



Shri Vile Parle Kelavani Mandal's  
**MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE &  
AMRUTBEN JIVANLAL COLLEGE OF COMMERCE AND ECONOMICS  
(AUTONOMOUS)**

*NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),  
Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of  
India,  
Best College (2016-17), University of Mumbai*

Affiliated to the  
**UNIVERSITY OF MUMBAI**

**Program: T.Y.B.Sc Botany**

**Course: USMABO501, USMABO502, USMABO503, USMABO504**

**Semester V**

**Choice Based Credit System (CBCS) with effect from the Academic  
year 2019-20**

### **PROGRAMME SPECIFIC OUTCOMES (PSO'S)**

On completion of the B.Sc. the learners should be enriched with knowledge and be able to-

- PSO1:** Identify different groups of Botany and appreciate Plant Biodiversity.
- PSO2:** Understand the current developments in the different areas of Botany.
- PSO3:** Analyze and apply the methodologies and techniques learnt during the course of studying Botany.
- PSO4:** Integrate the knowledge acquired in botany to solve problem, take real time decisions and innovate, while working with plants.
- PSO5:** Share social and environmental consciousness with their fellow citizens.
- PSO6:** To develop better understanding of good laboratory practices and safety.
- PSO7:** Synthesize the scientific character of observation, reasoning and apply the knowledge in designing experiments.
- PSO8:** Develop skills to pursue career in the arena related to plant sciences namely Medicinal Botany, forestry and floristic pursuits.
- PSO9:** To acquire technological and analytical skills needed for industrial support services.

### **Preamble**

As Autonomy has been granted to the college, the syllabus has been restructured. Keeping in tune with the revised syllabi of F.Y.B.Sc. and S.Y.B.Sc., the committee has taken utmost care to maintain the continuity in the flow of information of higher level at T.Y.B.Sc. Hence some of the modules of the earlier syllabus of T.Y.B.Sc. have been upgraded with the new modules in order to make the learners aware about the recent developments in various branches of Botany (like Algae, Fungi, Bryophyta, Pteridophyta, Gymnosperms, Angiosperms, Genetics, Molecular Biology, Anatomy, Physiology, Biotechnology) with an objective to raise the students awareness in interdisciplinary courses such as Biostatistics, Biophysics, Bioinformatics, Computational Biochemistry, Bioinstrumentation, Palynology, Embryology, Medicinal Botany & Cosmetology.

I am thankful to all the members of the Committee for their great efforts and for timely submission of the draft syllabus.

**SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben  
Jivanlal College of Commerce & Economics (AUTONOMOUS)**

**Evaluation Pattern**

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

**a) Details of Continuous Assessment (CA)**

25% of the total marks per course:

<b>Continuous Assessment</b>	<b>Details</b>	<b>Marks</b>
<b>Component 1 (CA-1)</b>	Test/Assignment	15 marks
<b>Component 2 (CA-2)</b>	Test/ Assignment	10 marks

**b) Details of Semester End Examination**

75% of the total marks per course. Duration of examination will be two and half hours.

<b>Question Number</b>	<b>Description</b>	<b>Marks</b>	<b>Total Marks</b>
Q.1	Long questions of Unit I a & b (any 1 out of 2)	a- 7 b- 8	15 Marks
Q.2	Long questions of Unit II a & b (any 1 out of 2)	a- 7 b- 8	15 Marks
Q.3	Long questions of Unit III a & b (any 1 out of 2)	a- 7 b- 8	15 Marks
Q.4	Long questions of Unit IV a & b(any 1 out of 2)	a- 7 b- 8	15 Marks
Q.5	Short notes (Unit I, II, III, & IV) (any three out of 4)	5 marks each	15 Marks
<b>Total Marks</b>			<b>75</b>

Signature

Signature

Signature

HOD

Approved by Vice –Principal

Approved by Principal

**SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben  
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<b>Program: B.A. B.Sc . (2019-20)</b>				<b>Semester: I</b>	
<b>Course: Plant Diversity V</b>				<b>Course Code: USMABO501</b>	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutori al (Hour s per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 25)</b>	<b>Semester End Examinations (SEE) (Marks- 75 in Question Paper)</b>
4	4		2.5	25	75
<b>Learning Objectives:</b> Plant diversity V includes Microbiology, Algae, Fungi and Plant pathology that deals with both conceptual and practical tools for identifying, classifying & studying microbes, the life cycles of algae and fungi, and plant diseases. It develops knowledge of life cycle, economic importance & outline of their classification in general. Identifying them based on their morphological features. This course will also help students to build on the basic skills regarding methods of controlling plant diseases.					
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Recognize and classify the diversity of Bacteria, Fungi and Algae. <b>CO2:</b> Use and demonstrate the various culturing techniques <b>CO3:</b> Predicting the role of microbes in fermentation technology <b>CO4:</b> Know the systematics, morphology, structure and life cycle of algae and fungi. <b>CO5:</b> Investigate and recognize the fungal pathogens causing crop destruction. <b>CO6:</b> Know and develop the preventive and control measures of plant disease which effect the economy of crops					
<b>Outline of Syllabus: (per session plan)</b>					
<b>Module</b>	<b>Description</b>				<b>No of Hours</b>
<b>1</b>	Microbiology				48mins
<b>2</b>	Algae				48mins
<b>3</b>	Fungi				48mins
<b>4</b>	Plant Pathology				48mins
	<b>Total</b>				<b>3hrs 12 min</b>
<b>PRACTICALS</b>					<b>3hrs 12 min</b>

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Unit	Topic	Credits 2.5
<b>Module 1</b>	<p><b>Microbiology</b></p> <ul style="list-style-type: none"> <li>• Types of Microbes- Bacteria: Size, shape &amp; arrangement, ultrastructure of bacterial cell, growth &amp; reproduction, significance of bacteria; Rickettsiae, Archaeobacteria, Mycoplasma, Algae, Fungi, Actinomycetes &amp; Protozoa</li> <li>• Culturing: Sterilization, media - only general media, PDB &amp; PDA and Nutrient broth &amp; Nutrient Agar; staining- monochrome &amp; Gram's staining; colony characters</li> <li>• Isolation of Pure cultures-single cell isolation, streak plate, stroke culture, serial dilution, pour plate &amp; spread plate method.</li> <li>• Role of microbes in fermentation: Alcohol and Antibiotics</li> </ul>	15 Lecture
<b>Module 2</b>	<p><b>Algae</b></p> <ul style="list-style-type: none"> <li>• Structure, life cycle and systematic position of <i>Zygnema</i>.</li> <li>• Structure, life cycle and systematic position of <i>Polysiphonia</i>, <i>Batrachospermum</i>.</li> <li>• Structure, life cycle and systematic position of <i>Vaucheria</i>.</li> <li>• Structure, life cycle and systematic position of <i>Pinnularia</i></li> </ul>	15 Lecture
<b>Module 3</b>	<p><b>Fungi</b></p> <ul style="list-style-type: none"> <li>• Basidiomycetae: <ul style="list-style-type: none"> <li>○ Classification and General characters</li> <li>○ Life cycle of <i>Agaricus</i></li> <li>○ Life cycle of <i>Puccinia</i></li> </ul> </li> <li>• Deuteromycetae: <ul style="list-style-type: none"> <li>○ Classification and General Characters</li> <li>○ Life cycle of <i>Alternaria</i></li> </ul> </li> </ul>	15 Lecture
<b>Module 4</b>	<p><b>Plant Pathology</b></p> <ul style="list-style-type: none"> <li>• Study of plant diseases: Causative organism, symptoms, predisposing factors, disease cycle and control measures of the following. <ul style="list-style-type: none"> <li>○ White Rust – <i>Albugo sp.</i></li> <li>○ Tikka disease of ground nut: <i>Cercospora</i></li> <li>○ Damping off disease: <i>Pythium</i></li> </ul> </li> </ul>	15 Lecture

	<ul style="list-style-type: none"><li>○ Citrus canker – <i>Xanthomonas</i> sp.</li><li>○ Leaf curl – leaf curl virus</li><li>● Study of Physical, chemical and biological control methods of plant diseases.</li></ul>	
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*To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester*

## **PRACTICAL I**

### **MICROBIOLOGY**

- Study of aeromycoflora by Exposed plate method
- Isolation of soil microorganisms by 'T' method
- Determination of Minimum Inhibitory Concentration (MIC) of sucrose against selected micro organism
- Study of antimicrobial activity by the disc diffusion method

### **ALGAE**

Study of stages in the life cycle of the following Algae from fresh / preserved material and permanent slides

- *Zygnema*
- *Polysiphonia*
- *Batrachospermum*
- *Vaucheria*
- *Pinnularia*

### **FUNGI**

Study of stages in the life cycle of the following Fungi from fresh / preserved material and permanent slides

- *Agaricus*
- *Puccinia*
- *Alternaria*

### **PLANT PATHOLOGY**

Study of the following fungal diseases:

- White rust
- Tikka disease in Groundnut
- Damping off disease
- Citrus canker
- Leaf curl

## **Suggested Readings**

**SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben  
Jivanlal College of Commerce & Economics (AUTONOMOUS)**

1. Industrial Microbiology by Cassida, New Age International, New Delhi
2. Industrial Microbiology Mac Millan Publications, New Delhi
3. Smith, Gilbert M. (1955). Cryptogamic Botany Algae & Fungi Volume 1; 2nd edition; McGrawhill book Comp. Tokyo
4. Vasishtha, B.R. and Sinha, A. K. (2005). Botany for degree students Part 1 ALGAE; S. Chand & Company Ltd, 1st edition, revised.
5. Dutta, A.C. (1976). A Class book of Botany; 15th edition; Calcutta: Oxford University Press.
6. Sambamurty, A. V. S. S. (2005). A Textbook of Algae. I K International Publishing House.
7. Awasthi, A.K. (2015). Textbook of Algae. 1<sup>st</sup> ed. S Chand publication.
8. Robert Edward Lee (2008). Phycology. 4<sup>th</sup> ed. Cambridge publication.
9. James E. Graham, Lee W. Wilcox, Linda E. Graham. (2020). Algae. 2<sup>nd</sup> ed, Graham Publication.
10. Christiaan Hoek, Hoek C van den, David Mann, H. M. Jahns, Martin Jahns (1995). Algae An introduction to phycology, Cambridge university press.
11. Dinabandhu Sahoo, Joseph Seckbach, (2015). The Algae World. Springer Publication
12. Smith, Gilbert M. (1955). Cryptogamic Botany Algae & Fungi Volume 1; 2nd edition; McGraw Hill Book Comp. Tokyo.
13. Gangulee, Das and Dutta (2011). College Botany Volume I and II. Central Education enterprises.
14. Peter Roberts, Shelley Evans (2014). The Book of Fungi: A Life-Size Guide to Six Hundred Species from around the world.
15. Mishra, S.R. (2005). Morphology of Fungi. Discovery Publishing House.
16. Sharma, O.P. (1989). A text book on Fungi. Tata McGraw-Hill Publications, New Delhi.
17. Michael J. Carlile, Sarah C. Watkinson, G. W. Gooday (2008). The Fungi. Elsevier Publications.
18. Kevin Kavanagh (2005). Fungi: Biology and Applications, John Wiley and sons Ltd.
19. Ingold, C.T. & Hudson H.J. (1993). The Biology of Fungi, Chapman & Hall.
20. Mukerji, K.G., Manoharachary, C. (2010). Taxonomy and Ecology of Indian Fungi, I.K International.
21. Deacon, J. W. (2006). Fungal biology. (4th Ed.) Blackwell publishing.

**SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben  
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<b>Course: Plant Diversity VI</b>				<b>Course Code: USMABO502</b>	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutori al (Hour s per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 25)</b>	<b>Semester End Examinations (SEE) (Marks- 75 in Question Paper)</b>
4	4		2.5	25	75
<b>Learning Objectives:</b> Plant diversity VI deals with study of Paleobotany, Angiosperms, Anatomy and Palynology. It develops knowledge of higher plants, economic importance & outline of Bentham & Hooker's classification of angiosperm families. The lessons also give students hands-on competence for studying families in nature & identifying them based on their morphological features. This course will also help students to build on the basic skills to study anatomical characters, pollen morphology and applications of the studies in industry.					
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Know the scope of Paleobotany, types of fossils representing different fossil groups. <b>CO2:</b> Interpret the morphological characters of plants through field visits <b>CO3:</b> Using information can justify the merits and demerits of systems of classification <b>CO4:</b> Compare the microscopical structures of root, stem, leaves, etc with respect to anomalous secondary growth <b>CO5:</b> Evaluating and identifying the types of stomata for taxonomical studies. <b>CO6:</b> Expertise in field study by identifying the diagnostic characters of angiosperm families. <b>CO7:</b> Understand the economic importance of the pollen and the scope of Palynology					
<b>Outline of Syllabus: (per session plan)</b>					
<b>Module</b>	<b>Description</b>				<b>No of Hours</b>
<b>1</b>	Paleobotany				48mins
<b>2</b>	Angiosperms I				48mins
<b>3</b>	Anatomy I				48mins
<b>4</b>	Palynology				48mins
	<b>Total</b>				<b>3hrs 12 min</b>
<b>PRACTICALS</b>					<b>3hrs 12 min</b>



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Unit	Topic	Credits 2.5
<b>Module 1</b>	<p><b>Paleobotany</b></p> <ul style="list-style-type: none"> <li>• <i>Calamites</i> – All form genera Stem, leaf, male and female frutification</li> <li>• <i>Lepidodendron</i>–All form genera root, stem, bark, leaf, male and female fructification</li> <li>• <i>Lyginopteris</i> – All form genera root, stem, leaf, male and female fructification</li> <li>• <i>Pentoxylon</i> – All form genera.</li> <li>• Contribution of BirbalSahni, BirbalSahni Institute of Paleobotany, Lucknow</li> </ul>	15 Lecture
<b>Module 2</b>	<p><b>Angiosperms I</b></p> <ul style="list-style-type: none"> <li>• Morphology of fruit.</li> <li>• Complete classification of Bentham and Hooker (only for prescribed families), Merits and demerits</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>○ Capparidaceae</li> <li>○ Umbelliferae</li> <li>○ Cucurbitaceae</li> <li>○ Verbenaceae</li> <li>○ Rubiaceae</li> <li>○ Commelinaceae</li> <li>○ Graminae</li> </ul> </li> </ul>	15 Lecture
<b>Module 3</b>	<p><b>Anatomy</b></p> <ul style="list-style-type: none"> <li>• Anomalous secondary growth in the Stems of <i>Bignonia</i>, <i>Salvadora</i>, <i>Achyranthes</i>, <i>Aristolochia</i>, <i>Dracaena</i>.</li> <li>• Storage roots of Beet, Radish, Root stem transition</li> <li>• Types of Stomata – Anomocytic, Anisocytic, Diacytic, Paracytic, and Graminaceous</li> </ul>	15 Lecture
<b>Module 4</b>	<p><b>Palynology</b></p> <ul style="list-style-type: none"> <li>• Pollen Morphology</li> <li>• Pollen viability – storage</li> <li>• Germination and growth of pollen</li> </ul>	15 Lecture

	<ul style="list-style-type: none"><li>• Application of Palynology in honey industry, coal and oil exploration, Aerobiology and pollen allergies, forensic science</li></ul>	
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*To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester*

## **PRACTICAL II**

### **PALEOBOTANY**

Study of the following form genera with the help of permanent slides/ photomicrographs.

- *Calamites*
- *Lepidodendron*
- *Lyginopteris*
- *Pentoxylon*

### **ANGIOSPERMS**

- Morphology of fruit
- Study of plants from each of the following Angiosperm families
- Capparidaceae
- Umbelliferae
- Cucurbitaceae
- Rubiaceae
- Verbenaceae
- 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

### **ANATOMY**

Study of anomalous secondary growth in the stems of the following plants using double staining technique:

- *Bignonia*
- *Salvadora*
- *Achyranthes*
- *Aristolochia*
- *Dracaena*

Study of anomalous secondary growth in the roots of

- Beet
- Radish

Types of Stomata

- Anomocytic
- Anisocytic
- Diacytic
- Paracytic
- Graminaceous

### **PALYNOLOGY**

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Study of pollen morphology (NPC Analysis) of the following by Chitale's Method

- *Hibiscus*
- *Datura*
- *Ocimum*
- *Pancreaticum*
- *Canna*

Determination of pollen viability

Pollen analysis from honey sample – unifloral and multifloral honey

Effect of varying concentration of sucrose on In vitro Pollen germination.

### **Suggested Readings**

1. Gurucharan Singh (2019). Plant Systematics, oxford and IBH Public.
2. Lawrence George H.M. (1967). Taxonomy of Vascular Plants, Oxford & IBH
3. Sharma O.P. (2009). Plant Taxonomy 2<sup>nd</sup> edition. Tata McGraw-Hill Education Pvt. Ltd. Publication.
4. Mondal A.K. (2009) Advanced Plant Taxonomy, New Central Book Agency (P) Ltd. London.
5. Vasudevan Nair R. (1997) Plant Systematics. Oxford & IBH.
6. Gangulee Das & Dutta (2011) College Botany Vol. II. New Central Book Agency (P) Limited
7. Sambamurthy A.V.S.S. (2010). Taxonomy of Angiosperms. I. K. International Pvt Ltd,
8. Vashishta P. C. (2001). Taxonomy of Angiosperms S. Chand Publication.
9. Michael G. Simpson. (2006) Plant Systematics. Elsevier Academy Press
10. Cooke T. (1901) Flora of Bombay Presidency. London: vol . 1, 2 & 3. Taylor and Francis
11. George. H.M,1967, Taxonomy of Vascular Plants, Oxford & IBH.
12. Sharma.O.P.1988, Plant Taxonomy.
13. Erdtman.G,1971, Pollen Morphology and Plant Taxonomy,Hafner.Publ.Co.N.Y
14. Faegri.K & Eversen.J,1989 Text Book of Pollen Analysis (4thedtn),John Wiley & Sons,N.Y
15. KashinathBhattacharya etc; 2011, A text Book of Palynology(Basic and Applied)New Central Book Agency (P)Ltd,London.
16. Maheswari.P. An Introduction to the Embryology of Angiosperms, McGraw Hill Book Co.Inc,N.W.
17. Nair.P.K.K. 1970, Pollen Morphology of Angiosperms, Scholar Publ.House, Lucknow.
18. Shivanna K.R.,2003, Pollen Biology and Biotechnology-Special Indian Edition, Oxford and IBH Publ.CoPvt.Ltd,New Delhi.
19. Shivanna.K.R.&Johri.B.M, 1985,The Angiosperm Pollen:Structure and Function,Wiley Eastern Ltd, New delhi.
20. Tilak.S.T,1982,Aerobiology,VaijayanthiPrakashan,Aurangabad,India.
21. Bhojwani S. S. and Bhatnagar S. P. (1999). The embryology of angiosperms. Vikas Pub. House.
22. Bhojwani S.S. and Soh W.Y. (2001). Current Trends in Embryology of Angiosperms Kluwer Academic Publishers.

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<b>Program: B.Sc . (2019-20)</b>				<b>Semester: V</b>	
<b>Course: Form and Function V</b>				<b>Course Code: USMABO503</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutori al (Hour s per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 25)</b>	<b>Semester End Examinations (SEE) (Marks- 75 in Question Paper)</b>
4	4		2.5	25	75
<b>Learning Objectives:</b> Form & Function V includes Cytology, Molecular biology, Physiology, Environmental Botany and Plant Tissue Culture. This course deals with both conceptual and practical tools for studying the nucleus and its behavior, water relations in plants, plant adaptations to environmental factors and distribution and bioremedial properties of plants, Knowledge of basic Plant tissue culture techniques, micropropagation and their applications.					
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Describe the ribosomes and giant chromosomes. <b>CO2:</b> To interpret and understand the translation and transcription in prokaryotes and eukaryotes. <b>CO3:</b> Execute the knowledge of plant water relationship to safe guard the loss of water <b>CO4:</b> Structuring the process of translocation of solutes in plants by various hypothesis. <b>CO5:</b> Monitoring and investigating the bioremediation and phytoremediation with respect to environment. <b>CO6:</b> Designing the basic protocols for Plant Tissue Culture					
<b>Outline of Syllabus: (per session plan)</b>					
<b>Module</b>	<b>Description</b>				<b>No of Hours</b>
<b>1</b>	Cytology and Molecular biology				48mins
<b>2</b>	Physiology I				48mins
<b>3</b>	Environmental Botany				48mins
<b>4</b>	Plant tissue culture				48mins
	<b>Total</b>				<b>3hrs 12 min</b>
<b>PRACTICALS</b>					<b>3hrs 12 min</b>

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Unit	Topic	Credits 2.5
<b>Module 1</b>	<p><b>CYTOLOGY AND MOLECULAR BIOLOGY</b></p> <ul style="list-style-type: none"> <li>• Ribosomes (prokaryotic, eukaryotic and subunits)</li> <li>• Structure and function of giant chromosomes</li> <li>• The genetic code: Characteristics of the genetic code</li> <li>• Transcription and Translation in Prokaryotes and Eukaryotes</li> </ul>	15 Lecture
<b>Module 2</b>	<p><b>PHYSIOLOGY</b></p> <ul style="list-style-type: none"> <li>• Water relations: Water Potential, osmosis, transpiration, imbibition.</li> <li>• Solute transport: Transport of ions across cell membranes, active and passive transport, carriers, channels and pumps.</li> <li>• Translocation of solutes: Composition of phloem sap, girdling experiment, pressure flow model, phloem loading and unloading, anatomy of sieve tube elements, mechanisms of sieve tube translocation, Munch's hypothesis.</li> </ul>	15 Lecture
<b>Module 3</b>	<p><b>ENVIRONMENTAL BOTANY</b></p> <ul style="list-style-type: none"> <li>• Bioremediation: Principles, factors responsible and microbial population in bioremediation.</li> <li>• Phytoremediation: Metals, Organic pollutants</li> <li>• Plant succession: Hydrosere and Xerosere – Formation of barren space, succession on the land citing different seres leading upto the climax, succession in water, ecesis, poly and monoclinal theories</li> </ul>	15 Lecture
<b>Module 4</b>	<p><b>PLANT TISSUE CULTURE</b></p> <ul style="list-style-type: none"> <li>• Aspects of micropropagation with reference to Floriculture: Detailed study of Orchid cultivation.</li> <li>• Plant cell suspension cultures for the production of secondary metabolites: with special reference to Shikonin production.</li> <li>• Somatic embryogenesis and artificial seeds: Protoplast fusion and Somatic hybridization:               <ul style="list-style-type: none"> <li>i) Concept, definition, and various methods of protoplast fusion</li> <li>ii) Applications of somatic hybridization in agriculture</li> </ul> </li> </ul>	15 Lecture

*To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester*

### PRACTICAL III

#### CYTOLOGY AND MOLECULAR BIOLOGY

- Mounting of Giant chromosomes from Chironomous larva
- Smear preparation from *Tradescantia* buds
- DNA sequencing- Sanger's method

#### PHYSIOLOGY

- Estimation of Phosphate phosphorus (one standard tube, R.M and blank tube method- Plant acid extract ).
- Estimation of Iron (one standard tube, R.M and blank tube method- Plant acid extract).

#### ENVIRONMENTAL BOTANY

Estimation of the following in given water sample

- Dissolved oxygen demand
- Biological oxygen demand
- Hardness
- Salinity and Chlorinity

#### MICROPROPOGATION

Plant Tissue culture:

- Identification – Multiple shoot culture, hairy root culture, somatic embryogenesis
- Problems based on preparation of stock solutions for tissue culture media.

#### Suggested Readings

1. De Robertis, E.D.P.; Nowinski, Wiktor W.; Saez, Francisco A.; Cell Biology; Philadelphia : W.B. Saunders Company , 1970. Gerald Karp and Nancy L Pruitt (1979) Cell and Molecular Biology Textbook 6 Ed.
2. Geoffrey M. Cooper (2015). The Cell: Textbook 2 Ed.
3. Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander D.Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter (2013). Essential Cell Biology by 4 Ed.
4. Verma, P.S. (2016). Cell Biology, Genetics, Molecular Biology 1 Ed.
5. Verma, P.S. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. 2 Ed
6. Gupta, P.K. (2011). Cell-biology, Genetics, Evolution and Ecology.
7. Odum, E .P. and Barrett, G .W. ( 2005). Fundamentals of Ecology by Thompson Asia Pvt Ltd. Singapore Vol 87
8. Chapman, J.L. and Reiss M.J. (2005). Ecology Principles and Applications, Cambridge University Press London.
9. Dash, M.C. (1994). Fundamentals of Ecology, Tata McGraw Hill, New Delhi.
10. Introduction to Biomes Book by Susan L. Woodward Vol 8 (Pb 2009)
11. Santra SC. (2011). Environmental Science, New Central book agency
12. Subrahmanyam, N.S.; Sambamurty, A.V.S.S.; (2000) Ecology; 1st edition; New Delhi : Narosa Publishing House

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13. William Hopkins (2009). Introduction to plant physiology Book by 4 Ed.
14. Cleon W. Ross and Frank B. Salisbury (1992). Plant Physiology Book by 1 Ed.
15. Noggle, Ray G.;Fritz, George J. (1991). Introductory plant physiology; 2nd edition; New Delhi : Prentice-Hall Of India Private Limited.
16. Sinha, B.K.;Pandey, S.N., (1981). Plant Physiology; 1st edition; New Delhi : Vikas Publishing House Pvt. Ltd.
17. Salisbury, Frank B.;Ross, Cleon W., (1996, 2001). Plant physiology; 3rd edition, Reprint; New Delhi : CBS Publishers & Distributors.
18. Devlin, Robert M.;Witham, Francis H. (1986, 2003). Plant Physiology; 4th edition, Indian reprint; Delhi : CBS Publishers & Distributors.
19. Kochhar, P.L., (1964). A textbook of Plant Physiology; 7th edition; Delhi :Atma Ram & Sons.

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<b>Program: B.Sc . (2019-20)</b>				<b>Semester: V</b>	
<b>Course: Current Trends in Plant Science III</b>				<b>Course Code: USMABO504</b>	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutori al (Hour s per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 25)</b>	<b>Semester End Examinations (SEE) (Marks- 75 in Question Paper)</b>
4	4		2.5	25	75
<b>Learning Objectives:</b> Current trends in plant sciences III includes Instrumentation, Ethnobotany, Mushroom industry, Pharmacognosy, Medicinal Botany and Herbal Cosmetology. This course deals study of instruments and working principles, Plants and people relation with reference to traditional medicines and mushroom cultivation. Pharmacognosy, medicinal botany, Herbal cosmetology deal with studying the plants for their medicinal properties and applications in cosmetics					
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Know to operate the various instruments like Calorimeter & Spectrophotometer <b>CO2:</b> Exemplify the use of various chromatography techniques and its applications <b>CO3:</b> Executing the data collection methods of ethnobotany. <b>CO4:</b> Gain knowledge about the traditional medicine and its uses in various ailments and its application in research. <b>CO5:</b> Understand and outline the importance of plant antioxidant and herbs in relation to cosmetics and human health. <b>CO6:</b> Planning an entrepreneurship skill through this course					
<b>Outline of Syllabus: (per session plan)</b>					
<b>Module</b>	<b>Description</b>				<b>No of Hours</b>
<b>1</b>	Instrumentation				48mins
<b>2</b>	Ethnobotany & Mushroom industry				48mins
<b>3</b>	Pharmacognosy and medicinal botany				48mins
<b>4</b>	Herbal Cosmetology				48mins
	<b>Total</b>				<b>3hrs 12 min</b>
<b>PRACTICALS</b>					<b>3hrs 12 min</b>



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Unit	Topic	Credits 2.5
<b>Module 1</b>	<p><b>INSTRUMENTATION</b></p> <ul style="list-style-type: none"> <li>• Colorimetry and Spectrophotometry (Visible, UV and IR)- Instrumentation, working, principle and applications.</li> <li>• Chromatography: General account of Column chromatography. Principle and bedding material involved in adsorption and partition chromatography, ion exchange chromatography, molecular sieve chromatography.</li> </ul>	15 Lecture
<b>Module 2</b>	<p><b>ETHNOBOTANY AND MUSHROOM INDUSTRY</b></p> <ul style="list-style-type: none"> <li>• Ethnobotany - Definition, history, sources of data and methods of study.</li> <li>• Applications of ethnobotany <ul style="list-style-type: none"> <li>○ Ethnomedicines</li> <li>○ Agriculture</li> <li>○ Edible plants</li> <li>○ Famine related plants,</li> <li>○ Toxic plants and Antidotes.</li> </ul> </li> <li>• Traditional medicines as used by tribals in maharashtra <ul style="list-style-type: none"> <li>○ Skin ailments: <i>Rubia cordifolia</i>, <i>Curcuma</i>, Sandalwood</li> <li>○ Liver ailments : <i>Phyllanthus</i> , <i>Andrographis</i></li> <li>○ Wound healing and ageing: <i>Centella</i>, <i>Typha</i>, <i>Terminalia</i>, <i>Tridax</i></li> <li>○ Fever : <i>Vitex negundo</i>, <i>Tinospora cordifolia</i> leaves</li> <li>○ Diabetis: <i>Momordica charantia</i>, <i>Syzygium cuminii</i></li> </ul> </li> <li>• Mushroom industry: <ul style="list-style-type: none"> <li>○ Detail general account of production of mushrooms with respect to methods of Composting, spawning, casing, harvesting of mushroom. Cultivation of <i>Pleurotus</i>, <i>Agaricus</i>, <i>Volvariella</i> Mushroom to be studied in detail.</li> <li>○ General account of mushrooms: Nutritional value, picking and packaging, economic importance .</li> </ul> </li> </ul>	15 Lecture

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<b>Module 3</b>	<p><b>PHARMACOGNOSY AND MEDICINAL BOTANY</b></p> <ul style="list-style-type: none"> <li>• 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, Senna leaves, Clove buds, <i>Allium sativum</i>, <i>Acorus calamus</i> and <i>Curcuma longa</i></li> </ul>	15 Lecture
<b>Module 4</b>	<p><b>HERBAL COSMETOLOGY</b></p> <ul style="list-style-type: none"> <li>• Plant antioxidants: Free radicals, sources of free radicals, types of free radicals, antioxidant defence; Superoxide dismutase, catalase, antioxidant vitamins; vitamin C and E. Use of antioxidants in cosmetics.</li> <li>• Application of herbs in the following herbal cosmetics <ul style="list-style-type: none"> <li>○ Herbal Shampoo</li> <li>○ Herbal Hair Dye/ Herbal Hair Oil/Hair Cream/Hair Gel</li> <li>○ Herbal Face Mask</li> <li>○ Herbal Bath Oil</li> </ul> </li> <li>• Current status of Herbal Cosmetic Industry in India, Problems and Future prospects of Herbal Cosmetic Industry in India.</li> </ul>	15 Lecture

*To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester*

**PRACTICAL IV**

**INSTRUMENTATION**

- 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.

**ETHNOBOTANY AND MUSHROOM INDUSTRY**

- 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 *Agaricus*, *Pleurotus*, *Volvariella*

### **PHARMACOGNOSY**

Macroscopic/ Microscopic characters and Chemical tests for active constituents of the following plants

- *Allium sativum*
- *Acorus calamus*
- *Curcuma longa*
- *Senna angustifolia*
- *Strychnos nux-vomica*
- *Eugenia caryophyllata*

### **COSMETOLOGY**

- Estimation of vitamin C from given herb
- Study of SOD activity of the given plant material
- Study of Antioxidant activity by DPPH method
- Estimation of Total phenols by colorimetric method.

### **Suggested Readings**

1. Ruzin, S.E. (1999) Plant Microtechnique and Microscopy. Oxford University Press, USA.
2. Yolanda, M. and Hartmann, H. (2017) Light Microscopy, Methods and Protocols. Humana Press, USA.
3. Sharma. B.K., 2007. Chromatography, Goel publishing house.
4. Mukherjee P.K, (2002). Quality Control of Herbal Drugs-An approach to evaluation of Botanicals: Business Horizons Pharmaceutical Publishers, New Delhi.
5. Khandelwal KR. (2004). Practical Pharmacognosy. Nirali prakshan, 2004.
6. Anonymous, (1996) Pharmacopoeia of India, Ministry of health and family welfare, Govt. of India.
7. Trease & Evans (1996) Pharmacognosy. Sunders company ltd.
8. Wallis T.E. (1985) Textbook of Pharmacognosy. CBS PRESS.
9. Jain S.K. (1987). A manual of Ethnobotany. Sci. Publ. Jodhapur.
10. Jain S.K. & Mundal V. (1999). A hand book of Ethnobotany. Bishen Singh Mahendra Pal Singh, Dehradun.
11. Jain S.K. (1986). Ethnobotany Interdisciplinary Sci. Rev 11 (3) 285-292.
12. Jain A.K. (2016). Indian Ethnobotany: Emerging Trends. Scientific Publishers
13. Vimladevi (2019) A textbook of Herbal Cosmetology.
14. Panda H. (2005). The complete technology book on herbal beauty products and formulations and processes. Asia Pacific Business Press Inc.



**Shri Vile Parle Kelavani Mandal's  
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(AUTONOMOUS)**

*NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),  
Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of India  
Best College (2016-17), University of Mumbai*

Affiliated to the  
**UNIVERSITY OF MUMBAI**

**Program: T.Y.B.Sc Botany**

**Course: USMABO601, USMABO602, USMABO603, USMABO604**

**Semester VI**

**Choice Based Credit System (CBCS) with effect from the  
Academic year 2019-20**

### **PROGRAMME SPECIFIC OUTCOMES (PSO'S)**

On completion of the B.Sc - Botany, the learners should be enriched with knowledge and be able to-

- PSO1:** Identify different groups of Botany and appreciate Plant Biodiversity.
- PSO2:** Understand the current developments in the different areas of Botany.
- PSO3:** Analyze and apply the methodologies and techniques learnt during the course of studying Botany.
- PSO4:** Integrate the knowledge acquired in botany to solve problem, take real time decisions and innovate, while working with plants.
- PSO5:** Share social and environmental consciousness with their fellow citizens.
- PSO6:** To develop better understanding of good laboratory practices and safety.
- PSO7:** Synthesize the scientific character of observation, reasoning and apply the knowledge in designing experiments.
- PSO8:** Develop skills to pursue career in the arena related to plant sciences namely Medicinal Botany, forestry and floristic pursuits
- PSO9:** To acquire technological and analytical skills needed for industrial support services.

#### **Preamble**

As Autonomy has been granted to the college, the syllabus has been restructured. Keeping in tune with the revised syllabi of F.Y.B.Sc. and S.Y.B.Sc., the committee has taken utmost care to maintain the continuity in the flow of information of higher level at T.Y.B.Sc. Hence some of the modules of the earlier syllabus of T.Y.B.Sc. have been upgraded with the new modules in order to make the learners aware about the recent developments in various branches of Botany (like Algae, Fungi, Bryophyta, Pteridophyta, Gymnosperms, Angiosperms, Genetics, Molecular Biology, Anatomy, Physiology, Biotechnology) with an objective to raise the students awareness in interdisciplinary courses such as Biostatistics, Biophysics, Bioinformatics, Computational Biochemistry, Bioinstrumentation, Palynology, Embryology, Medicinal Botany & Cosmetology.

I am thankful to all the members of the Committee for their great efforts and for timely submission of the draft syllabus.

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**Evaluation Pattern**

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

**c) Details of Continuous Assessment (CA)**

25% of the total marks per course:

<b>Continuous Assessment</b>	<b>Details</b>	<b>Marks</b>
<b>Component 1 (CA-1)</b>	Test/Assignment	15 marks
<b>Component 2 (CA-2)</b>	Test/ Assignment	10 marks

**d) Details of Semester End Examination**

75% of the total marks per course. Duration of examination will be two and half hours.

<b>Question Number</b>	<b>Description</b>	<b>Marks</b>	<b>Total Marks</b>
Q.1	Long questions of Unit I a & b (any 1 out of 2)	c- 7 d- 8	15 Marks
Q.2	Long questions of Unit II a & b (any 1 out of 2)	c- 7 d- 8	15 Marks
Q.3	Long questions of Unit III a & b (any 1 out of 2)	c- 7 d- 8	15 Marks
Q.4	Long questions of Unit IV a & b(any 1 out of 2)	c- 7 d- 8	15 Marks
Q.5	Short notes (Unit I, II, III, & IV) (any three out of 4)	5 marks each	15 Marks
<b>Total Marks</b>			<b>75</b>

Signature

Signature

Signature

HOD

Approved by Vice –Principal

Approved by Principal

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<b>Program: B.Sc . (2019-20)</b>				<b>Semester: VI</b>	
<b>Course: Plant Diversity VII</b>				<b>Course Code: USMABO601</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutori al (Hour s per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 25)</b>	<b>Semester End Examinations (SEE) (Marks- 75 in Question Paper)</b>
4	4		2.5	25	75
<b>Learning Objectives:</b> Plant diversity is the course under T.Y.B.Sc (Botany).The learning objective of the course is to let the students understand and conceptualize the classification and life cycle of members belonging to Bryophytes, Pteridophytes and Gymnosperms. The course also offers to make students learn and understand certain applied aspects of both Bryophytes & Pteridophytes viz. their evolution, diversity, distribution, their ecology, economic importance and their use as pollution indicators. Besides, the course also caters to making the learners understand their economic importance. Practically, the learners will be studying these members from preserved and fresh material. One crucial aspect that adds to comprehensive learning about these groups of plants is through regular field visits, which reinforces classroom-learning objectives about the variety of plant groups					
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Identify the taxonomic position, occurrence and describe thallus structure and life cycle of Bryophytes. <b>CO2:</b> Classify the taxonomic position, occurrence and life cycle of Pteridophytes. <b>CO3:</b> Outline the economic importance of Bryophytes and Pteridophytes. <b>CO4:</b> Judging the Diversity, distribution and evolution of Bryophytes and Pteridophytes. <b>CO5:</b> Understand the lifecycle pattern of Gymnosperms with various examples.					
<b>Outline of Syllabus: (per session plan)</b>					
<b>Module</b>	<b>Description</b>				<b>No of Hours</b>
<b>1</b>	Bryophyta				48mins
<b>2</b>	Pteridophyta				48mins
<b>3</b>	Bryophyta and Pteridophyta: Applied aspects				48mins
<b>4</b>	Gymnosperms				48mins
	<b>Total</b>				<b>3hrs 12 min</b>
<b>PRACTICALS</b>					<b>3hrs 12 min</b>

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<b>Unit</b>	<b>Topic</b>	<b>Credits 2.5</b>
<b>Module 1</b>	<b>Bryophyta</b> <ul style="list-style-type: none"> <li>• Life cycle of <i>Marchantia</i></li> <li>• Life cycle of <i>Pellia</i></li> <li>• Life cycle of <i>Sphagnum</i></li> </ul>	15 Lecture
<b>Module 2</b>	<b>Pteridophyta</b> <ul style="list-style-type: none"> <li>• Life cycle of <i>Lycopodium</i></li> <li>• Life cycle of <i>Pteris</i> and <i>Marselia</i></li> </ul>	15 Lecture
<b>Module 3</b>	<b>Bryophytes and Pteridophytes: Applied aspects</b> <ul style="list-style-type: none"> <li>• Ecology of Bryophytes</li> <li>• Economic importance of Bryophytes</li> <li>• Bryophytes as indicators of pollution</li> <li>• Evolution of Sporophyte and Gametophyte in Bryophytes</li> <li>• Economic importance of Pteridophytes</li> <li>• Diversity and distribution of Indian Pteridophytes</li> <li>• Types of sori and evolution of sori in Pteridophytes</li> </ul>	15 Lecture
<b>Module 4</b>	<b>Gymnosperms</b> <ul style="list-style-type: none"> <li>• Life cycle of <i>Biota (Thuja)</i>, Classification</li> <li>• Life cycle of <i>Gnetum</i>, Classification</li> <li>• Life cycle of <i>Ephedra</i>, Classification</li> <li>• Economic importance of Gymnosperms</li> </ul>	15 Lecture

*To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester*



## PRACTICAL I

### **Bryophyta**

Study of stages in the life cycle of the following Bryophyta from fresh / preserved material and permanent slides

- *Marchantia*
- *Pellia*
- *Sphagnum*

### **Pteridophyta**

- Study of stages in the life cycles of the following Pteridophytes from fresh / preserved material and permanent slides
  - *Lycopodium*
  - *Pteris*
  - *Marselia*

### **Bryophytes and Pteridophytes: Applied aspects**

- Economic importance of Bryophyta
- Economic importance of Pteridophyta
- Types of sporophytes in Bryophyta (from Permanent slides)- *Riccia, Marchantia,*
  - *Pellia, Anthoceros, Sphagnum & Funaria*
- Bryophytes as indicators of pollution
- Types of sori and soral arrangement in Pteridophytes- *Ophioglossum, Osmunda, Lycopodium, Pteris, Peolpeltis, Asplenium, Nephrolepis.*

### **Gymnosperms**

- Study of stages in the life cycles of the following Gymnosperms from fresh / preserved material and permanent slides
  - *Thuja/ Biota*
  - *Gnetum*
  - *Ephedra*
- Economic importance of Gymnosperms

### **Suggested Readings**

1. Smith, Gilbert M. (1955). Cryptogamic Botany Bryophyta & Pteridophyta Volume 2; 2nd edition; McGraw-Hill book Comp. Tokyo.
2. Vasishtha B.R. & Sinha A.K. (2005). Botany for degree students: Bryophyta; S. Chand & Company Ltd, 1st edition.
3. Gangulee, Das and Dutta (2011). College Botany Volume I and II. Central Education enterprises.
4. Alain Vanderpoorten Bernard Goffinet, (2009). Introduction to Bryophytes. Cambridge University Press.
5. Matt Von Konrat (2010). Bryophytes: The closest Living Relatives of Early Land Plants, Magnolia Press.
6. Chopra R.N. (2005). Biology of Bryophytes, New Age International publication.
7. Bernard Goffin, (2010). Bryophyte Biology, Cambridge Univ. Press, 2010
8. Sharma, O.P. (2010). Diversity of Cryptogams, McGraw-Hill.

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9. Vashistha B.R. & Singh (1971). Botany for Degree students - Pteridophytes. S. Chand Publishing.
10. Sharma, O. P. (2006). Botany for Degree: Pteridophyta, S. Chand Publishing.
11. Sporne, K.R. (1962). The morphology of pteridophytes: the structure of ferns and allied plants, Hutchinson University Library.
12. Krishna Rajaram Surange (1966). Indian Fossil Pteridophytes, C.S.I.R publication
13. James W. Byng (2015). The Gymnosperms Handbook: A practical guide to extant families and genera of the world by, JSTOR.
14. Bhatnagar S.P. (2013). Gymnosperms. New age International publication.
15. Chhaya Biswas & Johri B. M., (1997). The Gymnosperms Springer-Verlag.
- 16. Chopra, G. L (1978). A Text Book of Gymnosperms. S. Nagin Publishers.**
17. Vashishtha, B.R., Vashi Sinha AK and Anil Kumar. Botany for Degree Students Part V – Gymnosperms. S. Chand Publisher.

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<b>Program: B.Sc . (2019-20)</b>				<b>Semester: VI</b>	
<b>Course: Plant Diversity VIII</b>				<b>Course Code: USMABO602</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutori al (Hour s per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 25)</b>	<b>Semester End Examinations (SEE) (Marks- 75 in Question Paper)</b>
4	4		2.5	25	75
<b>Learning Objectives:</b> Plant diversity is the course under T.Y.B.Sc (Botany). The objective of the course is to let the students learn, recognize, and interpret plant morphology in angiosperms, to contrast the morphological, floral and vegetative characteristics of angiosperms, to learn scientific terminology used for morphological characteristics, to critique historical plant classification systems and compare with current classification, to apply plant identification terminology in classification and identification. Through ecological anatomy students learn how plants have evolved many different anatomical strategies and adaptive responses to various environmental conditions that enable them to survive and function under different conditions. In embryological studies, they learn experimental plant embryology, which re-creates the course of development of plant organisms in order to reveal the functional, biochemical, and genetic nature of embryonic processes. With bio-statistical computation and applications, students strengthen their forte in gaining career opportunities in the field of bioinformatics & biostatistics and also add to their analytical skills during research.					
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Identify and describe the process of fertilization, endosperm and embryogeny with emphases on evolution <b>CO2:</b> Explain microsporogenesis and megasporogenesis and development of male and female gametophytes <b>CO3:</b> Role play of BSI and Botanical gardens with respect taxonomy <b>CO4:</b> Compare the anatomical structure of plants adapting to various ecological conditions. <b>CO5:</b> Expertise in field study by identifying the diagnostic characters of angiosperm families. <b>CO6:</b> To apply statistical analysis to biological data for testing different hypothesis.					
<b>Outline of Syllabus: (per session plan)</b>					
<b>Module</b>	<b>Description</b>				<b>No of Hours</b>
<b>1</b>	Angiosperms II				48mins
<b>2</b>	Anatomy II				48mins
<b>3</b>	Embryology				48mins
<b>4</b>	Biostatistics				48mins
	<b>Total</b>				<b>3hrs 12 min</b>
<b>PRACTICALS</b>					<b>3hrs 12 min</b>

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<b>Unit</b>	<b>Topic</b>	<b>Credits 2.5</b>
<b>Module 1</b>	<p><b><u>Angiosperms II</u></b></p> <ul style="list-style-type: none"> <li>• Major Botanic gardens of India – Indian Botanic Garden, Howrah; National Botanic Garden (NBRI) Lucknow; Lloyd Botanic Garden, Darjeeling; Lalbaugh or Mysore State Botanic Garden Bangalore</li> <li>• Botanical survey of India and regional branches of India</li> <li>• Study of following plant families               <ul style="list-style-type: none"> <li>○ Rhamnaceae</li> <li>○ Combretaceae</li> <li>○ Asclepiadaceae</li> <li>○ Labiatae</li> <li>○ Euphorbiaceae</li> <li>○ Cannaceae</li> </ul> </li> <li>• Hutchinson's classification – merits and demerits</li> </ul>	15 Lecture
<b>Module 2</b>	<p><b>Anatomy II</b></p> <ul style="list-style-type: none"> <li>• Ecological anatomy</li> <li>• Hydrophytes – submerged, floating, rooted</li> <li>• Hygrophytes - <i>Typha</i></li> <li>• Mesophytes</li> <li>• Sciophytes</li> <li>• Halophytes</li> <li>• Epiphytes</li> <li>• Xerophytes</li> </ul>	15 Lecture
<b>Module 3</b>	<p><b>Embryology</b></p> <ul style="list-style-type: none"> <li>• Microsporogenesis</li> <li>• Megasporogenesis - Development of monosporic type, examples of all embryo sacs</li> <li>• Types of ovules</li> <li>• Double fertilization</li> <li>• Development of embryo – <i>Capsella</i></li> </ul>	15 Lecture
<b>Module 4</b>	<p><b>Biostatistics</b></p> <ul style="list-style-type: none"> <li>• Test of significance student's <i>t</i>-test (paired and unpaired)</li> <li>• Regression</li> <li>• ANOVA (one way)</li> </ul>	15 Lecture

*To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester*

## PRACTICAL II

### Angiosperms

- Study of one plant from each of the following Angiosperm families
  - 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

- Study of Ecological Anatomy of
  - Hydrophytes: *Hydrilla* stem, *Nymphaea* petiole, *Eichhornia* offset
  - Epiphytes: Orchid
  - Sciophytes: *Peperomia* leaf
  - Xerophytes: *Nerium* leaf, *Opuntia* phylloclade
  - Halophytes: *Avicennia* leaf and pneumatophore, *Sesuvium* / *Sueda* leaf
  - Mesophytes: *Vinca* leaf

### Embryology

- Study of various stages of Microsporogenesis, Megasporogenesis and Embryo Development with the help of permanent slides / photomicrographs
- Mounting of Monocot (Maize) and Dicot (Castor and Gram) embryo
- In vivo growth of pollen tube in *Portulaca/Vinca*

### Biostatistics

- t-test (paired and unpaired)
- Problems based on regression analysis
- ANOVA

### Suggested Readings

1. A.K.Mondal,2005,Advanced Plant Taxonomy, New central Book Agency(P)ltd, London
- 2.
3. Carlquist, S.1961 Comparative Plant Anatomy. Holt, Rinehart and Winston N.W.
4. Eames .A.J. and MACDANIELS,L.H,1947, An Introduction to Plant

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- Anatomy, McGrawHill, N.Y and London.
5. Easu, K, 1965. Plant Anatomy. Wiley N.W
  6. Fahn, A, 1997. Plant Anatomy 4th edition, Aditya Books Pvt Ltd, New-Delhi.
  7. Metcalfe and Chalk, L 1950, Anatomy of Dicotyledons Vol. I and II Clarendon Press, Oxford
  8. Davis, G.L. 1966, Systematic Embryology of the Angiosperms, John Wiley and Sons, N.Y
  9. Erdtman, G, 1971, Pollen Morphology and Plant Taxonomy, Hafner. Publ. Co. N.Y
  10. Faegri, K & Eversen, J, 1989 Text Book of Pollen Analysis (4th edn), John Wiley & Sons, N.Y
  11. Kashinath Bhattacharya etc; 2011, A text Book of Palynology (Basic and Applied) New Central Book Agency (P) Ltd, London.
  12. Maheswari, P. An Introduction to the Embryology of Angiosperms, McGraw Hill Book Co. Inc, N.W.
  13. Nair, P.K.K. 1970, Pollen Morphology of Angiosperms, Scholar Publ. House, Lucknow.
  14. Shivanna K.R., 2003, Pollen Biology and Biotechnology-Special Indian Edition, Oxford and IBH Publ. Co Pvt. Ltd, New Delhi.
  15. Shivanna, K.R. & Johri, B.M, 1985, The Angiosperm Pollen: Structure and Function, Wiley Eastern Ltd, New delhi.
  16. Tilak, S.T, 1982, Aerobiology, Vijayanthi Prakashan, Aurangabad, India.
  17. Bhojwani S. S. and Bhatnagar S. P. (1999). The embryology of angiosperms. Vikas Pub. House.
  18. Bhojwani S.S. and Soh W.Y. (2001). Current Trends in Embryology of Angiosperms Kluwer Academic Publishers. 4.
  19. Biostatistics: A foundation For Analysis In Health Sciences ( 7th Edition 1999) Wayne W. Daniel John Wiley & Sons Inc.
  20. Fundamentals of Biostatistics (2006) Veer Bala Rastogi Ane Books India
  21. Biostatistics- The Bare Essentials (Second Edition 2000) Nosman Streiner B. C. Decker Inc.

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<b>Program: B.Sc . (2019-20)</b>				<b>Semester: VI</b>	
<b>Course: Form and Function VI</b>				<b>Course Code: USMABO603</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutori al (Hour s per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 25)</b>	<b>Semester End Examinations (SEE) (Marks- 75 in Question Paper)</b>
4	4		2.5	25	75
<b>Learning Objectives:</b> Form & Function is the course under T.Y.B.Sc (Botany). The learning objective of the course is to let the students understand the structure of biomolecules, classification and functioning of enzymes. The course offers to make students understand various metabolic processes pertaining to nitrogen metabolism and various plant hormones. The chapter of genetics in the prescribed course enables students to develop and conceptualize genetic mapping, gene mutations and metabolic disorders. In bioinformatics they learn about organization of biological data and their exploration and retrieval. Hands on training will be provided to students to estimate protein and to evaluate and understand the effect of pH, temperature and substrate variation on the activity of enzymes. Estimation of reducing sugars and nitrogen analysis in laboratory takes their understanding higher in terms of plant physiological processes. With problems in bioinformatics students learn about computational biology, which, involves the development and application of tools to make biological discoveries					
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> To apply statistical analysis to biological data for testing different hypothesis. <b>CO2:</b> Realize the industrial application of Biochemistry. <b>CO3:</b> Understand the physiological and commercial applications of various plant growth regulators. <b>CO4:</b> Integrate the use of computer to visualize, explore and model sequence analysis. <b>CO5:</b> Able to explain the major steps in multiple sequence alignment, explain the principle for, and execute pair wise sequence alignment by dynamic programming.					
<b>Outline of Syllabus: (per session plan)</b>					
<b>Module</b>	<b>Description</b>				<b>No of Hours</b>
<b>1</b>	Plant Biochemistry				48mins
<b>2</b>	Physiology II				48mins
<b>3</b>	Genetics				48mins
<b>4</b>	Bioinformatics				48mins
	<b>Total</b>				<b>3hrs 12 min</b>
<b>PRACTICALS</b>					<b>3hrs 12 min</b>

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<b>Unit</b>	<b>Topic</b>	<b>Credits 2.5</b>
<b>Module 1</b>	<p><b>PLANT BIOCHEMISTRY</b></p> <ul style="list-style-type: none"> <li>• Structure of biomolecules: Carbohydrates ( sugars, starch, cellulose, pectin, lipids ( fatty acids and glycerol), proteins ( amino acids)</li> <li>• Carbohydrate Metabolism. Structure, synthesis and degradation of Sucrose, Starch, Fructans and Cellulose.</li> </ul>	15 Lecture
<b>Module 2</b>	<p><b>PLANT PHYSIOLOGY II</b></p> <ul style="list-style-type: none"> <li>• NITROGEN METABOLISM: Nitrogen cycle, root nodule formation, and leg haemoglobin, nitrogenase activity, assimilation of nitrates, (NR , NiR activity), assimilation of ammonia,(amination and transamination reactions) , nitrogen assimilation and carbohydrate utilisation.</li> <li>• Physiological effects and commercial applications of Auxins, Gibberillins, Cytokinins and Abscisic acid</li> </ul>	15 Lecture
<b>Module 3</b>	<p><b>GENETICS</b></p> <ul style="list-style-type: none"> <li>• 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</li> <li>• Gene mutations: definition, types of mutations, causes of mutations, induced mutations, the Ame's test</li> <li>• Metabolic disorders – enzymatic and non enzymatic: Gene control of enzyme structure Garrod's hypothesis of inborn errors of metabolism, Phenyl ketone urea, albinism, sickle cell anaemia</li> </ul>	15 Lecture
<b>Module 4</b>	<p><b>BIOINFORMATICS</b></p> <ul style="list-style-type: none"> <li>• Organization of biological data, databases</li> <li>• Exploration of data bases, retrieval of desired data, BLAST.</li> <li>• Protein structure analysis and application</li> <li>• Multiple sequence analysis and phylogenetic analysis</li> </ul>	15 Lecture

*To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester*



### **PRACTICAL III**

#### **PLANT BIOCHEMISTRY**

- 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**

- Determination of alpha-amino nitrogen
- Effect of GA on seed germination
- Estimation of reducing sugars by DNSA method

#### **GENETICS**

- 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 Allium- (pDB treatment)

#### **BIOINFORMATICS**

- BLAST:nBLAST, pBLAST
- Multiple sequence alignment
- Phylogenetic analysis
- RASMOL/ SPDBV

#### **Suggested Readings**

1. Biochemistry and Molecular Biology of Plants (2000) Edt. Buchanan, Grissem and Jones, American Soc. Plant Biologists, Waldorf
2. Practical Biochemistry: Principles and Techniques, 4th Edition, Wilson K and Walker J, Cambridge University Press, Cambridge, 1994
3. Physical Biochemistry, Freifielder D, Buchanan B, Gruissem G and Jones R. (2000) Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, USA.
4. Hans-Walter Heldt Birgit Piechulla (2010) Plant Biochemistry
5. Russel P. J. (2010). iGenetics-A Molecular Approach, Pearson Education Inc.
6. Gardner E. J., Simmons M. J., Snustad D. P. (1991). Principles of Genetics, John Wiley & Sons.
7. Strickberger M.W. (2008). Genetics, Pearson (Prentice Hall).
8. Acquaah G (2007). Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd. USA.
9. Allard R. W. (1999). Principles of Plant Breeding, John Wiley and Sons.
10. Singh R. J. (2002). Plant Cytogenetics, CRC Press. Department of Botany, University of Delhi-16/
11. Hartwell L. H., Hood L., Goldberg M. L., Reynolds A. E., Silver L. M., Veres R. C. (2006). Genetics-From Genes to Genomes, McGraw Hill

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12. Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.
13. Russel, P.J. 1998. Genetics (Fifth Edition). The Benjamin/Cummings Publishing Company IND., USA.
14. Snustad, D.P and Simmons, M.J 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc., USA
15. Bioinformatics: Sequence and Genome Analysis (Second Edition 2004) David W. Mount ColdSpringHarbor Laboratory Press
16. Bioinformatics and Functional Genomics ( 2003 ) Jonathan Pevsner John Wiley & Sons Publications
17. Verma S. K. (2003). Textbook of Plant physiology and Biochemistry ; 4th editon; S. Chand & Company Ltd.
18. Bennett, T. P., and Frieden, E., (1969). Modern Topics in Biochemistry, pg. 43-45, Macmillan, London.
19. Holum, J., (1968). Elements of General and Biological Chemistry, 2nd ed., 377, Wiley, NY.
20. Harrow, B., and Mazur, A., (1958). Textbook of Biochemistry, 109, Saunders, Philadelphia (1958).
21. Pfeiffer, J., (1954). Enzymes, the Physics and Chemistry of Life, pg 171-173, Simon and Schuster, NY.
22. Introduction to Plant Physiology by Noggle and Fritz, Prentice Hall Publishers (2002)
23. Plant Physiology by Salisbury and Ross CBS Publishers
24. Plant Physiology by Taiz and ZeigerSinauer Associates Inc.Publishers,2002

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<b>Program: B.Sc . (2019-20)</b>				<b>Semester: VI</b>	
<b>Course: Current Trends in Plant Science IV</b>				<b>Course Code: USMABO604</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutori al (Hour s per week)</b>	<b>Credit</b>	<b>Continuous Assessment (CA) (Marks - 25)</b>	<b>Semester End Examinations (SEE) (Marks- 75 in Question Paper)</b>
4	4		2.5	25	75
<b>Learning Objectives:</b> “Current trends in plant sciences” is the course under T.Y.B.Sc (Botany). The learning objective of the course is to let the students understand biotechnological concepts of genomic libraries, cloning, gene transcription and hybridization. Learners will get hands on training on plasmid DNA isolation. Students also get to learn about DNA sequence analysis, PCR and DNA barcoding. The course also offers students the understanding of phytogeographical regions of India, its conservation and consequences of loss of biodiversity. In economic botany students will learn about oil extraction techniques, chromatographic separation of oil and estimation of saponification value.					
<b>Course Outcomes:</b> After completion of the course, learners would be able to: <b>CO1:</b> Experimentally perform Plasmid DNA isolation. <b>CO2:</b> Sequence the DNA sample. <b>CO3:</b> DNA barcode the plant material, which has been suggested as a useful molecular technique to complement traditional taxonomic expertise for fast species identification and biodiversity inventories, in recent times. <b>CO4:</b> Understand experimentally the concept of Thin Layer Chromatography of essential oils <b>CO5:</b> Prepare vegetation map using Garmin’s GPS instrument. <b>CO6:</b> Recognise the problem of loss of biodiversity and will be infused with social responsibility of conservation of biological resources and biodiversity for the betterment and sustainability of our environment					
<b>Outline of Syllabus: (per session plan)</b>					
<b>Module</b>	<b>Description</b>				<b>No of Hours</b>
<b>1</b>	Plant biotechnology I				48mins
<b>2</b>	Plant biotechnology II				48mins
<b>3</b>	Plant Geography				48mins
<b>4</b>	Economic Botany				48mins
	<b>Total</b>				<b>3hrs 12 min</b>
<b>PRACTICALS</b>					<b>3hrs 12 min</b>

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<b>Unit</b>	<b>Topic</b>	<b>Credits 2.5</b>
<b>Module 1</b>	<p><b>PLANT BIOTECHNOLOGY I</b></p> <ul style="list-style-type: none"> <li>• Construction of genomic DNA libraries, Chromosome libraries and c- DNA libraries.</li> <li>• Identification of specific cloned sequences in cDNA libraries and Genomic libraries</li> <li>• Analysis of genes and gene transcripts – Restriction enzyme, analysis of cloned DNA sequences.</li> <li>• Hybridization (Southern Hybridization)</li> </ul>	15 Lec
<b>Module 2</b>	<p><b>PLANT BIOTECHNOLOGY II</b></p> <ul style="list-style-type: none"> <li>• DNA sequence analysis – Maxam – Gilbert Method and Sanger's method</li> <li>• Polymerase Chain reaction</li> <li>• DNA barcoding: Basic features, nuclear genome sequence, chloroplast genome sequence, <i>rbcL</i> gene sequence, <i>matK</i> gene sequence, present status of barcoding in plants</li> </ul>	15 Lec
<b>Module 3</b>	<p><b>Plant Geography</b> Phytogeographical regions of India. Biodiversity: Definition, diversity of flora found in various forest types of India Evolution of biodiversity with one example of an evolutionary tree Levels of biodiversity Importance and status of biodiversity Loss of biodiversity Conservation of biodiversity Genetic diversity- Molecular characteristics</p>	15 Lec
<b>Module 4</b>	<p><b>Economic Botany</b> Essential Oils: Extraction, perfumes, perfume oils, oil of rose, sandalwood, patchouli, champaca, 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</p>	15 Lec

*To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester*

## PRACTICAL IV

### BIOTECHNOLOGY I

- Plasmid DNA isolation and Separation of DNA using AGE
- Restriction mapping (problems), Southern blotting

### PLANT BIOTECHNOLOGY II

- DNA sequencing (Sanger's Method)
- DNA barcoding of plant material by using suitable data

### PLANT GEOGRAPHY

- Study of phytogeographic regions of India
- Preparation of vegetation map using Garmin's GPS Instrument- Demonstration
- Problems based on Simpson's diversity Index.

### ECONOMIC BOTANY

- Demonstration : Extraction of essential oil using Clevenger
- Thin layer chromatography of essential oil of patchouli and Citronella
- Saponification value of palm oil

**Visits:** A minimum of four field excursions with at least one beyond the limits of Maharashtra for habitat studies are compulsory and record of visits should be duly certified and presented at practical examination.

### Suggested Readings

1. Molecular Biology of the Cell. By Alberts, B., Bray, D Lewis, J., Raff, M., Roberts, K and Walter 1999. Garland Publishing, Inc., New York.
2. Molecular and Cellular Biology, By Wolfe S.L 1993 Wadsworth Publishing Co., California, USA.
3. Biochemistry and Molecular Biology of Plant. By Buchanan B.B, Gruissem W. and Jones R.L 2000. American Society of Plant Physiologist, Maryland, USA.
4. Plant Cell - An Introduction. By De D.N 2000. CISRO Publication, Collingwood, Australia.
5. Principles of Cell and Molecular Biology (Second Edition). By Kleinsmith L.J and Kish V.M 1995. Happer Collins College Publishers, New York, USA.
6. Molecular Cell Biology (Fourth Edition). By Lodish H., Berk A., Zipursky, S.L Matsudaira P., Baltimore D. and Darnell J. 2000. W.H. Freeman and Company, New USA.
7. Essentials of Molecular Biology, by David Freifelder 1996. Panima Publishing Company, New Delhi.

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8. Genomes – 3 – by Brown T.A 2007 Garland Science House, New York.
9. Concepts in Molecular Biology by Rastogi V.B. Ane publication
10. Advanced Molecular Biology. By Twxman R.M 2003 (Third Reprint). Viva Books Pvt. Ltd., New Delhi.
11. Molecular Biology of Gene. By Watson J.D Etal. Forth Edition, Benjamin and Cummings Publishing Co., California.
12. Plant Biotechnology by K. Ramawat
13. DNA barcoding plants: taxonomy in a new perspective 2010. K Vijayan and C H Tsou, Current Science, 1530 – 1541.
14. Economic Botany by A F Hill, TATA McGRAW-HILL Publishing Co. Ltd.
15. College Botany Vol I and II by Gangulee Das and Dutta Central Education enterprises



Shri Vile Parle Kelavani Mandal's  
**MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE &  
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*NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),  
Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of  
India,  
Best College (2016-17), University of Mumbai*

Affiliated to the  
**UNIVERSITY OF MUMBAI**

**Program: T.Y.B.Sc Botany**

**Course: HORTICULTURE & GARDENING – I**

**HORTICULTURE & GARDENING - II**

**Semester : V & VI**

**Choice Based Credit System (CBCS) with effect from  
the Academic year 2019-20**

## **PROGRAMME SPECIFIC OUTCOMES (PSO'S)**

On completion of the B.Sc Botany, the learners should be enriched with knowledge and be able to-

**PSO1:** Identify importance of Horticulture and its need for today's world.

**PSO2:** Understand the current developments in the different areas of Horticulture.

**PSO3:** Analyze and apply the methodologies and techniques learnt during the course of horticulture.

**PSO4:** Advanced level of learning of latest horticulture techniques and acquaintance to horticulture research centers in India

**PSO5:** Apply scientific information with sensitivity to values of different cultural groups.

**PSO6:** Learn various horticulture technologies used in agriculture and serve the rural population.

**PSO7:** Be well versed with current scientific developments in the discipline and adapt to technological advancements for better application of knowledge of Horticulture.

**PSO8:** Be thorough in plant identification especially for various garden locations and its application in garden and landscape designing.

**PSO9:** Apply fundamental principles for Post harvest management and horticultural skills and to start various business entities found in the horticultural industry.

### **Preamble**

The T.Y.B.Sc. Applied component syllabus is designed to impart advanced knowledge and skills that is career oriented.

Production of fruits and vegetables have outgrown the production of food grains in our country. It is a pride to acknowledge the fact that India is the second largest producer of fruits and vegetables in the world, ranks at first in position for the production of Banana, Mango, Lime and lemon, Papaya and Okra.

This curriculum includes the basics as well as advanced level of learning plant propagation, gardening techniques, landscaping, commercial production and preservation technology. Due importance is given to Floriculture and Green house production given the fact that the climate change warrants reducing natural devastation of crop produce.

Increase in demand for horticultural produce provides tremendous scope for this subject and has lot of potential for career aspirants.

### **Evaluation Pattern**



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The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

**e) Details of Continuous Assessment (CA)**

25% of the total marks per course:

<b>Continuous Assessment</b>	<b>Details</b>	<b>Marks</b>
<b>Component 1 (CA-1)</b>	Test/Assignment	15 marks
<b>Component 2 (CA-2)</b>	Test/Assignment	10 marks

**f) Details of Semester End Examination**

75% of the total marks per course. Duration of examination will be two and half hours.

<b>Question Number</b>	<b>Sub-part</b>	<b>Description</b>	<b>Marks</b>	<b>Total Marks</b>
Q1 A)	i) to ii)	Answer any 1 out of 2 questions.	10marks	10 Marks
Q1 B)	i)	Compulsory Question.	5 marks	5 marks
Q 2 to Q 4		Same as above		
		<b>TOTAL OF 4 QUESTIONS</b>		<b>60 marks</b>
Q5)	i) to iv)	Short notes Answer 3 out of 6	05 marks	15 Marks
			<b>TOTAL</b>	<b>15 Marks</b>
			<b>NET TOTAL</b>	<b>75 Marks</b>

Signature

Signature

Signature

HOD

Approved by Vice –Principal

Approved by Principal

<b>Program: B.Sc (2019-20)</b>	<b>Semester: V</b>
<b>Course: HORTICULTURE &amp; GARDENING - I</b>	<b>Course Code: USMAACBO501</b>

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Teaching Scheme				Evaluation Scheme		
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) (Marks - 25)	Semester Examinations (SEE) (Marks- 75 Question Paper)	End in
4	4		4	25	75	

**Learning Objectives:**

To understand the importance and objectives of Horticulture and its allied fields. Study of Horticulture is very relevant and makes the student aware how to increase income with environment sustenance. Study of Horticulture can be a key to agricultural and economic diversification and improved livelihoods. Acquaintance to horticultural research institutes will lead to a scientific aptitude among students and they would be updated with the current research in the field. Application of Tissue culture practices in Horticulture. Enable the students to understand the various theoretical and practical aspects of fertilisers, manures and natural insecticides. To highlight the potential of these studies to become an entrepreneur or manage horticultural business or become a consultant.

**Course Outcomes:**

After completion of the course, learners would be able to:

- CO1:** To learn basics of Horticulture and its various branches, the research institutes which are indulged in horticultural research, social forestry for strategy plantation
- CO2:** Be aware of various propagation practices and their relevance in improving the system. Application of tissue culture in horticulture
- CO3:** Develop understanding about the concept of bio-fertilizers, Green manures and organic fertilizers identify their types and their applications.
- CO4:** Knowledge of composting methods controlling pests and diseases, irrigation practices and significance of organic farming.

**Outline of Syllabus: (per session plan)**

Module	Description	No of Hours
1	<b>INTRODUCTION TO HORTICULTURE</b>	48 mins
2	<b>PROPAGATION PRACTICES</b>	48 mins
3	<b>MANURES, FERTILIZERS AND DISEASES</b>	48 mins
4	<b>GARDEN OPERATIONS FOR HORTICULTURE</b>	48 mins
<b>TOTAL</b>		<b>3 hrs. 12 mins.</b>
<b>PRACTICALS</b>		<b>3 hrs. 12 mins.</b>

Unit	Topic	No. of Hours/Credits
Module 1	<p><b><u>INTRODUCTION TO HORTICULTURE</u></b></p> <ul style="list-style-type: none"> <li>• Definition, importance and objectives of Horticulture, branches of Horticulture, Pomology, Olericulture, Landscape Gardening, Nurseries and development</li> <li>• 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.</li> <li>• Important Horticulture Research Institutes and Government Schemes for strategy plantations               <ul style="list-style-type: none"> <li>o Konkan Krishi Vidyapeeth – Dapoli</li> <li>o National Research Centre for grapes.</li> <li>o Regional Fruit Research centre Pune</li> <li>o Horticulture Training Centre (H.T.C.) – Talegaon.</li> <li>o Central Potato Tuber Research Institute ( CPTRI) – Shimla</li> </ul> </li> <li>• Strategy plantation – Lakhibaug Yojana</li> <li>• Horticultural business, management, Entrepreneurship development and Consultancy- Horticulture as a business definition and nature, organization, planning and operation of Horticulture farm business and consultancy.</li> </ul>	15 L
Module 2	<p><b><u>PROPAGATION PRACTICES</u></b></p> <ul style="list-style-type: none"> <li>• <b>By Seeds</b> 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.</li> <li>• <b>By specialized Vegetative structures</b> Bulbs, Tubers, Corms, Rhizomes, Root stock, runners, Offsets and suckers.</li> <li>• <b>Artificial methods of plant propagation</b> o Cutting– Root cutting, Stem cuttings, and leaf cuttings. Use of PGR's for rooting.</li> </ul>	15 L

	<ul style="list-style-type: none"> <li>○ Layering – Definition, Types: Simple, compound, (Serpentine) Tip, Trench, Mound, Air Layering.</li> <li>○ Grafting-Definition, advantages and disadvantages. Types: Splice, Whip/ Tongue, side, veneer, cleft, bark, epicotyls, approach, repair grafting – enarching, bridge and bracing.</li> <li>○ Budding – Definition, advantages and disadvantages. Types: T- budding, shield, patch , ring budding.</li> <li>○ Developing new varieties: Technique of Emasculation and bagging, role of polyploidy n production of seedless varieties in plants.</li> <li>• <b>Application of Tissue Culture in relation to Horticulture.</b></li> </ul>	
<p><b>Module 3</b></p>	<p><b><u>MANURES, FERTILIZERS AND DISEASES</u></b></p> <ul style="list-style-type: none"> <li>• <b>Manures:</b> Definition, importance, important manures FYM(compost), oil cakes, green manure, organic manures and vermicompost.</li> <li>• <b>Fertilizers:</b> Definition, Types – Straight, Compound and mixed. Nitrogenous (NH<sub>4</sub> )<sub>2</sub> SO<sub>4</sub>, Urea, Ca (NO<sub>3</sub>)<sub>2</sub>, NH<sub>4</sub>Cl, Phosphatic (Superphosphate, Bone meal), Potassic (Muriate of potash, K<sub>2</sub>SO<sub>4</sub></li> <li>• <b>Biofertilizers:</b> Bacteria, Cyanobacteria, Mycorrhiza, Sea weeds.</li> <li>• <b>Diseases:</b> Horticultural plant diseases and their control. Fungal diseases- Rust, Smut, Powdery mildew. Bacterial – Citrus canker, Bacterial wilt. Viral – TMV, Leaf curl.</li> <li>• <b>Pests</b> – common pests on horticultural crops – Aphids, beetle, stem borer, caterpillars and rats.</li> <li>• <b>Friends of farmers:</b> Earthworm, snakes and predaceous fungi.</li> </ul>	<p style="text-align: center;"><b>15 L</b></p>
<p><b>Module 4</b></p>	<p><b><u>GARDEN OPERATIONS FOR HORTICULTURE</u></b></p> <ul style="list-style-type: none"> <li>• Selection of site, Preparation of soils for garden</li> <li>• Soil manipulation for plantation of desirable varieties</li> <li>• Mulching, top- dressing, blanching</li> <li>• Sowing, transplanting, tree transplanting,</li> <li>• Irrigation, - Overhead, Surface, Underground</li> <li>• Weeding and pruning, - Principles, Objectives and general technique.</li> </ul>	<p style="text-align: center;">15 L</p>

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	<ul style="list-style-type: none"> <li>• Water management and conservation through horticulture, Dry land Horticulture.</li> <li>• <b>Organic Farming</b> Definition, Scope, Indian scenario, Future scope</li> </ul>	
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*To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester*

### **PRACTICALS**

<b>Semester V</b>	
Sr.No	<b>PRACTICAL - HORTICULTURE AND GARDENING –I Credits – 2</b>
1.	Garden implements and their uses .
2.	Different types of pots & Potting medium , Potting and repotting
3.	Propagation practices by seed, Vegetative propagation , cutting ,layering , budding, grafting .
4.	Identification of : Fertilizers – Identification by physical and chemical methods –Urea , Ammonium sulphate , Potassium sulphate, super phosphate . Manures – Identification of plants as green manure – <i>Glyricidia , Crotonaria, Leucaena</i> . Biofertilizers – Identification (material as slides) VAM, <i>Nostoc ,Rhizobium</i> .
5.	Soil pH, Use of soil testing Kit, electrical conductivity, pH of water, liquid fertilizers
6.	Diseases and pests Fungal – Powdery mildew ,Rust ,Wilt, Blight, Smut, Bacterial – Canker ,Wilt Viral – Leaf curl ,yellow vein Mosaic Insects – Sucking, Biting, Chewing, Borers & Ants . Non Insects pests- Nematodes, Rodents.
7.	Preparation of natural insecticides – Neem arka , Dashparni arka, Seetaphal powder, Tobacco extracts .
8.	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.

**Suggested Readings**

1. Plant Propagation by MK Sadhu
2. Floriculture in India by G. S. Randhawa. A. Mukhopadhyay
3. Complete Gardening In India by K. S. Gopaldaswamiengar
4. Principles of Horticulture by Prasad & Kumar
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<b>Program: B.Sc (2019-20)</b>				<b>Semester: VI</b>		
<b>Course: HORTICULTURE &amp; GARDENING - II</b>				<b>Course Code: USMAACBO601</b>		
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>		
<b>Lecture</b> (Hours per week)	<b>Practical</b> (Hours per week)	<b>Tutorial</b> (Hours per week)	<b>Credit</b>	<b>Continuous Assessment (CA)</b> (Marks - 25)	<b>Semester Examinations (SEE)</b> (Marks- 75 Question Paper)	<b>End in</b>
4	4		4	25	75	
<b>Learning Objectives:</b>						
<ul style="list-style-type: none"> <li>• To impart students a systematic approach to basic and applied aspects of food processing and technology.</li> <li>• Learn to design a garden, cultivate economically important flowers, marketing aspects and florist business management.</li> <li>• Enable them to manage plantations, handle harvesting produce, impart knowledge of latest food preservation technologies and increase market value and shelf life of horticultural produce.</li> </ul>						
<b>Course Outcomes:</b>						
After completion of the course, learners would be able to:						
<b>CO1:</b> The curriculum imparts complete knowledge of horticulture plantations, harvest management, preservation technology, marketing and high-tech horticultural production.						
<b>CO2:</b> Learn Floriculture, to facilitate students for taking up and shaping a successful career in Horticulture.						
<b>CO3:</b> Become an entrepreneur or manage horticultural produce.						
<b>CO4:</b> Learn about post harvest technology and take up jobs in booming FMCG sector .						
<b>Outline of Syllabus: (per session plan)</b>						
<b>Module</b>	<b>Description</b>					<b>No of Hours</b>
1	LANDSCAPE GARDENING					48 mins
2	HORTICULTURE PRODUCE					48 mins
3	COMMERCIAL PRODUCTION					48 mins
4	POST HARVEST TECHNOLOGY					48 mins
<b>TOTAL</b>						<b>3 hrs. 12 mins.</b>
<b>PRACTICALS</b>						<b>3 hrs. 12 mins.</b>

Unit	Topic	No. of Hours/ 2 Credits
Module 1	<p><b><u>LANDSCAPE GARDENING</u></b></p> <ul style="list-style-type: none"> <li>• Principles of landscaping &amp; garden design.</li> <li>• Indoor plants &amp; Indoor gardens- Hydroponics, Terrarium/ Bottle garden, Dish garden, Bonsai.</li> <li>• Important garden features- Paths &amp; Avenues, Hedges &amp; Edges, Lawn, Flowerbeds, Arches &amp; Pergolas, Fencing, Water bodies, Rock garden &amp; Plants suitable for different locations &amp; climates.</li> <li>• Lawn- Purpose of preparation of lawn, Method of preparation of lawn &amp; management of lawn &amp; lawn plants.</li> <li>• Mughal, Buddhist, Botanical garden, English and Japanese garden, Vertical wall garden &amp; Theme park</li> <li>• Important Gardens of India—Shalimar (Shrinagar),</li> <li>• Vrindavan( Mysore), Kamala Nehru park &amp; Sagar Upavan (BPT Garden)- Mumbai.</li> </ul>	15L
Module 2	<p><b>HORTICULTURE PRODUCE</b></p> <p>•<b>High –tech Horticultural production-</b> Green house technology- Meaning, types, layout &amp; construction, irrigation systems. Care &amp; attention. Hardening of plants. Space gardens.</p> <p>•<b>Floriculture</b> – Scope &amp; importance, soil and climatic requirement and cultivation practices and Economics of green house production of Gerbera, Carnation, Roses, Orchids.</p> <p>Propagation techniques, packing and marketing, enhancing and delaying period of bloom by special methods. Floral decoration (Indian, Western and Japanese), Dry flower arrangement, Florist shop management.</p>	15L



<p><b>Module 3</b></p>	<p><b>COMMERCIAL PRODUCTION</b></p> <ul style="list-style-type: none"> <li>• <b>Commercial production of the following</b> – in relation to propagation, post plantation care, harvesting, post harvest management &amp; varieties. <ul style="list-style-type: none"> <li>○ Tubers- potato</li> <li>○ Vegetables- Tomato</li> <li>○ Fruits- Mango &amp; Grapes.</li> <li>○ Spices/condiments- chilly</li> <li>○ Medicinal plants- <i>Aloe vera</i>, <i>Stevia rebaurdina</i>(Madura)</li> <li>○ Aromatic plant- <i>Rose</i> &amp; <i>Jasmine</i>.</li> </ul> </li> </ul>	<p style="text-align: center;"><b>15L</b></p>
<p><b>Module 4</b></p>	<p><b>POST HARVEST TECHNOLOGY &amp; ENTREPRENEURSHIP IN HORTICULTURE</b></p> <ul style="list-style-type: none"> <li>• Maturity- Factors responsible for maturity &amp; ripening methods used for delaying ripening.</li> <li>• Harvest- Time of harvest, harvesting and handling of harvested products</li> <li>• Storage of Plant Produce-</li> <li>• Fresh produce</li> <li>• Preservation of Fruits and Vegetables - <ul style="list-style-type: none"> <li>○ Drying (Dehydration)- (Natural conditions – Sun drying; Artificial drying- hot air drying, Vacuum drying, Osmotically dried fruits, Crystallized or Candied fruits, Fruit Leather, Freeze Drying)</li> <li>○ Freezing (Cold air blast system , Liquid immersion method, Platefreezers, Cryogenic Freezing, Dehydrofreezing, Freeze drying),</li> <li>○ Canning Pickling (in brine, in vinegar, Indian pickles)</li> <li>○ Sugar Concentrates (Jams, Jellies, Fruit juices)</li> </ul> </li> <li>• Marketing- grading, packing &amp; transportation. Ways of increasing the market value and shelf life of horticultural produce</li> </ul>	<p style="text-align: center;"><b>15L</b></p>

*To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester*

### PRACTICALS

Semester VI		
Sr.No	PRACTICAL- HORTICULTURE AND GARDENING –II	Credits 2
1.	Preparation of garden layout.	
2.	List of plants suitable for garden locations- 2-3 plants for each location.	
3.	Identification of important horticultural plants <ol style="list-style-type: none"> <li>1. Herbs – foliage any 2 and flowering any 2</li> <li>2. Shrubs – foliage any 2 flowering any 2</li> <li>3. Trees – foliage any 2 and flowering any 2</li> <li>4. Climbers – any 2</li> <li>5. Lianas – any 2</li> <li>6. Epiphytes – any 2</li> <li>7. Creepers –any 2</li> <li>8. Trailers – any 2</li> <li>9. Aquatic plants – any 3 (preferably various habitat)</li> <li>10. Succulents – any 2</li> <li>11. Weeds –any 10</li> </ol>	
4.	Flower arrangements –Indian (Gajara, veni, garland, bouquet - Baskets, hand, torch type, table floral arrangement), Japanese and western, Dry flower arrangement.	
5.	Method of preparing bonsai, Bottle Garden / Terrarium, Hanging baskets, Dish garden .	
6.	Preparation of Jams, Jellies, Squashes/ Syrups, Pickle, sauces	
7.	Fruit carving, vegetable carving & Bio-jewelery	
8.	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> .	

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

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