

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

Semester I USB0101		L	Cr
Paper I -- Plant Diversity 1		45	2
<u>UNIT I</u>		15	
<u>ALGAE</u>			
1	Structure, life cycle and systematic position of <i>Nostoc</i> and <i>Spirogyra</i> .		
2	Economic importance of Algae.		
<u>UNIT II</u>		15	
<u>FUNGI</u>			
1	Structure, life cycle and systematic position of <i>Rhizopus</i> and <i>Aspergillus</i>		
2	Economic importance of Fungi.		
3	Modes of nutrition in Fungi (Saprophytism and Parasitism).		
<u>UNIT III</u>		15	
<u>BRYOPHYTA</u>			
1	General characters of Hepaticae		
2	Structure, life cycle and systematic position of <i>Riccia</i> .		

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

<u>Semester I</u> USB0102		L	Cr
Paper II – Form and Function 1		45	2
<u>UNIT I</u>		15	
CELL BIOLOGY			
1	General structure of plant cell: cell wall Plasma membrane (bilayer lipid structure, fluid mosaic model)		
2	Ultra structure and functions of the following cell organelles: Endoplasmic reticulum and Chloroplast		
<u>UNIT II</u>		15	
ECOLOGY			
1	Energy pyramids, energy flow in an ecosystem.		
2	Types of ecosystems: aquatic and terrestrial.		
<u>UNIT III</u>		15	
GENETICS			
1	Phenotype/Genotype, Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios.		
2	Epistatic and non epistatic interactions; multiple alleles.		

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

	Semester I USBOP1	L	Cr
	PRACTICAL Paper I – Plant Diversity 1	30	1
1	Study of stages in the life cycle of <i>Nostoc</i> from fresh/ preserved material and permanent slides.		
2	Study of stages in the life cycle of <i>Spirogyra</i> from fresh/ preserved material and permanent slides.		
3	Economic importance of algae: <i>Ulva</i> (Biofuel), <i>Spirulina</i> (Neutraceutical), <i>Gelidium</i> (Agar)		
4	Study of stages in the life cycle of <i>Rhizopus</i> from fresh/ preserved material and permanent slides.		
5	Study of stages in the life cycle of <i>Aspergillus</i> from fresh/ preserved material and permanent slides.		
6	Economic importance of Fungi: Mushroom , Yeast, wood rotting fungi (any bracket fungus).		
7	Study of stages in the life cycle of <i>Riccia</i> from fresh/ preserved material.		
8	Study of stages in the life cycle of <i>Riccia</i> with the help of permanent slides.		
	PRACTICAL PAPER II- FORM AND FUNCTION 1	30	1
1	Examining various stages of mitosis in root tip cells (<i>Allium</i>)		
2	Cell inclusions: Starch grains (Potato and Rice); Aleurone Layer (Maize)		
3	Cystolith (<i>Ficus</i>); Raphides (<i>Pistia</i>); Sphaeraphides (<i>Opuntia</i>).		
4	Identification of cell organelles with the help of photomicrograph: Plastids: Chloroplast, Amyloplast, Endoplasmic Reticulum and Nucleus		
4	Identification of plants adapted to different environmental conditions: Hydrophytes: Floating: Free floating (<i>Pistia/Eichornia</i>); Rooted floating (<i>Nymphaea</i>); Submerged (<i>Hydrilla</i>)		
5	Mesophytes (any common plant); Hygrophytes (<i>Typha/Cyperus</i>)		

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

6	Xerophytes : Succulent (<i>Opuntia</i>); Woody Xerophyte (<i>Nerium</i>); Halophyte (<i>Avicennia</i> pneumatophore) No sections in ecology, only identification and description of specimens. Morphological adaptations only.		
7	Calculation of mean, median and mode.		
8	Calculation of standard deviation.		
9	Frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart.		
10	Study of Karyotypes: Human: Normal male and female, <i>Allium cepa</i> .		

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

Semester II USBO201		Hrs	Cr
Paper I -- Plant Diversity 1		45	2
<u>UNIT I</u>		15	
<u>PTERIDOPHYTES</u>			
1	Structure life cycle, systematic position and alternation of generations in <i>Nephrolepis</i>		
2	Stelar evolution		
<u>UNIT II</u>		15	
<u>GYMNOSPERMS</u>			
2	Structure life cycle systematic position and alternation of generations in <i>Cycas</i>		
3	Economic importance of Gymnosperms		
<u>Unit III</u>			
<u>ANGIOSPERMS</u>		15	
1.	Leaf: simple leaf, types of compound leaves, Incisions of leaf, venation, phyllotaxy, types of stipules, leaf apex, leaf margin, leaf base, leaf shapes. Modifications of leaf: spine, tendril, hooks, phyllode, pitcher, <i>Drosera</i> or insectivorous plants.		
2	Inflorescence: Racemose: simple raceme, spike, catkin, spadix, panicle. Cymose: monochasial, dichasial, polychasial. Compound: corymb, umbel, cyathium, capitulum, verticillaster, hypanthodium.		
3	Study of following families: Malvaceae, Amaryllidaceae.		

Semester II USBO202		Hrs	Cr
Paper II – Form and Function 1		45	2
<u>UNIT I</u>		15	
<u>ANATOMY</u>			
1	Simple tissues, complex tissues.		
2	Primary structure of dicot and monocot root, stem and leaf.		
3	Epidermal tissue system: types of hair, monocot and dicot stomata.		

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

<u>UNIT II</u>		15	
<u>PHYSIOLOGY</u>			
1	Photosynthesis: Light reactions, photolysis of water, photophosphorylation (cyclic and non cyclic), carbon fixation phase (C ₃ , C ₄ and CAM pathways).		
<u>UNIT III</u>		15	
<u>MEDICINAL BOTANY</u>			
1	Concept of primary and secondary metabolites, difference between primary and secondary metabolites.		
2	Grandma's pouch: Following plants have to be studied with respect to botanical source, part of the plant used, active constituents present and medicinal uses: <i>Oscimum sanctum</i> , <i>Adathoda vasica</i> , <i>Zinziber officinale</i> , <i>Curcuma longa</i> , <i>Santalum album</i> , <i>Aloe vera</i> .		

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

	Semester II USBOP2	Cr
	PRACTICAL Paper I – Plant Diversity 1	1
1	Study of stages in the life cycle of <i>Nephrolepis</i> : Mounting of ramentum, hydathode, T.S. of rachis.	
2	T.S. of pinna of <i>Nephrolepis</i> passing through sorus.	
3	Stelar evolution with the help of permanent slides: Protostele: haplostele, actinostele, plectostele, mixed protostele, siphonostele: ectophloic, amphiphloic, dictyostele, eustele and atactostele.	
4	<i>Cycas</i> : T.S of leaflet (<i>Cycas</i> pinna)	
5	Megasporophyll, microsporophyll, coralloid root, microspore, L.S. of ovule of <i>Cycas</i> – all specimens to be shown.	
6	Economic importance of Gymnosperms: <i>Pinus</i> (turpentine, wood, seeds)	
7	Leaf morphology : as per theory	
8	Types of inflorescence: as per theory	
9	Malvaceae	
10	Amaryllidaceae	
	PRACTICAL Paper II – Form and Function 1	1
1	Primary structure of dicot and monocot root.	
2	Primary structure of dicot and monocot stem.	
3	Study of dicot and monocot stomata.	
4	Epidermal outgrowths: with the help of mountings Unicellular: <i>Gossypium</i> /Radish Multicellular: <i>Lantana</i> /Sunflower Glandular: <i>Drosera</i> and Stinging: <i>Urtica</i> – only identification with the help of permanent slides. Peltate: <i>Thespesia</i> Stellate: <i>Erythrina</i> / <i>Sida acuta</i> / <i>Solanum</i> / <i>Helecteris</i>	

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

	T-shaped: <i>Avicennia</i>	
5	Separation of chlorophyll pigments by strip paper chromatography.	
6	Separation of amino acids by paper chromatography.	
7	Change in colour because of change in pH: Anthocyanin: black grapes/Purple cabbage	
8	Test for tannins: tea powder/catechu.	
9	Identification of plants or plant parts for grandma's pouch as per theory.	

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

DISTRIBUTION OF TOPICS AND CREDITS
F Y B Sc. BOTANY SEMESTER I

Course	Nomenclature	Credits	Topics
USBO1O1	PLANT DIVERSITY 1	02	1. Algae
			2. Fungi
			3. Bryophyta
USBO1O2	FORM AND FUNCTION I	02	1. Cell Biology
			2. Ecology
			3. Genetics
USBOP1	Plant Diversity I, form and Function I (Practical I & II)	02	

F Y B Sc BOTANY SEMESTER II

Course	Nomenclature	Credits	Topics
USBO2O1	PLANT DIVERSITY I	02	1. Pteridophytes
			2. Gymnosperms
			3. Angiosperms
USBO2O2	FORM AND FUNCTION I	02	1. Anatomy
			2. Physiology
			3. Medicinal Botany
USBOP2	Plant Diversity I, Form and Function I (Practical I & II)	02	

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

References

1. College Botany Volume I and II Gangulee, Das and Dutta latest edition. Central Education enterprises
2. Cryptogamic Botany Volume I and II by G M Smith McGraw Hill.
3. Genetics by Russel. Wesley Longman inc publishers. (5th edition)
4. Plant Physiology by Taiz and Zeiger Sinauer Associates inc. publishers
5. Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore.
6. Cell Biology by De Robertis

University of Mumbai
Board of Studies in Botany
FYBSc Syllabus Credit System 2014-2015 onwards

AC 7/4/2014
Item No. 4.23

Scheme of Examinations

Internal and External Assessment as per CBSS of University of Mumbai

Note:

- Two short field excursions 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 15 students.
- A candidate will be allowed to appear for the practical examinations only if he/she submits a certified journal of F.Y.B.Sc. Botany or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of F.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 practicals 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.

UNIVERSITY OF MUMBAI



**Syllabus for the S.Y.B.Sc.
Program: B.Sc.
Course : BOTANY**

(Credit Based Semester and Grading System with
effect from the academic year 2015–2016)

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

S.Y.B.Sc. Botany Syllabus
Restructured for Credit Based and Grading System
To be implemented from the Academic year 2015-2016

SEMESTER III

Course Code	UNIT	TOPICS	Credits	L / Week
USBO301	<u>PLANT DIVERSITY II</u>			
	I	Thallophyta- Algae	2	1
	II	Bryophyta		1
	III	Angiosperms		1
USBO302	<u>FORM AND FUNCTION II</u>			
	I	Instrumentation and Techniques	2	1
	II	Cell Biology		1
	III	Cytogenetics		1
USBO303	<u>CURRENT TRENDS IN PLANT SCIENCES I</u>			
	I	Pharmacognosy & Phytochemistry	2	1
	II	Forestry & Economic Botany		1
	III	Molecular Biology		1
USBOP3	Practical based on all the three courses in theory		3	9

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER IV

Course Code	UNIT	TOPICS	Credits	L / Week
USBO401	<u>PLANT DIVERSITY II</u>			
	I	Thallophyta: Fungi, Plant Pathology and Lichens	2	1
	II	Pteridophyta and Paleobotany		1
	III	Gymnosperms		1
USBO402	<u>FORM AND FUNCTION II</u>			
	I	Anatomy	2	1
	II	Physiology and Plant Biochemistry		1
	III	Ecology and Environmental Botany		1
USBO403	<u>CURRENT TRENDS IN BOTANY I</u>			
	I	Horticulture	2	1
	II	Biotechnology		1
	III	Biostatistics & Bioinformatics		1
USBOP4	Practical based on all the three courses in theory		3	9

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER III THEORY

Course Code	Title	Credits
USBO301	<u>PLANT DIVERSITY II</u>	2 Credits (45 lectures)
<u>Unit I : Thallophyta- Algae</u> <ul style="list-style-type: none"> General Characters of Division Phaeophyta: 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>Dictyota</i> <i>Sargassum</i> Pigments in Algae. 		15 Lectures
<u>Unit II : Bryophyta</u> <ul style="list-style-type: none"> General Account of Class Anthocerotae and Musci Structure, life cycle and systematic position of <ul style="list-style-type: none"> <i>Anthoceros</i> <i>Funaria</i> 		15 Lectures
<u>Unit III : Angiosperms</u> <u>Morphology of Flowering Plants</u> <ul style="list-style-type: none"> Flower Morphology : <ul style="list-style-type: none"> Parts of a flower, flower symmetry; Flower as a modified shoot, Thalamus, insertion of floral leaves on the thalamus The accessory whorls : Calyx types and modifications, Corolla – forms; aestivation, The Perianth; The Essential whorls: Androecium parts of the androecium, Number and insertion of stamens, Union of stamens; Types of Corona Gynoecium: the carpel, style and stigma; Union of Carpel; ovary- placentation, types of ovules, evolution of placenta in Angiosperm. Floral formula, floral diagram. With the help of Bentham and Hooker's system of classification for flowering plants study the vegetative, floral characters and economic importance of the following families: <ul style="list-style-type: none"> Magnoliaceae Myrtaceae Asteraceae Apocynaceae Amaranthaceae Palmae 		15 Lectures

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

Course Code	Title	Credits
USBO302	<u>FORM AND FUNCTION II</u>	2 Credits (45 lectures)
<u>Unit I : Instrumentation and Techniques</u> <ul style="list-style-type: none"> • Microscopy – Principle and working of Light, and electron microscope. • Chromatography- Principles and techniques in paper and thin layer chromatography. • Principles and techniques of Horizontal and Vertical electrophoresis. 		15 Lectures
<u>Unit II : Cell Biology</u> <ul style="list-style-type: none"> • Ultra Structure and functions of the following cell organelles: <ul style="list-style-type: none"> ○ Mitochondrion ○ Peroxisomes ○ Glyoxysomes ○ Ribosomes • Cell Division and its significance <ul style="list-style-type: none"> ○ Cell Cycle ○ Mitosis & Meiosis ○ Differences between Mitosis and Meiosis • Nucleic Acids: Types, structure and functions of <ul style="list-style-type: none"> ○ DNA ○ RNA 		15 Lectures
<u>Unit III : Cytogenetics</u> <ul style="list-style-type: none"> • Variation in Chromosome structure (Chromosomal Aberrations) Definition, Origin, Cytological and Genetic Effects of the following: Deletions, Duplications, Inversions and Translocations. • Variation in Chromosome Number Origin and production, morphological and cytological features, applications in crop improvement and evolution of Aneuploids and Euploids (Monoploids, Autopolyploids and allopolyploids) • Extranuclear Genetics Organelle heredity- <ul style="list-style-type: none"> ○ Chloroplast determines heredity -Plastid transmission in plants, Streptomycin resistance in <i>Chlamydomonas</i>. ○ Mitochondrion determined heredity- petite colonies in yeast 		15 Lectures

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

Course Code	Title	Credits
USBO303	<u>CURRENT TRENDS IN PLANT SCIENCES I</u>	2 Credits (45 lectures)
<u>Unit I : Pharmacognosy and Phytochemistry</u> <ul style="list-style-type: none"> • Introduction to pharmacopoeia • Study of secondary metabolites (sources, properties and uses) with reference to <ul style="list-style-type: none"> ○ Alkaloids, ○ Glycosides, ○ Tannins, ○ Volatile oils and ○ Gums and resins (example of one plant for each category) 		15 Lectures
<u>Unit II : Forestry and Economic Botany</u> <ul style="list-style-type: none"> • Types of forests – classification of forests, different types of forests in India • Applications of forestry- Social forestry, Reforestation, Aforestation, Deforestation. • Economic Botany: <ul style="list-style-type: none"> ○ Fibres: Types of fibres, fibre yielding plants ○ Paper: Types of paper, paper yielding plants, paper processing. ○ Spices and condiments: Nutmeg, Mace, Clove, Cardamom and Saffron 		15 Lectures
<u>Unit III : Molecular Biology</u> <ul style="list-style-type: none"> • DNA replication : Replication(prokaryotic and eukaryotic) • Protein Synthesis: <ul style="list-style-type: none"> ○ Central dogma of Protein synthesis ○ Transcription: The transcription process in prokaryotes and eukaryotes, RNA synthesis, RNA processing, Adenylation& Capping. 		15 Lectures

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER III PRACTICAL

Semester III USBOP3 PRACTICAL Paper I – Plant Diversity II	Cr 1
Algae <ol style="list-style-type: none">1. Study of stages in the life cycle of <i>Dictyota</i> from fresh/ preserved material and permanent slides.2. Study of stages in the life cycle of <i>Sargassum</i> from fresh/ preserved material and permanent slides.3. Economic importance and range of thallus in Phaeophyta Bryophyta <ol style="list-style-type: none">4. Study of stages in the life cycle of <i>Anthoceros</i> from fresh/ preserved material and permanent slides.5. Study of stages in the life cycle of <i>Funaria</i> from fresh/ preserved material and permanent slides. Angiosperms <ol style="list-style-type: none">6. Study of Floral Morphology7- Study of one plant from each family prescribed for theory: morphological9. peculiarities and economic importance of the members of these families.	

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

Semester III USBOP3 PRACTICAL Paper II – FORM AND FUNCTION- II	Cr 1
Instrumentation and Techniques 1 Preparation of herbarium and wet preservation technique 2 Chromatography: Separation of amino by circular paper chromatography 3 Separation of Carotenoids by thin layer chromatography 4 Horizontal and Vertical Gel Electrophoresis – Demonstration	
Cell Biology 5 Study of the ultra-structure of cell organelles prescribed for theory from Photomicrographs 6 Estimation of DNA from plant material (one Std& one Unknown, No Std Graph) 7 Estimation of RNA from plant material (one Std& one Unknown, No Std Graph)	
Cytogenetics 8 Study of inheritance pattern with reference to Plastid Inheritance 9 Aberrations --- karyotypes - Cri – du- chat, Philadelphia, D-G translocation, Down Syndrome.	

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

Semester III USBOP3		Cr
PRACTICAL - Paper III CURRENT TRENDS IN PLANT SCIENCES I		1
Pharmacognosy		
1	A. Tests for alkaloids from <i>Strychnos</i> (seeds) and <i>Holarrhena</i> (bark) B. Tests for glycosides from <i>Glycyrrhiza</i> rhizome/ <i>Aloe</i> leaf/ <i>Senna</i> leaf.	
2	Preparation of any herbal cosmetic.(Demonstration)	
3	Stomatal Index	
4	Palisade Ratio, Vein islet number	
Forestry and Economic Botany		
5	Study of Biodiversity Composition of different types of forests in India (tropical, subtropical & temperate)	
6	Sources, properties and uses of : fibres & paper	
7	Sources , properties and uses of spices and condiments	
Molecular Biology		
8	DNA sequencing- Sanger's method	
9	Determining the sequence of amino acids in the protein molecule synthesised from the given m-RNA strand (prokaryotic and eukaryotic)	

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER IV THEORY

Course Code	Title	Credits
USBO401	<u>PLANT DIVERSITY II</u>	2 Credits (45 lectures)
<u>Unit II : Thallophyta: Fungi, Plant Pathology and Lichens</u> <u>Fungi-</u> <ul style="list-style-type: none"> General characters of Ascomycetae Structure, life cycle and systematic position of <i>Erysiphe</i> and <i>Xylaria</i> <u>Plant Pathology-</u> <ul style="list-style-type: none"> Symptoms, causative organism, disease cycle and control measures of <ul style="list-style-type: none"> Powdery mildew and Late blight of potato <u>Lichens-</u> <ul style="list-style-type: none"> Classification, Structure, Method of Reproduction, Economic Importance and Ecological Significance of Lichens. 		15 Lectures
<u>Unit II : Pteridophyta and Paleobotany</u> <u>Pteridophyta-</u> <ul style="list-style-type: none"> Salient features and classification upto orders (with examples of each) of Psilophyta and Lepidophyta (G M Smith's system of classification to be followed), Structure, life cycle and systematic position of <i>Selaginella</i> <u>Paleobotany-</u> <ul style="list-style-type: none"> The geological time scale; Formation and types of fossils; Structure and systematic position of form genus <i>Rhynia</i> 		15 Lectures
<u>Unit III : Gymnosperms</u> <ul style="list-style-type: none"> Salient features, classification up to orders (with examples of each) and economic importance of Coniferophyta (Chamberlain's system of classification to be followed) Structure life cycle and systematic position of <i>Pinus</i> Structure and systematic position of the form genus <i>Cordaites</i> 		15 Lectures

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

Course Code	Title	Credits
USBO402	<u>FORM AND FUNCTION II</u>	2 Credits (45 lectures)
<u>Unit I : Anatomy</u> <ul style="list-style-type: none"> • Normal Secondary Growth in Dicotyledonous stem and root. • Secondary growth in Monocot stem – <i>Dracaena</i>. • Mechanical Tissue system <ul style="list-style-type: none"> ○ Tissues providing mechanical strength and support and their disposition ○ I-girders in aerial and underground organs • Conducting tissue system : <ul style="list-style-type: none"> ○ Xylem and its elements, ○ Phloem and its elements ○ Types of Vascular Bundles. 		15 Lectures
<u>Unit II : Plant Physiology and Plant Biochemistry</u> <ul style="list-style-type: none"> • Respiration: Aerobic: Glycolysis, TCA Cycle, ETS & Energetic of respiration; Anaerobic respiration. • Photorespiration • Photoperiodism: Phytochrome Response and Vernalization with reference to flowering in higher plants, Physico-chemical properties of phytochrome, Pr-Pfr interconversion, role of phytochrome in flowering of SDPs and LDPs; • Vernalization mechanisms and applications. 		15 Lectures
<u>Unit III : Ecology and Environmental Botany</u> <ul style="list-style-type: none"> • Biogeochemical Cycles- Carbon, Nitrogen and Water. • Ecological factors: Concept of environmental factors. Soil as an edaphic factor, Soil composition, types of soil, soil formation, soil profile. • Community ecology- Characters of community - Quantitative characters and qualitative characters 		15 Lectures

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

Course Code	Title	Credits
USBO403	<u>CURRENT TRENDS IN PLANT SCIENCES I</u>	2 Credits (45 lectures)
<u>Unit I : Horticulture and Gardening</u> <ul style="list-style-type: none"> • Introduction to Horticulture: Branches of Horticulture • Gardening: <ul style="list-style-type: none"> ○ Locations in the garden- edges, hedges, lawn, flower beds, avenue, water garden (with names of two plants for each category). Focal point. • Types of gardens <ul style="list-style-type: none"> ○ Formal and informal gardens, ○ National Park: Sanjay Gandhi National Park. ○ Botanical Garden: Veer Mata Jijabai Udyan (Victoria Garden). 		15 Lectures
<u>Unit II : Biotechnology</u> <ul style="list-style-type: none"> • Introduction to plant tissue culture <ul style="list-style-type: none"> ○ Laboratory organization and techniques in plant tissue culture ○ Totipotency ○ Organogenesis ○ Organ culture – root cultures, meristem cultures, anther and pollen culture, embryo culture. • R-DNA technology- <ul style="list-style-type: none"> ○ Gene cloning ○ Enzymes involved in Gene cloning ○ Vectors used for Gene cloning. 		15 Lectures
<u>Unit III : Biostatistics and Bioinformatics</u> <ul style="list-style-type: none"> • Biostatistics: <ul style="list-style-type: none"> ○ The chi square test. ○ Correlation – Calculation of coefficient of correlation. • Bioinformatics <ul style="list-style-type: none"> ○ Information technology: History and tools of IT, Internet and its uses. ○ Introduction to Bioinformatics- goal, need, scope and limitation ○ Aims of Bioinformatics: Data organization, Tools of Bioinformatics- tools for web search, Data retrieval tools- Entrez, ○ BLAST ○ Bioinformatics programme in India. 		15 Lectures

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER IV PRACTICAL

Semester IV USBOTP4 PRACTICAL Paper I – Plant Diversity	Cr 1
Fungi and Plant Pathology	
1 Study of stages in the life cycle of <i>Erysiphe</i> from fresh/ preserved material and permanent slides.	
2 Study of stages in the life cycle of <i>Xylaria</i> from fresh/ preserved material and permanent slides.	
3 Study of fungal diseases as prescribed for theory.	
4 Study of Lichens (crustose, foliose, & fruiticose).	
Pteridophyta and Palaeobotany	
5-6 Study of stages in the life cycle of <i>Selaginella</i> from fresh/ preserved material and permanent slides.	
7 Study of form genera <i>Rhynia</i> with the help of permanent slides/ photomicrographs.	
Gymnosperms	
8- Study of stages in the life cycle of <i>Pinus</i> from fresh/ preserved material and permanent slides.	
10 Study of the form genus <i>Cordaites</i> with the help of permanent slide/ photomicrographs.	

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER IV USBOT P4 PRACTICALS Paper II – FORM AND FUNCTION- II		Cr 1
Anatomy		
1 Study of normal secondary growth in the stem and root of a Dicotyledonous plant		
2 Study of secondary growth in monocot stem (<i>Dracena</i>).		
3 Types of mechanical tissues, mechanical tissue system in aerial, underground organs.		
4 Study of conducting tissues- Xylem and phloem elements in Gymnosperms and Angiosperms as seen in LS and through maceration technique.		
5 Study of different types of vascular bundles.		
Plant Physiology and Plant Biochemistry		
6 Q ₁₀ – germinating seeds using Phenol redindicator		
7 NR activity – <i>in-vivo</i>		
8 Estimation of proteins by Lowry's method (Prepare standard graph).		
Ecology and Environmental Botany		
9 Study of the working of the following Ecological Instruments- Soil thermometer, Soil testing kit, Soil pH, Wind anemometer.		
10 Mechanical analysis of soil by the sieve method & pH of soil.		
11 Quantitative estimation of organic matter of the soil by Walkley and Blacks Rapid titration method.		
12 Study of vegetation by the list quadrat method		

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER IV USBOP4		Cr
PRACTICALS - Paper III – CURRENT TRENTS IN PLANT SCIENCES		1
Horticulture		
1	Study of five examples of plants for each of the garden locations as prescribed for theory	
2	Preparation of garden plans – formal and informal gardens	
3	Bottle and dish garden preparation.	
Biotechnology		
4	Various sterilization techniques	
5	Preparation of Stock solutions, Preparation of MS medium.	
6	Seed sterilization, callus induction	
7	Regeneration of plantlet from callus	
8	Identification of the cloning vectors – pBR322, pUC 18, Ti plasmid.	
Biostatistics and Bioinformatics		
9	Chi square test	
10	Calculation of coefficient of correlation	
11	Web Search – Google, Entrez.	
12	BLAST	



Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER - III, , S.Y.B.Sc. BOTANY PRACTICAL SKELETON PAPER (PROPOSED)

TIME - 2 hours 15 min

PAPER – I

Total Marks – 50

- Q.1. Identify, Classify and describe specimen 'A' . Sketch neat and labeled diagram. (10)
Q.2. Identify, Classify and describe specimen 'B' . Sketch neat and labeled diagram. (10)
Q.3. Assign the specimen 'C' to its family giving reasons. Give the distinguishing characters, floral Diagram and floral formula. Sketch the L.S. of flower and T.S. of ovary. (10)
Q.4. Identify and describe the specimen/ slide/ photograph - 'D', 'E', 'F', 'G' and 'H'. (15)
Q.5. Journal. (05)

KEY :

- A. – *Dictyota / Sargassum*
B. – *Anthoceros / Funaria*
C. Any Angiospermic Family as per syllabus.
D. Algae – economic importance / range of thallus in Phaeophyta
E. *Anthoceros / Funaria*
F. Calyx / Corolla (any one type)
G. Androecium / Gynoecium (any one type)
H. Economic importance or morphological peculiarity of any one family.
-

SEMESTER - III, , S.Y.B.Sc. BOTANY PRACTICAL SKELETON PAPER (PROPOSED)

TIME - 2 hours 15 min

PAPER – II

Total Marks – 50

- Q.1. To Separate given material 'A' by any appropriate chromatography technique . (10)
Q.2. To estimate DNA/ RNA from the given sample 'B'. (10)
Q.3. Make an Idiogram from the given Karyotype 'C'. Identify and enlist the symptoms of the chromosomal aberration. (10)
Q.4. Identify and describe the specimen/ photograph - 'D' (05), 'E' (05) and 'F' (05 or 03 + 02). (15)
Q.5. Field Report. (05)

KEY :

- A. – Carotenoids/amino acids
B. Cauliflower
C. Cri-du-chat; Philadelphia; D-G translocation, Down Syndrome
D. Electrophoresis
E. Dry or wet preservation
F. Cell organelles / Plastid inheritance.

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER - III, , S.Y.B.Sc. BOTANY PRACTICAL SKELETON PAPER (PROPOSED)

TIME - 2 hours 15 min

PAPER – III

Total Marks – 50

- Q.1. a). Identify the active constituents present in specimen 'A' by performing suitable chemical tests. (08)
- Q.1. b). Calculate the stomatal index / palisade ratio / vein – islet numbers from the given specimen 'B'. (07)
- Q.2. Describe the ecological factors, enlist the dominant flora and mark the area on the map of a forest type 'C' . (10)
- Q.3. Determine the sequence of bases in a DNA strand by Sanger's method from the given data 'D' or Determine the sequence of amino acids in the polypeptide synthesized from the given m-RNA strand 'D' (08)
- Q.4. Identify and describe the specimen/ slide/ photograph - 'E', 'F' , and 'G'. (12)
- Q.5. Viva - Voce. (05)

KEY :

- A. Alkaloids / Glycosides.
B. Betel leaf / *Vinca* leaf.
E. Importance of _____ in herbal cosmetics.
F. Fibres / Paper.
G. Spices / Condiments.

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER - IV, , S.Y.B.Sc. BOTANY PRACTICAL SKELETON PAPER (PROPOSED)

TIME - 2hours 15 min

PAPER – I

Total Marks – 50

- Q.1. Identify, Classify and describe specimen 'A' . Sketch neat and labeled diagram. (10)
Q.2. Identify, Classify and describe specimen 'B' . Sketch neat and labeled diagram. (10)
Q.3. Identify, Classify and describe specimen 'C' .Sketch neat and labeled diagram. (10)
Q.4. Identify and describe the specimen/ slide/ photograph - 'D', 'E' and 'F' . (15)
Q.5. Journal. (05)

KEY :

A. – *Xylaria* / *Erysiphe*

B. – *Selaginella* – Stem / *strobilus*

C. *Pinus* – needle / stem / male cone.

D. Fungal disease – Powdery mildew / any other disease as per syllabus.

E. Lichen.

F. *Rhynia* / *Cordaitea*.

SEMESTER - IV, ,S.Y.B.Sc. BOTANY PRACTICAL SKELETON PAPER (PROPOSED)

TIME - 2hours 15 min

PAPER – II

Total Marks – 50

- Q.1. a). Make a temporary stained preparation of T.S. of specimen 'A' and comment on the secondary growth . (10)
Q.1. b). Make a temporary stained preparation of T.S. of specimen 'B' and comment on the mechanical tissue system .

OR

Macerate the given material 'B' and describe the conducting tissue seen. (05)

- Q.2. Perform the Physiological experiment 'C' allotted to you . (12)
Q.3. Perform the Ecological experiment 'D' allotted to you . (12)
Q.4. Identify and describe the specimen/ slide/ photograph - 'E', and 'F' . (06)
Q.5. Viva - Voce. (05)

KEY :

A. – Dicot stem/ dicot root / monocot stem.

B. – Mechanical Tissue (*Coleus* stem, *Typha* leaf, *Maize* stem and *Maize* root / *Annona* / *Magnolia* formaceration).

E. – Vascular bundles / phloem/xXylem.

F. – Ecological Instrument.

Syllabus for the S.Y.B.Sc. Program: B.Sc.Course : BOTANY

SEMESTER - IV, , S.Y.B.Sc. BOTANY PRACTICAL SKELETON PAPER (PROPOSED)

TIME - 2hours 15 min

PAPER – III

Total Marks – 50

- Q.1. Prepare a garden plan 'A' . Mention any three garden locations with suitable plants (Botanical names). (10)
- Q.2. Prepare MS medium OR Perform seed sterilization technique 'B' . (08)
- Q.3. a). Perform Chi- square test OR Coefficient of Correlation using the given data 'C' and analyse the results . (12)
- Q.3.b). Perform the experiment 'D' related to Web search. (06)
- Q.4.a). Identify and describe the specimen/ photograph -'E' (05)
- Q.4.b).** Identify and describe the specimen/ photograph - 'F', 'G' and 'H' . (09)

KEY :

- E. Bottle or dish garden.
- F. Sterilization Technique.
- G. Cloning Vectors.
- H. Bioinformatics.

University of Mumbai



No. UG/ 36 of 2019-20

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the recognized Institutions in Science & Technology Faculty is invited to this office Circular No. UG/95 of 2015-16, dated 5th October, 2015 relating to the revised syllabus as per (CBSGS) for the T.Y.B..Sc. Botany (Sem. V & VI).

They are hereby informed that the recommendations made by the Board of Studies in Botany at its meeting held on 18th March, 2019 have been accepted by the Academic Council at its meeting held on 10th May, 2019 vide item No. 4.26 and that in accordance therewith, the revised syllabus as per the (CBCS) for the T. Y .B.Sc. Botany in (Sem. V & VI) has been brought into force with effect from the academic year 2019-20, accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI - 400 032

03rd July, 2019

To

(Dr. Ajay Deshmukh)
REGISTRAR

The Principals of the affiliated Colleges and Directors of the recognized Institutions in Science & Technology Faculty. (Circular No. UG/334 of 2017-18 dated 9th January, 2018.)

A.C./4.26/10/05/2019

No. UG/ 36 -A of 2019

MUMBAI-400 032

3rd July, 2019

Copy forwarded with Compliments for information to:-

- 1) The I/c Dean, Faculty of Science & Technology,
- 2) The Chairman, Board of Studies in Botany,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Professor-cum-Director, Institute of Distance and Open Learning (IDOL),
- 5) The Director, Board of Students Development,
- 6) The Co-ordinator, University Computerization Centre,s

(Dr. Ajay Deshmukh)
REGISTRAR

University of Mumbai



UNIVERSITY OF MUMBAI

**Syllabus for the T.Y.B.Sc.
Program: B.Sc. Course: BOTANY**

(Credit Based Semester and Grading System with effect from
the academic year 2019–2020)

T.Y.B.Sc. Botany Syllabus
Restructured for Credit Based and Grading System
To be implemented from the Academic year 2019-2020

SEMESTER V

Course Code	UNIT	TOPICS	Credit	L / Weeks
USB0501	PLANT DIVERSITY III			
	I	Microbiology	2.5	1
	II	Algae		1
	III	Fungi		1
	IV	Plant Pathology		1
USB0502	PLANT DIVERSITY IV			
	I	Paleobotany	2.5	1
	II	Angiosperms I		1
	III	Anatomy I		1
	IV	Palynology		1
USB0503	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
USB0504	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
USBOP5	Practicals based on Two Courses in Theory (501 & 502) – For 6 Units		3	8
USBOP6	Practicals based on Two Courses in Theory (503 & 504) – For 6 Units		3	8
USBOP7	Practicals based on Two Courses in Theory (502 & 503) – For 3 Units		3	8
			16	32 + 8 (3 Units)

SEMESTER VI

Course Code	UNIT	TOPICS	Credit	L / Weeks
USBO601	PLANT DIVERSITY III			
	I	Bryophyta	2.5	1
	II	Pteridophyta		1
	III	Bryophyta and Pteridophyta: Applied Aspects		1
	IV	Gymnosperms		1
USBO602	PLANT DIVERSITY IV			
	I	Angiosperms II	2.5	1
	II	Anatomy II		1
	III	Embryology		1
	IV	Plant Geography		1
USBO603	FORM AND FUNCTION III			
	I	Plant Biochemistry	2.5	1
	II	Plant Physiology II		1
	III	Genetics		1
	IV	Biostatistics		1
USBO604	CURRENT TRENDS IN PLANT SCIENCES II			
	I	Plant Biotechnology II	2.5	1
	II	Bioinformatics		1
	III	Economic Botany		1
	IV	Post Harvest Technology		1
USBOP8	Practicals based on Two Courses in theory (601 & 602) – For 6 Units		3	8
USBOP9	Practicals based on Two Courses in theory (603 & 604) – For 6 Units		3	8
USBOP10	Practicals based on Two Courses in theory (602 & 603) – For 3 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
USBO501	PLANT DIVERSITY – III	2.5 Credits (60 Lectures)
Course outcomes: The students would be able : <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. 		
Unit I: Microbiology <ul style="list-style-type: none"> • Types of Microbes: Viruses, Bacteria, Algae, Fungi, Protozoa, Mycoplasma and Actinomycetes. • Culturing: Sterilization, media, staining, colony characters. • Pure cultures 		(15 lectures)
Unit –II: Algae (G.M. Smith Classification System to be followed) <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>Polysiphonia</i>, <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>. 		(15 lectures)
Unit III: Fungi (G.M. Smith Classification System to be followed) <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> 		(15 lectures)

Unit IV: Plant Pathology

- **Study of plant diseases:** Causative organism, symptoms, predisposing factors, disease cycle and control measures of the following.
 - White Rust –*Albugo candida*
 - Tikka disease of ground nut: *Cercospora*
 - Damping off disease: *Pythium*
 - Citrus canker –*Xanthomonas axonopodis* pv. citri
 - Leaf curl – leaf curl virus in *Papaya*.
- Study of Physical, chemical and biological control methods of plant diseases.

(15 lectures)

Course Code	Title	Credits
USBO502	PLANT DIVERSITY – IV	2.5 Credits (60 lectures)
Course outcomes: The students would be able : <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. 		
Unit I: Paleobotany <ul style="list-style-type: none"> <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)
Unit II: Angiosperms I <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 		(15 lectures)
Unit III: Anatomy I <ul style="list-style-type: none"> Anomalous secondary growth in the Stems of <i>Bignonia</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 Gramineous 		(15 lectures)

Unit IV: Palynology <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)
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Course Code	Title	Credits
USBO503	FORM AND FUNCTIONS- II	2.5 Credits (60 Lectures)
Course outcomes: The students would be able : <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. 		
Unit I: Cytology and Molecular Biology <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. 		(15 lectures)
Unit II: Plant Physiology I <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. 		(15 lectures)
Unit III: Environmental Botany <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 Sere leading up to the Climax, Succession in Water, Ecesis, Poly and Mono-climax theories. 		(15 lectures)
Unit IV: Plant Tissue Culture <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: i) Concept, Definition, and various methods of Protoplast Fusion ii) Applications of Somatic Hybridization in Agriculture 		(15 lectures)

Course Code	Title	Credits
USBO504	CURRENT TRENDS IN PLANT SCIENCES – II	2.5 Credits (60 Lectures)
Course outcomes: The students would be able : <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. 		
Unit I: Ethnobotany and Mushroom Industry <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 cuminii</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. 		(15 lectures)
Unit II: Plant Biotechnology I <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) 		(15 lectures)
Unit III: Instrumentation <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. 		(15 lectures)

<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> 	<p>(15 lectures)</p>
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SEMESTER V PRACTICAL

Minimum marks for passing: 20

Semester V USBOP5 – For 6 Units	Cr
PRACTICAL PAPER I–PLANT DIVERSITY III – USBOP 501 (For 6 Units)	1.5
Microbiology <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. 	
Algae (G.M. Smith Classification System to be followed) <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>Polysiphonia</i> ➤ <i>Batrachospermum</i> ➤ <i>Vaucheria</i> ➤ <i>Pinnularia</i> 	
Fungi (G.M. Smith Classification System to be followed) <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> 	
Plant Pathology <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 USBOP7 – For 3 Units	
PRACTICAL PAPER II–PLANT DIVERSITY IV USBOP 502 (For 3 & 6 Units)	Cr
Paleobotany <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> 	1.5
Angiosperms I <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 	

<ul style="list-style-type: none"> ➤ Rubiaceae ➤ Solanaceae ➤ Commelinaceae ➤ Graminae • 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</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"> 1) <i>Bignonia</i> 2) <i>Salvadora</i> 3) <i>Achyranthes</i> 4) <i>Dracaena</i> • Study of anomalous secondary growth in the roots of <ul style="list-style-type: none"> 1) Beet 2) Radish • Types of Stomata <ul style="list-style-type: none"> 1) Anomocytic 2) Anisocytic 3) Diacytic 4) Paracytic 5) 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>Pancratium</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	Cr
PRACTICAL –PAPER III FORM AND FUNCTION II USBOP 503 (For 3 & 6 Units)	1.5
Cytology and Molecular Biology <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) 	
Plant Physiology I <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>	
Environmental Botany <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 	
Micropropagation <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 USBOP6 – For 6 Units	
PRACTICAL – PAPER IV CURRENT TRENDS IN PLANT SCIENCES II USBOP 504 (For 6 Units)	Cr
Ethnobotany and mushroom industry <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> 	1.5
Biotechnology I <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 	
Instrumentation <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. 	

Pharmacognosy <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
USBO601	PLANT DIVERSITY – III	2.5 Credits (60 Lectures)
Course outcomes: The students would be able : <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. 		
Unit I: Bryophyta (G. M. Smith Classification system to be followed) <ul style="list-style-type: none"> Life cycle of <i>Marchantia</i> Life cycle of <i>Pelia</i> Life cycle of <i>Sphagnum</i> 		(15 lectures)
Unit II: Pteridophyta (G. M. Smith Classification System to be followed) <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>Adiantum</i> and <i>Marselia</i> 		(15 lectures)
Unit III: Bryophytes and Pteridophytes: Applied aspects <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 Diversity and distribution of Indian Pteridophytes Types of Sori and Evolution of Sori in Pteridophytes. 		(15 lectures)
Unit IV: Gymnosperms (Chamberlain's Classification System to be followed) <ul style="list-style-type: none"> Life cycle of <i>Thuja</i>, Life cycle of <i>Gnetum</i> Life cycle of <i>Ephedra</i>. Economic importance of Gymnosperms 		(15 lectures)

Course Code	Title	Credits
USBO602	PLANT DIVERSITY – IV	2.5 Credits (60 Lectures)
Course outcomes: The students would be able to : <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. 		
Unit I: Angiosperms II <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 		(15 lectures)
Unit II: Anatomy II <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 		(15 lectures)
Unit III: Embryology <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>Unit IV: Plant Geography (Shifted from Paper – IV)</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 ➤ Importance and status of biodiversity ➤ Loss of biodiversity ➤ Conservation of biodiversity ➤ Genetic diversity- Molecular characteristics 	<p>(15 lectures)</p>
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Course Code	Title	Credits
USBO603	FORMS AND FUNCTION – III	2.5 Credits 60 Lectures)
Course outcomes: The students would be able : <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. 		
Unit I: Plant Biochemistry <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. 		(15 lectures)
Unit II: Plant Physiology II <ul style="list-style-type: none"> Nitrogen Metabolism: Nitrogen cycle, 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. Physiological effects and commercial applications of Auxins, Gibberillins, Cytokinins and Absciscic acid 		(15 lectures)
Unit III: Genetics <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 Metabolic disorders– enzymatic and non-enzymatic: Gene control of enzyme structure Garrod's hypothesis of inborn errors of metabolism, Phenyl ketone urea. 		(15 lectures)
Unit IV: Biostatistics (Shifted from Paper – II) <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
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 preservation of post harvest produce and explore the possibility of entrepreneurship in the field. 		
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. 		(15 lectures)
Unit IV: Bioinformatics (Shifted from Paper – III) <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)
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>, 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)
Unit IV : Post Harvest Technology <ul style="list-style-type: none"> • Storage of Plant Produce –Preservation of Fruits and Vegetables <ul style="list-style-type: none"> ➤ 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, Dehydro-Freezing, Freeze Drying), ➤ 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**

Minimum marks for passing: 20

SEMESTER VI USBOP8 – FOR 6 UNITS	Cr
PRACTICAL PAPER I–PLANT DIVERSITY III – USBOP 601(For 6 Units)	1.5
Bryophyta (G.M. Smith Classification System to be followed) <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> 	
Pteridophyta (G.M. Smith Classification System to be followed) <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>Adiantum</i> ➤ <i>Marselia</i> 	
Bryophytes and Pteridophytes: Applied aspects <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 	
Gymnosperms (Chamberlain’s Classification System to be followed) <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>Thuja</i> ➤ <i>Gnetum</i> ➤ <i>Ephedra</i> Economic importance of Gymnosperms 	
USBOP10 – FOR 3 UNITS	
PRACTICAL PAPER II–PLANT DIVERSITY IV USBOP602 (For 3 & 6 Units)	1.5
Angiosperms II <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 Identify the genus and species with the help of flora 	

Anatomy II <ul style="list-style-type: none"> Study of Ecological Anatomy of <ul style="list-style-type: none"> Hydrophytes: <i>Hydrilla</i> stem, <i>Nymphaea</i> petiole, <i>Eichhornia</i> offset Epiphytes: Orchid Sciophytes: <i>Peperomia</i> leaf Xerophytes: <i>Nerium</i> leaf, <i>Opuntia phylloclade</i> 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, Megasporogenesis 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> /<i>Vinca</i> 	
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 	
Total Credit	3
SEMESTER VI USBOP9 – FOR 6 UNITS	Cr
SEMESTER VI USBOP10 – FOR 3 UNITS	
PRACTICAL PAPER III–FORM AND FUNCTION III USBOP603 (For 3 & 6 Units)	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) 	
PRACTICAL PAPER IV CURRENT TRENDS IN PLANT SCIENCES USBOP 604 (For 6 Units)	
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 <i>Patchouli</i> and <i>Citronella</i> • Saponification value of Palm oil 	
Post-Harvest Technology <ul style="list-style-type: none"> • Preparation of <ul style="list-style-type: none"> ➤ Squash ➤ Jam ➤ Jelly ➤ Pickle 	
Total Credit	3

Scheme of Examinations:

Theory Course: Semester End Assessment	100 Marks Each Theory Paper
Practical Course	50 Marks Each Practical Paper

❖ Students offering Double major (3 Units) will study Paper II and III

Semester End Theory Examination Question Paper Pattern:

Q.1 – Four (4) Long Answer Questions on Unit – I out of which Two (2) to be solved.	10 Marks Each
Q.2 – Four (4) Long Answer Questions on Unit – II out of which Two (2) to be solved.	10 Marks Each
Q.3 – Four (4) Long Answer Questions on Unit – III out of which Two (2) to be solved.	10 Marks Each
Q.4 – Four (4) Long Answer Questions on Unit – IV out of which Two (2) to be solved.	10 Marks Each
Q.5 – Six (6) Short Answer Questions on all four (4) Units out of which Four (4) to be solved.	05 Marks Each

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. 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 Report or a certificate from the Head of the Department/Institute 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.

UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY SEMESTER V (USBOP5)
Plant Diversity III (USBOP501)
Practical Paper – I

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.

UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY SEMESTER V (USBOP5)
Plant Diversity IV (USBOP502)
Practical Paper – II

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

UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY SEMESTER V (USBOP6)
FORMS AND FUNCTION III (USBOP503)
Practical Paper – III

Duration: 9:00 am to 01:00 pm

Max. Marks:50

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|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 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 <i>Chironomous</i> larva. | 08 |
| Q. 2 | Perform the experiment 'B' allotted to you (Physiology). | 12 |
| Q. 3 | Perform the experiment 'C' allotted to you (Ecology). | 12 |
| Q. 4. | Calculate the_____of the given solution 'D' to prepare the required solution. | 07 |
| Q. 5. | Identify and describe slide/specimen 'E' & 'F'. | 06 |
| 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.

UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY SEMESTER V (USBOP6)
CURRENT TRENDS IN PLANT SCIENCE II (USBOP504)
Practical Paper – IV

Duration: 9:00 am to 01:00 pm

Max. Marks:50

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- | | | |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 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

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

UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY SEMESTER V (USBOP7)
Plant Diversity IV (USBOP502) (For 3 Units)
Practical Paper – II

Duration: 9:00 am to 01:00 pm

Max. Marks:50

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- | | | |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------|----|
| Q. 1A. | Classify specimen 'A' up to their families giving reasons. Give floral formula. Sketch neat and labelled L.S. of flower and T.S. of 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 | Journal. | 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

UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY SEMESTER V (USBOP7)
FORMS AND FUNCTION III (USBOP503) (For 3 Units)
Practical Paper – III

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 <i>Chironomous</i> larva. | 08 |
| Q. 2 | Perform the experiment 'B' allotted to you (Physiology). | 12 |
| Q. 3 | Perform the experiment 'C' allotted to you (Ecology). | 12 |
| Q. 4 | Calculate the_____of the given solution 'D' to prepare the required solution. | 07 |
| Q. 5 | Identify and describe slide/specimen 'E' & 'F'. | 06 |
| Q.6. | Viva voce (based on Paper II and Paper III). | 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.

UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY SEMESTER VI
(USBOP8)

Plant Diversity III (USBOP601)

Practical Paper – I

Duration: 9:00 am to 01:00 pm

Max. Marks:50

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- | | | |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1 | Identify, classify and describe specimen 'A' and 'B'. Sketch neat and labelled diagrams of Morphological/Microscopical structures seen in the specimens. | 12 |
| 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)

UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY SEMESTER VI
(USBOP8)
Plant Diversity IV (USBOP602)
Practical Paper – II

Duration: 9:00 am to 01:00 pm

Max. Marks:50

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- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------|----|
| 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.3.A Calculate Simpson's Diversity Index from the given data 'D'. | 08 |
| Q.3.B 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 |

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)

UNIVERSITY OF MUMBAI
T.Y.B.Sc. BOTANY SEMESTER VI (USBOP9)
FORM AND FUNCTION III (USBOP603)
PRACTICAL III

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.

UNIVERSITY OF MUMBAI
T.Y.B.Sc. BOTANY SEMESTER VI (USBOP9)
CURRENT TRENDS IN PLANT SCIENCE II (USBOP604)
PRACTICAL IV

Duration: 9:00 am to 01:00 pm

Max. Marks:50

- | | | |
|-----|------------------------------------------------------------------------|----|
| Q.1 | Perform the DNA barcoding of plant material using given data 'A'. | 12 |
| OR | | |
| | Perform DNA sequencing by Sanger's method of the given sequence 'A'. | 12 |
| Q.3 | Perform the experiment 'B' allotted to you. | 12 |
| Q.4 | Perform the given analysis of data 'C' using computer(Bioinformatics). | 08 |
| Q.5 | Prepare the squash/Jam/jelly/pickle from the given material 'D'. | 12 |
| Q.6 | Viva voce. (Based on Paper III and Paper IV) | 06 |

KEY

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

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

UNIVERSITY OF MUMBAI
T.Y.B.SC. BOTANY SEMESTER V (USBOP10)
Plant Diversity IV (USBOP602) (For 3 Units)
Practical Paper – II

Duration: 9:00 am to 01:00 pm

Max. Marks:50

-
- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------|----|
| Q. 1A. 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.3.A Calculate Simpson's Diversity Index from the given data 'D'. | 08 |
| Q.3.B 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 Journal | 05 |

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)

UNIVERSITY OF MUMBAI
T.Y.B.Sc. BOTANY SEMESTER VI(USBOP10)
FORM AND FUNCTION III (USBOP603) (For 3 units)
PRACTICAL III

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'.	06
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	09
Q.6	Viva-voce. (based on Paper II and Paper III)	05

KEY

A– Plant Biochemistry Experiment.

B– Plant Physiology Experiment.

Reference Books

1. A handbook of Ethnobotany by S.K. Jain, V. Mudgal
2. Plants in folk religion and mythology (Contribution to Ethnobotany by S.K.Jain^{3rd}Rev.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.

AC 27/2/13
Item No. 4.12

UNIVERSITY OF MUMBAI



Syllabus for sem V & VI
Program: B.Sc.
Course: Horticulture
Applied Component

(Credit Based Semester and Grading System with
effect from the academic year 2013–2014)

T.Y.B.Sc. Applied Component Horticulture Syllabus
Credit Based and Grading System
To be implemented from the Academic year 2013-2014

SEMESTER V

Course Code	UNIT	TOPICS	Credits	L / Week
USACHO501	<u>HORTICULTURE & GARDENING -I</u>		2	4
	I	INTRODUCTION TO HORTICULTURE	2	1
	II	PROPAGATION PRACTICES		1
	III	MANURES, FERTILIZERS AND DISEASES		1
	IV	GARDEN OPERATIONS FOR HORTICULTURE		1
USACHO5P1	Practicals based on all courses in theory		2	4

SEMESTER VI

Course Code	UNIT	TOPICS	Credits	L / Week
USACHO601	<u>HORTICULTURE & GARDENING - II</u>		2	4
	I	LANDSCAPE GARDENING	2	1
	II	HORTICULTURE PRODUCE		1
	III	COMMERCIAL PRODUCTION		1
	IV	POST HARVEST TECHNOLOGY & ENTREPRENEURSHIP IN HORTICULTURE		1
USBO6P1	Practicals based on all the courses in theory		2	4

SEMESTER V
THEORY

Course Code	Title	Credits
USACHO501	<u>HORTICULTURE AND GARDENING –I</u>	2 Credits (60 lectures)
<u>Unit 1 INTRODUCTION TO HORTICULTURE</u> <ul style="list-style-type: none">• Definition, importance and objectives of Horticulture, branches of Horticulture, Pomology, Olericulture, Landscape Gardening, Nurseries and development• .Allied branches – Apiculture – Bee box, honey bee life cycle and role of apiculture in pollination, Sericulture – Silkworm life cycle, different types with host plant, Social Forestry, Exhibition: aims and objectives.• Important Horticulture Research Institutes and Government Schemes for strategy plantations<ul style="list-style-type: none">○ Konkan Krishi Vidyapeeth – Dapoli○ National Research Centre for grapes.○ Regional Fruit Research centre Pune○ Horticulture Training Centre (H.T.C.) – Talegaon.○ Central Potato Tuber Research Institute (CPTRI) – Shimla• Horticulture Consultancy• Strategy plantation – Lakhibaug Yojana		15 L
<u>Unit 2 PROPAGATION PRACTICES</u> <ul style="list-style-type: none">• By Seeds Advantages and disadvantages, method of seed propagation Production of seeds, Handling, Collection and Storage Sowing, Transplanting of seedlings and Hardening Seed treatment to control diseases Seedling diseases and their control.• By specialized Vegetative structures Bulbs, Tubers, Corms, Rhizomes, Root stock, runners, Offsets and suckers.• Artificial methods of plant propagation<ul style="list-style-type: none">○ Cutting– Root cutting, Stem cuttings, and leaf cuttings. Use of PGR’s for rooting.○ Layering – Definition, Types: Simple, compound, (Serpentine) Tip, Trench, Mound, Air Layering.○ Grafting-Definition, advantages and disadvantages. Types: Splice, Whip/ Tongue, side, veneer, cleft, bark, epicotyls, approach, repair grafting – enarching, bridge and bracing.○ Budding – Definition, advantages and disadvantages. Types: T-budding, shield, patch , ring budding.○ Developing new varieties: Technique of Emasculation and bagging, role of polyploidy n production of seedless varieties in		15 L

plants.	
<ul style="list-style-type: none"> • Application of Tissue Culture in relation to Horticulture. 	
<u>UNIT-3 MAURES, FERTILIZERS AND DISEASES</u> <ul style="list-style-type: none"> • Manures: Definition, importance, important manures FYM(compost), oil cakes, green manure, organic manures and vermicompost. • Fertilizers: Definition, Types – Straight, Compound and mixed. Nitrogenous (NH₄)₂ SO₄, Urea, Ca (NO₃)₂, NH₄Cl, Phosphatic (Superphosphate, Bone meal), Potassic (Muriate of potash, K₂SO₄ • Biofertilizers: Bacteria, Cyanobacteria, Mycorrhiza, Sea weeds. • Diseases: Horticultural plant diseases and their control. Fungal diseases- Rust, Smut, Powdery mildew. Bacterial – Citrus canker, Bacterial wilt. Viral – TMV, Leaf curl. • Pests – common pests on horticultural crops – Aphids, beetle, stem borer, caterpillars and rats. • Friends of farmers: Eartworm, snakes and predaceous fungi. 	15 L
<u>UNIT 4 GARDEN OPERATIONS FOR HORTICULTURE</u> <ul style="list-style-type: none"> • Selection of site, Preparation of soils for garden • Mulching, top- dressing, blanching • Sowing, transplanting, tree transplanting, • Irrigation, - Overhead, Surface, Underground • Weeding and pruning, - Principles, Objectives and general technique. • Water management and conservation through horticulture, Dry land Horticulture. • Organic Farming Definition, Scope, Indian scenario, Future scope 	15 L

Practicals

Semester V USACHO5P1		Cr
PRACTICAL		2
	Garden implements and their uses .	
	Different types of pots & Potting medium , Potting and repotting	
	Propagation practices by seed, Vegetative propagation , cutting ,layering , budding, grafting .	
	Identification of :	

<p>Fertilizers – Identification by physical and chemical methods –Urea , Ammonium sulphate , Potassium sulphate, super phosphate .</p> <p>Manures – Identification of plants as green manure – <i>Glyricidia</i> , <i>Crotolaria</i>, <i>Leucaena</i> .</p> <p>Biofertilizers – Identification (material as slides) VAM, <i>Nostoc</i> ,<i>Rhizobium</i> .</p>	
Soil pH, Use of soil testing Kit, electrical conductivity, pH of water, liquid fertilizers .	
Method of preparing bonsai, Bottle Garden / Terrarium, Hanging baskets ,Dish garden .	
<p>Diseases and pests</p> <p>Fungal – Powdery mildew ,Rust ,Wilt, Blight, Smut,</p> <p>Bacterial – Canker ,Wilt</p> <p>Viral – Leaf curl ,yellow vein Mosaic</p> <p>Insects – Sucking, Biting, Chewing, Borers & Ants .</p> <p>Non Insects pests- Nematodes, Rodents.</p>	
Preparation of natural insecticides – Neem arka , Dashparni arka, Seetaphal powder, Tobacco extracts .	
Project – Each student should individually present a project related to any topic related to Horticulture .It should be duly certified presented at practical examination.Project presentation college at level compulsory.	

SEMESTER VI
THEORY

Course Code	Title	Credits
USACHO601	<u>HORTICULTURE AND GARDENING –II</u>	2 Credits (60 lectures)
<u>Unit 1 LANDSCAPE GARDENING</u> <ul style="list-style-type: none"> Principles of landscaping & garden design. Indoor plants & Indoor gardens- Hydroponics, Terrarium/ Bottle garden, 		15 L

<p>Dish garden.</p> <ul style="list-style-type: none"> • Important garden features- Paths & Avenues, Hedges & Edges, Lawn, Flowerbeds, Arches& Pergolas, Fencing, Water bodies, Rock garden & Plants suitable for different locations & climates. • Lawn- Purpose of preparation of lawn, Method of preparation of lawn & management of lawn & lawn plants. • Soil manipulation for plantation of desirable varieties. • Mughal, Buddist, Botanical garden, Vertical wall garden & Theme park • Important Gardens of India—Shalimar (Shrinagar), Vrindavan(Mysore), Veer Jijamata Udyan(Mumbai) 	
<p><u>Unit 2 - HORTICULTURE PRODUCE</u></p> <ul style="list-style-type: none"> • High –tech Horticultural production- Green house technology- Meaning, types, layout & construction, irrigation systems. Care & attention. Hardening of plants. Space gardens. • Floriculture – Scope & importance, soil and climatic requirement and cultivation practices and Economics of green house production of Gerbera, Carnation, Roses, Orchids. Propagation techniques, packing and marketing, enhancing and delaying period of bloom by special methods. Floral decoration, Florist shop management. 	15 L
<p><u>UNIT-3 COMMERCIAL PRODUCTION</u></p> <ul style="list-style-type: none"> • Commercial production of the following – in relation to propagation, post plantation care, harvesting, post harvest management & varieties. <ul style="list-style-type: none"> ○ Tubers- potato ○ Vegetables- Tomato ○ Fruits- Mango, Grapes & Coconut- products like coco peat/ Coir etc. ○ Spices/condiments- chilly ○ Medicinal plants- <i>Aloe vera</i>, <i>Stevia rebaurdina</i>(Madura) ○ Aromatic plant- <i>Citronella</i>, Patchouli 	15 L
<p><u>UNIT 4 POST HARVEST TECHNOLOGY & ENTREPRENEURSHIP IN HORTICULTURE</u></p> <ul style="list-style-type: none"> • Maturity- Factors responsible for maturity & ripening methods used for delaying ripening. • Harvest- Time of harvest, harvesting and handling of harvested products • Storage of fresh produce- Types of storage of fruits & vegetables 	15 L

<ul style="list-style-type: none"> • Fruit & vegetables preservation technology. • Marketing- grading, packing & transportation. Ways of increasing the market value and shelf life of horticultural produce. • Horticultural business, management and Entrepreneurship development Horticulture as a business definition and nature, organization, planning and operation of Horticulture farm business. 	
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Practicals

Semester VI USACHO6P1		Cr
PRACTICAL		2
	Preparation of garden layout	
	List of plants suitable for garden locations- 2-3 plants for each location .	
	Identification of important horticultural plants <ol style="list-style-type: none"> 1. Herbs – foliage any 2 and flowering any 2 2. Shrubs – foliage any 2 flowering any 2 3. Trees – foliage any 2 and flowering any 2 4. Climbers – any 2 5. Lianas – any 2 6. Epiphytes – any 2 7. Creepers –any 2 8. Trailers – any 2 9. Aquatic plants – any 3 (preferably various habitat) 10. Succulents – any 2 11. Weeds –any 10 	
	Flower arrangements –Indian (Gajara , veni, garland , bouquet - Baskets , hand ,torch type , table floral arrangement), Japanese and western all type	
	Preparation of Jams, Jellies, Squashes/ Syrups, Pickle, sauces	
	Fruit & vegetable carving & Bio-jewelery	
	Green house plants- Information regarding to soil, temperature, irrigation, fertilizer requirements and propagation methods for <i>Anthurium</i> , <i>Gerbera</i> , Orchids, Tuberose, Carnation, Roses, <i>Capsicum</i>	

	Preparation of garden layout	
	List of plants suitable for garden locations- 2-3 plants for each location .	

Visits : To Garden /Parks / Nurseries/ Exhibition / Horticulture industries / Research Station and record of visits should be duly certified and presented at practical examination.

Modality of Assessment :

Theory Examination Pattern:

A) Internal Assessment - 40%

40 marks.

Theory

40 marks

Sr No	Evaluation type	Marks
1	One Assignments/Case study/Project	10
2	One class Test (multiple choice questions / objective)	20
3	Active participation in routine class instructional deliveries(case studies/ seminars//presentation)	05
4	Overall conduct as a responsible student, manners, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05

B) External examination - 60 %

Semester End Theory Assessment - 60%

60 marks

- i. Duration - These examinations shall be of two hours duration.
- ii. Theory question paper pattern :-
 1. There shall be **five** questions each of **12** marks. On each unit there will be one question & fifth one will be based on all the four units .
 2. All questions shall be compulsory with internal choice within the questions. Each question will be of **24** marks with options.
 3. Questions may be sub divided into sub questions a, b, c & d only, each carrying **six** marks **OR** a, b, c, d,e & f only each carrying **four** marks and the allocation of marks depends on the weightage of the topic.

Practical Examination Pattern:

(A) Internal Examination:-

There will not be any internal examination/ evaluation for practicals.

(B) External (Semester end practical examination) :-

Sr.No.	Particulars	Marks
1.	Laboratory work	80
2.	Journal	10
3.	Viva	10

Assessment pattern for semester end / External practical examination of 80 marks shall be finalized in the workshop of the subject

Semester end practical examination in applied component shall be conducted by the concerned department of the Institute/ College at the end of each semester and the marks of the candidates are to be sent to the University in the prescribed format.

Semester V:

Practical examination will be held at the college / institution at the end of the semester.

The students are required to present a duly certified journal for appearing at the 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 Head of the Department/ Co-ordinator of the department ; failing which the student will not be allowed to appear for the practical examination.

Semester VI

Practical examination will be held at the college / institution at the end of the semester. The students are required to present a duly certified journal for appearing at the 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 Head of the Department/ Co-ordinator of the department ; failing which the student will not be allowed to appear for the practical examination.