order to apply knowledge acquired for cleanup of polluted sites. To get exposure to principles and techniques of plant tissue culture and apply these studies for improving agriculture and horticulture and to become an entrepreneur. 		
<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 Translation in Prokaryotes and Eukaryotes. Cell Signaling : Introduction 		15L
<p>Unit II: Plant Physiology I</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 (Munch's hypothesis): Phloem loading and unloading, anatomy of sieve tube elements and mechanisms of sieve tube translocation. Mineral Nutrition: Role of Macro and Micro nutrients, physiological functions and deficiency symptoms 		15L
<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 Mono-climax theories. 		15L
<p>Unit IV: Plant Tissue Culture</p> <ul style="list-style-type: none"> Aspects of Micro-propagation 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: <ol style="list-style-type: none"> Concept, Definition, and various methods of Protoplast Fusion Applications of Somatic Hybridization in Agriculture 		15L

Course Code	Title	Credits
BH.USBO504	CURRENT TRENDS IN PLANT SCIENCES – II	2.5 Credits (60 Lectures)
<p>Course outcomes: The students would be able :</p> <ul style="list-style-type: none"> To get exposure to the technique of mushroom cultivation and explore the possibility of entrepreneurship in the same. To learn ethnobotanical principles, applications and utilize indigenous plant knowledge for the cure of common human diseases and improvement of agriculture. To gain knowledge about the latest molecular biology techniques for isolation and characterization of genes. To learn principles and application of commonly used techniques in instrumentation. To gain proficiency in the monograph study and pharmacognostic analysis of six medicinal plants. 		
<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: <ul style="list-style-type: none"> Ethno-medicines. Agriculture. Edible plants. Traditional medicines used by tribals in Maharashtra towards <ul style="list-style-type: none"> Skin ailments: <i>Rubia cordifolia</i>, <i>Sandalwood</i> Liver ailments: <i>Phyllanthus</i>, <i>Andrographis</i> Wound healing and ageing: <i>Centella</i>, <i>Typha</i>, <i>Terminalia</i>, <i>Tridax</i>. Fever: <i>Vitex negundo</i>, <i>Tinospora cordifolia</i> leaves Diabetes: <i>Momordica charantia</i>, <i>Syzygium cumini</i> Mushroom industry: <ul style="list-style-type: none"> 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. General account of mushrooms: Nutritional value, picking and packaging, economic importance. 		15L
<p>Unit II: Plant 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 c-DNA libraries and Genomic libraries Analysis of genes and gene transcripts –Restriction enzyme, analysis of cloned DNA sequences. Hybridization(Southern Hybridization) 		15L
<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 bedding material involved in adsorption and partition chromatography, ion exchange chromatography, molecular sieve chromatography., TLC, GC,etc 		15L
<p>Unit IV: Pharmacognosy and Medicinal Botany</p> <ul style="list-style-type: none"> Monographs of drugs with reference to biological sources, geographical distribution, common varieties, macro and microscopic characters, chemical constituents, therapeutic uses, adulterants- <i>Strychnos</i> seeds, <i>Senna</i> leaves, Clove buds, <i>Allium sativum</i>, <i>Acorus calamus</i> and <i>Curcuma longa</i> 		15L

SEMESTER V PRACTICAL

Semester V BH.USBOP5	Cr
PRACTICAL PAPER I–PLANT DIVERSITY III – BH.USBOP501	1.5
<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 (G.M. Smith Classification System to be followed)</p> <ul style="list-style-type: none"> • Study of stages in the life cycle of the following Algae from fresh / preserved material and permanent slides. <ul style="list-style-type: none"> ➤ <i>Batrachospermum</i> ➤ <i>Vaucheria</i> ➤ <i>Pinnularia</i> 	
<p>Fungi (Alexaupolous Classification System to be followed)</p> <ul style="list-style-type: none"> • Study of stages in the life cycle of the following Fungi from fresh / preserved material and permanent slides <ul style="list-style-type: none"> ➤ <i>Agaricus</i> ➤ <i>Puccinia</i> ➤ <i>Alternaria</i> 	
<p>Plant Pathology</p> <ul style="list-style-type: none"> • Study of the following fungal diseases: <ul style="list-style-type: none"> ➤ White rust in Cruciferae (Brassicaceae) ➤ Tikka disease in Groundnut ➤ Damping off disease ➤ Citrus canker ➤ Leaf curl in <i>Papaya Leaf</i> 	

Semester V BH.USBOP6	
PRACTICAL PAPER II–PLANT DIVERSITY IV BH.USBOP502	1.5
<p>Paleobotany</p> <ul style="list-style-type: none"> • Study of the following form genera with the help of permanent slides/ photomicrographs. <ul style="list-style-type: none"> ➤ <i>Lepidodendron</i> ➤ <i>Lyginopteris</i> ➤ <i>Pentoxylon</i> 	
<p>Angiosperms I</p> <ul style="list-style-type: none"> • Morphology of Flower – All Parts of Flower • Study of one plant from each of the following Angiosperm families as per Bentham and Hooker’s system of classification. <ul style="list-style-type: none"> ➤ Capparidaceae ➤ Umbelliferae ➤ Cucurbitaceae ➤ Rubiaceae ➤ Solanaceae ➤ Commelinaceae ➤ Graminae • Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families <ul style="list-style-type: none"> ➤ Identifying the genus and species of a plant with the help of Flora 	
<p>Anatomy I</p> <ul style="list-style-type: none"> • Study of anomalous secondary growth in the stems of the following plants using double staining technique. <ul style="list-style-type: none"> ➤ <i>Bignonia</i> ➤ <i>Salvadora</i> ➤ <i>Achyranthes</i> ➤ <i>Dracaena</i> ➤ <i>Aristolochia</i> • Study of anomalous secondary growth in the roots of <ul style="list-style-type: none"> ➤ Beet ➤ Radish • Types of Stomata <ul style="list-style-type: none"> ➤ Anomocytic ➤ Anisocytic ➤ Diacytic ➤ Paracytic ➤ Graminaceous 	
<p>Palynology I</p> <ul style="list-style-type: none"> • Study of pollen morphology (NPC Analysis) of the following by Chitale’s Method <ul style="list-style-type: none"> ➤ <i>Hibiscus</i> ➤ <i>Datura</i> ➤ <i>Ocimum</i> ➤ <i>Crinum</i> ➤ <i>Panocratium</i> ➤ <i>Canna</i> • 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 	
Total Credit	3

Semester V USBOP6 – For 6Units Semester V USBOP7 – For 3Units	
PRACTICAL –PAPER III FORM AND FUNCTION II BH.USBOP503 (For 3 & 6 Units)	1.5
<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>Plant Physiology I</p> <ul style="list-style-type: none"> • Estimation of Phosphate phosphorus (Plant acid extract) • Estimation of Iron (Plant acid extract) <p>Note: Preparation of a standard graph and determination of the multiplication factor for Phosphate / Iron estimation using a given standard phosphate / Standard Iron solution should be done in regular practical as this will also be put as a question in practical exam</p> <ul style="list-style-type: none"> • Identification of Mineral Deficiency Symptoms 	
<p>Environmental Botany</p> <ul style="list-style-type: none"> • Estimation of the following in given water sample <ul style="list-style-type: none"> ➤ Dissolved oxygen demand ➤ Biological oxygen demand ➤ Hardness ➤ Salinity and Chlorinity 	
<p>Micropropogation</p> <ul style="list-style-type: none"> • Plant Tissue culture: • Identification – Multiple shoot culture, hairy root culture, somatic embryogenesis • Preparation of stock solutions for preparation of MS medium <p>(Note: Concept of preparation of specified molar solutions should be taught and problems based on preparation of stock solutions for tissue culture media will be given).</p>	

Semester V BH.USBOP6	
PRACTICAL – PAPER IV CURRENT TRENDS IN PLANT SCIENCES II BH.USBOP504	1.5
<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 TLC/ silica gel column 	
<p>Pharmacognosy</p> <ul style="list-style-type: none"> • Macroscopic/ Microscopic characters and Chemical tests for active constituents of the following plants. <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> 	
Total Credit	3

Course Code	Title	Credits
BH.USBO 601	PLANT DIVERSITY – III	2.5 Credits (60 Lectures)
<p>Course outcomes:</p> <p>The students would be able :</p> <ul style="list-style-type: none"> • To identify, describe and study in detail the life cycles of three Bryophytes. • To and study in detail classification and general characters of three classes of Pteridophytes and identify as well as describe the life cycles of one example from each class. • To study evolutionary aspects and economic utilization of Bryophytes and Pteridophytes. • To identify, describe and study in detail the life cycles of three Gymnosperms. • 		
<p>Unit I: Bryophyta (G. M. Smith Classification system to be followed)</p> <ul style="list-style-type: none"> • Life cycle of <i>Marchantia</i> • Life cycle of <i>Pelia</i> • Life cycle of <i>Sphagnum</i> 		15L
<p>Unit II: Pteridophyta (G. M. Smith Classification System to be followed)</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, general characters; Life cycle of <i>Marselia</i> 		15L
<p>Unit III: Bryophytes and Pteridophytes: Applied aspects</p> <ul style="list-style-type: none"> • Ecology of Bryophytes. • Economic importance of Bryophytes. • Bryophytes as Indicators. • Evolution of Sporophyte and Gametophyte in Bryophytes. • Economic importance of Pteridophytes, Azolla as a biofertilizer • Diversity and distribution of Indian Pteridophytes • Types of Sori and Evolution of Sori in Pteridophytes 		15L
<p>Unit IV: Gymnosperms (Chamberlain’s Classification System to be followed)</p> <ul style="list-style-type: none"> • Life cycle of Aurocaria/ Taxus/ podocarpus –Any one • Life cycle of <i>Gnetum</i> • Life cycle of <i>Ephedra</i>. <p>Economic importance of Gymnosperms</p>		15L

Course Code	Title	Credits
BH.USBO602	PLANT DIVERSITY – IV	2.5 Credits (60 Lectures)
<p>Course outcomes:</p> <p>The students would be able :</p> <ul style="list-style-type: none"> To study contribution of Botanical gardens, BSI to Angiosperm study and provide plant description, describe the morphological and reproductive structures of seven families. To gain exposure to a phylogenetic system of classification. To gain insight into the anatomical adaptations of different ecological plant groups. To understand development plant of male and female gametophytes, embryonic structure and development. To understand the different aspects and importance of Biodiversity and utilize them for conservation of species so as to prevent further loss or extinction of Biodiversity and preserve the existing for future generations. 		
<p>Unit I: Angiosperms II</p> <ul style="list-style-type: none"> Major Botanic gardens of India– Indian Botanic Garden, Howrah; National Botanic Garden (NBRI) Lucknow; Lloyd Botanic Garden, Darjeeling; Lalbaugh Botanic Garden, Bangaluru. Botanical survey of India and regional branches of India Bentham and Hooker’s system of classification for flowering plants up to family with respect to the following prescribed families and economic importance, medicinal importance and fruit morphology for members of the families <ul style="list-style-type: none"> Rhamnaceae Combretaceae Asclepiadaceae Labiatae Euphorbiaceae Cannaceae Hutchinson’s classification system of Angiosperms Brief Introduction, Merits and Demerits of Hutchinson’s Classification System 		15L
<p>Unit II: Anatomy II</p> <ul style="list-style-type: none"> Ecological anatomy <ul style="list-style-type: none"> Hydrophytes – submerged, floating, rooted Hygrophytes -<i>Typha</i> Mesophytes Sciophytes Halophytes Epiphytes Xerophytes 		15L
<p>Unit III: Embryology</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> 		15L
<p>Unit IV: Plant Geography</p> <ul style="list-style-type: none"> Phytogeographical regions of India. Biodiversity: <ul style="list-style-type: none"> Definition, diversity of flora found in various forest types of India Levels of biodiversity Study of Diversity- Simpson Diversity Index Importance and status of biodiversity 		15L

	<ul style="list-style-type: none">➤ Loss of biodiversity➤ Conservation of biodiversity➤ Genetic diversity- Molecular characteristics, CBD	

Course Code	Title	Credits
BH.USBO603	FORMS AND FUNCTION – III	2.5 Credits 60 Lectures)
<p>Course outcomes:</p> <p>The students would be able :</p> <ul style="list-style-type: none"> • To study various plant biomolecular structures and appreciate the structures, role, functions and applications of enzymes. • To gain insight into the Nitrogen and plant hormone metabolism with applications of the same in agriculture and horticulture. • To understand principles of genetic mapping , mutations and solve problems based on them, gain knowledge of various metabolic disorders and their implications. • To generate and test hypotheses, make observations, collect data, analyze and interpret results, derive conclusions, and evaluate their significance within a broad scientific context, using suitable statistical techniques. 		
<p>Unit I: Plant Biochemistry</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 un-competitive inhibitors. 		15L
<p>Unit II: Plant Physiology II</p> <ul style="list-style-type: none"> • Nitrogen Metabolism: Nitrogen cycle, Cyanobacterial Nitrogen Fixation, root nodule formation, and leghaemoglobin, nitrogenase activity, assimilation of nitrates, (NR, NiR activity), assimilation of ammonia, (amination and transamination reactions), nitrogen assimilation and carbohydrate utilization. • Phytohormones. <ul style="list-style-type: none"> ➤ Physiological effects and commercial applications of Auxins, Gibberillins, Cytokinins and Abscisic acid, Ethylene 		15L
<p>Unit III: Genetics</p> <ul style="list-style-type: none"> • Genetic mapping in eukaryotes: discovery of genetic linkage, gene recombination, 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 Ame’s test <p>Metabolic disorders– enzymatic and non-enzymatic: Gene control of enzyme structure Garrod’s hypothesis of inborn errors of metabolism, Phenyl ketone urea.</p>		15L
<p>Unit IV: Biostatistics (Shifted from Paper – II)</p> <ul style="list-style-type: none"> • Test of significance student’s <i>t</i>-test – Paired and Unpaired & Problems based on the same • Regression analysis <ul style="list-style-type: none"> ➤ ANOVA (one way). ➤ Loss of biodiversity ➤ Conservation of biodiversity ➤ Genetic diversity- Molecular characteristics, CBD 		15L

Course Code	Title	Credits
BH.USBO604	Current Trends in Plant Science – II	2.5 Credits (60 Lectures)
Course outcomes: The students would be able : <ul style="list-style-type: none"> To gain insight into recent molecular biology techniques for DNA analysis and amplification and Barcoding techniques and applications therein. To understand and apply tools of Bioinformatics for data retrieval and phylogenetic analysis. To learn about the sources of economically important plants in the field of fats and oils and apply it for extraction, dealing with entrepreneurship in the field. To gain knowledge and proficiency in Plant breeding and hybridization 		
Unit I: Plant Biotechnology II <ul style="list-style-type: none"> DNA sequence analysis– Maxam – Gilbert Method and Sanger’s method, Pyro Sequencing. Polymerase Chain Reaction (PCR). DNA barcoding: Basic features, nuclear genome sequence, chloroplast genome sequence, <i>rbcL</i> gene sequence, <i>mat K</i> gene sequence, present status of barcoding in plants. 		15L
Unit II: Bioinformatics <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 		15L
Unit III: Economic Botany <ul style="list-style-type: none"> Essential Oils: Extraction, perfumes, perfume oils, oil of Rose, Sandalwood, <i>Patchouli</i>, <i>Champaca</i>, grass oils: <i>Citronella</i>, <i>Vetiver</i>. 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 		15L
IV: Plant Breeding <ul style="list-style-type: none"> Introduction to plant breeding Methods of plant breeding <ol style="list-style-type: none"> Selection Hybridization Hardy-Weinberg law 		15L

SEMESTER VI PRACTICAL

SEMESTER VI - BH.USBOP7 –	C r
PRACTICAL PAPER I–PLANT DIVERSITY III – BH.USBOP601	1.5
<p>Bryophyta (G.M. Smith Classification System to be followed)</p> <ul style="list-style-type: none"> • Study of stages in the life cycle of the following Bryophyta from fresh / preserved material and permanent slides <ul style="list-style-type: none"> ➤ <i>Marchantia</i> ➤ <i>Pelia</i> ➤ <i>Sphagnum</i> 	
<p>Pteridophyta (G.M. Smith Classification System to be followed)</p> <ul style="list-style-type: none"> • Study of stages in the life cycles of the following Pteridophytes from fresh / preserved material and permanent slides <ul style="list-style-type: none"> ➤ <i>Lycopodium</i> ➤ <i>Equisetum</i> ➤ <i>Marselia</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 (Chamberlain’s Classification System to be followed)</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>Aurocaria / Taxus/ Podocarpus – Any one example</i> ➤ <i>Gnetum</i> ➤ <i>Ephedra</i> • Economic importance of Gymnosperms 	

BH.USBOP7	Cr
PRACTICAL PAPER II–PLANT DIVERSITY IV BH.USBOP602	1.5
<p>Angiosperms II</p> <ul style="list-style-type: none"> • Study of one plant from each of the following Angiosperm families as per Bentham and Hooker’s system of classification. <ul style="list-style-type: none"> ➤ Rhamnaceae ➤ Combretaceae ➤ Asclepiadaceae ➤ Labiatae ➤ Euphorbiaceae ➤ Cannaceae • Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families <ul style="list-style-type: none"> ➤ Identify the genus and species with the help of flora 	
<p>Anatomy II</p> <ul style="list-style-type: none"> • Study of Ecological Anatomy of <ul style="list-style-type: none"> ➤ Hydrophytes: Hydrilla stem, Nymphaea petiole, Eichhornia offset ➤ Epiphytes: Orchid ➤ Sciophytes: Peperomia leaf ➤ Xerophytes: Nerium leaf, Opuntia phylloclade ➤ Halophytes: Avicennia leaf and pneumatophore, Sesuvium / Suedaleaf ➤ Mesophytes: Vinca leaf 	
<p>Embryology</p> <ul style="list-style-type: none"> • Study of various stages of Microsporogenesis, Megasporogenesis and Embryo Development with the help of permanent slides / photomicrographs • Mounting of Monocot (Maize) and Dicot (Castor and Gram)embryo • In vivo growth of pollen tube in Portulaca /Vinca 	
<p>Plant Geography</p> <ul style="list-style-type: none"> • Study of phytogeographic regions of India • Preparation of vegetation map using GPS Instrument • Problems based on Simpson’s diversity Index 	
Total Credit	3

SEMESTER VI - BH.USBO P8	Cr
SEMESTER VI BH.USBOP8	
PRACTICAL PAPER III-FORM AND FUNCTION III BH.USBO P603	1.5
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 II <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> 	
Biostatistics <ul style="list-style-type: none"> • <i>t</i>-test (paired and unpaired) • Problems based on regression analysis • ANOVA (One Way) 	

	Cr
PRACTICAL PAPER IV CURRENT TRENDS IN PLANT SCIENCES BH.USBOP604	1.5
Plant Biotechnology II	
<ul style="list-style-type: none"> • DNA sequencing by Sanger's Method and Pyro Sequencing Method • DNA barcoding of plant material by using suitable data 	
Bioinformatics	
<ul style="list-style-type: none"> • BLAST: nBLAST, pBLAST • Multiple sequence alignment • Phylogenetic analysis • RASMOL/SPDBV 	
Economic Botany	
<ul style="list-style-type: none"> • Demonstration: Extraction of essential oil using Clevenger • Thin layer chromatography of essential oil of Patchouli and Citronella • Saponification value of Palm oil 	
IV: Plant Breeding	
<ul style="list-style-type: none"> • Introduction to Plant breeder's kit • Determination of the amount of cross pollination • Emasculation and hybridization (Demonstration) • Hardy-Weinberg law: Calculating gene and genotypic frequencies. <ul style="list-style-type: none"> • Industrial Visit /Research Institute Visit and report writing so that students can get first-hand experience about application of plant biology for commercial exploitation 	

Scheme of Examinations:

Theory Course: Semester End Assessment	100 (60+40) Marks Each Theory Paper
Practical Course	50 Marks Each Practical Paper

Modality of Assessment**1. Theory Examination Pattern:****A) Internal Assessment- 40%- (40 Marks)**

Sr No	Evaluation type	Marks
1	Internal Class Test with Objective type questions and Short Notes (CIA-1)	20
2	One Assignment (CIA-2)	20
	TOTAL	40

Assignment types can include:

1. Theory based assignments testing student's analytic skills. OR
2. Survey based Project & Presentation. OR
3. Field reports & Presentation. OR
4. Industrial Visit report. OR
5. Paper Attendance/ Presentations in State/National/ International seminar/conference/ etc & Presentation. OR
6. Internships as per subject requirement & Presentation.

B) External Examination/ End Semester Examination (ESE) 60%- (60 Marks)

Duration - These examinations shall be of 2 hours

Paper Pattern:

Question	Options	Marks	Questions based on
Q.1)	A. Question of 8 marks. B. Question of 7 marks.	15	Unit I
Q.2)	A. Question of 8 marks. B. Question of 7 marks.	15	Unit II
Q.3)	A. Question of 8 marks. B. Question of 7 marks.	15	Unit III
Q.4)	A. Question of 8 marks. B. Question of 7 marks.	15	Unit IV
	TOTAL	60	

2. Practical examination pattern-

Each theory paper will have practical component of 50 marks each. Thus total 4 practical examinations for each semester will be conducted. Total 200 marks are allotted for practical component.

Note:

1. Minimum Marks of 20 are required in Every Practical Paper Examination in each semester.
2. A minimum of **Four field excursions (with at least one beyond the limits of Mumbai / Local area) 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.
3. **At least One Visit to Laboratory or / Industry / Research Institute in order to study Laboratory and equipment's is compulsory.**
4. A candidate will be allowed to appear for the practical examinations only if he/she submits a certified journal of T.Y.B.Sc. Botany and the Field/ **Industrial / Research Institute Visit** certified report duly sign by the Head of the Department to the effect that the candidate has completed the practical course of T.Y.B.Sc. 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.

ReferenceBooks

1. A handbook of Ethnobotany by S.K. Jain, V. Mudgal
2. Plants in folk religion and mythology (Contribution to Ethnobotany by S.K.Jain3rdRev.Ed.).
3. Introduction to Plant Physiology by Noggle and Fritz, Prentice Hall Publishers(2002)
4. Plant Physiology by Salisbury and Ross CBS Publishers
5. Plant Physiology by Taiz and Zeiger Sinauer Associates Inc. Publishers,2002
6. Genetics by Russel Peter Adison Wesley Longman Inc. (5thedition)
7. An introduction to Genetic analysis Griffith Freeman and Company(2000)
8. Fundamentals of Biostatistics by Rastogi, Ane Books Pvt. Ltd.(2009).
9. College Botany Vol I and II by Gangulee Das and Dutta Central Education enterprises.
10. Cryptogamic Botany Vol I and II by G M Smith, Mcgraw Hill
11. Industrial Microbiology by Cassida, New Age International, New Delhi
12. Industrial Microbiology Mac Millan Publications, New Delhi
13. Physiological Plant Anatomy by Haberlandt, Mac Millan and Company
14. Ayurveda Ahar by P H Kulkarni
15. Pharmacognosy by Kokate, Purohit and Gokhale, Nirali Publications
16. Bioinformatics by Sunder Rajan
17. Instant Notes on Bioinformatics by Westhead (2002), Taylor Francis Publications.
18. Bioinformatics by Ignasimuthu
19. DNA barcoding plants: taxonomy in a new perspective 2010. K Vijayan and C H Tsou, Current Science, 1530 –1541.
20. Introduction to Biostatistics by P K Banerjee, Chand Publication.
21. Plant Biotechnology by K. Ramawat
22. Practical Biochemistry by David Plummer, McGraw Hill Publ.
23. Economic Botany by A F Hill, TATA McGRAW-HILL Publishing Co. Ltd.
24. Post-Harvest Technology by Verma and Joshi, Indus Publication
25. Embryology of Plants by Bhojwani and Bhatnagar
26. Pollen Morphology and Plant Taxonomy by G. Erdtman, Hafner Publ. Co., N.Y.
27. A text Book of Palynology by K Bhattacharya, New Central Book Agency Pvt. Ltd., London
28. An introduction to Embryology of Angiosperms by P Maheshwari, McGraw Hill Book Co.
29. Plant Systematics by Gurcharan Singh, Oxford and IBH Publ.
30. Taxonomy of Vascular Plants by Lawrence George, H M, Oxford and IBH Publ.
31. Plant breeding Principles and methods

BHAVANS COLLEGE (AUTONOMOUS) ANDHERI (W)
AFFILIATED UNDR UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY
SEMESTER V (BH.USBOP5)
Practical Paper – I Plant Diversity (BH.USBOP501)

Duration: 9:00 am to 01:00 pm

Max. Marks:50

Q.1	Perform the given Microbiological Experiment 'A'	12
Q.2	Identify, Classify and Describe Specimens B, C and D . Sketch neat and labeled diagrams of Morphological / Microscopical structures seen in the specimens	24
Q.3	Identify and describe slides / specimens E, F and G .	09
Q.4	Journal	05

KEY:

A– Any one experiment out of four as prescribed in syllabus.

B & C– Algae.

D– Fungi.

E, F & G– Plant Pathology, Algae or Fungi not asked above in random order.

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AFFILIATED UNDR UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY
SEMESTER V (BH.USBOP5)
PRACTICAL PAPER – II- PLANT DIVERSITY IV (BH.USBOP502)

Duration: 9:00 am to 01:00 pm

Max. Marks:50

Q. 1A. Classify specimen 'A' up to their families giving reasons. Give floral formula.

Sketch neat and labeled L. S. of flower and T.S.
ovary.

10

Q. 1B. Identify genus and species of specimen 'B' using
flora.

05

Q.2 Make a temporary double stained preparation of T.S. specimen 'C' and comment
on the type of secondary
growth.

06

Q.3 Perform the Palynology experiment 'D' allotted to
you.

07

Q.4 Identify and describe slide/ specimen 'E', 'F', 'G' &
'H'.

12

Q.5 Field
report

05

Q.6 Viva voce (based on Paper I and Paper
II).

05

KEY

A– Families of T.Y.B.Sc only

B– Plants from F.Y & S.Y. B. Sc Families to be included

C– Anatomy Anomalous Secondary Growth

D– As per slip

E, F, G & H– Fossils, Types of Stomata, Morphology of flower & Morphology of Fruits Studied in Theory – in random order

BHAVANS COLLEGE (AUTONOMOUS) ANDHERI (W)
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T.Y.B.SC. BOTANY
SEMESTER V (BH.USBOP6)
PRACTICAL PAPER – III FORMS AND FUNCTION III (BH.USBOP503)

Duration: 9:00 am to 01:00 pm

Max. Marks:50

-
- | | | |
|-------|--|----|
| Q.1 | Make a smear preparation of material 'A' and show the slide to the Examiner.
Comment on your observation / Expose the giant chromosomes from the salivary glands of Chironomous | 08 |
| Q. 2 | Perform the experiment 'B' allotted to you (Physiology). | 10 |
| Q. 3 | Perform the experiment 'C' allotted to you (Ecology). | 10 |
| Q. 4. | Calculate the _____ of the given solution 'D' to prepare the required solution. | 05 |
| Q. 5. | Identify and describe slide/specimen 'E' & 'F'. G,H | 12 |
| Q.6. | Journal | 05 |

KEY

B– Physiology experiment.

C– Ecology experiment.

D– Plant Tissue Culture.

E & F– Multiple shoot culture, Hairy root culture, Somatic embryogenesis, Amino acid sequencing. **Mineral deficiency symptom's**

BHAVANS COLLEGE (AUTONOMOUS) ANDHERI (W)
AFFILIATED UNDR UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY
SEMESTER V (BH.USBOP6)
PRACTICAL PAPER – IV CURRENT TRENDS IN PLANT SCIENCE II
(BH.USBOP504)

Duration: 9:00 am to 01:00 pm

Max. Marks:50

- | | | |
|------------|--|-----------|
| Q.1 | Perform the experiment A – growth curve of <i>E.coli</i> / Isolate plasmid DNA and separate using AGE | 12 |
| Q.2 | Perform the experiment ' B ' allotted to you. | 10 |
| Q.3 | Describe macroscopical /microscopical character with the help of neat and labelled sketches of specimens 'C' and 'D'. Perform the chemical test / TLC to identify the active constituents. | 14 |
| Q.4 | Identify and explain the specimens/ photographs ' E ', ' F ' and ' G '. | 09 |
| Q.5 | Journal. | 05 |
-

KEY

B– Experiment based on Beer- Lambert's Law Experiment on separation of dyes/pigments using silica gel column chromatography/ **TLC**

C & D–*Allium sativum*, *Acorus calamus*, *Curcuma longa*, *Senna angustifolia*, *Strychnos nux-vomica* *Eugenia caryophyllata*

E, F & G– any stage of mushroom cultivation, any Plant from ethnobotany, problems on restriction mapping

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AFFILIATED UNDR UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY
SEMESTER VI (BH.USBOP7)
PRACTICAL PAPER – I- PLANT DIVERSITY III (BH.USBOP601)

Duration: 9:00 am to 01:00 pm

Max. Marks:50

- | | | |
|------------|--|-----------|
| Q.1 | Identify, classify and describe specimen 'A' and 'B'. Sketch neat and labelled diagrams of Morphological/Microscopical structures seen in the specimens. | 12 |
| Q.2 | Identify, classify and describe specimen 'C' and 'D'. Sketch neat and labeled diagrams of Morphological/Microscopical structures seen in the specimens. | 12 |
| Q.3 | Identify, classify and describe specimen 'E'. Sketch neat and labeled diagrams of Morphological/Microscopical structures seen in the specimens. | 06 |
| Q.4 | Identify and describe slides/specimen 'F', 'G', 'H', 'I' & 'J' | 15 |
| Q.5 | Journal. | 05 |
-

KEY

A & B– Bryophytes: *Marchantia, Pellia & Sphagnum*

C & D– Pteridophytes: *Lycopodium, Equisetum, Adiantum & Marsilea*

E– Gymnosperm: *Thuja, Gnetum & Ephedra*

F, G, H, I & J– Economic importance of Bryophytes, Economic importance of Pteridophytes Types of Sporophytes in Bryophyta, Types of Sori in Pteridophytes, Soral arrangement in Pteridophytes, Economic importance of Gymnosperms. (In random order)

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T.Y.B.SC. BOTANY
SEMESTER VI (BH.USBOP7)
PRACTICAL PAPER – II- PLANT DIVERSITY IV (BH.USBOP602)

Duration: 9:00 am to 01:00 pm

Max. Marks:50

- | | | |
|--------|---|----|
| Q. 1 A | Classify specimen 'A' up to its family giving reasons. Give floral formula.
Sketch neat and labeled L.S. of flower and T.S. ovary. | 08 |
| Q. 1.B | Identify genus and species of specimen 'B' using flora | 04 |
| Q. 2 | Make a stained preparation of specimen 'C' and comment on its ecological anatomy | 06 |
| Q.3A | Calculate Simpson's Diversity Index from the given data 'D' | 08 |
| Q.3B | Mark the Phytogeographic region 'E' in the map of India and Comment on the same | 05 |
| Q.4 | Identify and describe slide/specimen 'F', 'G' & 'H'. | 09 |
| Q.5 | Field Report | 05 |
| Q.6 | Viva voce (based on Paper I and Paper II) | 05 |
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KEY

A– Families of T.Y.B.Sc Sem – VI only

B– Plants from F.Y., S.Y. & T.Y. B. Sc.(Sem – V Families to be included).

C– Ecological anatomy.

F, G & H– Economic importance of specimen from prescribe families (Sem VI only), Morphological Peculiarities of prescribed families (Sem – VI only), Embryology. (In random order)

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AFFILIATED UNDR UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY
SEMESTER VI (BH.USBOP8)
PRACTICAL PAPER – III- FORM AND FUNCTION III (BH.USBOP603)

Duration: 9:00 am to 01:00 pm

Max. Marks:50

Q. 1	Perform the experiment 'A' allotted to you	10
Q. 2	Perform the experiment 'B' allotted to you.	10
Q. 3	Make a squash preparation to show the stage of mitosis from the pre-treated root tips 'C'	05
Q.4	Construct a chromosome map from the given data 'D' / Identify the type of mutation and comment on them (any two types of mutations)	10
Q.5	From the given data/ material 'E' determine test of significance using students t-test/ Regression Analysis /ANOVA	10
Q.6	Journal.	05

KEY

A– Plant Biochemistry Experiment.

B– Plant Physiology Experiment.

C- Mitosis

D - types of mutations

E- t-test/ Regression Analysis /ANOVA

BHAVANS COLLEGE (AUTONOMOUS) ANDHERI (W)
AFFILIATED UNDR UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY
SEMESTER VI (BH.USBOP8)
PRACTICAL PAPER – IV- CURRENT TRENDS IN PLANT SCIENCE II
(BH.USBOP604)

Duration: 9:00 am to 01:00 pm

Max. Marks:50

Q. 1	Perform the DNA barcoding of plant material using given data ‘A’	09
OR		
Q. 1	Perform DNA sequencing by Sanger’s method of the given sequence ‘A’.	09
Q. 2	Perform the experiment ‘B’ allotted to you.	09
Q.3	Perform the given analysis of data ‘C’ using computer (Bioinformatics).	09
Q.4	Determine the amount of Cross pollination for given data ‘D’ (Plant breeding:)	07
OR		
Q.4	Calculate the gene and genotypic frequency (Hardy-Weinberg law)for given data ‘D’	07
Q.5	Identify and describe the instruments ‘E’ & ‘F’	06
Q.6	Industrial Visit/ Research Center Visit Report	05
Q.7	Viva voce (based on Paper III and Paper IV)	05

KEY

B– TLC of *Patchouli* or *Citronella* / Saponification value

C– BLAST / Multiple Sequence Alignment (MSA) / Phylogenetic Analysis / RASMOL / SPDBV

D- Problems Based on: Plant breeding / Hardy-Weinberg law

E & F : Clevenger apparatus , Plant breeders kit.