

A.C. 10/2/12  
Item No. 4.2

# **UNIVERSITY OF MUMBAI**



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

(As per Credit Based Semester and Grading System  
with effect from the academic year 2012–2013)

**S.Y.B.Sc. Botany Syllabus**  
**Credit Based and Grading System**  
**To be implemented from the Academic year 2012-2013**

**SEMESTER III**

Course Code	UNIT	TOPICS	Credits	L / Week
USBO301	<u>Plant Diversity II</u>			
	I	Algae and Bryophytes	2	1
	II	Fungi and Plant Pathology		1
	III	Angiosperms		1
USBO302	<u>Form and Function II</u>			
	I	Instrumentation and Techniques	2	1
	II	Plant Physiology and Plant Biochemistry		1
	III	Cytogenetics		1
USBO303	<u>Current Trends in Plant Sciences I</u>			
	I	Pharmacognosy	2	1
	II	Forestry		1
	III	Ecology		1
USBOP3	Practicals based on all the three courses in theory		3	9

### SEMESTER IV

Course Code	UNIT	TOPICS	Credits	L / Week
USBO401	<u>Plant Diversity II</u>			
	I	Microbiology	2	1
	II	Pteridophyta, Paleobotany and Gymnosperms		1
	III	Angiosperms		1
USBO402	<u>Form and Function II</u>			
	I	Anatomy	2	1
	II	Environmental Botany and Plant Physiology		1
	III	Molecular Biology and Biostatistics		1
USBO403	<u>Current Trends in Botany I</u>			
	I	Economic Botany	2	1
	II	Horticulture		1
	III	Biotechnology and Bioinformatics		1
USBOP4	Practicals based on all the three courses in theory		3	9

**SEMESTER III**  
**THEORY**

Course Code	Title	Credits
<b>USBO301</b>	<b><u>PLANT DIVERSITY II</u></b>	<b>2 Credits (45 lectures )</b>
<p><b><u>Unit I : Algae and Bryophytes</u></b></p> <p><b>Algae</b></p> <ul style="list-style-type: none"> <li>• Structure, life cycle and systematic position of <i>Sargassum</i> <i>Batrachospermum</i></li> <li>• Pigments and reserve food in Algae</li> <li>• Range of thallus structure in Algae</li> </ul> <p><b>Bryophytes</b></p> <ul style="list-style-type: none"> <li>• Structure, life cycle and systematic position of <i>Anthoceros</i></li> </ul>		<b>15 Lectures</b>
<p><b><u>Unit II : Fungi and Plant Pathology</u></b></p> <ul style="list-style-type: none"> <li>• Structure, life cycle and systematic position of <i>Erysiphe</i> <i>Agaricus</i></li> <li>• Diseases- Symptoms, causative organism, disease cycle and control measures of Rust Powdery mildew</li> </ul>		<b>15 Lectures</b>
<p><b><u>Unit III : Angiosperms</u></b></p> <ul style="list-style-type: none"> <li>• Concerns of taxonomy Systematics Taxonomic structure Nomenclature</li> <li>• Characters of Taxonomic importance Exomorphic characters - Morphological characters of stem, root, leaf, flower, fruit, seed Phytochemical characters Primary constituents – Proteins, DNA, polysaccharides. Secondary constituents – Tannins, alkaloids</li> <li>• 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: Cruciferae Meliaceae Myrtaceae Combretaceae</li> </ul>		<b>15 Lectures</b>

Course Code	Title	Credits
USBO302	<b><u>FORM AND FUNCTION II</u></b>	<b>2 Credits (45 lectures )</b>
<b><u>Unit I : Instrumentation and Techniques</u></b>		<b>15 Lectures</b>
<ul style="list-style-type: none"> <li>• Microscopy – Phase contrast and electron microscopy</li> <li>• Chromatography- Principles and types of chromatography- absorption and partition chromatography, paper and thin layer chromatography.</li> </ul>		
<b><u>Unit II : Plant Physiology and Plant Biochemistry</u></b>		<b>15 Lectures</b>
<ul style="list-style-type: none"> <li>• <b>Photophysiology and Photorespiration</b> Electromagnetic spectrum, Plant pigments and their interaction with light, Concept of fluorescence and Phosphorescence, Light reaction and dark reaction of photosynthesis, C3, C4 and CAM pathways, Photorespiration.</li> <li>• <b>Carbohydrate Metabolism.</b> Structure, synthesis and degradation of Sucrose, Starch, Fructans and Cellulose.</li> </ul>		
<b><u>Unit III : Cytogenetics</u></b>		<b>15 Lectures</b>
<ul style="list-style-type: none"> <li>• <b>Genetic Mapping in eukaryotes</b> Introduction to meiosis (crossing over and recombination during meiosis), Linkage, crossing over and construction of chromosome maps (through 3- point test cross).</li> <li>• <b>Variation in Chromosome structure (Chromosomal Aberrations)</b> Definition, Origin, Cytological and Genetic Effects of the following: Deletions, Duplications, Inversions and Translocations.</li> <li>• <b>Extranuclear Genetics</b> Organelle hereditary- Chloroplast determines heredity -Plastid transmission in plants, Streptomycin resistance in <i>Chlamydomonas</i>. Mitochondrion determined heredity- petite colonies in yeast</li> </ul>		

Course Code	Title	Credits
<b>USBO303</b>	<b><u>CURRENT TRENDS IN PLANT SCIENCES I</u></b>	<b>2 Credits (45 lectures )</b>
<b><u>Unit I : Pharmacognosy</u></b> <ul style="list-style-type: none"> <li>• Introduction to pharmacopoeia</li> <li>• Concept of Primary and secondary metabolites</li> <li>• Study of secondary metabolites (sources, properties and uses) with reference to Alkaloids, Glycosides, Tannins, Volatile oils and Gums and resins</li> </ul>		<b>15 Lectures</b>
<b><u>Unit II : Forestry</u></b> <ul style="list-style-type: none"> <li>• Types of forests – classification of forests, different types of forests in India</li> <li>• Applications of forestry- Social forestry, Reforestation, Afforestation, Deforestation.</li> <li>• Forest Products</li> </ul>		<b>15 Lectures</b>
<b><u>Unit III : Ecology</u></b> <ul style="list-style-type: none"> <li>• Ecological factors</li> <li>• Concept of environmental factors. Soil as an edaphic factor, Soil composition,types of soil, soil formation, soil profile.</li> <li>• Community ecology</li> <li>• Concept of community</li> </ul>		<b>15 Lectures</b>

**SEMESTER III**  
**PRACTICAL**

<b>Semester III USBOP3</b>	
<b>PRACTICAL Paper I – Plant Diversity II</b>	<b>Cr 1</b>
<p><b>Algae</b></p> <ol style="list-style-type: none"><li>1 Study of stages in the life cycle of <i>Sargassum</i> from fresh/ preserved material and permanent slides.</li><li>2 Study of stages in the life cycle of <i>Batrachospermum</i> from fresh/ preserved material and permanent slides.</li><li>3 Study of Algal pigments – chromatographic separation</li><li>4 Study of range of thallus in Algae with the help of permanent slides and fresh/preserved material</li></ol> <p><b>Fungi and Plant Pathology</b></p> <ol style="list-style-type: none"><li>5 Study of stages in the life cycle of <i>Erysiphe</i> and <i>Agaricus</i> from fresh/ preserved material and permanent slides.</li><li>6 Study of fungal diseases as prescribed for theory.</li></ol> <p><b>Bryophyta</b></p> <ol style="list-style-type: none"><li>7 Study of stages in the life cycle of <i>Anthoceros</i> from fresh/ preserved material and permanent slides.</li></ol> <p><b>Angiosperms</b></p> <ol style="list-style-type: none"><li>8 Study of one plant from each family prescribed for theory: morphological peculiarities and economic importance of the members of these families.</li></ol>	
<b>PRACTICAL Paper II – FORM AND FUNCTION- II</b>	<b>Cr 1</b>
<p><b>Instrumentation and Techniques</b></p> <ol style="list-style-type: none"><li>1 Preparation of herbarium and wet preservation technique</li><li>2 Preparation of a report on visit to any Herbarium.</li><li>3 Chromatography: Separation of monosaccharides by circular paper chromatography</li><li>4 Separation of Carotenoids by thin layer chromatography</li><li>5 Horizontal Gel Electrophoresis – Demonstration</li></ol> <p><b>Plant Physiology and Plant Biochemistry</b></p> <ol style="list-style-type: none"><li>6 Study of Hill's Reaction</li><li>7 A. Quantitative estimation of photosynthetic pigments B. Study of absorption spectrum pattern of chlorophyll/carotenoid pigment</li><li>8 Qualitative tests for various types of sugars</li></ol> <p><b>Cytogenetics.</b></p> <ol style="list-style-type: none"><li>9 Study of cytological consequences of chromosomal aberrations (Laggards, Chromosomal Bridge, Ring chromosome, Chromosomal ring) from permanent slides or photomicrographs.</li><li>10 Construction of chromosome map based on three point test cross. (involving 3 linked genes) Study of inheritance pattern with reference to Plastid Inheritance</li></ol>	

**PRACTICAL - Paper III CURRENT TRENDS IN PLANT SCIENCES I**

**Cr  
1**

**Pharmacognosy**

- 1 A. Tests for alkaloids from *Strychnos* (seeds) and *Holarrhoena* (bark)  
B. Tests for glycosides from *Glycyrrhiza* rhizome/ *Aloe* leaf/ *Senna* leaf.  
C. Test for tannins from Clove/ *Arjuna* bark/ catechu.
- 2 Identification of drugs from grandma's pouch, comments on their uses.
- 3 Preparation of any herbal cosmetic.
- 4 Stomatal Index, Palisade Ratio, Vein islet number

**Economic Botany**

- 5 Sources, properties and uses of : fibres, paper and spices and condiments

**Forestry**

- 6 Study of Biodiversity Composition of different types of forests in India.

**Ecology**

- 7 Study of the working of the following Ecological Instruments- Soil thermometer, Soil testing kit, Soil pH, Wind anemometer
- 8 Mechanical analysis of soil by the sieve method.
- 9 Study of vegetation by the list quadrat method
- 10 Estimation of Biomass of aerial parts of herbaceous plants
- 11 Quantitative estimation of organic matter of the soil by Walkley and Blacks Rapid titration method.



**SEMESTER IV**  
**THEORY**

Course Code	Title	Credits
<b>USBO401</b>	<b><u>PLANT DIVERSITY II</u></b>	<b>2 Credits (45 lectures )</b>
<b><u>Unit I : Microbiology</u></b> <ul style="list-style-type: none"> <li>• Methods of microbiology</li> <li>• Basic principles of staining.</li> <li>• Culture media preparation.</li> <li>• Pure culture methods.</li> <li>• Classification of Bacteria based on mode of nutrition.</li> <li>• Bacterial bio fertilizers with reference to <i>Rhizobium</i> - mass propagation and methods of application.</li> <li>• Ecological microbiology - Bacteria in sulphur cycling and phosphate solubilisation.</li> </ul>		<b>15 Lectures</b>
<b><u>Unit II : Pteridophyta, Paleobotany and Gymnosperms</u></b> <b>Pteridophyta</b> <ul style="list-style-type: none"> <li>• Smith's Classification of Pteridophyta upto classes. Salient features of Psilophyta, Lepidophyta, Calamophyta and Pterophyta.</li> <li>• Structure life cycle and systematic position of <i>Selaginella</i></li> </ul> <b>Paleobotany</b> <ul style="list-style-type: none"> <li>• Formation and types of fossils, structure and systematic position of form genus <i>Calamites</i></li> </ul> <b>Gymnosperms</b> <ul style="list-style-type: none"> <li>• Structure life cycle and systematic position of <i>Pinus</i></li> </ul>		<b>15 Lectures</b>
<b><u>Unit III : Angiospermae</u></b> <ul style="list-style-type: none"> <li>• Hierarchy of categories in taxonomic structure</li> <li>• Tools of angiosperm taxonomy Museum (herbarium) Gardens (Botanical and Public) Sacred grooves</li> <li>• 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: <ul style="list-style-type: none"> <li>○ Tiliaceae</li> <li>○ Rubiaceae</li> <li>○ Apocynaceae</li> <li>○ Convolvulaceae</li> </ul> </li> </ul>		<b>15 Lectures</b>

Course Code	Title	Credits
<b>USBO402</b>	<b><u>FORM AND FUNCTION II</u></b>	<b>2 Credits (45 lectures )</b>
<b><u>Unit I : Antomy</u></b> <ul style="list-style-type: none"> <li>• Mechanical Tissue system <ul style="list-style-type: none"> <li>○ Tissues providing mechanical strength and support and their disposition</li> <li>○ I-girders in aerial and underground organs</li> </ul> </li> <li>• Conducting tissue system : Primary xylem and phloem, Types of Vascular Bundles, Stelar Evolution.</li> <li>• Defence mechanism in plants: Morphological, Anatomical, Physiological and Biochemical Defence mechanisms</li> </ul>		<b>15 Lectures</b>
<b><u>Unit II : Environmental Botany and Plant Physiology</u></b> <b>Environmental Botany</b> <ul style="list-style-type: none"> <li>• Ecological Succession: Hydrosere and Xerosere</li> <li>• Plant indicators</li> <li>• Environmental Impact Assessment (EIA)</li> <li>• Protected Area Network (PAN)</li> <li>• Ecotourism</li> </ul> <b>Plant Physiology –</b> 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.		<b>15 Lectures</b>
<b><u>Unit III : Molecular Biology and Biostatistics</u></b> <b>Molecular Biology</b> Protein synthesis <ul style="list-style-type: none"> <li>• Central dogma of Protein synthesis</li> <li>• Transcription, RNA molecules and RNA processing, The transcription process, RNA synthesis, Transcription in prokaryotes and eukaryotes.</li> <li>• Nature of the genetic code,</li> <li>• Translation of the genetic message,</li> <li>• Protein sorting in the cell</li> </ul> <b>Biostatistics</b> Testing of hypothesis: Chi square test		<b>15 Lectures</b>

Course Code	Title	Credits
USBO403	<b><u>CURRENT TRENDS IN PLANT SCIENCES I</u></b>	<b>2 Credits (45 lectures )</b>
<b><u>Unit I : Economic Botany</u></b>		
<ul style="list-style-type: none"> <li>• Fibres: Types of fibres, fibre yielding plants</li> <li>• Paper: Types of paper, paper yielding plants</li> <li>• Spices and condiments: Nutmeg, Mace, Clove, Cardamom and Saffron</li> </ul>		<b>15 Lectures</b>
<b><u>Unit II : Horticulture</u></b>		
<ul style="list-style-type: none"> <li>• Locations in the garden- edges, hedges, fence, lawn, flower beds, avenue, water garden (with two examples of each). Focal point.</li> <li>• Formal and informal gardens</li> <li>• National parks, Botanical gardens</li> </ul>		<b>15 Lectures</b>
<b><u>Unit III : Biotechnology and Bioinformatics</u></b>		
<b>Biotechnology</b>		
<ul style="list-style-type: none"> <li>• Recombinant DNA Technology and manipulation of DNA, Transgenic plant production by <i>Agrobacterium</i> mediated gene transfer (molecular basis), selectable markers, reporter genes, promoters used in plant vectors. Transgenic plants used for improving quality of seeds, edible vaccines.</li> </ul>		<b>15 Lectures</b>
<b>Bioinformatics</b>		
<ul style="list-style-type: none"> <li>• Introduction to bioinformatics- www, internet and its uses, tools used in bioinformatics related to Biotechnology, NCBI data models and other data bases, services offered by NCBI and EBI</li> </ul>		

**SEMESTER IV**  
**PRACTICAL**

<b>Semester IV USBOP4</b>	
<b>PRACTICAL Paper I – Plant Diversity</b>	<b>Cr 1</b>
<b>Microbiology</b> 1 Sterilization techniques (wet and dry). Preparation of nutrient agar. 2 Preparation of slants and plates. Study of streak plate technique. 3 Effect of plant extract (turmeric/garlic) on microbial growth by the agar-diffusion method	
<b>Pteridophyta and Paleobotany</b> 4 Study of stages in the life cycle of <i>Selaginella</i> from fresh/ preserved material and permanent slides. 5 Study of form genus <i>Calamites</i> with the help of permanent slides/ photomicrographs	
<b>Gymnosperms</b> 6 Study of stages in the life cycle of <i>Pinus</i> from fresh/ preserved material and permanent slides.	
<b>Angiosperms</b> 7 Study of one plant from each family prescribed for theory: morphological peculiarities and economic importance of the members of these families.	
<b>PRACTICALS Paper II – FORM AND FUNCTION- II</b>	<b>Cr 1</b>
<b>Cytogenetics , Molecular Biology</b> 1 Quantitative estimation of plant genomic DNA . 2 DNA sequencing –Sanger’s Method 3 Determining the sequence of amino acids in the protein molecule synthesised from the given m-RNA strand (prokaryotic and eukaryotic).	
<b>Biostatistics</b> 4 Chi square test	
<b>Anatomy</b> 6 Types of mechanical tissues, mechanical tissue system in aerial, underground organs. 7 Study of conducting tissues- Xylem and phloem elements in Gymnosperms and Angiosperms as seen in LS and through maceration technique. 8 Study of different types of vascular bundles and stellar evolution with the help of permanent slides. 9 Study of defence mechanism in plants	

**PRACTICALS - Paper III – CURRENT TRENTS IN PLANT SCIENCES**

**Cr  
1**

**Economic Botany**

1 Sources, properties and uses of : fibres, paper and spices and condiments

**Horticulture**

2 Study of five examples of plants for each of the garden locations as prescribed for theory

3 Preparation of garden plans – formal and informal gardens

4 Bottle and dish garden preparation.

**Biotechnology**

5 Identification of the cloning vectors Ti plasmid for the production of transgenic plants.

**Bioinformatics**

6 Internet search, BLAST

**Scheme of Examinations:**

**Theory Course:**

**Recommendations for Internal Assessment for** **40 marks**

One periodical test on class instructions 10 marks

Two assignments 20 marks

Active Participation (attentiveness/ability to answer questions) 05 marks

Leadership qualities in organizing or participation in academic or Co-curricular activities /mannerism and articulation etc. 05 marks

**External Assessment** 60 Marks

**Practical Course:** 50 marks with 20 marks for Internal and 30 marks for external.

**Note:**

1. A minimum of two 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 fifteen students.
2. A candidate will be allowed to appear for the practical examinations only if he/she submits a certified journal of SYBSC Botany or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of S 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.

## Reference Books

Latest editions of the following :

Smith G M *Crptogamic Botany* Vol I *Algae and Fungi* Mc Graw Hill Publ.

Smith G M *Crptogamic Botany* Vol II *Bryophytes and Pteridophytes* Mc Graw Hill Publ.

Gangulee, H C and Kar *College Botany* Vol. II New Central Book Agency

Sharma O P *Text book of Algae* Tata Mc Graw Hill Publ. India

Sharma Kanika *Text Book of Microbiology* Ane Books Pvt Ltd

Sharma Kanika *Manual of Microbiology, Tools and Techniques* Ane Books Pvt Ltd.

Vashishtha B R, Vashi Sinha AK and Anil Kumar *Botany for Degree Students Part I - Algae.* S Chand Publ.

Vashishtha B R, Vashi Sinha AK and Anil Kumar *Botany for Degree Students Part II - Fungi* S Chand Publ.

Vashishtha B R, Vashi Sinha AK and Anil Kumar *Botany for Degree Students Part III - Bryophyta* S Chand Publ.

Vashishtha B R, Vashi Sinha AK and Anil Kumar *Botany for Degree Students Part IV - Pteridophyta* S Chand Publ.

Vashishtha B R, Vashi Sinha AK and Anil Kumar *Botany for Degree Students Part V - Gymnosperms* S Chand Publ.

Chamberlain C J . *Gymnosperms Structure and Evolution*

Gangulee, Das and Datta *College Botany* Vol I New Central Book Agency

Sutaria R N A *Text Book of Systematic Botany*

Pandey S N and Mishra S D *Taxonoy of Angiosperms*

Sambamurthy A V S S *Taxonomy of Angiosperms*

Vashishtha P C *Taxonomy of Angiosperms* S Chand Publ.

Subramanyam N S *Modern Plant Taxonomy*

Henry A N *An Aid to the International Code of Botanical Nomenclature*

Eames A J *Introduction to Plant Anatomy* Mc Graw Hill Publ.

Esau, Katherine *Plant Anatomy*

Haberlandt G *Physiological Plant Anatomy*

Devlin R M *Plant Physiology*

Noggle G Ray and Fritz *Introduction to Plant Physiology* Pentrice Hall of India.

Salisbury F B and Ross *Plant Physiology*

Taiz Incoln *Plant Physiology*

Verma V *Text book of Plant Physiology*

Gardner E J *Principles of Genetics*

Glick B R and Pasternak J J, *Molecular Biotechnology- Principles and Application of Recombinant DNA*  
Panima Publ Corporation.

Rastogi Veer bala *Fundamentals of Biostatistics* Ane Books Pvt. Ltd.

Russels Peter

Mishra and Pandey *Plant Tissue Culture* Ane Books Pvt Ltd

Rastogi Veer Bala *Fundamentals of Molecular Biology* Ane Books Pvt Ltd

Hill *Economic Botany*

Wickens G *Economic Botany*. Springer.

Pandey B P *Economic Botany* S Chand Publ.

Verma V *Text book of Economic Botany* Ane Books Pvt Ltd. Sagreiya K P Forests and Forestry . NBT India

Higman, Mayers, Bass, Judd, *Sustainable Forestry – Handbook*.

Trease and Evans *Pharmacognosy*

Shah and Qadry *Pharmacognosy*

Prasad and Kumar *Principles of Horticulture*

Randhawa and Mukhopadyay. *Floriculture in India* Allied Publ.

Dash M C *Fundamentals of Ecology*. Tata Mc GrawHillPubl.

Kaushik A and Kaushik C P *Perspective in Environmental Sciences*.

Santra S C *Environmental Science* New Central Book Agency.

