

**CIRCULAR:-**

Attention of the  
Departments and Director  
invited to the syllabus up.  
Council at its meeting held

Copy to :-

1. The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),
2. The Deputy Registrar, College Affiliations & Development Department (CAD),
3. The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),
4. The Deputy Registrar, Research Administration & Promotion Cell (RAPC),
5. The Deputy Registrar, Executive Authorities Section (EA),
6. The Deputy Registrar, PRO, Fort, (Publication Section),
7. The Deputy Registrar, (Special Cell),
8. The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,
9. The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,

They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.

1. P.A to Hon'ble Vice-Chancellor,
2. P.A Pro-Vice-Chancellor,
3. P.A to Registrar,
4. All Deans of all Faculties,
5. P.A to Finance & Account Officers, (F.& A.O),
6. P.A to Director, Board of Examinations and Evaluation,
7. P.A to Director, Innovation, Incubation and Linkages,
8. P.A to Director, Board of Lifelong Learning and Extension (BLLE),
9. The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,
10. The Director of Board of Student Development,
11. The Director, Department of Students Welfare (DSD),
12. All Deputy Registrar, Examination House,
13. The Deputy Registrars, Finance & Accounts Section,
14. The Assistant Registrar, Administrative sub-Campus Thane,
15. The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,
16. The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,
17. The Assistant Registrar, Constituent Colleges Unit,
18. BUCTU,
19. The Receptionist,
20. The Telephone Operator,
21. The Secretary MUASA

for information.

AC \_\_\_\_\_

Item No. \_\_\_\_\_

# UNIVERSITY OF MUMBAI



**Program : M.Sc.**

**Course : Botany**

## **Syllabus for Semester I and II**

(Choice Based Credit System with effect from the Academic year 2020-21)

Cover Page

*Asant*  
**Head Department of Botany**  
Government of Maharashtra's  
Ismail Yusuf College of  
Arts, Science & Commerce,  
Jogeshwari (East), Mumbai - 400 060.

AC \_\_\_\_\_  
Item No. \_\_\_\_\_

**UNIVERSITY OF MUMBAI**



**Syllabus for Approval**

Sr. No.	Heading	Particulars
1	Title of the Course	M.Sc. Botany
2	Eligibility for Admission	B.Sc. Botany
3	Passing Marks	
4	Ordinances / Regulations ( if any)	
5	No. of Years / Semesters	Semester I & Semester II
6	Level	P.G. ( Strike out which is not applicable)
7	Pattern	Semester ( Strike out which is not applicable)
8	Status	New ( Strike out which is not applicable)
9	To be implemented from Academic Year	From Academic Year 2020-2021

Date:

Signature :

Name of BOS Chairman / : Dr Rajendra D. Shinde


*Rajendra D. Shinde*  
Chairman, BOS, Botany

**PROGRAMME SPECIFIC OUTCOMES FOR MSc BOTANY**  
 AT THE END OF **SEMESTER I AND II** THE STUDENTS WOULD HAVE ACQUIRED THE  
 FOLLOWING SKILLS:

1. Students will be able to identify the major groups of organisms amongst plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of Cryptogams and Phanerogams that differentiate them from each other and from other forms of life.
2. Students will be able to explain how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and behaviour of different forms of life.
3. Students will be able to explicate the ecological interconnectedness of life on earth by studying ecological principles and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems.
4. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and life history.
5. Students will be able to carry out a thorough study of the active constituents of medicinal plants with an emphasis on the use of plant based food as medicine.
6. Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for understanding the above.

**COURSE OUTCOMES**

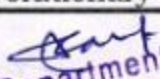
COURSE CODE	TITLE AND LEARNING OUTCOMES
PSBO101	<p style="text-align: center;"><b>Plant Diversity-Cryptogams I (Algae and Fungi)</b></p> <p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• Classify algae into various groups, understand the importance in various fields and will be able to collect and identify them</li> <li>• Classify fungi into various groups, understand the role of fungi in various fields and will be able to collect and identify fungi, fungal pathogens and culture them.</li> </ul>
PSBO102	<p style="text-align: center;"><b>Plant Diversity – Spermatophyta I (Gymnosperms and Angiosperms)</b></p> <p>Learning outcomes:                      The students will be able to differentiate between gymnosperms and angiosperms, study their origin and nomenclature, understand evolutionary theories for origin of Angiosperms, understand characteristics of selected Angiosperm families and learn the rules governing the code of botanical nomenclature, also learn the recent developments as in molecular systematics.</p>
PSBO103	<p style="text-align: center;"><b>Plant Physiology</b></p> <p>Students should be able to understand how to apply the basic concepts of Plant Physiology in other fields and also to know and</p>

  
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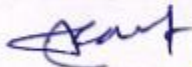
	discuss the concept of physiological processes of plants.
<b>PSBO104</b>	<b>Cytogenetics, Molecular Biology and Biotechnology</b> Students will be able to understand the control points in a cell cycle, Study and apply principles of microbial genetics, understand recombinant DNA technology and study applications of the same for the improvement of crops.
<b>PSBO201</b>	<b>Plant Diversity- Cryptogams II (Bryophyta and Pteridophyta)</b> The student will be able to: Classify Bryophytes into various groups, study their importance Classify Pteridophytes into various groups, study their importance and multiplication of important ferns
<b>PSBO202</b>	<b>Plant Diversity: Spermatophyta II (Anatomy, Developmental Botany and Palynology)</b> Students will be able to understand the development of pollen, spore, fertilization and to apply palynological information to plant systematics
<b>PSBO203</b>	<b>Plant Physiology and Environmental Botany</b> The students should be able to: • Distinguish key physiological processes underlying the seed germination • Identify the physiological factors that regulate growth and developmental processes of plants • Demonstrate clear understanding of crop-environment interaction and its implication on crop growth and yield • Integrate and apply their knowledge of crop physiology for analytical thinking and solving practical problems experienced in agricultural systems To understand and apply ecological principles and understand legislation and measures to solve environmental problems.
<b>PSBO204</b>	<b>MEDICINAL BOTANY AND DIETETICS</b> Students will be able to identify medicinal plants and understand the effects of plant chemical constituents on humans and the use of plants in Dietetics and as nutraceuticals.

### COURSE OUTCOMES

<b>COURSE CODE</b>	<b>TITLE AND LEARNING OUTCOMES</b>
<b>PSBO101</b>	<b>Plant Diversity-Cryptogams I (Algae and Fungi)</b> The students will be able to: • Classify algae into various groups, understand the importance in various fields and will be able to collect and identify them • Classify fungi into various groups, understand the role of fungi in various fields and will be able to collect and identify fungi, fungal pathogens and culture them.
<b>PSBO102</b>	<b>Plant Diversity - Spermatophyta I (Gymnosperms and Angiosperms)</b> Learning outcomes: The students will be able to differentiate between gymnosperms and angiosperms , study their origin and nomenclature, understand evolutionary theories for origin of Angiosperms, understand

  
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	characteristics of selected Angiosperm families and learn the rules governing the code of botanical nomenclature, also learn the recent developments as in molecular systematics.
<b>PSBO103</b>	<b>Plant Physiology</b> Students should be able to understand how to apply the basic concepts of Plant Physiology in other fields and also to know and discuss the concept of physiological processes of plants.
<b>PSBO104</b>	<b>Cytogenetics, Molecular Biology and Biotechnology</b> Students will be able to understand the control points in a cell cycle, Study and apply principles of microbial genetics, understand recombinant DNA technology and study applications of the same for the improvement of crops.
<b>PSBO201</b>	<b>Plant Diversity- Cryptogams II (Bryophyta and Pteridophyta)</b> The student will be able to: Classify Bryophytes into various groups, study their importance Classify Pteridophytes into various groups, study their importance and multiplication of important ferns
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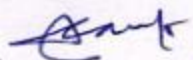
**SYLLABUS MSc I BOTANY  
SEMESTER I 2020-21**

Course Code	TOPIC HEADINGS	Credits	L / Week
PSBO101	Plant Diversity :Cryptogams I ( Algae and Fungi)	4	
UNIT I	Algae		1
UNIT II	Applied Phycology		1
UNIT III	Fungi		1
UNIT IV	Plant Pathology		1
PSBOP101	Practical based on the course : Plant Diversity :Cryptogams I ( Algae and Fungi)	2	

  
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Course Code	Topic	Credits: 4
PSBO101	<b>Plant Diversity-Cryptogams I (Algae and Fungi)</b>	
<b>UNIT 1</b>	<b>Algae</b> <ul style="list-style-type: none"> <li>• Classification of Algae up to orders, according to the system proposed by G.M Smith.</li> <li>• General account of the chloroplasts and chromatophores in different groups of algae</li> <li>• Asexual and Sexual spore bearing structures in various groups of algae</li> <li>• Life cycle of <i>Scytonema</i>, <i>Nitella</i>, <i>Padina</i> and <i>Dictyota</i>.</li> <li>• <i>Diversity and distribution of marine algae in Maharashtra.</i></li> </ul>	1
<b>UNIT 2</b>	<b>Applied Phycology</b> <ul style="list-style-type: none"> <li>• Culturing of algae and preservation</li> <li>• Contributions of Eminent Algologists in India: M. O. P. Iyengar and T. V. Desikachary.</li> <li>• Economic importance of algae with reference to : Food, Agriculture - Fodder, Biofuel, Biofertilizers, Industry: Agar agar, Medicine, Sewage disposal, Water pollution, Energy production.</li> <li>• Cultivation of algae with special reference to <i>Chlorella</i> and <i>Spirulina</i></li> </ul>	1
<b>UNIT 3</b>	<b>Fungi</b> <ul style="list-style-type: none"> <li>• Classification of fungi up to orders, according to the system proposed by Alexopoulos (1962).</li> <li>• General account of vegetative structure of unicellular and multicellular Mycelia, Septa, Hyphal modifications in various groups of fungi</li> <li>• General account of spore bearing organs and their arrangements in various groups of fungi.</li> <li>• Spore release and dispersal - with special reference to Basidiomycotina, Deuteromycotina</li> <li>• Life cycle of <i>Stemonitis</i>, <i>Phytophthora</i> and</li> </ul>	1

  
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	<p><i>Peziza</i>.</p> <ul style="list-style-type: none"> <li>• Mycorrhiza: type, distribution and significance with reference to agriculture and forestry</li> </ul>	
<b>UNIT 4</b>	<p><b>Plant Pathology</b></p> <ul style="list-style-type: none"> <li>• Integrated management of diseases</li> <li>• Study of the following diseases with reference to occurrence, symptoms, causal organism, disease cycle, predisposing factors and control measures of the following diseases: <ul style="list-style-type: none"> <li>a. Red rot of Sugarcane (<i>Colletotrichum falcatum</i>)</li> <li>b. Blast of Rice (<i>Pyricularia oryzae</i>)</li> <li>c. Wilt of Arhar/ Tur (<i>Fusarium oxysporum</i>)</li> <li>d. Green ear of Bajra (<i>Sclerospora graminicola</i>)</li> <li>e. Angular leaf spot of Cotton (<i>Xanthomonas axonopodis</i>)</li> </ul> </li> </ul>	1
<p>Learning outcomes: The students will be able to:</p> <ul style="list-style-type: none"> <li>• Classify algae into various groups, understand the importance in various fields and will be able to collect and identify them</li> <li>• Classify fungi into various groups, understand the role of fungi in various fields and will be able to collect and identify fungi, fungal pathogens and culture them.</li> </ul>		

<b>PSBOP101</b>	<b>Plant Diversity :Cryptogams I ( Algae and Fungi)</b>	<b>2</b>
<ul style="list-style-type: none"> <li>• Study of following type with reference to their systematic position, thallus and reproductive structures: <i>Scytonema</i>, <i>Lyngbya</i>, <i>Anabaena</i>, <i>Volvox</i>, <i>Scenedesmus</i>, <i>Ulothrix</i>, <i>Enteromorpha</i>, <i>Pithophora</i>, <i>Closterium</i>, <i>Nitella</i>, <i>Padina</i>, <i>Gracilaria</i> and <i>Dictyota</i>.</li> <li>• Extraction of algal pigments and their separation by paper chromatography.</li> <li>• Culturing of <i>Chlorella</i> and <i>Spirulina</i> algae</li> <li>• Culturing of <i>Penicillium</i> by streak method</li> <li>• Study of the following types with reference to their systematic position, thallus and reproductive structures: <i>Stemonitis</i>, <i>Saprolegnia</i>, <i>Phytophthora</i>, <i>Penicillium</i>, <i>Peziza</i>, <i>Polyporus</i>, <i>Daedalea</i>, <i>Fusarium</i> and <i>Trichoderma</i>.</li> <li>• Study of the disease mentioned in the syllabus (theory) with reference to the symptoms, Causal organisms, Disease cycle and Control measures.</li> </ul>		

  
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 Dr. Yusuf Chaudhary  
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 Jogeshwar (East), Mumbai - 400040.

**M. Sc. Sem I (Practical) Examination**  
**(09.00 AM to 2.00 PM)**  
**BOTANY-PRACTICAL-I PSBOP101**  
**[Plant Diversity – Cryptogams I (Algae and Fungi)]**

**Skeleton Question Paper**

**Time: 9.00 am To 2.00 pm**

**Max. Marks: 50**

- 1) Candidates should show their slides/ preparations/ results for all questions to the examiner.
- 2) Use of logarithm tables / simple calculator is allowed.

- Q. 1. Identify, classify and describe the morphological / reproductive structures observed in specimens **A, B, C and D** (20)
- Q.2. Identify any three algae in the given mixture **E** (06)
- Q.3. Separate the algal pigments by paper chromatography from the given sample **F** (05)
- Q.4. Identify and describe slides/ specimen **G, H and I** (09)
- Q.5. Journal (05)
- Q.6. *Viva-voce* (05)

.....  
**KEY**

**A and B** :(*Scytonema, Lyngbya, Anabaena, Volvox, Scenedesmus, Ulothrix, Enteromorpha, Pithophora, Closterium, Nitella, Padina, Gracilaria and Dictyota.*)

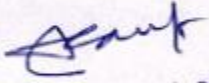
**C and D** *Stemonitis, Saprolegnia, Phytophthora, Penicillium, Peziza, Polyporus, Daedalea, Fusarium and Trichoderma*

**E** Mixture of six algae

**F** Separation of algal pigments by paper chromatography

**G, H, I** Red rot of sugar cane/ Blast of rice/ Wilt of tur or arhar/Green ear of bajra/ Angular leaf spot of cotton/ algae and fungi other than given above

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Course Code	Title	Credits
PSBO102	<b>Plant Diversity – Spermatophyta I (Gymnosperms and Angiosperms)</b>	4
	<b>Unit I: Gymnosperms I</b> 1. <b>Classification</b> of Gymnosperms up to orders according to the system proposed by C. J. Chamberlain. 2. Characters of Gymnosperms which resemble and differ from Pteridophytes, Angiosperms. 3. General characters; affinities and interrelationships of Cycadofilicales, Bennettitales, Cordaitales and Ginkgoales. 4. Life cycle of <i>Zamia</i> and <i>Araucaria</i>	1
	<b>Unit II: Origin of Angiosperms</b> 1. <b>Nature of probable ancestors of angiosperms</b> ➤ Isoetes monocotyledon theory ➤ Coniferales amentiferae theory ➤ Gnetales angiosperm theory ➤ Bennettitalean theory ➤ Caytonialean theory ➤ Pentoxylales theory 2. <b>Primitive and advanced character in angiosperms.</b>	1
	<b>Unit : III Angiosperms I</b> 1. Study of following families with reference to its systematic position, distribution, floral formula, floral diagram, affinities, morphological peculiarities, economically important plants and their uses. Menispermaceae, Brassicaceae, Tiliaceae, Portulacaceae, Sterculiaceae, Rutaceae, Celastraceae, Sapindaceae, Crassulaceae, Lythraceae, Gentianaceae, Boraginaceae, Chenopodiaceae, Cyperaceae.	1
	<b>Unit : IV Angiosperms II</b> 1. <b>International Code of Nomenclature for Algae, Fungi and Plants (I.C.N.)</b> Principles and Rules and recommendation. 2 <b>Systems of classification</b> a. Introduction to Artificial, Natural and Phylogenetic System of classification b. Bentham and Hooker's system of classification up to orders c. Introduction to A. P. G. systems. 3 <b>Taxonomy as synthetic branch-</b> Introduction, type function values of taxonomic characters- numerical taxonomy, Molecular systematics.	1
<b>Learning outcomes:</b> The students will be able to differentiate between gymnosperms and angiosperms , study their origin and nomenclature, understand evolutionary theories for origin of Angiosperms, understand characteristics of selected Angiosperm families and learn the rules governing the code of botanical nomenclature, also learn the recent developments as in molecular systematics.		

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PSBOP102	Plant Diversity - Spermatophyta I (Gymnosperms and Angiosperms)	2
<p><b>Gymnosperms:</b> A study of following types</p> <ul style="list-style-type: none"> <li>• <i>Cycadeoidea</i>(Fossil)</li> <li>• <i>Williamsonia</i> (Fossil)</li> <li>• <i>Zamia</i></li> <li>• <i>Cupressus</i></li> <li>• <i>Araucaria</i></li> <li>• <i>Podocarpus</i></li> </ul>		
<p><b>Angiosperms:</b></p> <ul style="list-style-type: none"> <li>• A study of the angiosperm families mentioned in theory with reference to their morphological peculiarities and economic importance of its members.</li> <li>• Identification of genus and species with the help of flora (In addition to the above mentioned families, all families studied in undergraduate classes are included)</li> </ul>		

  
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University of Mumbai

M. Sc. Sem I (Practical) EXAMINATION

BOTANY-PRACTICAL-II PSBOP102

[Plant Diversity -Spermatophyta I (Gymnosperms & Angiosperms)]

Time: 9.00 am To 2.00 pm

Max. Marks: 50

Skeleton Question Paper

N.B.

Candidates should show their slides/ preparations/ results for all questions to the examiner.

- Q1** Identify, classify and describe specimen **A**. (06)
- Q2(a)** Assign specimens **B** and **C** to their respective families giving reasons. Draw the floral diagram and give the floral formulae. Sketch and label the L.S. of the flower and T.S. of ovary. (18)
- (b)** With the help of flora, identify the genus and species of specimen **D** (05)
- Q3(a)** Describe the morphological peculiarities of specimen **E** (05)
- (b)** Give the economic importance of specimen **F** (03)
- Q4** Identify and describe specimen/slide **G** (03)
- Q5** Journal (05)
- Q6** Field Report (05)
- 

**KEY**

**A** *Zamia*, *Cupressus*, *Araucaria* and *Podocarpus* - stem, male cone, female cone

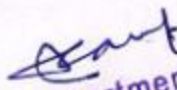
**B and C** Menispermaceae, Brassicaceae, Tiliaceae, Portulacaceae, Sterculiaceae, Rutaceae, Celastraceae, Sapindaceae, Crassulaceae, Lythraceae, Gentianaceae, Boraginaceae, Chenopodiaceae, Cyperaceae.

**D** Flora- Any plant from FYBSc to MSc families can be given.

**E** Any plant from FYBSc to MSc families can be given.

**F** Any part of the plant from MSc part I families can be given

**G** Fossil

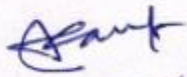
  
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**SEMESTER I**  
**Paper III**

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
PSBO103	Title of the Paper: Plant Physiology			
	I	Photosynthesis I	4	1
	II	Photosynthesis II		1
	III	Proteins		1
	IV	Plant Hormones		1

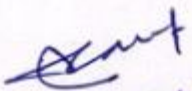
**Detailed Syllabus**

Course Code	Title: Plant Physiology	Credits
PSBO103		4
<b>Unit I: Photosynthesis I (Eukaryotes)</b> 1. ATP synthesis in chloroplasts (chemiosmotic hypothesis) 2. Regulation of C <sub>3</sub> , C <sub>4</sub> and CAM pathways of photosynthesis: <b>C<sub>3</sub> plants:</b> Role of light, regulation of RUBISCO <b>C<sub>4</sub> plants:</b> Role of light, regulation of PEPcase, transport of metabolites, carbonic anhydrase, NADP-MDH and PPDK Regulation of CAM through transport of metabolites. 3. <b>Pentose Phosphate Pathway</b> and its importance, effect of glucose-6-phosphate dehydrogenase deficiency.		1
<b>Unit II: Photosynthesis II (Prokaryotes)</b> <b>Photosynthesis of prokaryotes:</b> Classification of photosynthetic bacteria, Pigment systems, CO <sub>2</sub> fixation in bacteria and cyanobacteria, Structure and mechanism of light harvesting complex, Reductive TCA cycle.		1
<b>Unit : III Proteins</b> Primary, secondary, tertiary and quaternary structural features and their analysis – Theoretical and experimental; protein folding – biophysical and cellular aspects, Role of chaperons in protein folding.		1
<b>Unit : IV Plant Growth Regulators</b> Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid, Brassinosteroids and Jasmonic acid; Biosynthesis, storage, breakdown, transport and their physiological responses.		1
Learning outcomes: Students should be able to understand how to apply the basic concepts of Plant Physiology in other fields and also to know and discuss the concept of physiological processes of plants.		

  
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### Practical

PSBOP103	Plant Physiology	2	4
<b>Major experiments</b>			
<ol style="list-style-type: none"><li>1. Enzyme kinetics: Determination of <math>K_m</math> and <math>V_{max}</math> of the enzyme amylase (purified amylase).</li><li>2. Extraction of cellulase from a suitable fungal culture and study of enzyme activity by DNSA method.</li><li>3. Immobilisation of yeast cells and study of invertase activity.</li><li>4. Quantitative study of diurnal fluctuation in Titratable Acid Number (TAN) in a CAM plant.</li><li>5. Extraction and estimation of GOT and GPT from suitable plant material.</li><li>6. Determine the Chl a/Chl b ratio in <math>C_3</math> &amp; <math>C_4</math> plants.</li></ol>			
<b>Minor experiment</b>			
<ol style="list-style-type: none"><li>1. Separation of organic acids by paper chromatography.</li><li>2. Separation of sugars by paper chromatography.</li><li>3. A study of the enzyme polyphenol oxidase, from potato peels.</li><li>4. Solvent extraction of chlorophyll a/b, xanthophylls and study of absorption pattern.</li><li>5. Estimation of the total nitrogen content of a plant using Kjeldahl's method.</li></ol>			

  
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**University of Mumbai**  
**M. Sc. Botany (Semester-I) Practical Examination**  
**Skeleton Question Paper**  
**Plant Physiology PSBOP103**  
**Practical - III**

**Time: 9.00 am To 2.00 pm**

**Max. Marks: 50**

N. B. 1) Candidates should show their slides/preparations/results for all questions to the examiners.

2) Use of **logarithm tables**/simple **calculator** is **allowed**.

- Q.1** Perform the given experiments **A & B (major)** and analyze the results. **(30)**
- Q.2** Perform the given experiment **C (minor)** and analyze the results. **(10)**
- Q.3** Journal **(05)**
- Q.4** *Viva-voce* **(05)**
- \*\*\*\*\*

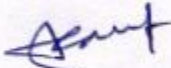
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Jogeshwari (East), Mumbai - 400 030.

MSc Sem 1 Paper IV Theory

Course Code	Title	Credits
PSBO104	<b>Cytogenetics, Molecular Biology and Biotechnology</b>	4
<p><b>Unit I: Cytogenetics Cell division and cell cycle: Steps in cell cycle and control of cell cycle.</b>                      Check points during cell cycle-G<sub>1</sub> to S, progression of S phase, G<sub>2</sub> to M phase, Anaphase check points and components involved as regulators of check points, role of cyclins and CDKs, synthesis and degradation of cyclins, structural features of CDKs and cyclins, activation and inactivation of CDKs; role of E2Fs, and DP proteins, P53, different types of Cyclin dependent CDKs, CDC25, CAKs, Wee1 proteins, nim-proteins, SCFs, Anaphase Promoting Complexes APC (cyclosomes), replication origin and replication initiation complexes.                      Centrosome activation- structure, duplication of centrosomes, Role of nucleophosmins, organization of mitotic apparatus, binding of tractile fibers to kinetochore complexes, molecular motors involved in movement of chromosomes to equatorial plate and in anaphase movement; cytokinesis by cleavage and phragmoplast formation- different gene products and structures involved and the mechanisms of cytokinesis.</p>		
<p><b>Unit II: Molecular Biology</b>                      Microbial Genetics: Molecular basis of transformation, transduction, Conjugation; fine structure of the gene, T4 Phage, complementation analysis, deletion mapping, cis-trans tests.                      Tetrad analysis in <i>Neurospora</i>: Linkage detection (2 genes and centromere)</p>		
<p><b>Unit : III Recombinant DNA Technology</b>                      General information onSV-40, Vaccinia, Baculovirus&amp; retroviral vectors.                      Use of YAC or YEp of yeast (<i>Saccharomyces cerevisiae</i>) as effective cloning vectors because of their high copy numbers in production of HBsAg vaccine                      Use of BAC and its advantages                      Strategies to create Transgenic plants with herbicide resistance: Following strategies to be studied in detail with reference to herbicide Glyphosate resistance:                      a) Overexpression of the target protein by using a strong promoter.                      b) Improved plant detoxification resulting in a more and faster conversion of toxic herbicide to non-toxic or less toxic compound.                      c) Detoxification of herbicide by using a foreign gene.                      d) Mutation of target protein                      Methods of modifying the Diazotrophs (N<sub>2</sub> fixing bacteria) by Gene alterations in <i>Rhizobium</i> sp. to                      a) Improve nitrogen fixing efficiency and bacterial and host</p>		

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<p>plant interaction.</p> <p>b) Induce symbiotic relationship with non- leguminous plants such as wheat, rice and corn</p> <p>c) Transfer of gene for nitrogen fixation from <i>Rhizobium</i> sps. to other bacteria such as <i>Agrobacterium tumefaciens</i>.</p>	
<p><b>Unit : IV Applications of Recombinant DNA technology</b></p> <p><b>Resistance to biotic stress:</b></p> <p>a) Transgenic plants with insect resistance: Resistance genes from microbes: Gene from <i>Bacillus thuringensis</i>, Cholesterol oxidase of <i>Streptomyces</i> culture filtrate, Isopentenyl transferase gene from <i>Agrobacterium tumefaciens</i> Resistance genes from higher plants: Genes for Proteinase inhibitors: eg. Cowpea trypsin inhibitor gene (CpTi), Genes for alpha amylase inhibitors.</p> <p>b) Transgenic plants with viral resistance: Employing virus encoded genes or virus coat proteins; e.g. Transgenic tobacco plants expressing tobacco mosaic virus coat protein gene were developed which express high level of resistance to TMV</p> <p><b>Improvement of nutritional content and Quality:</b></p> <p>a) Increase in sweetness and flavor in fruits and vegetables for e.g. Monellin gene from African plant (<i>Dioscoreophyllum cumminsii</i>)-introduction in tomato and lettuce</p> <p>b) Increase and change in the quality oils in <i>Brassica</i> species (increase in medium chain fatty acids and converting unsaturated fatty acid to saturated fatty acids).</p> <p>c) Increase in starch content (potato).</p> <p><b>Transgenics for delayed fruit ripening and extended shelf life- Tomato.</b></p> <p><b>Transgenic plants:</b> Plantibodies, vaccines, Biopolymers and vitamins.</p> <p><b>Transgenic plants in floriculture:</b> Increase in the shelf life of cut flowers - (Carnation flowers), Genetic engineering of Orchids, Genetic manipulation of flower pigmentation.</p> <p><b>Genetic engineering for inducing Male Sterility in plants.</b></p> <p><b>Transgenic plants for enhancing phytoremediation.</b></p>	
<p>Learning Outcomes: Students will be able to understand the control points in a cell cycle, Study and apply principles of microbial genetics, understand recombinant DNA technology and study applications of the same for the improvement of crops.</p>	

  
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MSc Sem 1 Paper IV Practical

PSBOP104	<b>Cytogenetics, Molecular Biology and Biotechnology</b>	2
	<ol style="list-style-type: none"><li>1. Preparation of cytological stains, fixatives and pre-treatment agents.</li><li>2. Squash preparation from pre-treated root tips (Colchicine/ Paradichlorobenzene/ Aesculin.</li><li>3. Squash preparation from mutagen treated root tips for study of aberrations.</li><li>4. Smear preparation from any suitable plant material.</li><li>5. Problems based on:<ol style="list-style-type: none"><li>a. Restriction map analysis and construction of restriction maps,</li><li>b. Tetrad analysis in <i>Neurospora</i> – two genes and centromere.</li><li>c. Deletion mapping in Bacteriophage.</li></ol></li></ol>	

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**University of Mumbai**  
**M. Sc. Botany (Semester-I) Practical Examination**  
**Skeleton Question Paper**  
**Cytogenetics, Molecular Biology and Biotechnology**  
**PSBOTP 104**

**Time: 9.00 am To 2.00 pm**

**Max. Marks: 50**

N.B. 1) Candidate should show their slides preparations/results for all questions to the examiners.

- 2) Use of logarithm tables/simple calculator is allowed
- 3) Use of Mobile phones is not allowed.

- Q. 1.** Make a squash preparation of the pre-treated specimen A and identify the anomalies. **(10)**
- Q. 2.** Make a smear preparation from the anthers of specimen B to show the stages of Meiosis. Comment on the same. **(10)**
- Q. 3** Construct a restriction map / deletion map for the given DNA strand from the data provided 'C'. **(08)**
- Q. 4** Construct a linkage map for the chromosome of *Neurospora* from the given Data 'D' **(12)**
- Q .5.** Journal. **(05)**
- Q. 6.** *Viva-voce.* **(05)**

Key:

- A - Pre-treated Onion root tips
- B - *Tradescantia discolor* buds
- C - Restriction map/ deletion map problem
- D - *Neurospora* - tetrad analysis problem

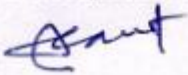
  
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## REFERENCE BOOKS

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Biochemistry by Zubay

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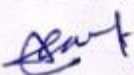
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**M.Sc. Semester I and II Botany Syllabus**  
**Choice Based Credit System**  
**To be implemented from the Academic year 2020--2021**

**SEMESTER II**

Course Code PSBO201	Title of the Paper- Plant Diversity- Cryptogams II (Bryophyta and Pteridophyta)			
	I	Bryophyta I	4	1
	II	Bryophyta II		1
	III	Pteridophyta I		1
	IV	Pteridophyta II		1

Course Code	Title	Credits
PSBO201	<b>Plant Diversity- Cryptogams II (Bryophyta and Pteridophyta)</b>	4
	<b>Unit I: Bryophyta I</b> 1. Classification of Bryophyta, up to orders, according to the system proposed by G. M. Smith. 2. Spore bearing organs in Bryophytes. 3. Alternation of generations in Bryophyta. 4. Type study of <i>Targionia</i> and <i>Pogonatum</i> .	1
	<b>Unit II: Bryophyta II</b> 1. Origin and evolution of Bryophyta with reference to habitat and form 2. Diversity and distribution of Indian Bryophytes. 3. Bryophytes: Applied aspects: Agriculture, medicine, Food technology and environmental aspects. 4. Contribution of Shiv Ram Kashyap and S. C. Srivastava in Bryology.	1
	<b>Unit : III: Pteridophyta I</b> 1. Classification of Pteridophyta, up to orders, according to the system proposed by G.M.Smith. 2. Heterospory and seed habit 3. Life cycle of <i>Psilotum</i> , <i>Pteris</i> and <i>Azolla</i>	1
	<b>Unit : IV Pteridophyta II</b> 1. The geological time scale and a study of fossil Pteridophytes (Horneophyton, Cladoxylon, Sphenophyllum, Coenopteris) 2. Cultivation and maintenance of ornamental Ferns. 3. Abnormalities in the life cycle- Apogamy and Apospory 4. Ethnomedicinal uses of Pteridophytes	1

  
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Learning outcomes: Upon successful completion of this course, the student will be able to:

Classify Bryophytes into various groups, study their importance  
Classify Pteridophytes into various groups, study their importance and multiplication of important ferns

#### Practical

Course Code	Title	Credits
PSBOP201	<b>Plant Diversity-Cryptogams II (Bryophyta and Pteridophyta)</b>	2
	1. Study of vegetative and reproductive structures in <i>Targionia</i> , <i>Plagiochasma</i> , <i>Fimbraria</i> , <i>Pellia</i> and <i>Pogonatum</i> . 2. Study of vegetative and reproductive structures in : <i>Isoetes</i> , <i>Ophioglossum</i> , <i>Pteris</i> , <i>Angiopteris</i> , <i>Lygodium</i> and <i>Azolla</i> 3. Study of fossils : <i>Horneophyton</i> , <i>Cladoxylon</i> , <i>Sphenophyllum</i> , <i>Coenopteris</i>	

**University of Mumbai**  
**M. Sc. Sem II (Practical) EXAMINATION**  
**BOTANY-PRACTICAL- PSBOP201**  
**[Plant Diversity - Cryptogams II ( Bryophyta and Pteridophyta)]**

Skeleton Question Paper

**Time: 9:00 am-2:00 pm**

**Max. Marks: 50**

N.B.

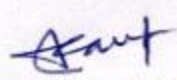
- 1) Candidates should show their slides/ preparations/ results for all questions to the examiner.
- 2) Use of logarithm tables /calculator is allowed.

1. Identify, classify and describe the morphological / reproductive structures observed in specimens A,B,C and D. **(24)**
2. Identify and describe slides/specimens E,F,G and H. **(16)**
3. Journal **(05)**
4. *Viva-voce* **(05)**

Key:

A, B, C and D: Bryophyta and Pteridophyta

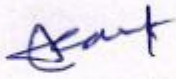
E, F, G and H: Bryophyta, Pteridophyta and Fossils (any 2)

  
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Course Code	Title		Credits
PSBO202	<b>Plant Diversity: Spermatophyta II (Anatomy, Developmental Botany and Palynology)</b>		
	I	Anatomy I	1
	II	Anatomy II	1
	III	Developmental Botany	1
	IV	Palynology	1


Course Code	Title	Credits
PSBO202	<b>Plant Diversity- II (Anatomy, Developmental Botany and Palynology)</b>	4
<b>Unit I: Anatomy I</b>		
<ol style="list-style-type: none"> <li><b>Meristems:</b> Definition type of meristems, apical cell theory, histogen theory and Tunica corpus theory</li> <li><b>Morphogenesis and organogenesis in plants:</b> Organization of shoot and root apical meristems; shoot and root development, leaf development and phyllotaxy; transition of flowering, floral meristems and floral development in <i>Arabidopsis</i> and <i>Antirrhinum</i></li> </ol>		1
<b>Unit II: Anatomy II</b>		
<ol style="list-style-type: none"> <li><b>Study of Tissue system:</b>  <b>Sensory and tactile tissue system:</b> Tactile sense organs, gravitational and optical sense organs.  <b>Secretory Tissues:</b> Introduction, Glands, Digestive glands, Nectaries, Resin ducts and oils ducts, Laticiferous ducts.</li> <li><b>Wood Anatomy:</b> Coniferous and Angiosperm wood            Parenchyma: Storied and non-storied wood parenchyma, Distribution of axial parenchyma            Distribution of vessels            Structure of rays            Characters used in identification of wood.</li> </ol>		1
<b>Unit : III Developmental Botany</b>		
<ol style="list-style-type: none"> <li>Male gametophyte: Pollen development and gene expression male sterility sperm dimorphism and hybrid seed production; pollen tube growth and guidance.</li> <li>Female gametophyte; Types of embryo sacs; structure of embryo sac cells.</li> <li>Pollination: Ultrastructural and histochemical details</li> </ol>		1

<p>of style and stigma, self and interspecific incompatibility, significance of pollen-pistil interaction, role of pollen wall proteins and stigma surface proteins, barriers to fertilization, methods to overcome incompatibilities, intra-ovarian pollination; in-vitro pollination.</p> <p>4. Fertilization: heterospermy, differential behavior of male gametes, discharge and movement of sperms; syngamy and triple fusion, post-fertilization metabolic &amp; structural changes in embryo-sac.</p> <p>5. <b>Seed development and fruit growth</b>; endosperm development during Early Maturation and Desiccation stages; embryogenesis, ultrastructure and nucellar cytology; cell lineage during late embryo development; storage proteins of endosperm and embryo; apomixis; embryo culture; dynamics of fruit growth; biochemistry and molecular biology of fruit maturation.</p>	
<p><b>Unit : IV Palynology</b></p> <p>1. Special relationships of pollen grain in pollen tetrads.</p> <p>2. Pollen Chemistry: Introduction, Chemical constituents of pollen-Major metabolites (Carbohydrates, Mineral content, Callose, Organic acids, Amino acids, Pigments, Vitamin. s, Hormones and steroids), Chemistry of pollen wall, Pollen wall proteins.</p> <p>3. Palynotaxonomy: Introduction, Systematic palynology-Palynotaxonomy of monocots (Pandanales, Glumiflorae, Principes, Liliflorae and Scitaminae) and dicots (Centospermae, Rhoadales, Rhamnales, Malvales, Umbelliflorae), Evolutionary trends among pollen grains based on palynotaxonomical work.</p> <p>4. Utilization of pollen: Pollen as health food, Pollen as medicine, Pollen allergens for diagnosis and therapy.</p>	1
<p>Learning outcomes: Students will be able to understand the development of pollen, spore, fertilization and to apply palynological information to plant systematics</p>	

  
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Practical

Course Code	Title	Credits
PSBOP202	<b>Spermatophyta II</b> <b>(Anatomy, Developmental Botany and Palynology)</b>	2
	<ol style="list-style-type: none"> <li>1. Study of wood elements in <i>Annona</i>, <i>Michelia</i>, <i>Sterculia</i> and <i>Thuja</i> &amp; <i>Araucaria</i> using the maceration technique.</li> <li>2. Study of the following leaves with respect to leaf surface characters (wax, cuticle, epidermis, stomata, epidermal outgrowth): <i>Pistia</i>, <i>Ficus</i>, <i>Avicennia</i> and <i>Peperomia</i>.</li> <li>3. Study of vessels, parenchyma: Axial &amp; Ray Parenchyma - Apotracheal: Terminal, Diffuse, Banded, Reticulate; Paratracheal: Vasicentric, Aliform, Confluent, Abaxial. Ray Parenchyma &amp; Rays: Homogenous &amp; Heterogenous Wood Fibres from dicotyledonous wood by temporary preparation.</li> <li>4. Mounting of Glands- salt glands of halophytes- <i>Avicennia</i>, <i>Ipomoea biloba</i>, <i>Sesuvium/Suaeda</i> Nectaries- Euphorbiaceae and Combretaceae (at least 3 examples from each family) Resin ducts- <i>Pinus</i> Oils ducts- <i>Citrus</i>, <i>Eucalyptus</i>, <i>Murraya</i> Laticiferous ducts Apocynaceae and Asclepiadaceae. Digestive glands- From permanent slides/ photomicrograph</li> <li>5. Microtomy- Processing of material, Block making &amp; staining (5 slides for submission).</li> <li>6. Camera lucida sketches of parenchyma/ rays.</li> <li>7. A study of types of ovules &amp; types of embryo sacs with the help of permanent slides/photomicrographs.</li> <li>8. <i>In vitro</i> germination of pollen grains, effect of temperature on pollen viability and short-term storage.</li> </ol>	

  
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	<p>9. Detection of amino-acids, sugars and lipids by paper/ Thin layer chromatography from pollen grains.</p> <p>10. Study of the morphology of the pollen (using Chitale's and acetolysis method) from the families studied in sem I &amp; II</p>	
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M. Sc. Sem II (Practical) EXAMINATION

**BOTANY-PRACTICAL- PSBOP202**

**[Plant Diversity -Spermatophyta(Anatomy, Developmental Botany &Palynology )]**

(Total Marks: 50)

Skeleton Question Paper

N.B.

1) Candidates should show their slides/ preparations/ results for all questions to the examiner.

1. Macerate the given material A. (05)
  2. Prepare a T.S. of leaf material B to show \_\_\_\_\_ &C to mount or show \_\_\_\_\_ Draw neat & labelled sketches. (10)
  3. Prepare a block of specimen D/ cut the ribbon of material D/ double stain the slide of material D. (08)
  4. Perform the palynology experiment E allotted to you. (06)
  5. Identify and describe slide/ specimen/ photomicrograph of F, G & H. (09)
  - 6.a. Journal. (05)
  - 6b. Submission of slides of Microtomy. (03)
  7. *Viva-voce*. (04)
- 2) Use of logarithm tables /calculator is allowed.

KEY:

A- *Annona, Michelia, Sterculia* and *Thuja* and *Araucaria*

B& C- *Pistia, Ficus, Avicennia* and *Peperomia*.

Salt glands of halophytes- *Avicennia, Ipomoeabiloba, Sesuvium/Suaeda*

Nectaries- Euphorbiaceae and Combretaceae (at least 3 examples from each family) Resin ducts- *Pinus*

Oils ducts- *Citrus, Eucalyptus, Murraya*

Laticiferous ducts- Apocynaceae and Asclepiadaceae.

D- Microtomy- Block making and trimming of block OR Ribbon cutting and mounting of ribbon on slide OR Double Staining of mounted ribbon on slide and preparing a permanent slide

E- Palynology experiment: *In vitro* germination of pollen grains, effect of temperature on pollen viability and short-term storage

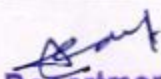
Detection of amino-acids, sugars and lipids by paper/ Thin layer chromatography from pollen grains.

F, G & H- Types of ovules and types of embryo sacs, Digestive glands, pollen grains, Anatomy not asked above.

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Course Code PSBO203	Title of the Paper- Plant Physiology and Environmental Botany		
	I	Seed Physiology	4
	II	Stress Physiology	
	III	The Environment, Biogeography and Population Ecology:	
	IV	Climate Change	
			1
			1
			1
			1
Course Code	Title		Credits
PSBO203	Plant Physiology and Environmental Botany		4
<b>UNIT I:</b> <b>Seed physiology:</b> <ol style="list-style-type: none"> <li>1. Physiology and Biochemistry of seed germination, Mobilization of food reserves, Germination and growth factors.</li> <li>2. Seed dormancy, Control and release of seed dormancy.</li> <li>3. Factors in control for the long term storage of seeds, seed proteins.</li> </ol>			1
<b>UNIT II:</b> <b>Stress Physiology:</b> <ol style="list-style-type: none"> <li>1. Biotic and abiotic stress, Response of plants to Biotic (pathogenic and insects) stress, Adaptations to eliminate and tolerate the infection, Hypersensitive reaction.</li> <li>2. Response of plants to abiotic stress - Drought stress, Heat stress - Heat shock proteins, Chilling, and freezing, Salinity stress</li> <li>3. Signaling pathways activated during stress.</li> </ol>			1
<b>UNIT III:</b> <b>The Environment, Biogeography and Population Ecology:</b> <ol style="list-style-type: none"> <li>1. Environment: Components, Major components of physical environment, biotic and abiotic interactions,</li> <li>2. Biogeography: Major terrestrial biomes, Theory of island bio-geography, Bio-geographical zones of India.</li> <li>3. Population Ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection).</li> </ol>			1
<b>UNIT IV</b> <b>Climate Change:</b> <ol style="list-style-type: none"> <li>1. Global warming, carbon credits, Kyoto mechanism.</li> <li>2. Factors responsible for climate change, Climate</li> </ol>			1

  
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<p>change in relation to the changes in patterns of temperature, precipitation and sea level rise, Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem. The Montreal Protocol, Paris Agreement, UNFCCC, IPCC.</p> <p>3. Adaptation Strategy/ Mitigation Measures, Blue carbon initiative.</p>	
<p>Learning outcomes: On completion of the course students should be able to:</p> <ul style="list-style-type: none"> <li>• Distinguish key physiological processes underlying the seed germination</li> <li>• Identify the physiological factors that regulate growth and developmental processes of plants</li> <li>• Demonstrate clear understanding of crop-environment interaction and its implication on crop growth and yield</li> <li>• Integrate and apply their knowledge of crop physiology for analytical thinking and solving practical problems experienced in agricultural systems</li> </ul> <p>To understand and apply ecological principles and understand legislation and measures to solve environmental problems.</p>	

**Practical**

PSBOP203	Plant Physiology and Environmental Botany	2
	<ol style="list-style-type: none"> <li>1. Assessing seed viability by TTC method</li> <li>2. Determination of Nygard index of algae in a water body.</li> <li>3. Determination of dust load on lives of roadside plant.</li> <li>4. Comparison of two population of a species collected from two areas.</li> <li>5. Determination of primary production of an area by harvest method.</li> <li>6. Determination of primary production of an area by chlorophyll method.</li> <li>7. Effect of water and salinity stress on chlorophyll content of leaves.</li> <li>8. Effect of water and salinity stress on Proline content of leaves</li> <li>9. Determination of Stomatal Index of leaves.</li> <li>10. Determination of LAI of different types of trees.</li> <li>11. Assessment of pollution in ambient air, on</li> </ol>	

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	<p>the basis of injured leaf area.</p> <p>Field exercises:</p> <ul style="list-style-type: none"> <li>• Assessment of erosion status of land along a 'stream' on a slope or on flat land</li> <li>• Assessment of status of waste land, on the basis of its appearance and visible plant growth.</li> <li>• Assessment of degradation of a forest on the basis of its canopy cover and height, strata and species diversity</li> </ul>	
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**M. Sc. Sem II (Practical) EXAMINATION**

**BOTANY-PRACTICAL-IV PSBOP203  
Plant Physiology and Environmental Botany**

**Time: 9:00 am-2:00 pm**

**Max. Marks : 50**

Skeleton Question Paper

N.B.

- 1) Candidates should show their slides/ preparations/ results for all questions to the examiner.
- 2) Use of logarithm tables /calculator is allowed.

Q.1. PHYSIOLOGY EXPERIMENT.....	(15)
Q.2. ECOLOGY EXPERIMENT...	(15)
Q.3. PHYSIOLOGY EXPI./ MINOR ECOLOGY EXPI ....	(10)
Q.4. JOURNAL...	(05)
Q.5. VIVA VOCE....	(05)

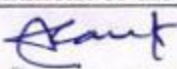
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**M.Sc - I**  
**SEMESTER - II, PAPER - IV**

PSBO204	Title of the Paper: MEDICINAL BOTANY AND DIETETICS		
	I	Medicinal Botany I	1
	II	Medicinal Botany II	1
	III	Dietetics I	1
	IV	Dietetics II	1

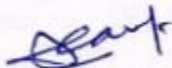
Course Code	Title	Credits
PSBO204	Medicinal Botany and Dietetics	4
<b>Unit I: Medicinal Botany I</b>		1
Monograph of drugs with respect to Biological source, Geographical distribution, macro and microscopic characters, chemical constituents and therapeutic uses of the following drugs: Root: ..... <i>Withania somnifera</i> (Ashwagandha) Rhizome:..... <i>Zingiber officinale</i> (Ginger) Stem bark:.. <i>Cinnamom zeylanicum</i> (Cinnamon) and <i>Holarrhena antidysenterica</i> (Kurchi) Leaf: ..... <i>Azadirachta indica</i> (Neem) Fruit:..... <i>Foeniculum vulgare</i> (Fennel) Seed: ..... <i>Plantago ovata</i> (Isabgol)		
<b>Unit II: Medicinal Botany II</b>		1
<b>Introduction to Pharmacopeia:</b> Indian pharmacopeia and Ayurvedic pharmacopeia <b>Quality control of crude drugs:</b> <ul style="list-style-type: none"> <li>• Morphological examination - Exomorphic characters</li> <li>• Microscopical evaluation - Anatomical characters</li> <li>• Preliminary phytochemical tests.</li> <li>• Development of standardization parameters - Moisture content, Ash values, Solvent extraction value, bitterness value, foaming index, swelling index and heavy metal.</li> </ul>		
<b>Unit III: Dietetics I</b>		1
<b>Nutraceuticals:</b> <ul style="list-style-type: none"> <li>• Definition and Introduction, classification (Dietary supplements, functional foods, Medicinal food, Pharmaceuticals)</li> <li>• Role of plant nutraceuticals in health benefits (onion, garlic, tomato, carrot, beet, turmeric).</li> <li>• Current trends and future prospective of nutraceuticals.</li> </ul>		
<b>Unit IV: Dietetics II</b>		1
<b>Plant Food as medicine</b>		
Plant food in the treatment of diseases - arthritis, constipation, diarrhoea,		

  
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diabetes, , hypertension, cancer, jaundice, memory and piles Concept of Antioxidants, their significance, Plants as a source of antioxidants.	
Learning outcomes: Students will be able to identify medicinal plants and understand the effects of plant chemical constituents on humans and the use of plants in Dietetics and as nutraceuticals.	

## PRACTICAL

Course Code	Title	Credits
PSBOP204	Medicinal Botany and Dietetics	2
<p><b>Medicinal Botany -I</b></p> <p>1. A study of the macroscopic and microscopic characters and identification of active ingredients of drugs mentioned in the syllabus for theory by means of chemical tests.</p> <ul style="list-style-type: none"> <li>• Root:..... <i>Withania somnifera</i> (Ashwagandha)</li> <li>• Rhizome:.....<i>Zingiber officinale</i>(Ginger)</li> <li>• Stem bark: ...<i>Cinnamom zeylanicum</i> (Cinnamon) and <i>Holarrhena antidysenterica</i> (Kurchi)</li> <li>• Leaf:.....<i>Azadirachta indica</i>(Neem)</li> <li>• Fruit:.....<i>Foeniculum vulgare</i> (Fennel)</li> <li>• Seed: .....<i>Plantago ovata</i> (Isabgol)</li> </ul> <p><b>Medicinal Botany -II</b></p> <p>2. Determination of Moisture content, Ash values, Solvent extraction value of the given sample.</p> <p>3. Determination of foaming index of the given sample.</p> <p>4. Determination of swelling index of the given sample.</p> <p><b>NUTRACEUTICALS</b></p> <ul style="list-style-type: none"> <li>➤ Extraction and detection of lycopene by TLC</li> <li>➤ Amino acid profile of a plant/plant product</li> </ul> <p>6. Identification of plants Nutraceuticals for health benefits (As per theory topics)</p>		

  
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M. Sc. Sem II (Practical) EXAMINATION

BOTANY-PRACTICAL- PSBOP204  
[Medicinal Botany and dietetics]

Time: 9:00 am-2:00 pm

Max. Marks : 50

Skeleton Question Paper

N.B.

- 1) Candidates should show their slides/ preparations/ results for all questions to the examiner.
- 2) Use of logarithm tables /calculator is allowed.

- Q 1. Identify and describe Macroscopic and Microscopic characters of specimen A and B. Identify the active ingredients from the same using chemical tests/TLC. (16)
- Q 2. Estimate the Fresh Weight and Dry Weight ratio and total ash content/foaming index/swelling index of the given plant material C. (08)
- Q3. Extract and detect lycopene from given material D (08)
- OR**
- Q3. Perform TLC to show the amino acid profile of the plant material D (08)
- Q4. Identify and describe botanical source and uses of the specimens E and F (08)
- Q 5. Journal. (05)
- Q 6. Viva-voce. (05)

**KEY:**

A and B

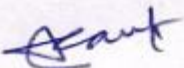
- Withania somnifera* (Ashwagandha)
- Zingiber officinale* (Ginger)
- Cinnamom zeylanicum* (Cinnamon) and
- Holarrhena antidysenterica* (Kurchi)
- Azadirachta indica* (Neem)
- Foeniculum vulgare* (Fennel)
- Plantago ovata* (Isabgol)

C and D

Any plant material

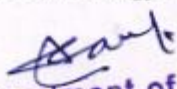
E and F

Nutraceuticals as per theory topics

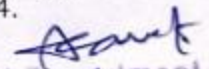
  
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### Reference books:

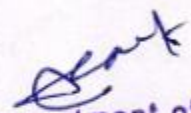
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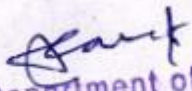
  
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**AC 7/4/2014**  
**Item No. 4.23**

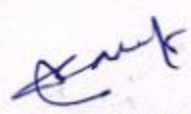
Semester I USBO101		L	Cr
Paper I -- Plant Diversity I		45	2
<b>UNIT I</b>		<b>15</b>	
<b>ALGAE</b>			
1	Structure, life cycle and systematic position of <i>Nostoc</i> and <i>Spirogyra</i> .		
2	Economic importance of Algae.		
<b>UNIT II</b>		<b>15</b>	
<b>FUNGI</b>			
1	Structure, life cycle and systematic position of <i>Rhizopus</i> and <i>Aspergillus</i>		
2	Economic importance of Fungi.		
3	Modes of nutrition in Fungi (Saprophytism and Parasitism).		
<b>UNIT III</b>		<b>15</b>	
<b>BRYOPHYTA</b>			
1	General characters of Hepaticae		
2	Structure, life cycle and systematic position of <i>Riccia</i> .		

  
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**AC 7/4/2014**  
**Item No. 4.23**

<b>Semester I USBO102</b>		<b>L</b>	<b>Cr</b>
<b>Paper II – Form and Function 1</b>		<b>45</b>	<b>2</b>
<b>UNIT I</b>		<b>15</b>	
<b>CELL BIOLOGY</b>			
1	General structure of plant cell: cell wall Plasma membrane (bilayer lipid structure, fluid mosaic model)		
2	Ultra structure and functions of the following cell organelles: Endoplasmic reticulum and Chloroplast		
<b>UNIT II</b>		<b>15</b>	
<b>ECOLOGY</b>			
1	Energy pyramids, energy flow in an ecosystem.		
2	Types of ecosystems: aquatic and terrestrial.		
<b>UNIT III</b>		<b>15</b>	
<b>GENETICS</b>			
1	Phenotype/Genotype, Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios.		
2	Epistatic and non epistatic interactions; multiple alleles.		

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

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

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

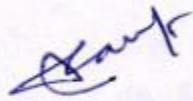
<b>Semester II USBO202</b>		<b>Hrs</b>	<b>Cr</b>
<b>Paper II – Form and Function 1</b>		<b>45</b>	<b>2</b>
<b>UNIT I</b>		<b>15</b>	
<b>ANATOMY</b>			
1	Simple tissues, complex tissues.		
2	Primary structure of dicot and monocot root, stem and leaf.		
3	Epidermal tissue system: types of hair, monocot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

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

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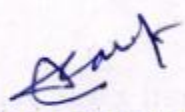
Semester II USBOP2		Cr
<b>PRACTICAL Paper I – Plant Diversity 1</b>		<b>1</b>
1	Study of stages in the life cycle of <i>Nephrolepis</i> : Mounting of ramentum, hydathode, T.S. of rachis.	
2	T.S. of pinna of <i>Nephrolepis</i> passing through sorus.	
3	Stelar evolution with the help of permanent slides: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

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

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

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

**F Y B Sc BOTANY SEMESTER II**

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


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**Item No. 4.23**

References

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

  
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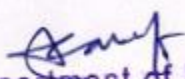
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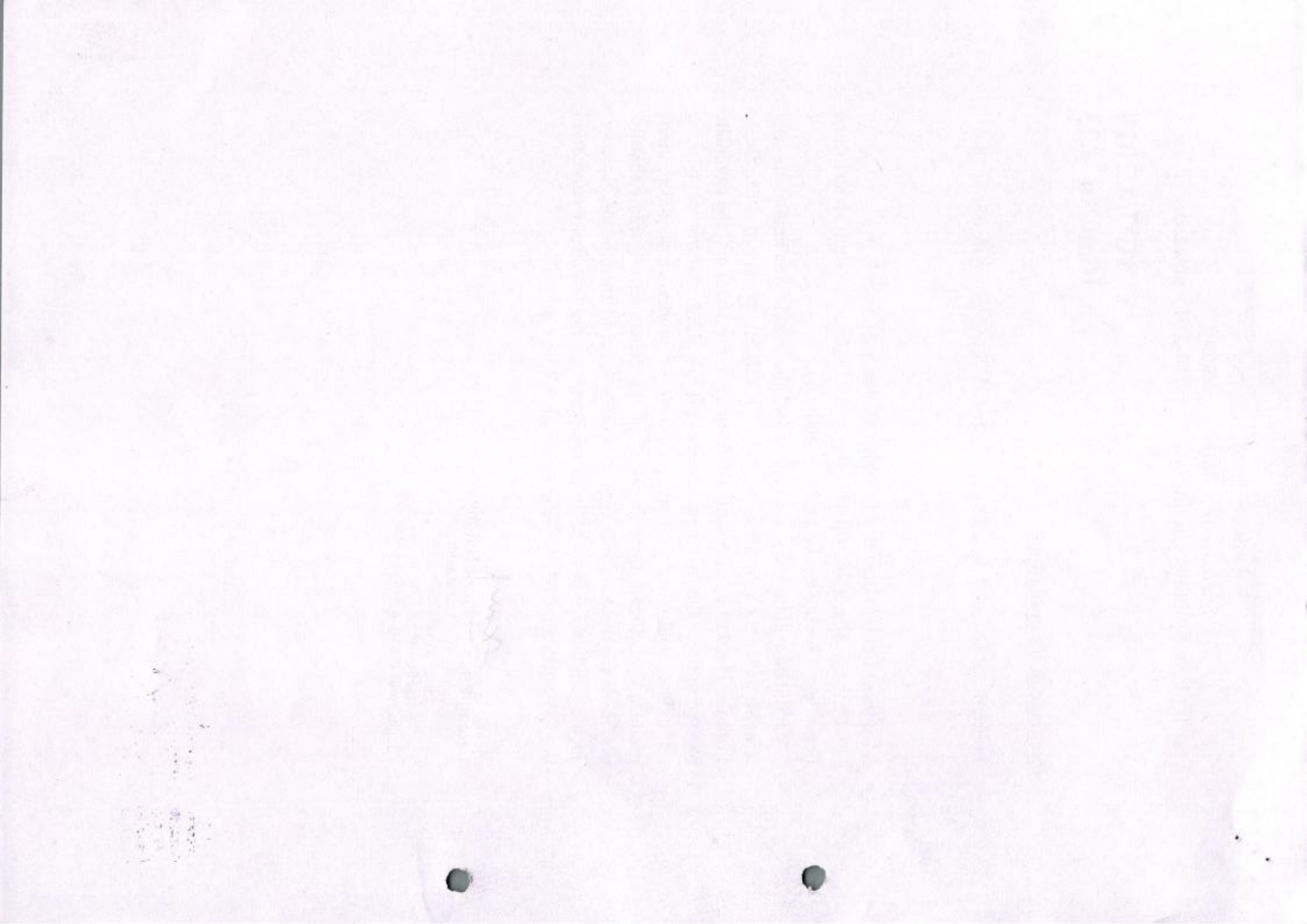
**Scheme of Examinations**

Internal and External Assessment as per CBSS of University of Mumbai

Note:

- Two short field excursions for habitat studies are compulsory.  
Field work of not less than eight hours duration is equivalent to one period per week for a batch of 15 students.
- A candidate will be allowed to appear for the practical examinations only if he/she submits a certified journal of F.Y.B.Sc. Botany or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of F.Y.B.Sc. Botany as per the minimum requirements. In case of loss of journal a candidate must produce a certificate from the Head of the department /Institute that the practicals for the academic year were completed by the student. However such a candidate will be allowed to appear for the practical examination but the marks allotted for the journal will not be granted.

  
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**UNIVERSITY OF MUMBAI**

No. UG/14 of 2018-19

**CIRCULAR:-**

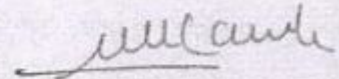
Attention of the Principals of the affiliated Colleges and Directors of the recognized Institutions in Science & Technology Faculty is invited to this office Circular No. UG/95 of 2015-16, dated 5<sup>th</sup> October, 2015 relating to syllabus of the Bachelor of Science (B.Sc.) degree course.

They are hereby informed that the recommendations made by the Board of Studies in Botany at its meeting held on 9<sup>th</sup> April, 2018 have been accepted by the Academic Council at its meeting held on 5<sup>th</sup> May, 2018 **vide** item No. 4.25 and that in accordance therewith, the revised syllabus as per the (CBCS) for the T.Y.B.Sc. in Botany (Sem -V & VI), has been brought into force with effect from the academic year 2018-19, accordingly. (The same is available on the University's website [www.mu.ac.in](http://www.mu.ac.in)).

MUMBAI - 400 032

14<sup>th</sup> June, 2018

To



(Dr. Dinesh Kamble)

I/c REGISTRAR

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

A.C/4.25/05/05/2018

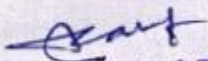
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No. UG/14 -A of 2018

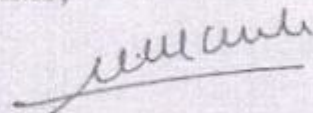
MUMBAI-400 032 14<sup>th</sup> June, 2018

Copy forwarded with Compliments for information to:-

- 1) The I/c Dean, Faculty of Science & Technology,
- 2) The Chairman, Board of Studies in Botany,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Co-Ordinator, University Computerization Centre,



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(Dr. Dinesh Kamble)

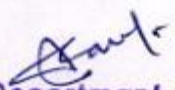
I/c REGISTRAR



# **UNIVERSITY OF MUMBAI**

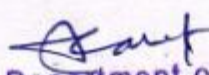
**Syllabus for the T.Y.B.Sc.  
Program: B.Sc. Course: BOTANY**

(Credit Based Semester and Grading System with effect from  
the academic year 2018-2019)

  
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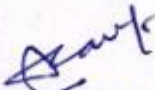
**T.Y.B.Sc. Botany Syllabus**  
**Restructured for Credit Based and Grading System**  
**To be implemented from the Academic year 2018-2019**  
**SEMESTER V**

Course Code	UNIT	TOPICS	Credit	L / Weeks
USBO501	<b>PLANT DIVERSITY III</b>		2.5	
	I	Microbiology		
	II	Algae		
	III	Fungi		
	IV	Plant Pathology		
USBO502	<b>PLANT DIVERSITY IV</b>		2.5	
	I	Paleobotany		
	II	Angiosperms I		
	III	Anatomy I		
	IV	Palynology		
USBO503	<b>FORM AND FUNCTION III</b>		2.5	
	I	Cytology and Molecular biology		
	II	Physiology I		
	III	Environmental Botany		
	IV	Plant tissue culture		
USBO504	<b>CURRENT TRENDS IN PLANT SCIENCES II</b>		2.5	
	I	Ethnobotany and Mushroom Industry		
	II	Biotechnology I		
	III	Instrumentation		
	IV	Pharmacognosy and medicinal botany		
USBOP5	Practicals based on all the four courses in theory		6	16

  
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**SEMESTER VI**

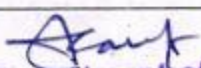
Course Code	UNIT	TOPICS	Credit	L / Weeks
USBO601	<b>PLANT DIVERSITY III</b>			
	I	Bryophyta	2.5	1
	II	Pteridophyta		1
	III	Bryophyta and Pteridophyta: Applied aspects		1
	IV	Gymnosperms		1
USBO602	<b>PLANT DIVERSITY IV</b>			
	I	Angiosperms II	2.5	1
	II	Anatomy II		1
	III	Embryology		1
	IV	Biostatistics		1
USBO603	<b>FORM AND FUNCTION III</b>			
	I	Plant Biochemistry	2.5	1
	II	Physiology II		1
	III	Genetics		1
	IV	Bioinformatics		1
USBO604	<b>CURRENT TRENDS IN PLANT SCIENCES II</b>			
	I	Plant biotechnology II	2.5	1
	II	Plant Geography		1
	III	Economic Botany		1
	IV	Post Harvest Technology		1
USBOP6	Practicals based on all the four courses in theory		6	16

  
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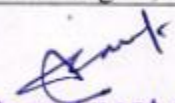


**SEMESTER V****THEORY**

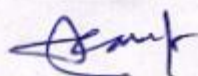
Course Code	Title	Credits
<b>USBO501</b>	<b>PLANT DIVERSITY III</b>	<b>2.5 Credits (60 lectures)</b>
<b>Unit I: Microbiology</b> <ul style="list-style-type: none"> <li>• Types of Microbes</li> <li>• Culturing: Sterilization, media, staining, colony characters</li> <li>• Pure cultures</li> </ul> Role of microbes in fermentation: Alcohol and Antibiotics		<b>(15 lectures)</b>
<b>Unit II : Algae</b> <ul style="list-style-type: none"> <li>• Division <u>Rhodophyta</u> Classification and General Characters: Distribution, Cell structure, pigments, reserve food, range of thallus, reproduction: asexual and sexual, Alternation of Generations, Economic Importance.</li> <li>• Structure, life cycle and systematic position of <i>Polysiphonia</i> <i>Batrachospermum</i></li> <li>• Classification and General Characters of <u>Xanthophyta</u>: Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance.</li> <li>• Structure, life cycle and systematic position of <i>Vaucheria</i></li> <li>• Classification and General Characters of <u>Bacillariophyta</u>: Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance.</li> <li>• Structure, life cycle and systematic position of <i>Pinnularia</i></li> </ul>		<b>(15 lectures)</b>
<b>Unit III : Fungi</b> <ul style="list-style-type: none"> <li>• Basidiomycetes: Classification and General characters</li> <li>• Life cycle of <i>Agaricus</i></li> <li>• Life cycle of <i>Puccinia</i></li> <li>• Deuteromycetae: Classification and General Characters</li> <li>• Life cycle of <i>Alternaria</i></li> </ul>		<b>(15 lectures)</b>
<b>Unit IV : Plant Pathology</b> <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</i> sp.</li> <li>➤ Tikka disease of ground nut: <i>Cercospora</i></li> <li>➤ Damping off disease: <i>Pythium</i></li> <li>➤ Citrus canker – <i>Xanthomonas</i> sp.</li> <li>➤ Leaf curl – leaf curl virus</li> </ul> </li> <li>• Study of Physical, chemical and biological control methods of plant diseases.</li> </ul>		<b>(15 lectures)</b>

  
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Course Code	Title	Credits
<b>USBO502</b>	<b>PLANT DIVERSITY III</b>	<b>2.5 Credits (60 lectures)</b>
<b><u>Unit I : Paleobotany</u></b>		
<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 Birbal Sahni, Birbal Sahni Institute of Paleobotany, Lucknow</li> </ul>		<b>(15 lectures)</b>
<b><u>Unit II : Angiosperms I</u></b>		
<ul style="list-style-type: none"> <li>• Morphology of flower and 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>• Rubiaceae</li> <li>• Solanaceae</li> <li>• Commelinaceae</li> <li>• Graminae</li> </ul> </li> </ul>		<b>(15 lectures)</b>
<b><u>Unit III : Anatomy</u></b>		
<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>. Storage roots of Beet, Radish</li> <li>• Root stem transition</li> <li>• Types of Stomata – Anomocytic, Anisocytic, Diacytic, Paracytic, and Graminaceous</li> </ul>		<b>(15 lectures)</b>
<b><u>Unit IV : Palynology</u></b>		
<ul style="list-style-type: none"> <li>• Pollen Morphology</li> <li>• Pollen viability – storage</li> <li>• Germination and growth of pollen</li> <li>• Application of Palynology in honey industry, coal and oil exploration, Aerobiology and pollen allergies, forensic science</li> </ul>		<b>(15 lectures)</b>

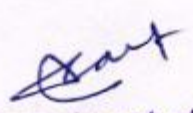
  
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Course Code	Title	Credits
<b>USBO503</b>	<b>FORM AND FUNCTIONS- II</b>	<b>2.5 Credits (60 lectures)</b>
<b>UNIT I : CYTOLOGY AND MOLECULAR BIOLOGY</b> Structure and function of nucleus Structure and function of vacuole Structure and function of giant chromosomes The genetic code: Characteristics of the genetic code Transcription and Translation in Eukaryotes		<b>(15 lectures)</b>
<b>UNIT II: PHYSIOLOGY</b> <b>Water relations:</b> Potential, osmosis, transpiration, imbibition, Solute transport: Transport of ions across cell membranes, active and passive transport, carriers, channels and pumps. Translocation of solutes: Composition of phloem sap, girdling experiment, pressure flow model, phloem loading and unloading, anatomy of sieve tube elements, mechanisms of sieve tube translocation, Munch's hypothesis.		<b>(15 lectures)</b>
<b>UNIT III ENVIRONMENTAL BOTANY</b> <b>Bioremediation:</b> Principles, factors responsible and microbial population in bioremediation. <b>Phytoremediation:</b> Metals, Organic pollutants <b>Plant succession:</b> Hydrosere and Xerosere – Formation of barren space, succession on the land citing different seres leading upto the climax, succession in water, ecesis, poly and monocl意思 theories		<b>(15 lectures)</b>
<b>UNIT IV PLANT TISSUE CULTURE</b> Aspects of micropropagation with reference to Floriculture: Detailed study of Orchid cultivation Plant cell suspension cultures for the production of secondary metabolites: with special reference to Shikonin production. Somatic embryogenesis and artificial seeds: Protoplast fusion and Somatic hybridization: i) Concept, definition, and various methods of protoplast fusion ii) Applications of somatic hybridization in agriculture		<b>(15 lectures)</b>



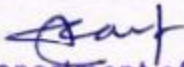
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Course Code	Title	Credits
<b>USBO504</b>	<b><u>CURRENT TRENDS IN PLANT SCIENCES I</u></b>	<b>2.5 Credits (60 lectures)</b>
<b>UNIT I ETHNOBOTANY AND MUSHROOM INDUSTRY</b> <b>Ethnobotany</b> - Definition, history, sources of data and methods of study. <b>Applications of ethnobotany</b> 1) Ethnomedicines 2) Agriculture 3) Edible plants 4) Famine related plants, 5) Toxic plants and Antidotes. <b>Traditional medicines</b> as used by tribal in Maharashtra towards i) Skin ailments: <i>Rubia cordifolia</i> , Sandalwood ii) Liver ailments : <i>Phyllanthus</i> , <i>Andrographis</i> iii) Wound healing and ageing: <i>Centella</i> , <i>Typha</i> , <i>Terminalia</i> , <i>Tridax</i> iv) Fever : <i>Vitex negundo</i> , <i>Tinospora cordifolia</i> leaves v) Diabetis: <i>Momordica charantia</i> , <i>Syzygium cuminii</i> <b>Mushroom industry:</b> i)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. ii)General account of mushrooms: Nutritional value, picking and packaging, economic importance.		<b>(15 lectures)</b>
<b>Unit II BIOTECHNOLOGY I</b> <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> </ul> Hybridization (Southern Hybridization)		<b>(15 lectures)</b>
<b>UNIT III INSTRUMENTATION</b> Colorimetry and Spectrophotometry (Visible, UV and IR)- Instrumentation, working, principle and applications. Chromatography: General account of Column chromatography. Principle and bedding material involved in adsorbtion and partition chromatography, ion exchange chromatography, molecular sieve chromatography.		<b>(15 lectures)</b>
<b>UNIT IV PHARMACOGNOSY AND MEDICINAL BOTANY</b> 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>		<b>(15 lectures)</b>

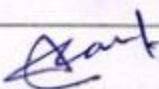
  
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**SEMESTER V**  
**PRACTICAL**

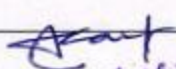
Semester V USBOP5	Cr
<b>PRACTICAL Paper I – PLANT DIVERSITY III</b>	<b>1.5</b>
<b>Microbiology</b> <ul style="list-style-type: none"> <li>• Study of aeromicrobiota by petri plate exposed method Fungal culture; Bacterial culture</li> <li>• Determination of Minimum Inhibitory Concentration (MIC) of sucrose against selected micro organism</li> <li>• Study of antimicrobial activity by the disc diffusion method</li> </ul>	
<b>Algae</b> Study of stages in the life cycle of the following Algae from fresh / preserved material and permanent slides <ul style="list-style-type: none"> <li>• <i>Polysiphonia</i></li> <li>• <i>Batrachospermum</i></li> <li>• <i>Vaucheria</i></li> <li>• <i>Pinnularia</i></li> </ul>	
<b>Fungi</b> Study of stages in the life cycle of the following Fungi from fresh / preserved material and permanent slides <ul style="list-style-type: none"> <li>• <i>Agaricus</i></li> <li>• <i>Puccinia</i></li> <li>• <i>Alternaria</i></li> </ul>	
<b>Plant Pathology</b> Study of the following fungal diseases: <ul style="list-style-type: none"> <li>• White rust</li> <li>• Tikka disease in Groundnut</li> <li>• Damping off disease</li> <li>• Citrus canker</li> <li>• Leaf curl</li> </ul>	
<b>PRACTICAL Paper II – PLANT DIVERSITY IV</b>	
<b>Paleobotany</b> Study of the following form genera with the help of permanent slides/ photomicrographs. <ul style="list-style-type: none"> <li>• <i>Calamites</i></li> <li>• <i>Lepidodendron</i></li> <li>• <i>Lyginopteris</i></li> <li>• <i>Pentoxylon</i></li> </ul>	

  
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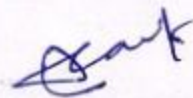
<p><b>Angiosperms</b></p> <ul style="list-style-type: none"> <li>• Morphology of Flower</li> <li>• Morphology of fruit</li> <li>• Study of one plant from each of the following Angiosperm families <ul style="list-style-type: none"> <li>• Capparidaceae</li> <li>• Umbelliferae</li> <li>• Cucurbitaceae</li> <li>• Rubiaceae</li> <li>• Solanaceae</li> <li>• Commelinaceae</li> <li>• Graminae</li> </ul> </li> <li>• Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families</li> <li>• Identifying the genus and species of a plant with the help of Flora</li> </ul>	
<p><b>Anatomy I</b></p> <p>Study of anomalous secondary growth in the stems of the following plants using double staining technique:</p> <ul style="list-style-type: none"> <li>• <i>Bignonia</i></li> <li>• <i>Salvadora</i></li> <li>• <i>Achyranthes</i></li> <li>• <i>Aristolochia</i></li> <li>• <i>Dracaena</i></li> </ul> <p>Study of anomalous secondary growth in the roots of</p> <ul style="list-style-type: none"> <li>• Beet</li> <li>• Radish</li> </ul> <p>Types of Stomata</p> <ul style="list-style-type: none"> <li>• Anomocytic</li> <li>• Anisocytic</li> <li>• Diacytic</li> <li>• Paracytic</li> <li>• Graminaceous</li> </ul>	
<p><b>Palynology</b></p> <p>Study of pollen morphology (NPC Analysis) of the following by Chitale's Method</p> <ul style="list-style-type: none"> <li>• <i>Hibiscus</i></li> <li>• <i>Datura</i></li> <li>• <i>Ocimum</i></li> <li>• <i>Crinum</i></li> <li>• <i>Pancreatium</i></li> <li>• <i>Canna</i></li> </ul> <p>Determination of pollen viability</p> <p>Pollen analysis from honey sample – unifloral and multifloral honey</p> <p>Effect of varying concentration of sucrose on <i>In vitro</i> Pollen germination</p>	

  
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<b>PRACTICAL - Paper III FORM AND FUNCTION II</b>	
<b>CYTOLOGY AND MOLECULAR BIOLOGY</b> <ul style="list-style-type: none"> <li>• Mounting of Giant chromosomes from Chironomous larva</li> <li>• Smear preparation from <i>Tradescantia</i> buds</li> <li>• Predicting the sequence of amino acids in the polypeptide chain that will be formed following translation (Eukaryotic)</li> </ul>	
<b>PHYSIOLOGY</b> <ul style="list-style-type: none"> <li>• Estimation of Phosphate phosphorus (Plant acid extract)</li> <li>• Estimation of Iron (Plant acid extract)</li> </ul> <p>Note: Preparation of a standard graph and determination of the multiplication factor for Phosphate / Iron estimation using a given standard phosphate / Standard Iron solution should be done in regular practical as this will also be put as a question in practical exam</p>	
<b>ENVIRONMENTAL BOTANY</b> Estimation of the following in given water sample <ul style="list-style-type: none"> <li>• Dissolved oxygen demand</li> <li>• Biological oxygen demand</li> <li>• Hardness</li> <li>• Salinity and Chlorinity</li> </ul>	
<b>MICROPROPOGATION</b> Plant Tissue culture: <ul style="list-style-type: none"> <li>• Identification – Multiple shoot culture, hairy root culture, somatic embryogenesis</li> <li>• Preparation of stock solutions for preparation of MS medium</li> </ul> <p>(Note: Concept of preparation of specified molar solutions should be taught and problems based on preparation of stock solutions for tissue culture media will be given).</p>	
<b>PAPER IV CURRENT TRENDS IN PLANT SCIENCES II</b>	
<b>ETHNOBOTANY AND MUSHROOM INDUSTRY</b> <ul style="list-style-type: none"> <li>• Study of plants mentioned in theory for Ethnobotany</li> <li>• Mushroom cultivation (To be demonstrated)</li> <li>• Identification of various stages involved in mushroom cultivation – spawn, pin head stage, mature/ harvest stage of <i>Agaricus</i>, <i>Pleurotus</i>, <i>Volvariella</i></li> </ul>	
<b>BIOTECHNOLOGY I</b> <ul style="list-style-type: none"> <li>• Growth curve of <i>E. coli</i></li> <li>• Plasmid DNA isolation and Separation of DNA using AGE</li> <li>• Restriction mapping (problems), Southern blotting</li> </ul>	
<b>INSTRUMENTATION</b> <ul style="list-style-type: none"> <li>• Demonstration of Beer Lambert's Law</li> <li>• Experiment based on ion exchange chromatography for demonstration</li> <li>• Experiment based on separation of dyes/ plant pigments using silica gel column.</li> </ul>	
<b>UNIT IV PHARMACOGNOSY</b> Macroscopic/ Microscopic characters and Chemical tests for active constituents of the following plants <ul style="list-style-type: none"> <li>• <i>Allium sativum</i></li> </ul>	

  
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| <ul style="list-style-type: none"><li>• <i>Acorus calamus</i></li><li>• <i>Curcuma longa</i></li><li>• <i>Senna angustifolia</i></li><li>• <i>Strychnos nux-vomica</i></li><li>• <i>Eugenia caryophyllata</i></li></ul> |  |
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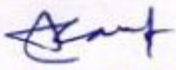


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## SEMESTER VI

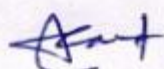
Course Code	Title	Credits
<b>USBO601</b>	<b>PLANT DIVERSITY III</b>	<b>2.5 Credits (60 lectures)</b>
<b><u>Unit I : Brvophyta</u></b> <ul style="list-style-type: none"><li>• Life cycle of <i>Marchantia</i></li><li>• Life cycle of <i>Pelia</i></li><li>• Life cycle of <i>Sphagnum</i></li></ul>		<b>(15 lectures)</b>
<b><u>Unit II : Pteridophyta</u></b> <ul style="list-style-type: none"><li>• Lepidophyta – Classification, general characters; Life cycle of <i>Lycopodium</i></li><li>• Calamophyta – Classification, general characters; Life cycle of <i>Equisetum</i></li><li>• Pterophyta – Classification and general characters, Life cycle of <i>Adiantum</i> and <i>Marselia</i></li></ul>		<b>(15 lectures)</b>
<b><u>Unit III : Bryophytes and Pteridophytes: Applied aspects</u></b> <ul style="list-style-type: none"><li>• Ecology of Bryophytes</li><li>• Economic importance of Bryophytes</li><li>• Bryophytes as indicators</li><li>• Evolution of Sporophyte and Gametophyte</li><li>• Economic importance of Pteridophytes</li><li>• Diversity and distribution of Indian Pteridophytes</li><li>• Types of sori and evolution of sori</li></ul>		<b>(15 lectures)</b>
<b><u>Unit IV : Gymnosperms</u></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>		<b>(15 lectures)</b>

  
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Course Code	Title	Credits
<b>USBO602</b>	<b>PLANT DIVERSITY IV</b>	<b>2.5 Credits (60 lectures)</b>
<b><u>Unit I : Angiosperms II</u></b> <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>		<b>(15 lectures)</b>
<b><u>Unit II : Anatomy II</u></b> Ecological anatomy <ul style="list-style-type: none"> <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>		<b>(15 lectures)</b>
<b><u>Unit III : Embryology</u></b> <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>		<b>(15 lectures)</b>
<b><u>Unit IV : Biostatistics</u></b> <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>		<b>(15 lectures)</b>

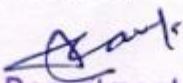
  
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Course Code	Title	Credits
USBO603	FORM AND FUNCTION III	2.5 Credits (60 lectures)
<b>UNIT I PLANT BIOCHEMISTRY</b>		15 Lectures
<ul style="list-style-type: none"> <li>• Structure of biomolecules: Carbohydrates (sugars, starch, cellulose, pectin, lipids (fatty acids and glycerol), proteins ( amino acids)</li> <li>• Enzymes: Nomenclature, classification, mode of action, Enzyme kinetics, Michaelis Menten equation, competitive non-competitive, and uncompetitive inhibitors.</li> </ul>		
<b>UNIT II PLANT PHYSIOLOGY II</b>		15 Lectures
<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>		
<b>UNIT III : GENETICS</b>		15 Lectures
<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>		
<b>UNIT IV: BIOINFORMATICS</b>		15 Lectures
<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>		



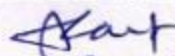
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Course Code	Title	Credits
USBO604	<b>CURRENT TRENDS IN PLANT SCIENCES II</b>	<b>2.5 Credits (60 lectures)</b>
<b>Unit I PLANT BIOTECHNOLOGY II</b>		<b>15 Lectures</b>
<ul style="list-style-type: none"> <li>• DNA sequence analysis – Maxam – Gilbert 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>		
<b>Unit II: Plant Geography</b>		<b>15 Lectures</b>
<b>Phytogeographical regions of India.</b> <b>Biodiversity:</b> <ul style="list-style-type: none"> <li>• Definition, diversity of flora found in various forest types of India</li> <li>• Evolution of biodiversity with one example of an evolutionary tree</li> <li>• Levels of biodiversity</li> <li>• Importance and status of biodiversity</li> <li>• Loss of biodiversity</li> <li>• Conservation of biodiversity</li> <li>• Genetic diversity- Molecular characteristics</li> </ul>		
<b>Unit III: Economic Botany</b>		<b>15 Lectures</b>
<ul style="list-style-type: none"> <li>• <b>Essential Oils:</b> Extraction, perfumes, perfume oils, oil of rose, sandalwood, patchouli, champaca, grass oils: <i>Citronella</i>, vetiver.</li> <li>• <b>Fatty oils:</b> Drying oil (linseed and soyabean oil), semidrying oils (cotton seed, sesame oil) and non-drying oils (olive oil and peanut oil),</li> <li>• <b>Vegetable Fats:</b> Coconut and Palm oil</li> </ul>		
<b>Unit IV : Post Harvest Technology</b>		<b>15 Lectures</b>
<ul style="list-style-type: none"> <li>• <b>Storage of Plant Produce- Preservation of Fruits and Vegetables</b></li> <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, Plate freezers, Cryogenic Freezing, Dehydrofreezing, Freeze drying),</li> <li>• Canning</li> <li>• Pickling (in brine, in vinegar, Indian pickles)</li> <li>• Sugar Concentrates (Jams, Jellies, Fruit juices)</li> <li>• Food preservatives</li> <li>• <b>Use of antioxidants in preservation</b></li> </ul>		


  
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**SEMESTER VI**  
**PRACTICAL**

Semester VI USBOP	Cr
<b>PRACTICAL PAPER I – PLANT DIVERSITY III</b>	<b>1.5</b>
<p><b>Bryophyta</b> Study of stages in the life cycle of the following Bryophyta from fresh / preserved material and permanent slides</p> <ul style="list-style-type: none"> <li>• <i>Marchantia</i></li> <li>• <i>Pelia</i></li> <li>• <i>Sphagnum</i></li> </ul>	
<p><b>Pteridophyta</b> Study of stages in the life cycles of the following Pteridophytes from fresh / preserved material and permanent slides</p> <ul style="list-style-type: none"> <li>• <i>Lycopodium</i></li> <li>• <i>Equisetum</i></li> <li>• <i>Adiantum</i></li> <li>• <i>Marselia</i></li> </ul>	
<p><b>Bryophytes and Pteridophytes: Applied aspects</b></p> <ul style="list-style-type: none"> <li>• Economic importance of Bryophyta</li> <li>• Economic importance of Pteridophyta</li> <li>• Types of sporophytes in Bryophyta (from Permanent slides)</li> <li>• Types of sori and soral arrangement in Pteridophytes</li> </ul>	
<p><b>Gymnosperms</b> Study of stages in the life cycles of the following Gymnosperms from fresh / preserved material and permanent slides</p> <ul style="list-style-type: none"> <li>• <i>Thuja/ Biota</i></li> <li>• <i>Gnetum</i></li> <li>• <i>Ephedra</i></li> </ul> <p>Economic importance of Gymnosperms</p>	
<b>PRACTICAL PAPER II – PLANT DIVERSITY IV</b>	<b>1.5</b>
<p><b>Angiosperms</b> Study of one plant from each of the following Angiosperm families</p> <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> <p>Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families Identify the genus and species with the help of flora.</p>	

  
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<b>Anatomy</b> Study of Ecological Anatomy of <ul style="list-style-type: none"> <li>Hydrophytes: <i>Hydrilla</i> stem, <i>Nymphaea</i> petiole, <i>Eichhornia</i> offset</li> <li>Epiphytes: Orchid</li> <li>Sciophytes: <i>Peperomia</i> leaf</li> <li>Xerophytes: <i>Nerium</i> leaf, <i>Opuntia</i> phylloclade</li> <li>Halophytes: <i>Avicennia</i> leaf and pneumatophore, <i>Sesuvium</i> / <i>Sueda</i> leaf</li> <li>Mesophytes: <i>Vinca</i> leaf</li> </ul>	
<b>Embryology</b> <ul style="list-style-type: none"> <li>Study of various stages of Microsporogenesis, Megasporeogenesis and Embryo Development with the help of permanent slides / photomicrographs</li> <li>Mounting of Monocot (Maize) and Dicot (Castor and Gram) embryo</li> <li><i>In vivo</i> growth of pollen tube in <i>Portulaca/Vinca</i></li> </ul>	
<b>Biostatistics</b> <ul style="list-style-type: none"> <li><i>t</i>-test (paired and unpaired)</li> <li>Problems based on regression analysis</li> <li>ANOVA</li> </ul>	
<b>PRACTICAL PAPER III – Form and function III</b>	<b>1.5</b>
<b>PLANT BIOCHEMISTRY</b> <ul style="list-style-type: none"> <li>Estimation of proteins by Biuret method</li> <li>Effect of temperature on the activity of amylase</li> <li>Effect of pH on the activity of amylase</li> <li>Effect of substrate variation on the activity of amylase</li> </ul>	
<b>PLANT PHYSIOLOGY</b> <ul style="list-style-type: none"> <li>Determination of alpha-amino nitrogen</li> <li>Effect of GA on seed germination</li> <li>Estimation of reducing sugars by DNSA method</li> </ul>	
<b>GENETICS</b> <ul style="list-style-type: none"> <li>Problems based on three-point crosses, construction of chromosome maps</li> <li>Identification of types of mutations from given DNA sequences</li> <li>Study of mitosis using pre-treated root tips of <i>Allium</i></li> </ul>	
<b>BIOINFORMATICS</b> <ul style="list-style-type: none"> <li>BLAST: nBLAST, pBLAST</li> <li>Multiple sequence alignment</li> <li>Phylogenetic analysis</li> <li>RASMOL/ SPDBV</li> </ul>	

  
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<b>PRACTICAL PAPER IV CURRENT TRENDS IN PLANT SCIENCES</b>	<b>1.5</b>
<b>PLANT BIOTECHNOLOGY II</b> <ul style="list-style-type: none"> <li>• DNA sequencing (Sanger's Method)</li> <li>• DNA barcoding of plant material by using suitable data</li> </ul>	
<b>Plant Geography</b> <ul style="list-style-type: none"> <li>• Study of phytogeographic regions of India</li> <li>• Preparation of vegetation map using Garmin's GPS Instrument</li> <li>• Problems based on Simpson's diversity Index</li> </ul>	
<b>Economic Botany</b> <ul style="list-style-type: none"> <li>• Demonstration: Extraction of essential oil using Clevenger</li> <li>• Thin layer chromatography of essential oil of patchouli and <i>Citronella</i></li> <li>• Saponification value of palm oil</li> </ul>	
<b>Post-Harvest Technology</b> Preparation of <ul style="list-style-type: none"> <li>• Squash</li> <li>• Jam</li> <li>• Jelly</li> <li>• Pickle</li> </ul>	

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**Scheme of Examinations:**

**Students offering Double major will study Paper II and III.**

<b>Theory Course: Term end Assessment</b>	100 Marks
<b>Practical Course</b>	50 marks

**Note:**

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



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UNIVERSITY OF MUMBAI  
T.Y.B.Sc. BOTANY SEMESTER V  
PLANT DIVERSITY III  
PRACTICAL I

Duration: 3 hours

Max. Marks : 50

- Q. 1 Perform the given Microbiological experiment 'A'. 12M
- Q. 2 Identify, classify and describe specimen B, C and D. Sketch neat and labeled diagrams of morphological/microscopical structures seen in the specimens. 24M
- Q. 3 Identify and describe slides/ specimens E, F and G. 09M
- Q. 4 Journal. 05M

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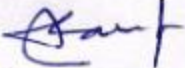
Key-

A- Any one experiment out of four as prescribed in syllabus

B & C- Algae

D- Fungi

E, F & G - (Plant Pathology, Algae or Fungi not asked above) in random order

  
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PLANT DIVERSITY IV  
PRACTICAL II

Duration: 3 hours

Max. Marks: 50

- Q. 1 A. Classify specimen 'A' up to their families giving reasons. Give floral formula. Sketch and labelled L.S. of flower and T.S. ovary. **10M**
- Q. 1.B. Identify genus and species of specimen 'B' using flora. **05M**
- Q. 2 Make a temporary double stained preparation of T.S. specimen 'C' and comment on the type of secondary growth. **08M**
- Q. 3 Perform the Palynology experiment 'D' allotted to you. **07M**
- Q. 4 Identify and describe slide/ specimen 'E', 'F', 'G' &'H'. **12M**
- Q. 5 Field report **03M**
- Q. 6 Viva voce (based on Paper I and Paper II). **05M**

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A - Families of T.Y.B.Sc only

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

C- Anatomy- Anomalous Secondary Growth

D- As per slip

E, F, G & H

Fossils, Types of Stomata, Morphology of flower & Fruits - in random order

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T.Y.B.Sc. BOTANY SEMESTER V  
FORM AND FUNCTION III  
PRACTICAL III

Duration: 3 hours

Max. Marks : 50

- Q. 1 Make a smear preparation of material 'A' and show the slide to the Examiner. Comment on your observation/ Expose the giant Chromosomes from the salivary glands of Chironomous larva. 08
- Q. 2 Perform the experiment 'B' allotted to you ( physiology). 12
- Q. 3 Perform the experiment 'C' allotted to you (ecology). 12
- Q. 4. Calculate the \_\_\_\_\_ of the given solution 'D' to prepare the required solution. 07
- Q. 5. Identify and describe slide/specimen 'E' & 'F' 06
- Q.6. Journal 05

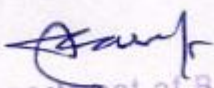
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B: Physiology experiment

C: Ecology experiment

D: Plant tissue culture

E & F: Multiple shoot culture, hairy root culture, somatic embryogenesis, amino acid sequencing.

  
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T.Y.B.Sc. BOTANY SEMESTER V  
CURRENT TRENDS IN PLANT SCIENCE II  
PRACTICAL IV

Duration: 3 hours

Max. Marks: 50

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

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Key-

**B** – experiment based on Beer- Lambert's Law

Experiment on separation of dyes/pigments using silica gel column chromatography

**C & D**- *Allium sativum*

*Acorus calamus*

*Curcuma longa*

*Senna angustifolia*

*Strychnos nux-vomica*

*Eugenia caryophyllata*

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

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PLANT DIVERSITY III  
PRACTICAL I

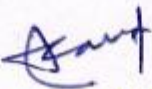
Duration: 3 hours

Max. Marks : 50

- Q. 1 Identify, classify and describe specimen **A** and **B**. Sketch neat and labelled diagrams of morphological/microscopical structures seen in the specimens. **10M**
- Q. 2. Identify, classify and describe specimen **C** and **D**. Sketch neat and labeled diagrams of morphological/microscopical structures seen in the specimens. **10M**
- Q.3 Identify, classify and describe specimen '**E**'. Sketch neat and labeled diagrams of morphological/microscopical structures seen in the specimens. **07M**
- Q. 4. Identify and describe slides/specimen '**F**', '**G**' '**H**', '**I**' & '**J**'. **15M**
- Q. 5. Journal. **05M**
- Q. 6. Field report **03M**

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**A & B-** *Marchantia, Pellia & Sphagnum*  
**C & D-** *Lycopodium, Equisetum, Adiantum & Marsilea*  
**E-** Gymnosperm- *Thuja, Gnetum & Ephedra*  
**F, G & H, I & J-** [In random order]  
Economic importance of Bryophytes  
Economic importance of Pteridophytes  
Types of sporophytes in Bryophyta  
Types of Sori in Pteridophytes  
Soral arrangement in Pteridophytes  
Economic importance of Gymnosperms

  
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PLANT DIVERSITY IV  
PRACTICAL II

Duration: 3 hours

Max. Marks: 50

- Q. 1. From the given data/ material **A** determine test of significance using students t-test/ Regression Analysis/ ANOVA **10M**
- Q. 2 A. Classify specimen **'B'** up to their families giving reasons. Give floral formula. Sketch and labelled L.S. of flower and T.S. ovary. **10M**
- Q. 2.B. Identify genus and species of specimen **'C'** using flora. **05M**
- Q. 3 Make a stained preparation of specimen **'D'** and comment on its ecological anatomy. **08M**
- Q. 4 Identify and describe slide/specimen **'E', 'F', 'G'** and **'H'**. **12M**
- Q. 5 Viva voce (based on Paper III and paper IV) **05M**

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**Key- Paper-II**

- A-** Problem on biostats  
**B-** Families of T.Y.B.Sc only  
**C-**Plants from F.Y., S.Y. & T.Y. B. Sc SEM V Families to be included  
**D-**Ecological anatomy  
**E, F, G & H** [In random order]  
, Economic importance of specimen from prescribe families (sem VI only) & Embryology



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T.Y.B.Sc. BOTANY SEMESTER VI  
FORM AND FUNCTION III  
PRACTICAL III**

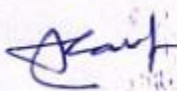
**Duration: 3 hours**

**Max. Marks : 50**

- Q. 1. Perform the experiment 'A' allotted to you. **10**
- Q. 2. Perform the experiment 'B' allotted to you. **10**
- Q.3. Make a squash preparation to show the stage of mitosis from the pre-treated root tips B. **06**
- Q. 4. Construct a chromosome map from the given data C/ Identify the type of mutation and comment on them (any two types of mutations) **12**
- Q. 5. Perform the given analysis of data D using computer (Bioinformatics). **07**
- Q. 5. Journal. **05**

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A: Plant Biochemistry Experiment  
B: Plant Physiology Experiment

  
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**T.Y.B.Sc. Botany Practical Paper Pattern**

**Credit System**

**UNIVERSITY OF MUMBAI  
T.Y.B.Sc. BOTANY SEMESTER VI  
CURRENT TRENDS IN PLANT SCIENCE II  
PRACTICAL IV**

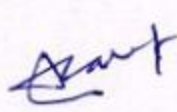
**Duration: 3 hours**

**Max. Marks: 50**

- Q. 1. Perform the DNA barcoding of plant material using given data 'A' **10**  
**OR**  
Perform DNA sequencing by Sanger's method of the given sequence 'A'. **10**
- Q. 2. Calculate Simpson's Diversity Index from the given data 'B'. **08**
- Q.3. Mark the \_\_\_\_\_ phylogeographic region 'C' in the map of India and  
Comment on the same. **05**
- Q. 3 Perform the experiment 'C' allotted to you **10**
- Q. 4 Prepare the squash/Jam/jelly/pickle from the given material 'D'. **12**
- Q. 5. Viva voce. **05**

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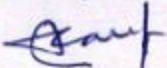
C- TLC of Patchouli or *Citronella* / saponification value

  
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## Reference Books

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

  
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No. UG/14 of 2018-19

**CIRCULAR:-**

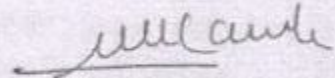
Attention of the Principals of the affiliated Colleges and Directors of the recognized Institutions in Science & Technology Faculty is invited to this office Circular No. UG/95 of 2015-16, dated 5<sup>th</sup> October, 2015 relating to syllabus of the Bachelor of Science (B.Sc.) degree course.

They are hereby informed that the recommendations made by the Board of Studies in Botany at its meeting held on 9<sup>th</sup> April, 2018 have been accepted by the Academic Council at its meeting held on 5<sup>th</sup> May, 2018 **vide** item No. 4.25 and that in accordance therewith, the revised syllabus as per the (CBCS) for the T.Y.B.Sc. in Botany (Sem -V & VI), has been brought into force with effect from the academic year 2018-19, accordingly. (The same is available on the University's website [www.mu.ac.in](http://www.mu.ac.in)).

MUMBAI - 400 032

14<sup>th</sup> June, 2018

To



(Dr. Dinesh Kamble)

I/c REGISTRAR

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

A.C/4.25/05/05/2018

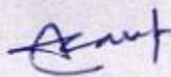
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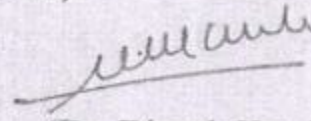
MUMBAI-400 032 14<sup>th</sup> June, 2018

Copy forwarded with Compliments for information to:-

- 1) The I/c Dean, Faculty of Science & Technology,
- 2) The Chairman, Board of Studies in Botany,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Co-Ordinator, University Computerization Centre,



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(Dr. Dinesh Kamble)

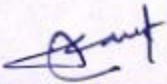
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# UNIVERSITY OF MUMBAI

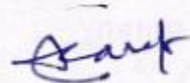
**Syllabus for the T.Y.B.Sc.  
Program: B.Sc. Course: BOTANY**

(Credit Based Semester and Grading System with effect from  
the academic year 2018–2019)

  
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**T.Y.B.Sc. Botany Syllabus**  
**Restructured for Credit Based and Grading System**  
**To be implemented from the Academic year 2018-2019**  
**SEMESTER V**

Course Code	UNIT	TOPICS	Credit	L / Weeks
USBO501	<b>PLANT DIVERSITY III</b>		2.5	1
	I	Microbiology		
	II	Algae		
	III	Fungi		
	IV	Plant Pathology		
USBO502	<b>PLANT DIVERSITY IV</b>		2.5	1
	I	Paleobotany		
	II	Angiosperms I		
	III	Anatomy I		
	IV	Palynology		
USBO503	<b>FORM AND FUNCTION III</b>		2.5	1
	I	Cytology and Molecular biology		
	II	Physiology I		
	III	Environmental Botany		
	IV	Plant tissue culture		
USBO504	<b>CURRENT TRENDS IN PLANT SCIENCES II</b>		2.5	1
	I	Ethnobotany and Mushroom Industry		
	II	Biotechnology I		
	III	Instrumentation		
	IV	Pharmacognosy and medicinal botany		
USBOP5	Practicals based on all the four courses in theory		6	16



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**SEMESTER VI**

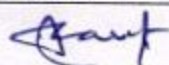
Course Code	UNIT	TOPICS	Credit	L / Weeks
USBO601	<b>PLANT DIVERSITY III</b>			
	I	Bryophyta	2.5	1
	II	Pteridophyta		1
	III	Bryophyta and Pteridophyta: Applied aspects		1
	IV	Gymnosperms		1
USBO602	<b>PLANT DIVERSITY IV</b>			
	I	Angiosperms II	2.5	1
	II	Anatomy II		1
	III	Embryology		1
	IV	Biostatistics		1
USBO603	<b>FORM AND FUNCTION III</b>			
	I	Plant Biochemistry	2.5	1
	II	Physiology II		1
	III	Genetics		1
	IV	Bioinformatics		1
USBO604	<b>CURRENT TRENDS IN PLANT SCIENCES II</b>			
	I	Plant biotechnology II	2.5	1
	II	Plant Geography		1
	III	Economic Botany		1
	IV	Post Harvest Technology		1
USBOP6	Practicals based on all the four courses in theory		6	16

*Amy*

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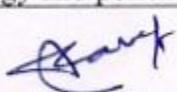
**SEMESTER V****THEORY**

Course Code	Title	Credits
<b>USBO501</b>	<b>PLANT DIVERSITY III</b>	<b>2.5 Credits (60 lectures)</b>
<b>Unit I: Microbiology</b> <ul style="list-style-type: none"> <li>• Types of Microbes</li> <li>• Culturing: Sterilization, media, staining, colony characters</li> <li>• Pure cultures</li> </ul> Role of microbes in fermentation: Alcohol and Antibiotics		<b>(15 lectures)</b>
<b>Unit II : Algae</b> <ul style="list-style-type: none"> <li>• Division <u>Rhodophyta</u> Classification and General Characters: Distribution, Cell structure, pigments, reserve food, range of thallus, reproduction: asexual and sexual, Alternation of Generations, Economic Importance.</li> <li>• Structure, life cycle and systematic position of <i>Polysiphonia</i> <i>Batrachospermum</i></li> <li>• Classification and General Characters of <u>Xanthophyta</u>: Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance.</li> <li>• Structure, life cycle and systematic position of <i>Vaucheria</i></li> <li>• Classification and General Characters of <u>Bacillariophyta</u>: Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance.</li> <li>• Structure, life cycle and systematic position of <i>Pinnularia</i></li> </ul>		<b>(15 lectures)</b>
<b>Unit III : Fungi</b> <ul style="list-style-type: none"> <li>• Basidiomycetes: Classification and General characters</li> <li>• Life cycle of <i>Agaricus</i></li> <li>• Life cycle of <i>Puccinia</i></li> <li>• Deuteromycetae: Classification and General Characters</li> <li>• Life cycle of <i>Alternaria</i></li> </ul>		<b>(15 lectures)</b>
<b>Unit IV : Plant Pathology</b> <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</i> sp.</li> <li>➤ Tikka disease of ground nut: <i>Cercospora</i></li> <li>➤ Damping off disease: <i>Pythium</i></li> <li>➤ Citrus canker – <i>Xanthomonas</i> sp.</li> <li>➤ Leaf curl – leaf curl virus</li> </ul> </li> <li>• Study of Physical, chemical and biological control methods of plant diseases.</li> </ul>		<b>(15 lectures)</b>



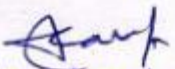
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Course Code	Title	Credits
<b>USBO502</b>	<b>PLANT DIVERSITY III</b>	<b>2.5 Credits (60 lectures)</b>
<b><u>Unit I : Paleobotany</u></b>		<b>(15 lectures)</b>
<ul style="list-style-type: none"> <li>• <i>Calamites</i> – All form genera Stem, leaf, male and female fructification</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 Birbal Sahni, Birbal Sahni Institute of Paleobotany, Lucknow</li> </ul>		
<b><u>Unit II : Angiosperms I</u></b>		<b>(15 lectures)</b>
<ul style="list-style-type: none"> <li>• Morphology of flower and 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>• Rubiaceae</li> <li>• Solanaceae</li> <li>• Commelinaceae</li> <li>• Graminae</li> </ul> </li> </ul>		
<b><u>Unit III : Anatomy</u></b>		<b>(15 lectures)</b>
<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>. Storage roots of Beet, Radish</li> <li>• Root stem transition</li> <li>• Types of Stomata – Anomocytic, Anisocytic, Diacytic, Paracytic, and Graminaceous</li> </ul>		
<b><u>Unit IV : Palynology</u></b>		<b>(15 lectures)</b>
<ul style="list-style-type: none"> <li>• Pollen Morphology</li> <li>• Pollen viability – storage</li> <li>• Germination and growth of pollen</li> <li>• Application of Palynology in honey industry, coal and oil exploration, Aerobiology and pollen allergies, forensic science</li> </ul>		

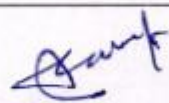
  
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Course Code	Title	Credits
<b>USBO503</b>	<b>FORM AND FUNCTIONS- II</b>	<b>2.5 Credits (60 lectures)</b>
<b>UNIT I : CYTOLOGY AND MOLECULAR BIOLOGY</b> Structure and function of nucleus Structure and function of vacuole Structure and function of giant chromosomes The genetic code: Characteristics of the genetic code Transcription and Translation in Eukaryotes		<b>(15 lectures)</b>
<b>UNIT II: PHYSIOLOGY</b> <b>Water relations:</b> Potential, osmosis, transpiration, imbibition, Solute transport: Transport of ions across cell membranes, active and passive transport, carriers, channels and pumps. Translocation of solutes: Composition of phloem sap, girdling experiment, pressure flow model, phloem loading and unloading, anatomy of sieve tube elements, mechanisms of sieve tube translocation, Munch's hypothesis.		<b>(15 lectures)</b>
<b>UNIT III ENVIRONMENTAL BOTANY</b> <b>Bioremediation:</b> Principles, factors responsible and microbial population in bioremediation. <b>Phytoremediation:</b> Metals, Organic pollutants <b>Plant succession:</b> 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		<b>(15 lectures)</b>
<b>UNIT IV PLANT TISSUE CULTURE</b> Aspects of micropropagation with reference to Floriculture: Detailed study of Orchid cultivation Plant cell suspension cultures for the production of secondary metabolites: with special reference to Shikonin production. Somatic embryogenesis and artificial seeds: Protoplast fusion and Somatic hybridization: i) Concept, definition, and various methods of protoplast fusion ii) Applications of somatic hybridization in agriculture		<b>(15 lectures)</b>

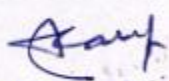
  
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Course Code	Title	Credits
<b>USBO504</b>	<b><u>CURRENT TRENDS IN PLANT SCIENCES I</u></b>	<b>2.5 Credits (60 lectures)</b>
<b>UNIT I ETHNOBOTANY AND MUSHROOM INDUSTRY</b> <b>Ethnobotany</b> - Definition, history, sources of data and methods of study. <b>Applications of ethnobotany</b> 1) Ethnomedicines 2) Agriculture 3) Edible plants 4) Famine related plants, 5) Toxic plants and Antidotes. <b>Traditional medicines</b> as used by tribal in Maharashtra towards i) Skin ailments: <i>Rubia cordifolia</i> , Sandalwood ii) Liver ailments : <i>Phyllanthus</i> , <i>Andrographis</i> iii) Wound healing and ageing: <i>Centella</i> , <i>Typha</i> , <i>Terminalia</i> , <i>Tridax</i> iv) Fever : <i>Vitex negundo</i> , <i>Tinospora cordifolia</i> leaves v) Diabetis: <i>Momordica charantia</i> , <i>Syzygium cuminii</i> <b>Mushroom industry:</b> i)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. ii)General account of mushrooms: Nutritional value, picking and packaging, economic importance.		<b>(15 lectures)</b>
<b>Unit II BIOTECHNOLOGY I</b> <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> </ul> Hybridization (Southern Hybridization)		<b>(15 lectures)</b>
<b>UNIT III INSTRUMENTATION</b> Colorimetry and Spectrophotometry (Visible, UV and IR)- Instrumentation, working, principle and applications. Chromatography: General account of Column chromatography. Principle and bedding material involved in adsorption and partition chromatography, ion exchange chromatography, molecular sieve chromatography.		<b>(15 lectures)</b>
<b>UNIT IV PHARMACOGNOSY AND MEDICINAL BOTANY</b> 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>		<b>(15 lectures)</b>

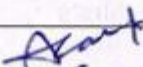
  
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**SEMESTER V**  
**PRACTICAL**

Semester V USBOP5	Cr
<b>PRACTICAL Paper I – PLANT DIVERSITY III</b>	<b>1.5</b>
<b>Microbiology</b> <ul style="list-style-type: none"> <li>• Study of aeromicrobiota by petri plate exposed method Fungal culture; Bacterial culture</li> <li>• Determination of Minimum Inhibitory Concentration (MIC) of sucrose against selected micro organism</li> <li>• Study of antimicrobial activity by the disc diffusion method</li> </ul>	
<b>Algae</b> Study of stages in the life cycle of the following Algae from fresh / preserved material and permanent slides <ul style="list-style-type: none"> <li>• <i>Polysiphonia</i></li> <li>• <i>Batrachospermum</i></li> <li>• <i>Vaucheria</i></li> <li>• <i>Pinnularia</i></li> </ul>	
<b>Fungi</b> Study of stages in the life cycle of the following Fungi from fresh / preserved material and permanent slides <ul style="list-style-type: none"> <li>• <i>Agaricus</i></li> <li>• <i>Puccinia</i></li> <li>• <i>Alternaria</i></li> </ul>	
<b>Plant Pathology</b> Study of the following fungal diseases: <ul style="list-style-type: none"> <li>• White rust</li> <li>• Tikka disease in Groundnut</li> <li>• Damping off disease</li> <li>• Citrus canker</li> <li>• Leaf curl</li> </ul>	
<b>PRACTICAL Paper II – PLANT DIVERSITY IV</b>	
<b>Paleobotany</b> Study of the following form genera with the help of permanent slides/ photomicrographs. <ul style="list-style-type: none"> <li>• <i>Calamites</i></li> <li>• <i>Lepidodendron</i></li> <li>• <i>Lyginopteris</i></li> <li>• <i>Pentoxylon</i></li> </ul>	

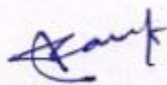
  
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<p><b>Angiosperms</b></p> <ul style="list-style-type: none"> <li>• Morphology of Flower</li> <li>• Morphology of fruit</li> <li>• Study of one plant from each of the following Angiosperm families <ul style="list-style-type: none"> <li>• Capparidaceae</li> <li>• Umbelliferae</li> <li>• Cucurbitaceae</li> <li>• Rubiaceae</li> <li>• Solanaceae</li> <li>• Commelinaceae</li> <li>• Graminae</li> </ul> </li> <li>• Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families</li> <li>• Identifying the genus and species of a plant with the help of Flora</li> </ul>	
<p><b>Anatomy I</b></p> <p>Study of anomalous secondary growth in the stems of the following plants using double staining technique:</p> <ul style="list-style-type: none"> <li>• <i>Bignonia</i></li> <li>• <i>Salvadora</i></li> <li>• <i>Achyranthes</i></li> <li>• <i>Aristolochia</i></li> <li>• <i>Dracaena</i></li> </ul> <p>Study of anomalous secondary growth in the roots of</p> <ul style="list-style-type: none"> <li>• Beet</li> <li>• Radish</li> </ul> <p>Types of Stomata</p> <ul style="list-style-type: none"> <li>• Anomocytic</li> <li>• Anisocytic</li> <li>• Diacytic</li> <li>• Paracytic</li> <li>• Graminaceous</li> </ul>	
<p><b>Palynology</b></p> <p>Study of pollen morphology (NPC Analysis) of the following by Chitale's Method</p> <ul style="list-style-type: none"> <li>• <i>Hibiscus</i></li> <li>• <i>Datura</i></li> <li>• <i>Ocimum</i></li> <li>• <i>Crinum</i></li> <li>• <i>Pancreatium</i></li> <li>• <i>Canna</i></li> </ul> <p>Determination of pollen viability</p> <p>Pollen analysis from honey sample – unifloral and multifloral honey</p> <p>Effect of varying concentration of sucrose on <i>In vitro</i> Pollen germination</p>	

  
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<b>PRACTICAL - Paper III FORM AND FUNCTION II</b>	
<b>CYTOLOGY AND MOLECULAR BIOLOGY</b> <ul style="list-style-type: none"> <li>• Mounting of Giant chromosomes from Chironomous larva</li> <li>• Smear preparation from <i>Tradescantia</i> buds</li> <li>• Predicting the sequence of amino acids in the polypeptide chain that will be formed following translation (Eukaryotic)</li> </ul>	
<b>PHYSIOLOGY</b> <ul style="list-style-type: none"> <li>• Estimation of Phosphate phosphorus (Plant acid extract)</li> <li>• Estimation of Iron (Plant acid extract)</li> </ul> <p>Note: Preparation of a standard graph and determination of the multiplication factor for Phosphate / Iron estimation using a given standard phosphate / Standard Iron solution should be done in regular practical as this will also be put as a question in practical exam</p>	
<b>ENVIRONMENTAL BOTANY</b> Estimation of the following in given water sample <ul style="list-style-type: none"> <li>• Dissolved oxygen demand</li> <li>• Biological oxygen demand</li> <li>• Hardness</li> <li>• Salinity and Chlorinity</li> </ul>	
<b>MICROPROPAGATION</b> Plant Tissue culture: <ul style="list-style-type: none"> <li>• Identification – Multiple shoot culture, hairy root culture, somatic embryogenesis</li> <li>• Preparation of stock solutions for preparation of MS medium</li> </ul> <p>(Note: Concept of preparation of specified molar solutions should be taught and problems based on preparation of stock solutions for tissue culture media will be given).</p>	
<b>PAPER IV CURRENT TRENDS IN PLANT SCIENCES II</b>	
<b>ETHNOBOTANY AND MUSHROOM INDUSTRY</b> <ul style="list-style-type: none"> <li>• Study of plants mentioned in theory for Ethnobotany</li> <li>• Mushroom cultivation (To be demonstrated)</li> <li>• Identification of various stages involved in mushroom cultivation – spawn, pin head stage, mature/ harvest stage of <i>Agaricus</i>, <i>Pleurotus</i>, <i>Volvariella</i></li> </ul>	
<b>BIOTECHNOLOGY I</b> <ul style="list-style-type: none"> <li>• Growth curve of <i>E. coli</i></li> <li>• Plasmid DNA isolation and Separation of DNA using AGE</li> <li>• Restriction mapping (problems), Southern blotting</li> </ul>	
<b>INSTRUMENTATION</b> <ul style="list-style-type: none"> <li>• Demonstration of Beer Lambert's Law</li> <li>• Experiment based on ion exchange chromatography for demonstration</li> <li>• Experiment based on separation of dyes/ plant pigments using silica gel column.</li> </ul>	
<b>UNIT IV PHARMACOGNOSY</b> Macroscopic/ Microscopic characters and Chemical tests for active constituents of the following plants <ul style="list-style-type: none"> <li>• <i>Allium sativum</i></li> </ul>	

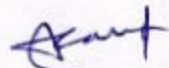
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| <ul style="list-style-type: none"><li>• <i>Acorus calamus</i></li><li>• <i>Curcuma longa</i></li><li>• <i>Senna angustifolia</i></li><li>• <i>Strychnos nux-vomica</i></li><li>• <i>Eugenia caryophyllata</i></li></ul> |  |
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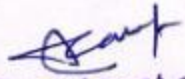
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## SEMESTER VI

Course Code	Title	Credits
USBO601	PLANT DIVERSITY III	2.5 Credits (60 lectures)
<b>Unit I : Bryophyta</b> <ul style="list-style-type: none"><li>• Life cycle of <i>Marchantia</i></li><li>• Life cycle of <i>Pelia</i></li><li>• Life cycle of <i>Sphagnum</i></li></ul>		(15 lectures)
<b>Unit II : Pteridophyta</b> <ul style="list-style-type: none"><li>• Lepidophyta – Classification, general characters; Life cycle of <i>Lycopodium</i></li><li>• Calamophyta – Classification, general characters; Life cycle of <i>Equisetum</i></li><li>• Pterophyta – Classification and general characters, Life cycle of <i>Adiantum</i> and <i>Marselia</i></li></ul>		(15 lectures)
<b>Unit III : 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</li><li>• Evolution of Sporophyte and Gametophyte</li><li>• Economic importance of Pteridophytes</li><li>• Diversity and distribution of Indian Pteridophytes</li><li>• Types of sori and evolution of sori</li></ul>		(15 lectures)
<b>Unit IV : 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 lectures)

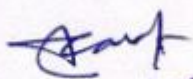
  
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Course Code	Title	Credits
USBO602	PLANT DIVERSITY IV	2.5 Credits (60 lectures)
<b><u>Unit I : Angiosperms II</u></b> <ul style="list-style-type: none"> <li>• Major Botanic gardens of India – Indian Botanic Garden, Howrah; National Botanic Garden (NBRI) 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 lectures)
<b><u>Unit II : Anatomy II</u></b> Ecological anatomy <ul style="list-style-type: none"> <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 lectures)
<b><u>Unit III : Embryology</u></b> <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 lectures)
<b><u>Unit IV : Biostatistics</u></b> <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 lectures)

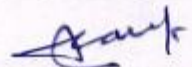
  
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USBO603	FORM AND FUNCTION III	2.5 Credits (60 lectures)
<b>UNIT I PLANT BIOCHEMISTRY</b>		15 Lectures
<ul style="list-style-type: none"> <li>• Structure of biomolecules: Carbohydrates (sugars, starch, cellulose, pectin, lipids (fatty acids and glycerol), proteins ( amino acids)</li> <li>• Enzymes: Nomenclature, classification, mode of action, Enzyme kinetics, Michaelis Menten equation, competitive non-competitive, and uncompetitive inhibitors.</li> </ul>		
<b>UNIT II PLANT PHYSIOLOGY II</b>		15 Lectures
<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>		
<b>UNIT III : GENETICS</b>		15 Lectures
<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>		
<b>UNIT IV: BIOINFORMATICS</b>		15 Lectures
<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>		

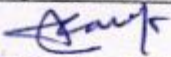
  
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Course Code	Title	Credits
USBO604	<b>CURRENT TRENDS IN PLANT SCIENCES II</b>	<b>2.5 Credits (60 lectures)</b>
<b>Unit I PLANT BIOTECHNOLOGY II</b>		<b>15 Lectures</b>
<ul style="list-style-type: none"> <li>DNA sequence analysis – Maxam – Gilbert Method 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>		
<b>Unit II: Plant Geography</b>		<b>15 Lectures</b>
<b>Phytogeographical regions of India.</b> <b>Biodiversity:</b> <ul style="list-style-type: none"> <li>Definition, diversity of flora found in various forest types of India</li> <li>Evolution of biodiversity with one example of an evolutionary tree</li> <li>Levels of biodiversity</li> <li>Importance and status of biodiversity</li> <li>Loss of biodiversity</li> <li>Conservation of biodiversity</li> <li>Genetic diversity- Molecular characteristics</li> </ul>		
<b>Unit III: Economic Botany</b>		<b>15 Lectures</b>
<ul style="list-style-type: none"> <li><b>Essential Oils:</b> Extraction, perfumes, perfume oils, oil of rose, sandalwood, patchouli, champaca, grass oils: <i>Citronella</i>, vetiver.</li> <li><b>Fatty oils:</b> Drying oil (linseed and soyabean oil), semidrying oils (cotton seed, sesame oil) and non-drying oils (olive oil and peanut oil),</li> <li><b>Vegetable Fats:</b> Coconut and Palm oil</li> </ul>		
<b>Unit IV : Post Harvest Technology</b>		<b>15 Lectures</b>
<ul style="list-style-type: none"> <li><b>Storage of Plant Produce- Preservation of Fruits and Vegetables</b></li> <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, Plate freezers, Cryogenic Freezing, Dehydrofreezing, Freeze drying),</li> <li>Canning</li> <li>Pickling (in brine, in vinegar, Indian pickles)</li> <li>Sugar Concentrates (Jams, Jellies, Fruit juices)</li> <li>Food preservatives</li> <li><b>Use of antioxidants in preservation</b></li> </ul>		

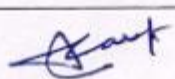
  
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**SEMESTER VI**  
**PRACTICAL**

Semester VI USBOP	Cr
<b>PRACTICAL PAPER I – PLANT DIVERSITY III</b>	<b>1.5</b>
<p><b>Bryophyta</b> Study of stages in the life cycle of the following Bryophyta from fresh / preserved material and permanent slides</p> <ul style="list-style-type: none"> <li>• <i>Marchantia</i></li> <li>• <i>Pelia</i></li> <li>• <i>Sphagnum</i></li> </ul>	
<p><b>Pteridophyta</b> Study of stages in the life cycles of the following Pteridophytes from fresh / preserved material and permanent slides</p> <ul style="list-style-type: none"> <li>• <i>Lycopodium</i></li> <li>• <i>Equisetum</i></li> <li>• <i>Adiantum</i></li> <li>• <i>Marselia</i></li> </ul>	
<p><b>Bryophytes and Pteridophytes: Applied aspects</b></p> <ul style="list-style-type: none"> <li>• Economic importance of Bryophyta</li> <li>• Economic importance of Pteridophyta</li> <li>• Types of sporophytes in Bryophyta (from Permanent slides)</li> <li>• Types of sori and soral arrangement in Pteridophytes</li> </ul>	
<p><b>Gymnosperms</b> Study of stages in the life cycles of the following Gymnosperms from fresh / preserved material and permanent slides</p> <ul style="list-style-type: none"> <li>• <i>Thuja/ Biota</i></li> <li>• <i>Gnetum</i></li> <li>• <i>Ephedra</i></li> </ul> <p>Economic importance of Gymnosperms</p>	
<b>PRACTICAL PAPER II – PLANT DIVERSITY IV</b>	<b>1.5</b>
<p><b>Angiosperms</b> Study of one plant from each of the following Angiosperm families</p> <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> <p>Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families Identify the genus and species with the help of flora</p>	

  
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<b>Anatomy</b> Study of Ecological Anatomy of <ul style="list-style-type: none"> <li>Hydrophytes: <i>Hydrilla</i> stem, <i>Nymphaea</i> petiole, <i>Eichhornia</i> offset</li> <li>Epiphytes: Orchid</li> <li>Sciophytes: <i>Peperomia</i> leaf</li> <li>Xerophytes: <i>Nerium</i> leaf, <i>Opuntia</i> phylloclade</li> <li>Halophytes: <i>Avicennia</i> leaf and pneumatophore, <i>Sesuvium</i> / <i>Sueda</i> leaf</li> <li>Mesophytes: <i>Vinca</i> leaf</li> </ul>	
<b>Embryology</b> <ul style="list-style-type: none"> <li>Study of various stages of Microsporogenesis, Megasporogenesis and Embryo Development with the help of permanent slides / photomicrographs</li> <li>Mounting of Monocot (Maize) and Dicot (Castor and Gram) embryo</li> <li><i>In vivo</i> growth of pollen tube in <i>Portulaca/Vinca</i></li> </ul>	
<b>Biostatistics</b> <ul style="list-style-type: none"> <li><i>t</i>-test (paired and unpaired)</li> <li>Problems based on regression analysis</li> <li>ANOVA</li> </ul>	
<b>PRACTICAL PAPER III – Form and function III</b>	<b>1.5</b>
<b>PLANT BIOCHEMISTRY</b> <ul style="list-style-type: none"> <li>Estimation of proteins by Biuret method</li> <li>Effect of temperature on the activity of amylase</li> <li>Effect of pH on the activity of amylase</li> <li>Effect of substrate variation on the activity of amylase</li> </ul>	
<b>PLANT PHYSIOLOGY</b> <ul style="list-style-type: none"> <li>Determination of alpha-amino nitrogen</li> <li>Effect of GA on seed germination</li> <li>Estimation of reducing sugars by DNSA method</li> </ul>	
<b>GENETICS</b> <ul style="list-style-type: none"> <li>Problems based on three-point crosses, construction of chromosome maps</li> <li>Identification of types of mutations from given DNA sequences</li> <li>Study of mitosis using pre-treated root tips of <i>Allium</i></li> </ul>	
<b>BIOINFORMATICS</b> <ul style="list-style-type: none"> <li>BLAST: nBLAST, pBLAST</li> <li>Multiple sequence alignment</li> <li>Phylogenetic analysis</li> <li>RASMOL/ SPDBV</li> </ul>	

  
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<p style="text-align: center;"><b>PRACTICAL PAPER IV</b> <b>CURRENT TRENDS IN PLANT SCIENCES</b></p>	<p style="text-align: center;"><b>1.5</b></p>
<p><b>PLANT BIOTECHNOLOGY II</b></p> <ul style="list-style-type: none"> <li>• DNA sequencing (Sanger's Method)</li> <li>• DNA barcoding of plant material by using suitable data</li> </ul>	
<p><b>Plant Geography</b></p> <ul style="list-style-type: none"> <li>• Study of phytogeographic regions of India</li> <li>• Preparation of vegetation map using Garmin's GPS Instrument</li> <li>• Problems based on Simpson's diversity Index</li> </ul>	
<p><b>Economic Botany</b></p> <ul style="list-style-type: none"> <li>• Demonstration: Extraction of essential oil using Clevenger</li> <li>• Thin layer chromatography of essential oil of patchouli and <i>Citronella</i></li> <li>• Saponification value of palm oil</li> </ul>	
<p><b>Post-Harvest Technology</b></p> <p>Preparation of</p> <ul style="list-style-type: none"> <li>• Squash</li> <li>• Jam</li> <li>• Jelly</li> <li>• Pickle</li> </ul>	

*[Handwritten Signature]*

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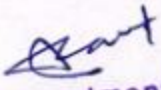
### Scheme of Examinations:

Students offering Double major will study Paper II and III.

Theory Course: Term end Assessment	100 Marks
Practical Course	50 marks

### Note:

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

  
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T.Y.B.Sc. BOTANY SEMESTER V  
PLANT DIVERSITY III  
PRACTICAL I

Duration: 3 hours

Max. Marks : 50

- Q. 1 Perform the given Microbiological experiment 'A'. 12M
- Q. 2 Identify, classify and describe specimen B, C and D. Sketch neat and labeled diagrams of morphological/microscopical structures seen in the specimens. 24M
- Q. 3 Identify and describe slides/ specimens E, F and G. 09M
- Q. 4 Journal. 05M

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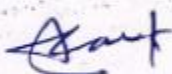
Key-

A- Any one experiment out of four as prescribed in syllabus

B & C- Algae

D- Fungi

E, F & G - (Plant Pathology, Algae or Fungi not asked above) in random order



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T.Y.B.Sc. BOTANY SEMESTER V  
PLANT DIVERSITY IV  
PRACTICAL II

Duration: 3 hours

Max. Marks: 50

- Q. 1 A. Classify specimen 'A' up to their families giving reasons. Give floral formula. Sketch and labelled L.S. of flower and T.S. ovary. **10M**
- Q. 1.B. Identify genus and species of specimen 'B' using flora. **05M**
- Q. 2 Make a temporary double stained preparation of T.S. specimen 'C' and comment on the type of secondary growth. **08M**
- Q. 3 Perform the Palynology experiment 'D' allotted to you. **07M**
- Q. 4 Identify and describe slide/ specimen 'E', 'F', 'G' &'H'. **12M**
- Q. 5 Field report **03M**
- Q. 6 Viva voce (based on Paper I and Paper II). **05M**

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- A – Families of T.Y.B.Sc only  
B – Plants from F.Y & S.Y. B. Sc Families to be included  
C- Anatomy- Anomalous Secondary Growth  
D- As per slip  
E, F, G & H  
Fossils, Types of Stomata, Morphology of flower & Fruits – in random order

*Start*  
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T.Y.B.Sc. BOTANY SEMESTER V  
FORM AND FUNCTION III  
PRACTICAL III

Duration: 3 hours

Max. Marks : 50

- Q. 1 Make a smear preparation of material 'A' and show the slide to the Examiner. Comment on your observation/ Expose the giant Chromosomes from the salivary glands of Chironomous larva. 08
- Q. 2 Perform the experiment 'B' allotted to you ( physiology). 12
- Q. 3 Perform the experiment 'C' allotted to you (ecology). 12
- Q. 4. Calculate the \_\_\_\_\_ of the given solution 'D' to prepare the required solution. 07
- Q. 5. Identify and describe slide/specimen 'E' & 'F' 06
- Q.6. Journal 05

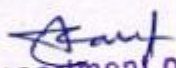
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B: Physiology experiment

C: Ecology experiment

D: Plant tissue culture

E & F: Multiple shoot culture, hairy root culture, somatic embryogenesis, amino acid sequencing.

  
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T.Y.B.Sc. BOTANY SEMESTER V  
CURRENT TRENDS IN PLANT SCIENCE II  
PRACTICAL IV

Duration: 3 hours

Max. Marks: 50

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

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Key-

**B** – experiment based on Beer- Lambert's Law

Experiment on separation of dyes/pigments using silica gel column chromatography

**C & D**- *Allium sativum*

*Acorus calamus*

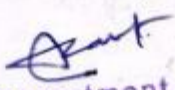
*Curcuma longa*

*Senna angustifolia*

*Strychnos nux-vomica*

*Eugenia caryophyllata*

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

  
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T.Y.B.Sc. BOTANY SEMESTER VI  
PLANT DIVERSITY III  
PRACTICAL I

Duration: 3 hours

Max. Marks : 50

- Q. 1 Identify, classify and describe specimen **A** and **B**. Sketch neat and labelled diagrams of morphological/microscopical structures seen in the specimens. **10M**
- Q. 2. Identify, classify and describe specimen **C** and **D**. Sketch neat and labeled diagrams of morphological/microscopical structures seen in the specimens. **10M**
- Q.3 Identify, classify and describe specimen '**E**'. Sketch neat and labeled diagrams of morphological/microscopical structures seen in the specimens. **07M**
- Q. 4. Identify and describe slides/specimen '**F**', '**G**' '**H**', '**I**' & '**J**'. **15M**
- Q. 5. Journal. **05M**
- Q. 6. Field report **03M**

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**A & B-** *Marchantia, Pellia & Sphagnum*  
**C & D-** *Lycopodium, Equisetum, Adiantum & Marsilea*  
**E-** Gymnosperm- *Thuja, Gnetum & Ephedra*  
**F, G & H , I & J-** [In random order]  
Economic importance of Bryophytes  
Economic importance of Pteridophytes  
Types of sporophytes in Bryophyta  
Types of Sori in Pteridophytes  
Soral arrangement in Pteridophytes  
Economic importance of Gymnosperms

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PLANT DIVERSITY IV  
PRACTICAL II

Duration: 3 hours

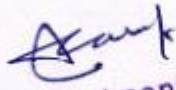
Max. Marks: 50

- Q. 1. From the given data/ material **A** determine test of significance using students t-test/ Regression Analysis/ ANOVA **10M**
- Q. 2 A. Classify specimen **'B'** up to their families giving reasons. Give floral formula. Sketch and labelled L.S. of flower and T.S. ovary. **10M**
- Q. 2.B. Identify genus and species of specimen **'C'** using flora. **05M**
- Q. 3 Make a stained preparation of specimen **'D'** and comment on its ecological anatomy. **08M**
- Q. 4 Identify and describe slide/specimen **'E', 'F', 'G'** and **'H'**. **12M**
- Q. 5 Viva voce (based on Paper III and paper IV) **05M**

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**Key- Paper-II**

- A-** Problem on biostats  
**B-** Families of T.Y.B.Sc only  
**C-**Plants from F.Y., S.Y. & T.Y. B. Sc SEM V Families to be included  
**D-**Ecological anatomy  
**E, F, G & H** [In random order]  
, Economic importance of specimen from prescribe families (sem VI only) & Embryology

  
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T.Y.B.Sc. BOTANY SEMESTER VI  
FORM AND FUNCTION III  
PRACTICAL III

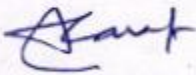
Duration: 3 hours

Max. Marks : 50

- Q. 1. Perform the experiment 'A' allotted to you. 10
- Q. 2. Perform the experiment 'B' allotted to you. 10
- Q.3. Make a squash preparation to show the stage of mitosis from the pre-treated root tips B. 06
- Q. 4. Construct a chromosome map from the given data C/ Identify the type of mutation and comment on them (any two types of mutations) 12
- Q. 5. Perform the given analysis of data D using computer (Bioinformatics). 07
- Q. 5. Journal. 05

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A: Plant Biochemistry Experiment  
B: Plant Physiology Experiment

  
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PRACTICAL IV

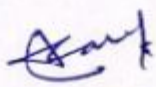
Duration: 3 hours

Max. Marks: 50

- Q. 1. Perform the DNA barcoding of plant material using given data 'A' 10  
OR  
Perform DNA sequencing by Sanger's method of the given sequence 'A'. 10
- Q. 2. Calculate Simpson's Diversity Index from the given data 'B'. 08
- Q.3. Mark the \_\_\_\_\_ phytogeographic region 'C' in the map of India and  
Comment on the same. 05
- Q. 3 Perform the experiment 'C' allotted to you 10
- Q. 4 Prepare the squash/Jam/jelly/pickle from the given material 'D'. 12
- Q. 5. Viva voce. 05

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C- TLC of Patchouli or *Citronella* / saponification value

  
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## Reference Books

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2. Plants in folk religion and mythology (Contribution to Ethnobotany by S.K. Jain 3<sup>rd</sup> Rev. Ed.).
3. Introduction to Plant Physiology by Noggle and Fritz, Prentice Hall Publishers (2002)
4. Plant Physiology by Salisbury and Ross CBS Publishers
5. Plant Physiology by Taiz and Zeiger Sinauer Associates Inc. Publishers, 2002
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8. Fundamentals of Biostatistics by Rastogi, Ane Books Pvt. Ltd. (2009).
9. College Botany Vol I and II by Gangulee Das and Dutta Central Education enterprises.
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11. Industrial Microbiology by Cassida, New Age International, New Delhi
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16. Bioinformatics by Sunder Rajan
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19. DNA barcoding plants: taxonomy in a new perspective 2010. K Vijayan and C H Tsou, Current Science, 1530 – 1541.
20. Introduction to Biostatistics by P K Banerjee, Chand Publication.
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22. Practical Biochemistry by David Plummer, McGraw Hill Publ.
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25. Embryology of Plants by Bhojwani and Bhatnagar
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30. Taxonomy of Vascular Plants by Lawrence George, H M, Oxford and IBH Publ.

  
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