

Principal : Dr. Manju Lalwani Pathak

Ref No: CHM (A) AC/C/02/2025

Date: 01st December, 2025


CIRCULAR

The immediate attention of all concerned is invited to this office Circular No. CHM (A) AC 08/2025 dated 31st October, 2025 regarding the Choice Based and Credit Based Syllabus (CBCS) for all subjects of F.Y.B.Sc, S.Y.B.Sc & T.Y.B.Sc. in Botany SEM-II SEM-IV & SEM-VI respectively.

It is hereby communicated that the recommendations of the syllabus made by the Ad-hoc Board of Studies in Botany coordinated by the Dean, Faculty of Pure Sciences in the meeting of Academic Council held on 20th November, 2025 have been accepted and subsequently passed.

In accordance, therewith, the syllabus as per the CBCS has been brought into force with effect from the Academic Year 2025–2026 and accordingly the same is attached for reference and is available on the College's website www.chmcollege.in

Ulhasnagar - 421 003
01st December, 2025


Dr. Manju Lalwani Pathak
Principal & Chairperson, Academic Council

Copy forwarded for information to:-

1. The Dean, Faculty of Pure Sciences.
2. The Chairperson, Ad-hoc Board of Studies.
3. The Controller of Examination Cell
4. The Registrar



**HSNC Board's
Smt. Chandibai Himathmal Mansukhani College, Ulhasnagar
(Autonomous)
Affiliated to the University of Mumbai**

Bachelor of Science (Botany)

Semester – VI

**Choice Based and Credit Based syllabus
with effect from the Academic
Year 2025-2026**

PREAMBLE

Botany is one of the most important subjects of life sciences. Plants have a unique position as a source of oxygen, food, fuel, medicines and almost all our daily necessities. Their role in the environment is unquestionable. This makes plant science a very interesting study with innumerable scopes. A B.Sc. degree in Botany opens doors to a myriad of career opportunities in fields such as plant science research, agriculture, environmental consulting, pharmaceuticals, biotechnology, conservation, education, and beyond. It provides a solid foundation for understanding and appreciating the fundamental role of plants in shaping our world.

The Botany department at this college has facilities of smart class, two laboratories as well as a well-equipped research laboratory, Fungal culture collection centre, seed bank, herbaria, Glass house for succulent plants, a well-managed K.M. Kundanani botanical garden with medicinal and economically important plants. The department conducts regular study tours, field studies, Nursery visit and industrial/research institute visits to impart knowledge on the basic and applied aspects of the subject. Through various experiments, projects, hands-on trainings and workshops; All such activities develop critical thinking, problem-solving, and analytical skills in students. Botany graduates are equipped to address pressing global challenges such as food security, biodiversity conservation, climate change, and sustainable resource management.

Program Outcomes for Undergraduate Degree in Botany

The Undergraduate Program in Botany is designed to provide students with comprehensive domain knowledge across various branches of plant science. In alignment with the **National Education Policy (NEP) 2020**, the program emphasizes skill-based learning, hands-on experience, and interdisciplinary integration.

This curriculum connects traditional Indian agricultural wisdom with modern scientific advances in Tissue culture, genetics, Plant Physiology, ecology, and environmental studies—preparing students for academic excellence, research, and real-world applications

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Comprehension of Plant Diversity-Understand the diversity and evolutionary complexity of plant life, ranging from lower forms such as algae and fungi to higher land plants. Examine representative taxa to analyze morphological, physiological, and ecological adaptations, as well as their interactions and significance to human welfare

PSO2: Integration of Core Botanical Disciplines-Demonstrate foundational and advanced knowledge in core areas of plant science including:

- **Cell Biology:** Cellular structure, organelles, and cellular processes
- **Genetics:** Principles of inheritance, molecular genetics, and gene expression
- **Plant Anatomy and Taxonomy:** Internal structure of plant organs and systematic classification of plant species
- **Ecology and Environmental Science:** Ecosystem dynamics, biodiversity, and plant-environment interactions
- **Plant Physiology and Biochemistry:** Functional aspects of plant life processes and underlying chemical mechanisms

PSO3: Application of Botany in Agriculture and Industry-Apply botanical knowledge to the cultivation and management of food and industrial crops.

PSO4: Environmental Awareness and Sustainability-Recognize the interdependence of flora, fauna, and humans within ecosystems. Advocate for biodiversity conservation, promote sustainable resource use, and contribute towards achieving national and global environmental goals, including the **United Nations Sustainable Development Goals (UN-SDGs)**

PSO5: Experimental Competence and Scientific Inquiry-Design and perform experiments in laboratory and field settings. Develop competencies in data collection, statistical analysis, and interpretation of results, scientific reporting, and effective communication of biological concepts

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B.Sc.
(Botany)**

Semester- VI

Title: PLANT DIVERSITY– III

PAPER-I

Major Subject -2.5 Credits

**with effect from
Academic Year 2025-2026**

Title: Plant Diversity– III
Course Code: CHM(A)USBO601

| Sr. No. | Heading | Particulars |
|---------|---|---|
| 1 | Description of the Course: | This course explores the diversity, life cycles, and evolutionary significance of Bryophytes, Pteridophytes, and Gymnosperms. It includes detailed study of representative genera such as <i>Marchantia</i> , <i>Pellia</i> , <i>Sphagnum</i> , <i>Lycopodium</i> , <i>Equisetum</i> , <i>Adiantum</i> , <i>Marsilea</i> , <i>Thuja</i> , <i>Gnetum</i> , and <i>Ephedra</i> . Students will learn classification systems, ecological roles, and economic importance of these plant groups. The course also emphasizes applied aspects such as Bryophyte ecology and indicators, sporophyte and gametophyte evolution, and evolution in ferns, and the industrial and ecological significance of Gymnosperms. |
| 2 | Vertical | ----- |
| 3 | Type Teaching Methods | Theory Lecture, Presentation, Seminars, Simulations |
| 4 | Credit | 2.5 Credits |
| 5 | Hours allotted | 48 Hours |
| 6 | Marks allotted | 100 Marks |
| 7 | Course Objectives: <ol style="list-style-type: none"> 1. Understand the classification, structure, and life cycles of key Bryophytes, Pteridophytes, and Gymnosperms. 2. Study evolutionary trends in sporophyte and gametophyte development across plant groups. 3. Examine ecological roles, economic importance, and distribution of lower vascular and non-vascular plants. 4. Develop foundational knowledge of plant diversity and adaptation through representative genera and applied aspects. | |
| 8 | Learning Outcomes: Student will be able to LO1. To identify, describe and study in detail the life cycles of three Bryophytes. LO2. To study in detail the classification and general characters of the three classes | |

| | |
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| | <p>of Pteridophytes and identify as well as describe the life cycles of one example from each class.</p> <p>LO3. To study evolutionary aspects and economic utilization of Bryophytes and Pteridophytes.</p> <p>LO4. To identify, describe, and study in detail the life cycles of three Gymnosperms.</p> |
| <p>9</p> | <p style="text-align: center;">Syllabus</p> <p>Unit I: Bryophyta (G.M. Smith Classification system to be followed)</p> <ul style="list-style-type: none"> • Life cycle of <i>Marchantia</i> • Lifecycle of <i>Pellia</i> <p>Unit II: Pteridophyta (G.M. Smith Classification System to be followed)</p> <ul style="list-style-type: none"> • Lepidophyta–Classification, general characters; Life cycle of • <i>Lycopodium</i> • Calamophyta–Classification, general characters; Lifecycle of • <i>Equisetum</i> • Pterophyta-Classification, general characters; Lifecycle of <i>Marselia</i> <p>Unit III: Bryophytes and Pteridophytes: Applied aspects</p> <ul style="list-style-type: none"> • Ecology of Bryophytes. • Economic importance of Bryophytes. • Bryophytes as Indicators. • Evolution of Sporophyte and Gametophyte in Bryophytes. • Economic importance of Pteridophytes • Diversity and distribution of Indian Pteridophytes <p>Unit IV: Gymnosperms (Chamberlain’s Classification System to be followed)</p> <ul style="list-style-type: none"> • Life cycle of <i>Gnetum</i> • Life cycle of <i>Ephedra</i> • Economic importance of Gymnosperms |

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|-----------|---|---|--------------|
| 10 | Scheme of Examination and Assessment Pattern | | |
| | Theory Paper – 100 Marks | | |
| | External Examination: Semester End External - 75 marks Time: 2:30 hour | | |
| | Format of Question Paper | | |
| | Question No | Questions | Marks |
| | Q1 | MCQs Question based on all units | 15 |
| | Q2 | Attempt Any Two of the following | 15 |
| | a | Unit-1- Long Answer Type | 7.5 |
| | b | Unit-1- Long Answer Type | 7.5 |
| | c | Unit-1- Long Answer Type | 7.5 |
| | d | Unit-1- Long Answer Type | 7.5 |
| | Q3 | Attempt Any Two of the following | 15 |
| | a | Unit-2 Long Answer Type | 7.5 |
| | b | Unit-2 Long Answer Type | 7.5 |
| | c | Unit-2 Long Answer Type | 7.5 |
| | d | Unit-2 Long Answer Type | 7.5 |
| | Q3 | Attempt Any Two of the following | 15 |
| | a | Unit-3 Long Answer Type | 7.5 |
| | b | Unit-3 Long Answer Type | 7.5 |
| | c | Unit-3 Long Answer Type | 7.5 |
| | d | Unit-3 Long Answer Type | 7.5 |
| | Q4 | Attempt Any Two of the following | 15 |
| | a | Unit-4 Long Answer Type | 7.5 |
| | b | Unit-4 Long Answer Type | 7.5 |
| | c | Unit-4 Long Answer Type | 7.5 |
| | d | Unit-4 Long Answer Type | 7.5 |
| | TOTAL | 30 | |
| | Internal Examination: Continuous Evaluation - 20 marks | | |
| | | Assessment / evaluation | Marks |
| | 1. | Class Test (Short notes/ MCQ's/ Match the Pairs/ Answer in one sentence/ Puzzles) | 20 |
| 2. | Attendance/Viva-Voce | 05 | |
| | | Total 25 | |
| 11 | REFERENCE: | | |
| | 1. College Botany Vol II by Gangulee Das and Dutta Central Education Enterprises. | | |
| | 2. Cryptogamic Botany Vol I and II by G M Smith, McGraw-Hill | | |
| | 3. Economic Botany by A. F. Hill, TATAMcGRAW-HILL Publishing Co.Ltd. | | |

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B.Sc.
(Botany)**

Semester- VI

**TITLE: PRACTICAL - I
PLANT DIVERSITY– III**

Major Practical-1.5 Credit

**with effect from
AcademicYear2025**

Title: Practical - I: Plant Diversity-III

Course Code: CHM(A)USBOP8

| Sr. No. | Heading | Particulars |
|---------|---|--|
| 1 | Description the Course: | This course explores the diversity, life cycles, and evolutionary significance of Bryophytes, Pteridophytes, and Gymnosperms. It includes detailed study of representative genera such as <i>Marchantia</i> , <i>Pellia</i> , <i>Sphagnum</i> , <i>Lycopodium</i> , <i>Equisetum</i> , <i>Adiantum</i> , <i>Marsilea</i> , <i>Thuja</i> , <i>Gnetum</i> , and <i>Ephedra</i> . Students will learn classification systems, ecological roles, and economic importance of these plant groups. The course also emphasizes applied aspects such as Bryophyte ecology and indicators, sporophyte and gametophyte evolution, and evolution in ferns, and the industrial and ecological significance of Gymnosperms. |
| 2 | Vertical | ---- |
| 3 | Type Teaching Methods | Practicum |
| 4 | Credit | 1.5 Credits |
| 5 | Hours allotted | 45 Hours |
| 6 | Marks allotted | 50 Marks |
| 7 | Course Objectives: | <ol style="list-style-type: none">1. To understand the classification, key features and evolutionary significance of Bryophyta, Pteridophyta and Gymnosperms.2. To observe and interpret the life-cycle stages of selected genera (e.g., <i>Marchantia</i>, <i>Pelia</i>, <i>Lycopodium</i>, <i>Equisetum</i>, <i>Marselia</i>, <i>Gnetum</i>) using fresh, preserved and slide specimens.3. Economic and applied importance of Bryophytes, Pteridophytes and Gymnosperms.4. To develop practical skills in botanical observation, identification and laboratory-technique relevant to lower and seed-plants. |
| 8 | Learning Outcomes: Student will be | <p>LO1. Describe and classify the major groups: Bryophyta, Pteridophyta and Gymnosperms (under the specified classification systems).</p> <p>LO 2. Identify and interpret the life-cycle stages of selected genera (e.g. <i>Marchantia</i>, <i>Pelia</i>, <i>Lycopodium</i>, <i>Equisetum</i>, <i>Marselia</i>, <i>Gnetum</i>) from fresh, preserved and slide material.</p> <p>LO 3. Analyse the evolutionary adaptations evident in bryophytes, pteridophytes and gymnosperms (e.g., sporophyte–gametophyte relationships, vascularisation, and seed habit).</p> <p>LO 4. Demonstrate the economic and applied significance of bryophytes, pteridophytes and gymnosperms (in ecology, industry, conservation).</p> |

LO 5. Apply microscopic and macroscopic techniques to observe plant structures and record observations accurately

9

Syllabus

Bryophyta (G.M. Smith Classification System to be followed)

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

Pteridophyta (G.M. Smith Classification System to be followed)

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

Bryophytes and Pteridophytes: Applied aspects

- Economic importance of Bryophyta
- Economic importance of Pteridophyta
- Types of Sporophytes in Bryophyta (from Permanent Slides)

Gymnosperms (Chamberlain's Classification System to be followed)

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

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Scheme of Examination and Assessment Pattern

Practical Paper – 50 Marks

A. Semester End Practical exam - 50 marks Time: 3:00 hours

Format of Question Paper

| Question No | Questions | Marks |
|-------------|--|-------|
| Q1 | Identify, Classify and Describe specimen A & B | 12 |
| Q2 | Identify, Classify and Describe specimen C & D | 12 |

| | | | |
|-----------|--|---|----|
| | Q3 | Identify, Classify and Describe specimen E | 06 |
| | Q4 | Identify and Describe specimens F,G,H,I & J | 15 |
| | Q5 | Journal | 05 |
| | TOTAL | 50 | |
| | Keys A& B- Bryophyta C &D- Pteridophyta E- Gymnosperm F, G, H,I & J- Economic Importance of Bryophytes. Pteridophytes & Gymnosperms, Types of sporophytes in Bryophyta | | |
| 11 | REFERENCE: 1. College Botany Vol. II by Gangulee Das and Dutta Central Education Enterprises. 2. Cryptogrammic Botany Vol. I and II by G M Smith, McGraw-Hill 3. Economic Botany by A. F. Hill, TATAMcGRAW-HILL Publishing Co.Ltd. | | |

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B.Sc.
(Botany)
Semester- VI**

**TITLE: PLANT DIVERSITY– IV
PAPER-II**

Major Subject -2.5 Credits

**Choice Based and Credit Based syllabus
with effect from the Academic
Year 2025-2026**

Title: Plant Diversity– IV
Course Code: CHM(A)USBO602

| Sr. No. | Heading | Particulars |
|---------|-----------------------------------|--|
| 1 | Description of the Course: | This course offers a comprehensive study of classification through the lens of Angiosperms, and Ecology, Embryology and Plant geography. It explores the diversity and taxonomy of flowering plants (Angiosperms), the ecological adaptation of angiosperms (Plant Ecology), and study of formation of spores and gametes, fertilization and formation of embryo (Embryology),and biodiversity and its conservation (Plant geography). Together, these topics provide a well-rounded understanding of plant form, function, and evolution. |
| 2 | Vertical | ---- |
| 3 | Type | Theory |
| 4 | Credit | 2.5Credits |
| 5 | Lecture allotted | 48 Lectures |
| 6 | Marks allotted | 100 Marks |
| 7 | Course Objectives: | <ul style="list-style-type: none"> • To familiarize students with key botanical institutions and herbaria in India and to understand major angiosperm classification systems and selected plant families with their diagnostic, economic, and medicinal importance. • To explore adaptive anatomical features of plants growing under diverse ecological conditions (ecological anatomy) and understand structural modifications related to different habitats. • To comprehend the processes of plant reproduction, including microsporogenesis, megasporogenesis, fertilization, embryo development, and to identify types of ovules and their significance. • To gain knowledge of plant distribution and biodiversity, understand the phytogeographical regions of India, levels and significance of biodiversity, causes of biodiversity loss, and strategies for its conservation. |

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| 8 | <p>Course Outcomes: Student will be able to</p> <p>LO 1. Explain the roles of major botanical institutions and herbaria in India and classify angiosperms using key taxonomic systems while identifying important plant families based on diagnostic, economic, and medicinal features.</p> <p>LO 2. Analyze and interpret adaptive anatomical features of plants in relation to different ecological conditions and habitats.</p> <p>LO3. Students will be able to describe and differentiate the stages and processes involved in plant reproduction, including microsporogenesis, megasporogenesis, fertilization, and embryo development, along with types of ovules.</p> <p>LO4. Students will be able to evaluate patterns of plant distribution and biodiversity in India, recognize causes of biodiversity loss, and propose suitable conservation strategies.</p> |
| 9 | <p style="text-align: center;">Syllabus</p> <p>Unit I: Angiosperms II</p> <ul style="list-style-type: none"> • Botanical survey of India and regional branches of India • Blatter Herbarium St. Xavier's College, Mumbai. • Bentham and Hooker's system of classification for flowering plants up to family with respect to the following prescribed families and economic importance, medicinal importance and fruit morphology for members of the families <ul style="list-style-type: none"> ➤ Combretaceae ➤ Asclepiadaceae ➤ Euphorbiaceae ➤ Cannaceae • Hutchinson's classification system of Angiosperms Brief Introduction, Merits and Demerits of Hutchinson's Classification System <p>Unit II: Anatomy II</p> <ul style="list-style-type: none"> • Ecological anatomy <ul style="list-style-type: none"> ➤ Hydrophytes– submerged, floating, rooted ➤ Hygrophytes-Typha ➤ Mesophytes ➤ Sciophytes ➤ Halophytes |

| | <ul style="list-style-type: none"> ➤ Epiphytes ➤ Xerophytes <p>Unit III: Embryology</p> <ul style="list-style-type: none"> • Microsporogenesis – Structure of T.S of anther, formation of microspores, and development of male gametophyte. • Megasporogenesis- Structure of ovule (megasporangium), formation of megaspores, Development of female gametophyte, Structure of monosporic embryo sac. • Types of ovules • Double fertilization • Structure of embryo –Dicot and Monocot <p>Unit IV: Plant Geography</p> <ul style="list-style-type: none"> • Phytogeographical regions of India. • Biodiversity: <ul style="list-style-type: none"> Levels of biodiversity Importance and status of biodiversity Loss of biodiversity- Rare, Endemic and Threatened species and their significance • Conservation of biodiversity | | | | | | | | | | | | | | | | | | | | | |
|-----------------|--|----------|-----------------|-------|------|---|----|------|--|----------|------|---|----------|------|--|----------|------|---|----------|-----------------|--|--|
| 10 | <p style="text-align: center;">Scheme of Examination and Assessment Pattern Paper – 100 Marks External Examination: Semester End External - 75 marks Time: 2.5 hours Format of Question Paper All questions are compulsory.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Sr. No.</th> <th style="width: 70%;">Evaluation type</th> <th style="width: 20%;">Marks</th> </tr> </thead> <tbody> <tr> <td>Q.1.</td> <td>MultipleChoice20Questions(Attemptany15(1markeach)</td> <td style="text-align: center;">15</td> </tr> <tr> <td>Q.2.</td> <td>Four (4) Long Answer Questions on Unit – I out of which two (2) to be solved</td> <td style="text-align: center;">15 Marks</td> </tr> <tr> <td>Q.3.</td> <td>Four (4) Long Answer Questions on Unit – II out of which two (2) to be solved</td> <td style="text-align: center;">15 Marks</td> </tr> <tr> <td>Q.4.</td> <td>Four (4) Long Answer Questions on Unit – III out of which two (2) to be solved</td> <td style="text-align: center;">15 Marks</td> </tr> <tr> <td>Q.5.</td> <td>Four (4) Long Answer Questions on Unit – IV out of which two (2) to be solved</td> <td style="text-align: center;">15 Marks</td> </tr> <tr> <td colspan="2" style="text-align: right;">Total 75</td> <td></td> </tr> </tbody> </table> <p>Note</p> <ol style="list-style-type: none"> 1. Equal weightage is to be given to all the Units. 2. 15 marks question may be subdivided into 8 marks + 7 marks, 10 marks + 5 marks and | Sr. No. | Evaluation type | Marks | Q.1. | MultipleChoice20Questions(Attemptany15(1markeach) | 15 | Q.2. | Four (4) Long Answer Questions on Unit – I out of which two (2) to be solved | 15 Marks | Q.3. | Four (4) Long Answer Questions on Unit – II out of which two (2) to be solved | 15 Marks | Q.4. | Four (4) Long Answer Questions on Unit – III out of which two (2) to be solved | 15 Marks | Q.5. | Four (4) Long Answer Questions on Unit – IV out of which two (2) to be solved | 15 Marks | Total 75 | | |
| Sr. No. | Evaluation type | Marks | | | | | | | | | | | | | | | | | | | | |
| Q.1. | MultipleChoice20Questions(Attemptany15(1markeach) | 15 | | | | | | | | | | | | | | | | | | | | |
| Q.2. | Four (4) Long Answer Questions on Unit – I out of which two (2) to be solved | 15 Marks | | | | | | | | | | | | | | | | | | | | |
| Q.3. | Four (4) Long Answer Questions on Unit – II out of which two (2) to be solved | 15 Marks | | | | | | | | | | | | | | | | | | | | |
| Q.4. | Four (4) Long Answer Questions on Unit – III out of which two (2) to be solved | 15 Marks | | | | | | | | | | | | | | | | | | | | |
| Q.5. | Four (4) Long Answer Questions on Unit – IV out of which two (2) to be solved | 15 Marks | | | | | | | | | | | | | | | | | | | | |
| Total 75 | | | | | | | | | | | | | | | | | | | | | | |

5 marks + 5 marks + 5 marks. Internal options may be given however it is not mandatory.

3. Wherever possible more importance is to be given to the practical problem.

Internal Examination: Continuous Evaluation - 20 marks

| | Assessment / evaluation | Marks |
|----|---|-----------------|
| 1. | Class Test (Short notes/ MCQ's/ Match the Pairs/ Answer in one sentence/ Puzzles) | 20 |
| 2. | Attendance/ <i>Viva Voce</i> | 5 |
| | | Total 25 |

11

Reference books:

1. Physiological Plant Anatomy by Haberl and Mac Millan and Company.
2. A Textbook of Plant Ecology 16Ed (2023) by R S Ambasht. CBS Publishers & Distributors.
3. College Botany Vol. I, II and III by Gangulee Das and Dutta Central Education enterprises.
4. Sharma, O.P. (1993) Plant Taxonomy. Tata McGraw-Hill Publishing Company Limited, New Delhi
5. The Embryology of Angiosperm Edition 6th SS Bhojwani S.P, Bhatnagar& PK Dantu Vikas Publisher
6. Plant Ecology and Phytogeography by N. Arumugam, V. Kumaresan, Saras Publication
7. A Textbook of Botany Plant Biodiversity by y Dr PratimaVishwakarma. Discount group of publication, Ghorakhpur.

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B.Sc.
(Botany)**

Semester- IV

**Title: PRACTICAL -II
PLANT DIVERSITY– IV**

Major Practical– 1.5 Credits

**Choice Based and Credit Based syllabus
with effect from the Academic
Year 2025-2026**

Title: Practical- II: Plant Diversity– IV

Course Code: CHM(A)USBOP8

| Sr. No. | Heading | Particulars |
|---------|-----------------------------------|--|
| 1 | Description of the Course: | This course covers the study of selected Angiosperm families (Combretaceae, Asclepiadaceae, Euphorbiaceae, and Cannaceae) with emphasis on their morphology, anatomy, and economic importance. It includes practical identification using flora and ecological anatomy of different plant types such as hydrophytes, xerophytes, halophytes, mesophytes, epiphytes, and sciophytes. The embryology section focuses on microsporogenesis, megasporogenesis, and embryo development, along with mounting and pollen tube studies. The plant geography unit introduces phytogeographic regions of India, GIS applications, and biodiversity analysis using Simpson's Diversity Index. |
| 2 | Vertical 1 | Major |
| 3 | Type Teaching Methods | Practicum |
| 4 | Credit | 1.5 Credits |
| 5 | Hours allotted | 45 Hours |
| 6 | Marks allotted | 50 Marks |
| 7 | Course Objectives: | <ol style="list-style-type: none">1. To understand the distinguishing morphological and anatomical features of selected Angiosperm families and their economic importance.2. To develop skills in plant identification using floras and taxonomic keys.3. To study ecological anatomical adaptations of plants to different habitats such as aquatic, xeric, halophytic, epiphytic, and mesophytic environments.4. To gain knowledge of plant reproductive processes through the study of microsporogenesis, megasporogenesis, embryo development, and pollen tube growth. |

| | |
|-----------------|---|
| | <p>5. To explore plant distribution patterns using phytogeographic concepts, GIS tools, and biodiversity indices such as Simpson's Diversity Index.</p> |
| <p>8</p> | <p>Learning Outcomes: Student will be able to</p> <p>LO1. Identify and describe key morphological and anatomical characteristics of selected Angiosperm families and explain their taxonomic significance.</p> <p>LO2. Recognize and differentiate plant adaptations to various ecological conditions such as hydrophytic, xerophytic, halophytic, mesophytic, epiphytic, and sciophytic habitats.</p> <p>LO3. Demonstrate understanding of plant reproductive processes, including microsporogenesis, megasporogenesis, and embryo development, through microscopic and mounting techniques.</p> <p>LO4. Apply practical skills in plant identification using regional floras and interpret anatomical structures in relation to ecological adaptations.</p> <p>LO5. Analyze plant distribution patterns across India using phytogeographic knowledge, GIS applications, and biodiversity assessment tools like Simpson's Diversity Index.</p> |
| <p>9</p> | <p style="text-align: center;">Syllabus</p> <p>Angiosperms II</p> <ul style="list-style-type: none"> • Study of one plant from each of the following Angiosperm families as per Bentham and Hooker's system of classification. <ul style="list-style-type: none"> Combretaceae Asclepiadaceae Euphorbiaceae Cannaceae • Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families • Identify the genus and species with the help of flora <p>Anatomy II</p> <ul style="list-style-type: none"> • Study of Ecological Anatomy of • Hydrophytes: Hydrilla stem, Nymphaea petiole, Eichhornia offset • Epiphytes: Orchid |

| | <ul style="list-style-type: none"> • Sciophytes: <i>Peperomia</i> leaf • Xerophytes: <i>Nerium</i> leaf, <i>Opuntia</i> phylloclade • Halophytes: <i>Avicennia</i> leaf and pneumatophore, <i>Sesuvium</i> / <i>Sueda</i> leaf • Mesophytes: <i>Vinca</i> leaf <p>Embryology</p> <ul style="list-style-type: none"> • Study of various stages of Microsporogenesis, Megaspороgenesis and Embryo • Development with the help of permanent slides / photomicrographs • Mounting of Monocot (Maize) and Dicot (Castor and Gram) embryo • In-vivo growth of pollen tube in <i>Portulaca</i> / <i>Vinca</i> <p>Plant Geography</p> <ul style="list-style-type: none"> • Study of phytogeographic regions of India • GIS • Problems based on Simpson's diversity Index | | | | | | | | | | | | | | | | | | |
|-------------|---|-------------|-----------|-------|----|-----------|----|----|-----------|----|----|----------------|----|----|---------|----|--|--------------|-----------|
| 10 | <p style="text-align: center;">Scheme of Examination and Assessment Patten Theory Paper- 50 Marks A. External Examination: Semester End External- 50 Marks Time: 2 hrs. Format of Question Paper</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Question No</th> <th style="width: 60%;">Questions</th> <th style="width: 25%;">Marks</th> </tr> </thead> <tbody> <tr> <td>Q1</td> <td>Practical</td> <td>20</td> </tr> <tr> <td>Q2</td> <td>Practical</td> <td>15</td> </tr> <tr> <td>Q3</td> <td>Identification</td> <td>10</td> </tr> <tr> <td>Q4</td> <td>Journal</td> <td>05</td> </tr> <tr> <td></td> <td style="text-align: center;">TOTAL</td> <td style="text-align: center;">50</td> </tr> </tbody> </table> | Question No | Questions | Marks | Q1 | Practical | 20 | Q2 | Practical | 15 | Q3 | Identification | 10 | Q4 | Journal | 05 | | TOTAL | 50 |
| Question No | Questions | Marks | | | | | | | | | | | | | | | | | |
| Q1 | Practical | 20 | | | | | | | | | | | | | | | | | |
| Q2 | Practical | 15 | | | | | | | | | | | | | | | | | |
| Q3 | Identification | 10 | | | | | | | | | | | | | | | | | |
| Q4 | Journal | 05 | | | | | | | | | | | | | | | | | |
| | TOTAL | 50 | | | | | | | | | | | | | | | | | |
| 11. | <p>REFERENCES:</p> <ol style="list-style-type: none"> 1. Physiological Plant Anatomy by Haberlandt, Mac Millan and Company. 2. A Textbook of Plant Ecology 16Ed (2023) by R S Ambasht. CBS Publishers & Distributors. 3. College Botany Vol. I, II and III by Gangulee Das and Dutta Central Education enterprises. 4. Sharma, O.P. (1993) Plant Taxonomy. Tata McGraw-Hill Publishing Company Limited, New Delhi 5. The Embryology of Angiosperm Edition 6th SS BhojwaniSpBhatnagar& PK DantuVikas Publisher 6. Plant Ecology and Phytogeography by N. Arumugam, V. Kumaresan, Saras Publication 7. A Textbook of Botany Plant Biodiversity by y DrPratimaVishwakarma. Discount group of publication, Ghorakhpur.. | | | | | | | | | | | | | | | | | | |

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B.Sc.
(Botany)**

Semester- VI

**TITLE: FORMS AND FUNCTION– III
PAPER-III**

Major Subject -2.5Credits

**with effect from
Academic Year 2025-2026**

Title: Forms and Function– III

Course Code: CHM(A)USBO603

| Sr. No. | Heading | Particulars |
|---------|--|---|
| 1 | Description of the Course: | This course provides an in-depth understanding of fundamental concepts in Plant Biochemistry, Physiology, Genetics, and Biostatistics . It covers the structure and function of biomolecules such as carbohydrates, lipids, and proteins, along with enzyme classification, kinetics, and inhibition mechanisms. The physiology section focuses on nitrogen metabolism and plant growth regulators essential for plant development. The genetics unit introduces genetic mapping, gene mutations, and metabolic disorders, emphasizing molecular and biochemical principles. The course also includes basic statistical tools such as t-tests, regression, and ANOVA , enabling students to analyze and interpret biological data effectively |
| 2 | Vertical 1 | Major |
| 3 | Type Teaching Methods | Theory Lecture, Presentation, Seminars, Simulations |
| 4 | Credit | 2.5 Credits |
| 5 | Hours allotted | 48 Hours |
| 6 | Marks allotted | 100 Marks |
| 7 | Course Objectives: <ol style="list-style-type: none">1. To understand the structure, function, and biochemical significance of major biomolecules and enzymes in plant systems.2. To explain key physiological processes in plants, including nitrogen metabolism and the role of plant growth regulators.3. To develop knowledge of genetic mapping, mutation mechanisms, and metabolic disorders related to gene function.4. To apply statistical methods such as t-tests, regression, and ANOVA for analysis and interpretation of biological data | |
| 8 | Learning Outcomes: Student will be able to LO1. study various plant biomolecular structures and appreciate the structures, role, functions and applications of enzymes. | |

| | |
|---|---|
| | <p>LO2. gain insight into the Nitrogen and plant hormone metabolism with applications of the same in agriculture and horticulture.</p> <p>LO3. understand principles of genetic mapping , mutations and solve problems based on them, gain knowledge of various metabolic disorders and their implications.</p> <p>LO4. generate and test hypotheses, make observations, collect data, analyze and interpret results, derive conclusions, and evaluate their significance within a broad scientific context, using suitable statistical techniques.</p> |
| 9 | <p style="text-align: center;">Syllabus</p> <p>Unit I: Plant Biochemistry</p> <p>Structure of biomolecular: Carbohydrates (sugars, starch, cellulose, lipids (fatty acids and glycerol), Proteins (amino acids)</p> <ul style="list-style-type: none"> • Enzymes: Nomenclature, classification, mode of action, Enzyme kinetics, Michaelis-Menten equation, competitive, non- competitive and un-competitive inhibitors <p>Unit II: Plant Physiology II</p> <ul style="list-style-type: none"> • Nitrogen Metabolism: Nitrogen cycle, root nodule formation, and leg hemoglobin, nitrogenase activity, assimilation of nitrates, (NR, NiR activity), assimilation of ammonia, (amination and transamination reactions), nitrogen assimilation and carbohydrate utilization. • Plant Growth Regulators: Auxins, Gibberillins, Cytokinins and Abscisic acid. <p>Unit III: Genetics</p> <ul style="list-style-type: none"> • Genetic mapping in eukaryotes: discovery of genetic linkage, gene recombination, construction of genetic maps, three- point crosses and mapping chromosomes, problems based on the same • Gene mutations: definition, types of mutations, causes of mutations, the Ame’s test. • Metabolic disorders– enzymatic and non-enzymatic: Gene control of enzyme structure Garrod’s hypothesis of inborn errors of metabolism, Phenyl ketone urea. <p>Unit IV: Biostatistics</p> <ul style="list-style-type: none"> • Test of significance student’s <i>t</i>-test–Paired and Unpaired. • Regression. • ANOVA (one way). |

| | | | |
|-----------|--|---|--------------|
| 10 | Scheme of Examination and Assessment Pattern | | |
| | Theory Paper – 100 Marks | | |
| | External Examination: Semester End External - 75 marks Time: 2:30 hour | | |
| | Format of Question Paper | | |
| | Question No | Questions | Marks |
| | Q1 | MCQs Question based on all units | 15 |
| | Q2 | Attempt Any Two of the following | 15 |
| | a | Unit-1- Long Answer Type | 7.5 |
| | b | Unit-1- Long Answer Type | 7.5 |
| | c | Unit-1- Long Answer Type | 7.5 |
| | d | Unit-1- Long Answer Type | 7.5 |
| | Q3 | Attempt Any Two of the following | 15 |
| | a | Unit-2 Long Answer Type | 7.5 |
| | b | Unit-2 Long Answer Type | 7.5 |
| | c | Unit-2 Long Answer Type | 7.5 |
| | d | Unit-2 Long Answer Type | 7.5 |
| | Q3 | Attempt Any Two of the following | 15 |
| | a | Unit-3 Long Answer Type | 7.5 |
| | b | Unit-3 Long Answer Type | 7.5 |
| | c | Unit-3 Long Answer Type | 7.5 |
| | d | Unit-3 Long Answer Type | 7.5 |
| | Q4 | Attempt Any Two of the following | 15 |
| | a | Unit-4 Long Answer Type | 7.5 |
| | b | Unit-4 Long Answer Type | 7.5 |
| | c | Unit-4 Long Answer Type | 7.5 |
| | d | Unit-4 Long Answer Type | 7.5 |
| | TOTAL | 30 | |
| | Internal Examination: Continuous Evaluation - 20 marks | | |
| | | Assessment / evaluation | Marks |
| | 1. | Class Test (Short notes/ MCQ's/ Match the Pairs/ Answer in one sentence/ Puzzles) | 20 |
| 2. | Attendance/Viva-Voce | 05 | |
| | | Total 25 | |
| 11 | REFERENCE : | | |
| | 1. Text Book of Plant Biochemistry and Molecular Biology (2024) Publisher: Kalyani ISBN: 978-93-6440-112-8 | | |
| | 2. Plant Biochemistry — David T. Dennis, Michael Goodwin, Bob B. Buchanan (Buchanan, Grisse & Jones: Biochemistry & Molecular Biology of Plants) | | |
| | 3. Plant Physiology and Development — Lincoln Taiz, Alan J. Zeiger, Ian M. Møller, Angus Murphy | | |
| | 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 th edition) | | |
| | 7. An introduction to Genetic analysis Griffith Freeman and Company (2000) | | |

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Second Year B.Sc.
(Botany)**

Semester- VI

**TITLE: PRACTICAL – III
FORM AND FUNCTION III**

Practical: 1.5 Credit

**with effect from
Academic Year 2025**

Title: Practical –III: Form and Function III

Course Code: CHM(A)USBOP9

| Sr. No. | Heading | Particulars |
|---------|---|---|
| 1 | Description the Course: | This practical course is designed to provide students with a comprehensive understanding of fundamental experimental techniques in Plant Biochemistry, Plant Physiology, Genetics, and Biostatistics . It emphasizes the biochemical analysis of proteins, enzymes, and metabolites; the physiological study of plant growth and metabolism; the genetic interpretation of inheritance patterns and mutations; and the application of statistical tools for data analysis. Through these experiments, students develop practical skills, scientific reasoning, and analytical proficiency essential for exploring plant function, genetic variation, and quantitative evaluation of biological data. |
| 2 | Vertical | ----- |
| 3 | Type Teaching Methods | Practicum |
| 4 | Credit | 1.5 Credits |
| 5 | Hours allotted | 45 Hours |
| 6 | Marks allotted | 50 Marks |
| 7 | Course Objectives: | <ol style="list-style-type: none">1. To develop practical skills in estimating biomolecules and studying enzyme kinetics in plants.2. To understand physiological processes such as nitrogen metabolism and hormonal regulation of seed germination.3. To analyze genetic principles through linkage mapping, mutation identification, and mitotic studies.4. To apply biostatistical tools for accurate interpretation and validation of experimental data. |
| 8 | Learning Outcomes: Student will be able to | <p>LO1. Estimate proteins and reducing sugars and analyze enzyme activity under varying physiological conditions.</p> <p>LO2. understand the influence of factors such as pH, substrate concentration, and hormones (GA) on plant metabolic and growth processes.</p> <p>LO3. gain proficiency in solving genetic problems, constructing chromosome maps, identifying mutations, and observing stages of mitosis microscopically.</p> <p>LO4. acquire the ability to apply statistical methods—t-tests, regression analysis, and</p> |

| | ANOVA—for biological data interpretation and result validation. LO5. Overall, students will develop analytical, observational, and data interpretation skills essential for experimental plant sciences. | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------|--|-------------|-----------|-------|----|--|----|----|--|----|----|---|----|----|---|----|----|---|----|----|---------|----|--------------|-----------|--|
| 9 | <p style="text-align: center;">Syllabus</p> <p>Plant Biochemistry</p> <ul style="list-style-type: none"> • Estimation of proteins by Biuret method • Effect of pH on the activity of amylase • Effect of substrate variation on the activity of amylase <p>Plant Physiology II</p> <ul style="list-style-type: none"> • Determination of alpha-amino nitrogen • Effect of GA on seed germination • Estimation of reducing sugars by DNSA method. <p>Genetics</p> <ul style="list-style-type: none"> • Problems based on three-point crosses, construction of chromosome maps • Identification of types of mutations from given DNA sequences • Study of mitosis using pre-treated root tips of <i>Allium</i> <p>Biostatistics</p> <ul style="list-style-type: none"> • <i>t</i>-test(paired and unpaired) • Problems based on regression analysis • ANOVA(One Way) | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | <p style="text-align: center;">Scheme of Examination and Assessment Pattern Practical Paper – 50 Marks B. Semester End Practical exam - 50 marks Time: 3:00 hours Format of Question Paper</p> <table border="1"> <thead> <tr> <th>Question No</th> <th>Questions</th> <th>Marks</th> </tr> </thead> <tbody> <tr> <td>Q1</td> <td>Perform the experiment ‘A’ allotted to you</td> <td>10</td> </tr> <tr> <td>Q2</td> <td>Perform the experiment ‘B’ allotted to you</td> <td>10</td> </tr> <tr> <td>Q3</td> <td>Make a squash preparation to show the stage of mitosis from the pre-treated root tips ‘C’</td> <td>05</td> </tr> <tr> <td>Q4</td> <td>Construct a chromosome map from the given data ‘D’ / Identify the type of mutation and comment on them (any two types of mutations)</td> <td>10</td> </tr> <tr> <td>Q5</td> <td>From the given data/ material ‘E’ determine test of significance using students t-test/ Regression Analysis/ANOVA</td> <td>10</td> </tr> <tr> <td>Q6</td> <td>Journal</td> <td>05</td> </tr> <tr> <td>TOTAL</td> <td>50</td> <td></td> </tr> </tbody> </table> | Question No | Questions | Marks | Q1 | Perform the experiment ‘A’ allotted to you | 10 | Q2 | Perform the experiment ‘B’ allotted to you | 10 | Q3 | Make a squash preparation to show the stage of mitosis from the pre-treated root tips ‘C’ | 05 | Q4 | Construct a chromosome map from the given data ‘D’ / Identify the type of mutation and comment on them (any two types of mutations) | 10 | Q5 | From the given data/ material ‘E’ determine test of significance using students t-test/ Regression Analysis/ANOVA | 10 | Q6 | Journal | 05 | TOTAL | 50 | |
| Question No | Questions | Marks | | | | | | | | | | | | | | | | | | | | | | | |
| Q1 | Perform the experiment ‘A’ allotted to you | 10 | | | | | | | | | | | | | | | | | | | | | | | |
| Q2 | Perform the experiment ‘B’ allotted to you | 10 | | | | | | | | | | | | | | | | | | | | | | | |
| Q3 | Make a squash preparation to show the stage of mitosis from the pre-treated root tips ‘C’ | 05 | | | | | | | | | | | | | | | | | | | | | | | |
| Q4 | Construct a chromosome map from the given data ‘D’ / Identify the type of mutation and comment on them (any two types of mutations) | 10 | | | | | | | | | | | | | | | | | | | | | | | |
| Q5 | From the given data/ material ‘E’ determine test of significance using students t-test/ Regression Analysis/ANOVA | 10 | | | | | | | | | | | | | | | | | | | | | | | |
| Q6 | Journal | 05 | | | | | | | | | | | | | | | | | | | | | | | |
| TOTAL | 50 | | | | | | | | | | | | | | | | | | | | | | | | |

| | |
|------------------|--|
| | <p>Keys A–Plant Biochemistry Experiments B–Plant Physiology Experiments C- Mitosis</p> |
| <p>11</p> | <p>REFERENCE :</p> <ol style="list-style-type: none"> 1. Text Book of Plant Biochemistry and Molecular Biology (2024) Publisher: Kalyani ISBN: 978-93-6440-112-8 2. Plant Biochemistry — David T. Dennis, Michael Goodwin, Bob B. Buchanan (Buchanan, Grissem & Jones: Biochemistry & Molecular Biology of Plants) 3. Plant Physiology and Development — Lincoln Taiz, Alan J. Zeiger, Ian M. Møller, Angus Murphy 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. (5th edition) An introduction to Genetic analysis Griffith Freeman and Company (2000) |

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B.Sc.
(Botany)**

Semester- VI

**TITLE: CURRENT TRENDS IN PLANT SCIENCE–II
PAPER-IV**

Major Subject -2.5 Credits

**with effect from
Academic Year 2025-2026**

Title: Current Trends in Plant Science–II

Course Code: CHM(A)USBO604

| Sr. No. | Heading | Particulars |
|---------|---|---|
| 1 | Description of the Course: | <p>This course explain the principles and methodologies of DNA sequencing, including Maxam–Gilbert, Sanger, and Pyrosequencing methods, and apply this knowledge to analyze DNA sequences for plant biotechnology applications and understanding of Polymerase Chain Reaction (PCR) techniques and DNA barcoding concepts using nuclear and chloroplast genome sequences for plant identification and authentication.</p> <p>It also exploits bioinformatics tools and databases for biological data retrieval, perform BLAST searches, and interpret results to identify gene or protein sequences and analyzes protein structures and conduct multiple sequence and phylogenetic analyses to understand molecular evolution and functional relationships.</p> <p>The course also describes various methods of extraction, and applications of essential oils and its applications in aromatherapy, citing examples of selected oils. In addition, it also includes study of vegetable fats and oils.</p> <p>It also Explains post-harvest technologies for storage and preservation of plant produce, including methods like drying, freezing, canning, and the use of food preservatives and antioxidants.</p> |
| 2 | Vertical | — ---- ——— |
| 3 | Type Teaching Methods | Theory Lecture, Presentation, Seminars, Simulations |
| 4 | Credit | 2.5Credits |
| 5 | Hours allotted | 48 Hours |
| 6 | Marks allotted | 100 Marks |
| 7 | Course Objectives: 1. To understand the advanced concepts and methodologies of DNA sequencing, Polymerase Chain Reaction (PCR) and DNA barcoding. | |

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|---|---|
| | <ol style="list-style-type: none"> 2. To familiarize with the principles and applications of bioinformatics, emphasizing the organization, storage, and retrieval of biological data using various databases and computational tools and to train students to utilize bioinformatics tools. 3. To develop an understanding of essential oils, including their extraction methods, classification, and therapeutic applications in aromatherapy and educate students on the types and characteristics of vegetable fats and oils. 4. To introduce the fundamentals of post-harvest technology, emphasizing techniques for storage and preservation of plant produce such as drying, freezing, canning, and the use of preservatives and antioxidants. |
| 8 | <p>Learning Outcomes:</p> <p>LO1. Students will be able to gain insight into recent molecular biology techniques for DNA analysis and amplification and Barcoding techniques and applications therein.</p> <p>LO2. Students will be able to understand and apply tools of Bioinformatics or data retrieval and phylogenetic analysis.</p> <p>LO3. Students will be able learn about the sources of economically important plants in the field of Fats and oils and apply it for extraction, dealing with entrepreneurship in the field.</p> <p>LO4. Students will be able to gain knowledge and proficiency in preservation of post-harvest produce and explore the possibility of entrepreneurship in the field.</p> |
| 9 | <p style="text-align: center;">Syllabus</p> <p>UNIT I: Plant Biotechnology II</p> <ul style="list-style-type: none"> • DNA sequence analysis–Maxam–Gilbert Method and, Sanger’s method, Pyro Sequencing • Polymerase Chain Reaction (PCR) • DNA barcoding: Basic features, nuclear genome sequence, chloroplast genome sequence, <i>rbcL</i> gene sequence, <i>matK</i> gene sequence <p>UnitII: Bioinformatics</p> <ul style="list-style-type: none"> • Organization of biological data, databases • Exploration of data bases, retrieval of desired data, BLAST • Protein structure analysis and application • Multiple sequence analysis and phylogenetic analysis <p>UNIT–III:</p> |

- Essential Oils: Methods of Extraction of essential oils, Essential oils and Aromatherapy, Introduction to Aromatherapy, Classification of Aromatherapy, Applications of essential oils in Aromatherapy citing examples-Jojoba oil, lemongrass oil and Lavender oil
 - Vegetable Fats and oils: Introduction to vegetable Fats and oils, Classification of vegetable Fats and oils
 - Vegetable Fats: Coconut and Palm oil
 - Fatty oils:
 - Drying oil (Linseed and Safflower oil),
 - Semidrying oils (Sunflower oil and Sesame oil) and
 - Non-drying oils (Olive oil, Castor oil and Peanut oil)
- Unit IV: Post Harvest Technology**
- Storage of Plant Produce–Preservation of Fruits and Vegetables
 - Drying (Dehydration) – Natural conditions – Sun drying, Artificial Drying – Hot Air Drying, Vacuum Drying, Osmotically Dried Fruits, Crystallized or Candied Fruits, Fruit Leather, Freeze Drying)
 - Freezing (Cold Air Blast System, Liquid Immersion method, Plate Freezers, Cryogenic Freezing, Dehydro-Freezing, Freeze Drying),
 - Canning
 - Food Preservatives
 - Use of Antioxidants in Preservation

10

Scheme of Examination and Assessment Pattern

Theory Paper – 100 Marks

External Examination: Semester End External –75 marks Time: 2 hour 30 minutes

Format of Question Paper

| Sr. No. | Evaluation type | Marks |
|---------|--|-----------|
| Q.1 | Multiple choice 20 questions (Attempt 15, 1 Mark each) | 15 |
| Q.2 | Four (4) Long Answer Questions on unit-1, out of which two (2) to be solved. | 15 |
| Q.3 | Four (4) Long Answer Questions on unit-2, out of which two (2) to be solved. | 15 |
| Q.4 | Four (4) Long Answer Questions on unit-3, out of which two (2) to be solved. | 15 |
| Q.5 | Four (4) Long Answer Questions on unit-4, out of which two (2) to be solved. | 15 |
| | TOTAL | 75 |

Internal Examination: Continuous Evaluation - 25 marks

| | Assessment / evaluation | Marks |
|----|--|-----------|
| 1. | Class Test (Short notes/ MCQ's/ Match the Pairs/ Answer in one sentence/ Puzzles) | 20 |
| 2. | Attendance + Class room performance | 05 |
| | Total | 25 |

11

REFERENCE :

4. Introduction To Bioinformatics by S Sundara Rajan, Balaji R. (2005), Himalaya Publishing House
5. Instant Notes on Bioinformatics by Westhead (2002), Taylor Francis Publications.
6. Basic Bioinformatics by Ignacimuthu (2013). Narosa Publishing House Pvt. Ltd. - New Delhi
7. DNA barcoding in plants: Taxonomy in a new perspective 2010.K. Vijayan and CHTsou, Current Science, 1530 –1541.
8. Introduction to Biostatistics by P. K. Banerjee, Chand Publication.
9. Economic Botany by A. F. Hill, TATA McGraw-Hill Publishing Co.Ltd.
10. Post-Harvest Technology by Verma and Joshi, Indus Publication

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B.Sc.
(Botany)**

Semester- VI

**TITLE: PRACTICAL-IV
CURRENT TRENDS IN PLANT SCIENCE–II**

Practical IV-1.5 Credit

**with effect from
Academic Year 2025-26**

Title: Practical -IV: Current Trends in Plant Science–II**Course Code: CHM(A)USBOP9**

| Sr. No. | Heading | Particulars |
|----------------|-----------------------------------|--|
| 1 | Description of the Course: | This course provides practical exposure to Plant Biotechnology techniques like DNA sequencing and DNA barcoding of plant material by using suitable data. It also give hands on training on Bioinformatics tools like BLAST: n BLAST, p BLAST, Multiple sequence alignment, Phylogenetic analysis which will help to identify regions of similarity between sequences to infer functional and evolutionary relationships and to construct phylogenetic trees. The course also includes extracting essential oils from aromatic plants using hydro-distillation and separation of components using TLC technique. Students will also learn various preservation techniques under post-Harvest technology. |
| 2 | Vertical | — ----- — |
| 3 | Type Teaching Methods | Practicum |
| 4 | Credit | 1.5Credits |
| 5 | Hours allotted | 45 Hours |
| 6 | Marks allotted | 50 Marks |
| 7 | Course Objectives: | <ol style="list-style-type: none">1. To understand and demonstrate the principles of DNA sequencing techniques for determining nucleotide sequences and to identify plant species based on their unique DNA barcode sequences.2. To use BLAST for comparing nucleotide (nBLAST) and protein (pBLAST) sequences and construct phylogenetic trees showing evolutionary relationships.3. To extract essential oils from plants and to separate and identify components of essential oils and to estimate saponification value of vegetable oil.4. To learn and perform preservation methods to enhance shelf life, preparing jam, jelly |

| | |
|---|---|
| | from fruit extracts. |
| 8 | <p>Learning Outcomes: Student will be able to</p> <p>LO1. Learn how sequencing data is generated and interpreted to determine gene or genome sequences, understanding molecular identification and biodiversity studies using bioinformatics tools.</p> <p>LO2. Able to retrieve homologous sequences and analyse genetic similarities and Interpretation of evolutionary relationships among organisms.</p> <p>LO3. Understanding principles of essential oil extraction and skill in chromatographic analysis and detection of volatile compounds.</p> <p>LO4. Understanding preservation methods using sugar and preservation processes to enhance shelf life.</p> |
| 9 | <p style="text-align: center;">Syllabus</p> <p>Plant Biotechnology II</p> <ul style="list-style-type: none"> • DNA sequencing by Sanger’s Method and Pyro Sequencing Method • DNA barcoding of plant material by using suitable data <p>Bioinformatics</p> <ul style="list-style-type: none"> • BLAST: nBLAST, pBLAST • Multiple sequence alignment • Phylogenetic analysis • RASMOL/SPDBV <p>Economic Botany</p> <ul style="list-style-type: none"> • Demonstration: Extraction of essential oil using Clevenger • Thin layer chromatography of essential oil of Patchouli and Citronella • Saponification value of Palm oil <p>Post-Harvest Technology</p> <ul style="list-style-type: none"> • Preparation of <ul style="list-style-type: none"> ➤ Squash ➤ Jam ➤ Jelly ➤ Pickle |

| | | |
|------------|---|---|
| 10 | Scheme of Examination and Assessment Pattern (Practical- 50 Marks) | |
| | C. External Examination: Semester End External Practical- 50 Marks Time: 4:00 hours | |
| | Format of Question Paper | |
| | Duration: 4 Hours | |
| | Marks: 50 | |
| | Sr. No. | Marks |
| | Q.1 | Perform the DNA barcoding of plant material using given data 'A'. OR Perform DNA sequencing by Sanger's method of the given sequence 'A'. |
| | Q.2 | Perform the experiment 'B' allotted to you. |
| | Q.3 | Perform the analysis of data 'C' using computer (Bioinformatics). |
| Q.4 | Prepare the squash/Jam/jelly/pickle from the given material 'D'. | |
| Q.5 | <i>Viva voce</i> (Based on Paper III and Paper IV) | |
| | TOTAL | 50 |
| 11. | References: <ol style="list-style-type: none"> 1. Introduction To Bioinformatics by S Sundara Rajan, Balaji R. (2005),Himalaya Publishing House 2. Instant Notes on Bioinformatics by Westhead (2002), Taylor Francis Publications. 3. Basic Bioinformatics by Ignacimuthu (2013). Narosa Publishing House Pvt. Ltd. - New Delhi 4. DNA barcoding in plants: Taxonomy in a new perspective 2010.K. Vijayan and CHTsou, Current Science, 1530 –1541. 5. Introduction to Biostatistics by P. K. Banerjee, Chand Publication. 6. Economic Botany by A. F. Hill, TATA McGraw-Hill Publishing Co.Ltd. Post-Harvest Technology by Verma and Joshi, Indus Publication | |

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B.Sc.
(Botany)**

Semester- VI

Title: Applied Component (Horticulture & Gardening-II)

Applied Paper -2.5 Credits

**with effect from
Academic Year 2025-2026**

Title: HORTICULTURE & GARDENING-II

Course Code: CHM(A)USACHO601

| Sr. No. | Heading | Particulars |
|---------|--|---|
| 1 | Description of the Course: | This course provides a comprehensive foundation in landscape gardening, high-tech horticultural production and commercial horticulture, combining theory and practical skills. Students will learn garden design, indoor plant systems, and garden styles; greenhouse and floriculture technologies; commercial crop production, post-harvest handling, marketing and entrepreneurship in horticulture. |
| 2 | Vertical 1 | Major |
| 3 | Type Teaching Methods | Theory Lecture, Presentation, Seminars, Simulations |
| 4 | Credit | 2.5Credits |
| 5 | Hours allotted | 48 Hours |
| 6 | Marks allotted | 100 Marks |
| 7 | Course Objectives: <ol style="list-style-type: none">1. Equip students with the ability to design and implement diverse landscape and indoor garden systems using appropriate features, layout and plant selections.2. Enable students to apply advanced horticultural production technologies—including greenhouse design, hydroponics, and floriculture—and understand how modern tools (such as AI) enhance horticulture.3. Develop competency in commercial horticultural production, post-harvest management, value-addition, marketing and entrepreneurship in crops, fruits, vegetables, spices, aromatics and medicinal plants.4. Foster the capacity to integrate ecological, economic and aesthetic considerations in horticultural practice, and to evaluate and operate horticultural systems sustainably and professionally. | |
| 8 | Learning Outcomes: LO 1. Students will be able to plan and design gardens and indoor plant systems. | |

LO 2. Students will select and grow suitable plants for landscaping, greenhouse and commercial production.

LO 3. Students will apply techniques for harvesting, preservation, marketing and entrepreneurship in horticulture.

LO 4. Students will document their observations and integrate practical insights with theoretical knowledge.

9

Syllabus

UNIT 1: LANDSCAPE GARDENING

- Principles of landscaping & garden design.
Indoor plants & Indoor gardens: Hydroponics, Terrarium/Bottle garden, Dish garden, Aquascaping, Kokedama, Air-purifying plants.
- Important garden features- Paths & Avenues, Hedges & Edges, Lawn, Flower beds, Arches & Pergolas, Fencing, Waterbodies, Rock garden & Plants suitable for different locations & climates.
- Mughal, Buddhist, Botanical garden, Vertical wall garden & Theme park
Important Gardens of India—Shalimar (Srinagar), Vrindavan (Mysore), Veer Jijamata Udyan (Mumbai).

Unit 2: HORTICULTURE PRODUCE

- **High-tech Horticultural production- Greenhouse technology-** Meaning, types, layout, and construction, irrigation systems. Care & attention. Hardening of plants. Space gardens.
- **Floriculture** – Scope & importance, soil and climatic requirements, and cultivation practices and economics of greenhouse production of Gerbera, Carnation, Roses, Orchids.
Propagation techniques, packing and marketing, Floral arrangements, and value addition.
- Role of AI in modern Horticulture.

UNIT3: COMMERCIAL PRODUCTION

- **Commercial production of the following—in relation to propagation, post plantation care, harvesting, post-harvest management & varieties.**
 - Tubers- Potato
 - Vegetables-Tomato
 - Fruits- Coconut products like cocopeat/Coir etc.
 - Spices/condiments- Chilly
 - Medicinal plants- *Stevia rebaurdiana* (Madura)
 - Aromatic plant- Patchouli

UNIT4: POST-HARVEST TECHNOLOGY & ENTREPRENEURSHIP IN

HORTICULTURE

- **Maturity**- Factors responsible for maturity and ripening methods used for delaying ripening.
- **Harvest**-Time of harvest, harvesting, handling of harvested products
- **By-product utilization and waste management**- solid organic waste (Peels, seeds, and leaves)
- **Storage of fresh produce**-Types of storage for fruits & vegetables.
- **Fruit & vegetables preservation technology.**
- **Marketing**-grading, packing & transportation. Ways to increase the market value and shelf life of horticultural produce.
- **Horticultural business, management, and entrepreneurship development.** Horticulture is the definition, nature, organization, planning, and operation of a horticulture farm business.

10

Scheme of Examination and Assessment Pattern

Theory Paper – 100 Marks

External Examination: Semester End External - 75 marks Time: 2:30 hour

Format of Question Paper

| Question No | Questions | Marks |
|---|---|--------------|
| Q1 | MCQs Question based on all units | 15 |
| Q2 | Attempt any Two of the following | 15 |
| a | Unit-1- Long Answer Type | 7.5 |
| b | Unit-1- Long Answer Type | 7.5 |
| c | Unit-1- Long Answer Type | 7.5 |
| d | Unit-1- Long Answer Type | 7.5 |
| Q3 | Attempt Any Two of the following | 15 |
| a | Unit-2 Long Answer Type | 7.5 |
| b | Unit-2 Long Answer Type | 7.5 |
| c | Unit-2 Long Answer Type | 7.5 |
| d | Unit-2 Long Answer Type | 7.5 |
| Q3 | Attempt Any Two of the following | 15 |
| a | Unit-3 Long Answer Type | 7.5 |
| b | Unit-3 Long Answer Type | 7.5 |
| c | Unit-3 Long Answer Type | 7.5 |
| d | Unit-3 Long Answer Type | 7.5 |
| Q4 | Attempt Any Two of the following | 15 |
| a | Unit-4 Long Answer Type | 7.5 |
| b | Unit-4 Long Answer Type | 7.5 |
| c | Unit-4 Long Answer Type | 7.5 |
| d | Unit-4 Long Answer Type | 7.5 |
| TOTAL | 30 | |
| Internal Examination: Continuous Evaluation - 20 marks | | |
| | Assessment / evaluation | Marks |
| 1. | Class Test | 20 |

| | | | |
|-----------|-------------------|--|-----------------|
| | | (Short notes/ MCQ's/ Match the Pairs/ Answer in one sentence/ Puzzles) | |
| | 2. | Attendance/Viva-Voce | 05 |
| | | | Total 25 |
| 11 | REFERENCE: | | |

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B.Sc.
(Botany)**

Semester- VI

Title: Practical Horticulture and Gardening–II

**with effect from
Academic Year 2025**

Title: HORTICULTURE AND GARDENING–II


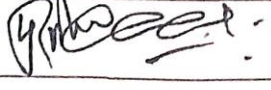


Course Code: CHM(A)USACHO6P1


| Sr. No. | Heading | Particulars |
|---------|--------------------------------|---|
| 1 | Description the Course: | This course introduces students to the fundamentals of garden planning, plant selection, horticultural practices and related creative applications. It covers garden-layout preparation; selection and identification of key plant groups (herbs, shrubs, trees, climbers, lianas, epiphytes, creepers, aquatic plants, succulents, weeds); floral arrangements in Indian, Japanese and Western styles; processing of garden produce into jams, squashes, pickles and cookies; fruit & vegetable carving and bio-jewellery; greenhouse cultivation of indoor/air-purifying plants (soil, temperature, irrigation, fertiliser, propagation); and includes visits to gardens, nurseries, horticultural exhibitions and research stations. Practical components and field visits are integral, and students are required to document and present certified records of these visits for assessment. |
| 2 | Vertical | ---- |
| 3 | Type Teaching Methods | Practicum |
| 4 | Credit | 1.5 Credits |
| 5 | Hours allotted | 45 Hours |
| 6 | Marks allotted | 100 Marks |
| 7 | Course Objectives: | <ol style="list-style-type: none">1. Design and plan functional garden spaces.2. Select suitable plants for diverse garden settings.3. Identify and classify major horticultural plant types.4. Create floral arrangements in Indian, Japanese and Western styles.5. Process garden produce into value-added products.6. Execute creative horticultural crafts (carving, bio-jewellery).7. Manage indoor/greenhouse plants with correct soil, climate, water and propagation. |

| 8 | <p>Learning Outcomes: Students will be able to</p> <p>LO1.Apply garden-design principles to prepare layout plans suited to various site conditions.</p> <p>LO 2. Identify and select appropriate plants for different locations, recognizing major horticultural categories and their requirements.</p> <p>LO 3. Execute a variety of floral arrangements and processed garden produce products using correct techniques and creative design.</p> <p>LO 4. Manage indoor/greenhouse plants and conduct field visits, documenting observations and integrating theory with practical horticultural practice.</p> | | | | | | | | | |
|-------------|--|-------------|-----------|-------|----|--|----|----|--|----|
| 9 | <p style="text-align: center;">Syllabus</p> <ol style="list-style-type: none"> 1. Preparation of garden layout 2. List of plants suitable for garden locations: 2- 3 plants for each location. 3. Identification of important horticultural plants <ul style="list-style-type: none"> • Herbs – foliage any 2 and flowering any 2 • Shrubs–foliage any 2 flowering any 2 • Trees – foliage any 2 and flowering any 2 • Climbers–any 2 • Lianas – any 2 • Epiphytes–any 2 • Creepers–any 2 • Aquatic plants – any 3 (preferably various habitat) • Succulents–any2 • Weeds –any 5 4. Flower arrangements –Indian (Gajara, garland, bouquet- Baskets, hand-torch type, table floral arrangement), Japanese and Western all types 5. Preparation of Jams, Squashes, Pickles, Fruit Cakes/Millet cookies. 6. Fruit & vegetable carving & Bio-jewelry. 7. Green house plants- Information regarding to soil, temperature, irrigation, fertilizer requirements, and propagation methods for Air-purifying plants, <i>Chlorophytum</i> ferns, <i>Sansevieria</i>. 8. Visits: To Garden/Parks/Nurseries/Exhibition/Horticulture industries/Research Station, and a record of visits should be duly certified and presented at the practical examination. | | | | | | | | | |
| 10 | <p style="text-align: center;">Scheme of Examination and Assessment Pattern Practical Paper – 50 Marks A. Semester End Practical exam - 50 marks Time: 3:00 hours Format of Question Paper</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Question No</th> <th style="width: 70%;">Questions</th> <th style="width: 15%;">Marks</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Q1</td> <td></td> <td style="text-align: center;">20</td> </tr> <tr> <td style="text-align: center;">Q2</td> <td></td> <td style="text-align: center;">20</td> </tr> </tbody> </table> | Question No | Questions | Marks | Q1 | | 20 | Q2 | | 20 |
| Question No | Questions | Marks | | | | | | | | |
| Q1 | | 20 | | | | | | | | |
| Q2 | | 20 | | | | | | | | |

| | | | |
|-----------|-------------------|------------|----|
| | Q3 | | 20 |
| | Q4 | | 20 |
| | Q5 | | 15 |
| | Q6 | | 05 |
| | TOTAL | 100 | |
| | Keys | | |
| 11 | REFERENCE: | | |

Syllabus Committee:

| Sr. No | Name of the Faculty | Designation and College | Signature |
|--------|---------------------|--|---|
| 1. | Dr. Lal Sahab Yadav | Head & Associate Professor Smt. CHM College, Ulhasnagar |  |
| 2 | Mr. Prashant Patil | Assistant Professor Smt. CHM College, Ulhasnagar |  |
| 3 | Dr. Darshana Patil | Associate Professor Smt. CHM College, Ulhasnagar |  |
| 4 | Dr. Lakshmi Girish | Associate Professor Smt. CHM College, Ulhasnagar |  |

Name & Signature of the BoS Chairperson: DR. LALSAHAB YADAV 

Name & Signature of the Dean: Dr. NEENA ANAND 