**MANONMANIAM SUNDARANAR UNIVERSITY**

**TIRUNELVELI – 627012**

**B.Sc. Botany Degree**
(CHOICE BASED CREDIT SYSTEM)

**Learning Outcomes Based Curriculum Framework (LOCF) & Syllabus**

**Major & Allied Botany**

**(Effective from the academic year 2021-2022 onwards)**

# MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

## B.Sc. Botany

(Choice Based Credit System)

**(Effective from the academic year 2021-2022 onwards)**

### 1. Preamble

Botany deals with the study of chemical and physical processes of living systems. Botany holds promises in areas of Zoology and Chemistry. The B.Sc. Degree programme aims at providing in-depth knowledge and understanding of the core principles of Botany and their practical aspects in order to pursue higher studies and employment. The Learning Outcomes Based Curriculum Framework (LOCF) for B.Sc. Botany programme has been framed as per the guidelines prescribed by University Grants Commission (UGC) under Choice Based Credit System (CBCS).

### 2. Vision

Excellent education in Botany to bring forth intellectual, personal and social wellbeing.

### 3. Mission

- Provide healthy learning environment to imbibe comprehensive knowledge, skills and values to bridge academia, industries and society.
- Promote research and open scientific platforms that transform students proficient and globally competent.
- Nurture moral values among students and help them grow as socially sensible and responsible persons.

| **Department of Botany**<br>**Bachelor of Science in Botany** | |
|---|---|
| **Name of the Faculty handled:** | **No. of Students:** |
| **Year: I Semester: I Semester: Odd/ Even** | **Academic year : 20__-__** |

**Score card for the mapping of CO-PO**

**Measuring Course Outcomes attained through University Examinations:**

***Attainment Level 1:*** *60% students scoring B Grade and above*

***Attainment Level 2:*** *70% students scoring A Grade and above*

***Attainment Level 3:*** *80% students scoring $A^+$ Grade and above*

**Measuring Course Outcomes attained through Internal Exams:**

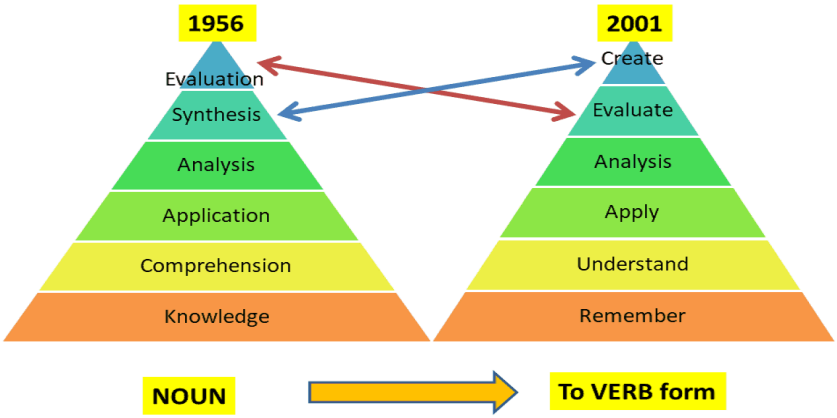
***Attainment Level 1:*** *65% students scoring 32.5 and more marks out of 50*

***Attainment Level 2:*** *75% students scoring 37.5 and more marks out of 50*

***Attainment Level 3:*** *85% students scoring 42.5 and more marks out of 50*

| Course Outcomes | Tool | Percentage of students scoring more than the target | Attainment level | Attainment of Course Outcome | Course Outcome |
|---|---|---|---|---|---|
| **CO1** | Best INT- I (20%) | 73.13% | **1** | (0.2x1) + (0.8 x 3) | **2.6** |
| | UNIV (80%) | 80.59% | **3** | | |
| **CO2** | Best INT- II (20%) | 73.13% | **1** | (0.2x1) + (0.8 x 3) | **2.6** |
| | UNIV (80%) | 80.59% | **3** | | |
| **CO3** | Best INT- I (20%) | 92.53% | **3** | (0.2x3) + (0.8 x 3) | **3.0** |
| | UNIV (80%) | 80.59% | **3** | | |
| **CO4** | Best INT- II (20%) | 92.53% | **3** | (0.2x3) + (0.8 x 3) | **3.0** |
| | UNIV (80%) | 80.59% | **3** | | |
| **CO5** | Best INT- I (20%) | 68.56% | **1** | (0.2x1) + (0.8 x 3) | **2.6** |
| | UNIV (80%) | 80.59% | **3** | | |
| **CO6** | Assignment | | | | |
| **CO7** | Seminar | | | | |

**Blooms Taxonomy Levels**



List of Cognitive Levels and their codes given in the mapping

K: **Knowledge**
C: **Comprehension**
Ap: **Application**
An: **Analysis**
S: **Synthesis**
E: **Evaluation**

## 4. Programme Educational Objectives (PEOs)

B.Sc. Botany Programme Outcomes (PO's)

**PEO1:** Provide the fundamental knowledge on different branches of Botany.
**PEO2:** Impart the theoretical and practical skills in basic and modern techniques in Botany and related subjects.
**PEO3:** Motivate the students for critical thinking and self-reflection to draw conclusions
**PEO4:** Inculcate moral values and help them to grow as good citizens.
**PEO5:** Enable the students with profound understanding in various field of applications and make them competent.

## 5. Programme Outcomes (POs)

On completion of B.Sc. Botany programme, the student shall be able to

**PO1**. **Basic Knowledge:** Understanding of plant diversity and its significance in maintaining ecological equilibrium.

**PO2**. **Inferential Knowledge:** Students learn how to understand plant morphology and anatomy, plant identification, and vegetation analysis techniques in the field and in the laboratory.

**PO3**. **Application Knowledge:** Apply the knowledge of basic science, biological sciences, and plant fundamentals.

**PO4**. **Analytical and Critical Knowledge:** Prioritize exploration into current techniques and tools for biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue Culture trials, cellular and physiological assessments of plants, and review of its applications in human life.

**PO5**. **Creative Knowledge:** Develop and pivot in societal upliftment through tackling health, environmental challenges, food insecurity, and so on.

## 6. Programme Specific Outcomes (PSO)

On completion of B.Sc. Botany programme, the student shall be able to

**PSO1**. Understanding and identifying thoughts and arguments by gathering important plant related information in order to determine their place in classification systems and at the evolutionary level.

**PSO2**. Students will be able to search, categorise, compare, and link primary literature, choose works pertinent to a certain topic, and assess the scientific validity of these works in the field of Botany.

**PSO3**. Students will be able to compare and contrast the properties of many plant groupings, including algae, fungi, bryophytes, pteridophytes, gymnosperms, and angiosperms.

**PSO4**. Students will be able to explain the sole scientific explanation for the unity and variety of life on Earth using data from comparative biology.

**PSO5**. Students will be able to describe how plants work at the gene, genomic, cellular, and tissue levels.

**PSO6**. Students will be able to link environmental physical aspects to the structure of populations, communities, and ecosystems.

**PSO7**. Students will be able to comprehend the idea of artificial propagation of plants via vegetative methods and to find a livelihood *via* establishing miniature plant nurseries.

## 7. Eligibility for admission to the course and examination

Candidates shall be admitted to the course provided he/she has passed plus two examinations of the State or Central Board with Chemistry / Biology / Maths Biology / Agriculture as one of the subjects or any other Science subject that may be considered as equivalent by the M.S. University.

## 8. Duration of the Course

The students shall undergo the prescribed course of study for a period of not less than three academic years (Six semesters). Each semester contains 90 working days.

## 9. Medium of instruction and examination

The medium of instruction as well as examination will be in English.

## 10. Theory examination

The external evaluation will be based on the examination to be conducted by the university at the end of each semester.

## 11. Practical examination

Practical examinations will be conducted at the end of each semester.

## 12. Evaluation

**A.** Each paper carries an internal component

**B.** There is a pass minimum of 40% for external and overall components

Theory External: Internal Assessment = 75:25
Practical External: Internal Assessment = 50:50

### C. Internal Assessment

Internal marks for Theory shall be allocated in the following manner.

| | |
|---|---|
| The average of the best two tests from three compulsory tests | 20 Marks |
| Assignment | 05 Marks |
| **Total** | **25 Marks** |

Note: Each test will be of one hour duration.

### D. Practical

Internal marks for Practical shall be allotted in the following manner.

| | |
|---|---|
| Experimental work | 20 Marks |
| Record | 10 Marks |
| Model Test | 20 Marks |
| **Total** | **50 Marks** |

## 13. Grading System

The performance of the student is indicated by the Seven Points Scale Grading System as per the UGC norms given below

| Grade | Grade point | Percentage of marks | Performance |
|---|---|---|---|
| O | 9.5 and above | 95-100 | Outstanding |
| E | 8.5 and above | 85-94 | Excellent |
| D | 7.5 and above | 75-84 | Distinction |
| A | 7 and above | 70-74 | Very Good |
| B | 6and above | 60-69 | Good |
| C | 5 and above | 50-59 | Average |
| RA | 0 | Up to 49 | Re-Appear |

**F.** The overall performance level of the candidates will be assessed by the following formulae:

Cumulative weighted average of marks = $\frac{\sum(\text{marks} + \text{credits})}{\sum \text{credits}}$

Cumulative weighted average grade points = $\frac{\sum(\text{Grade points} \times \text{credits})}{\sum \text{credits}}$

## 14. The question paper pattern for all theory papers shall be as follows.

Duration of Exam: 3Hours

| Section | Type of questions | Mark |
|---|---|---|
| Part-A | Multiple choice question<br>(Two question from each unit compulsory) | 1×10=10 Marks |
| Part-B | Internal Choice questions<br>(One question from each unit: either/or) | 5×5=25 marks |
| Part-C | Internal Choice questions<br>(One question from each unit: either/or) | 8×5=40 marks |
| | **Total** | **75 Marks** |

## 15. The question paper pattern for all practical papers shall be as follows.

Duration of Practical Exam: 3 hours

| | | |
|---|---|---|
| 1 | Major experiment | 25 |
| 2 | Minor Experiment | 15 |
| 3 | Spotters | 05 |
| 4 | Record | 05 |
| | **Total** | **50 Marks** |

**MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI - 12**

UG - COURSES - AFFILIATED COLLEGES

**B.Sc. BOTANY**

(CHOICE BASED CREDIT SYSTEM)

(With effect from the academic year 2021 - 2022 onwards)

| Course Structure for B.Sc Botany Major (With effect from the academic year 2021 - 2022 onwards) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sem.** | **Part** | **Sub. No.** | **Subject Status** | **Subject Title** | **Course Paper** | **Hrs./ Week** | **Credits** |
| **I** | I | 1 | Language | Tamil / Other Languages | 1 | 6 | 4 |
| | II | 2 | Language | Communicative English-I | 1 | 6 | 4 |
| | III | 3 | Core I | Algae and Bryophytes | 1 | 4 | 4 |
| | III | 4 | Major Practical I | Algae and Bryophytes - Practical | 1 | 2 | 2 |
| | III | 5 | Add on Major (Mandatory) | Professional English for Life Sciences - I | 1 | 4 | 4 |
| | III | 6 | Allied I | Plant Diversity and Medicinal Botany | 1 | 4 | 3 |
| | III | 7 | Allied Practical I | Plant Diversity and Medicinal Botany-Practical | 1 | 2 | 2 |
| | IV | 8 | Common | Environmental Studies | 1 | 2 | 2 |
| | | | | **Sub Total** | **8** | **30** | **25** |
| **II** | I | 9 | Language | Tamil / Other Languages | 1 | 6 | 4 |
| | II | 10 | Language | Communicative English-II | 1 | 6 | 4 |
| | III | 11 | Core II | Plant Anatomy and Micro-Techniques | 1 | 4 | 4 |
| | III | 12 | Major Practical II | Plant Anatomy and Micro-Techniques -Practical | 1 | 2 | 2 |
| | III | 13 | Add on Major (Mandatory) | Professional English for Life Sciences - II | 1 | 4 | 4 |
| | III | 14 | Allied II | Embryology, Plant Anatomy, Physiology and Biotechnology | 1 | 4 | 3 |
| | III | 15 | Allied Practical II | Embryology, Plant Anatomy, Physiology and Biotechnology - Practical | 1 | 2 | 2 |
| | IV | 16 | Common | Value Based Education / சமுக ஒழுக்கங்களும் பண்பாட்டு விழுமியங்களும் / Social Harmony | 1 | 2 | 2 |
| | | | | **Sub Total** | **8** | **30** | **25** |

| Sem. | Part | Sub. No. | Subject Status | Subject | Course Paper | Hrs./ Week | Credit |
|---|---|---|---|---|---|---|---|
| **III** | I | 17 | Language | Tamil | 1 | 6 | 4 |
| | II | 18 | Language | English | 1 | 6 | 4 |
| | III | 19 | Core III | Fungi, Plant Pathology and Lichenology | 1 | 4 | 4 |
| | III | 20 | Major Practical III | Fungi, Plant Pathology and Lichenology - Practical | 1 | 2 | 2 |
| | III | 21 | Allied – I Paper I | | 1 | 4 | 3 |
| | III | 22 | Allied Practical I | Practical | 1 | 2 | 2 |
| | III | 23 | Skill Based | Mushroom Culture Technology - I(A) | 1 | 4 | 4 |
| | | | | Organic Farming - I(B) | | | |
| | IV | 24 | Non-Major Elective I | Gardening and Garden Management - I(A) | 1 | 2 | 2 |
| | | | | Herbal Medicine - I(B) | | | |
| | IV | | Common | Yoga | - | - | 2 |
| | | | | **Sub Total** | **8** | **30** | **27** |
| **IV** | I | 25 | Language | Tamil | 1 | 6 | 4 |
| | II | 26 | Language | English | 1 | 6 | 4 |
| | III | 27 | Core IV | Pteridophytes, Gymnosperms and Paleobotany | 1 | 4 | 4 |
| | III | 28 | Major Practical IV | Pteridophytes, Gymnosperms and Paleobotany - Practical | 1 | 2 | 2 |
| | III | 29 | Allied II - Paper II | | 1 | 4 | 3 |
| | III | 30 | Allied Practical II | Practical | 1 | 2 | 2 |
| | IV | 31 | Skill Based | Floriculture - I(A) | 1 | 4 | 4 |
| | | | | Preservation of Fruits and Vegetables - I(B) | | | |
| | IV | 32 | Non-Major Elective II | Food and Nutrition - II(A) | 1 | 2 | 2 |
| | | | | Botany for Competitive Examination - II(B) | | | |
| | IV | | Common | Computers for Digital Era | - | - | 2 |
| | V | 33 | Extension Activities | NCC / NSS / YRC / YWF | - | - | 1 |
| | | | | **Sub Total** | **8** | **30** | **28** |

| Sem. | Part | Sub. No. | Subject Status | Subject | Course Paper | Hrs./ Week | Credit |
|---|---|---|---|---|---|---|---|
| **V** | III | 34 | Core V | Cell Biology and Embryology of Angiosperms | 1 | 5 | 4 |
| | III | 35 | Core VI | Morphology and Taxonomy of Angiosperms | 1 | 5 | 4 |
| | III | 36 | Core VII | Biochemistry and Bioinformatics | 1 | 5 | 4 |
| | III | 37 | Elective - I | Plant Ecology and Phytogeography - I(A)<br>Marine Biotechnology - I(B) | 1 | 5 | 4 |
| | III | 38 | Major Practical - V | Cell Biology, Embryology, Morphology and Taxonomy of Angiosperms - Practical | 1 | 2+2 | 2 |
| | III | 39 | Major Practical VI | Biochemistry, Bioinformatics and **Elective – I** Practical | 1 | 2+2 | 2 |
| | IV | 40 | Skill Based Common | Personality Development<br>Effective Communication<br>Youth Leadership | 1 | 2 | 2 |
| | | | | **Sub Total** | **7** | **30** | **22** |
| **VI** | III | 41 | Core VIII | Genetics, Evolution and Biostatistics | 1 | 5 | 4 |
| | III | 42 | Core IX | Plant Physiology | 1 | 5 | 4 |
| | III | 43 | Core X | Microbiology | 1 | 4 | 4 |
| | III | 44 | Elective I | Horticulture and Plant Breeding - I(A)<br>Forestry - I(B) | 1 | 4 | 4 |
| | III | 45 | Elective II | Plant Biotechnology and Genetic Engineering - II(A)<br>Environmental Biotechnology - II(B) | 1 | 4 | 4 |
| | III | 46 | Major Practical VII | Genetics, Evolution, Biostatistics and Elective - I Practical | 1 | 2+1 | 2 |
| | III | 47 | Major Practical VIII | Plant Physiology - Practical | 1 | 2 | 2 |
| | III | 48 | Major Practical IX | Microbiology and Elective II - Practical | 1 | 2+1 | 2 |
| | | | | **Sub Total** | **8** | **30** | **26** |

**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - I**
**CORE PAPER – III: ALGAE AND BRYOPHYTES**
**(4 hrs / week)**

**UNIT – I** **12 Hours**

General characters and classification of Algae based on Fritsch (1945), life cycle patterns of Algae, systematic position, distribution, structure, reproduction and life history of *Volvox* and *Caulerpa*.

**UNIT – II** **12 Hours**

Systematic position, distribution, structure, reproduction and life history of *Chara*, *Sargassum* and *Gracilaria*.

**UNIT – III** **12 Hours**

Seaweed cultivation - *Gracilaria*; Methods of extraction and uses of agar-agar and carrageenin; Economic importance of Algae.

**UNIT – IV** **12 Hours**

Morphology, mass culture and nutritive importance of Spirulina; Morphology, mass culture and economic importance of *Nostoc*.

**UNIT – V** **12 Hours**

General characters and classification of Bryophytes by Rothmaler (1951); systematic position, distribution, structure, reproduction and life history of Marchantia.

**REFERENCES**:


1. Dubey R.C. 1993 A text book of bio-technology S.Chand & Comp. Ltd., New Delhi.
2. Fritsch F.E. 1972. The structure and reproduction of Algae Vol. I & II
3. Kamat N.D. 1982. Topics in algae, Sai Kraipa Prakashan Aurangabad.
4. Kumar H.D & Singh H. N. 1982 A Text book of Algae East West Press Pvt. Ltd New Delhi.
5. Pandey S.N & Trivedi P.S. 1977. Text book of Botany Vol I - Vikas Publishing House J Pvt. Ltd., New Delhi.
6. Parihar N.S. 1967. Bryophyta-Central Book Depot Publications in Botany, Allahabad.
7. Sharma O.P. 1986. Text Book of Algae. Tata Me Graw- Hill Publications. New Delhi,
8. Vashista B.R. 1997. The Algae, S. Chand & Co, New Delhi.
9. Venkatraman. 1969. The cultivation of Algae-Indian council of Agricultural Research - New Delhi.
10. Watson E.V. 1974. Structure and life cycle of Bryophytes- B.I. Publications New Delhi.

## ALGAE AND BRYOPHYTES - PRACTICAL

1. Study of Morphology of the Algae and Bryophytes prescribed in the syllabus.
2. Make suitable micro preparations of the following: a. Caulerpa – Rhizome; b. Sargassum - Stipe, leaf; c. Gracilaria - Thallus with cystocarp; d. Marchantia - Thallus.
3. Observe and identify the microslides
   a) Volvox - Vegetative colony, colony with daughter colonies and sex organs.
   b) Chara - Sex organs
   c) Sargassum - Male and female conccptacles
   d) Gracilaria - Thallus with cystocarp.
   e) Marchantia - V.S of Gemma cup, V.S of Antheridiophore,
   f) V.S of Archcgoniophore, V.S of Sporophyte
   g) Algal Slides / Tablet - Spirulina, Nostoc; BGA-fertilizer (packet);

4. Field trip of minimum one day.

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To understand the general characters and classification and lifecycle of Algae. | PO1, PO2 | PSO1, PSO2 | C |
| CO. 2 | To comprehend Algae systematic position, structure, reproduction, and economic significance. | PO2, PO3 | PSO3, PSO4 | K, C |
| CO. 3 | To examine and analyse various plant Seaweed cultivation and describe about their economic importance of Algae | PO3, PO4, PO5 | PSO5, PSO6 | An |
| CO. 4 | To examine and analyse various plant mass culture and describe about their economic importance. | PO3, PO4, PO5 | PSO5, PSO6 | An |
| CO. 5 | To understand the general characters and classification and lifecycle of Bryophytes. | PO4, PO5 | PSO6, PSO7 | Ap, E |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| ALGAE AND BRYOPHYTES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| **2** | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 |
| **3** | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 |
| **4** | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER – I - Allied - I**
**PLANT DIVERSITY AND MEDICINAL BOTANY**
**(4 hrs / week)**

**UNIT – I** **12 Hours**

General characters and economic importance of Algae - Distribution, Structure and Life History of Volvox; General characters and economic importance of Fungi - Distribution, Structure and Life History of Polyporus.

**UNIT – II** **12 Hours**

General characters and classification of Lichens; Structure and Reproduction of Usnea.
General characters of Bryophytes; Structure, Reproduction and Life History of Funaria.

**UNIT – III** **12 Hours**

General characters of Pteridophytes; Structure, Reproduction and Life History of Lycopodium.
General characteristics of Gymnosperms; Structure, Reproduction and Life History of Pinus,

**UNIT – IV** **12 Hours**

Bentham and Hooker's system of classification; Critical study of the following families: Rutaceae, Asclepiadaceae, Euphorbiaceae and Poaceae.

**UNIT – V** **12 Hours**

Study of the following plants with reference to the morphology of the useful parts and their medicinal importance: Aloe vera, Piper nigrum, Phvllanthus amarus, Coleus amboinicus and Catharanthus roseus,.

**REFERENCES**:


1. Chapman, V.J & Chapman, D.J. Elbs and Macmillian. 1960.
2. The Algae, Chamberlain C.J. 1986. Gymnosperm, structure and Evolution CBS Publishers and Distributors, Delhi.
3. Chopra, R.N. and Kumar, P.K. 1988. Biology of Bryophytes, Wiley Eastern Ltd., New Delhi.
4. Kokate, C.F. Purohit, A.P. and Gohale, S.R. 2004. Pharmacognosy, Nirali Prakashan, New Delhi.
5. Pandey, B.P. 1997. Taxonomy of Angiosperms, S. Chand and company Ltd., New Delhi.
6. Rashid, A. 1976. An Introduction to Pteriodophytes, Vikas Publishing House, New Delhi.
7. Vashista, B.R. 1990. Botany for Degree Students, Fungi S. Chand and Co., Ltd., New Delhi.

**MSU/2021-2022 UG-Colleges/Part-Ill (B.Sc. Botany)/Semester-I /Allied Practical-I**
**PLANT DIVERSITY AND MEDICINAL BOTANY – PRACTICAL**

1. Assign the given plant to its family, giving reasons.
2. Dissect out and draw the floral parts of the plants belong to the families prescribed in the syllabus.
3. Make suitable micropreparations of Lycopodium stem, Pinus needle.
4. Identify and record the medicinal values and morphology of the useful parts of the plants prescribed in the syllabus.
5. Observe and identify the following specimens: Polyporus, Funaria, Lycopodium and Pinus -male and female cone.
6. Identify the slides showing Volvox. Nostoc, Yeast, Lycopodium - cone L.S and Funaria -capsule L.S.

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To understand the general characters and economic importance classification and lifecycle of Alage and fungi. | PO1, PO2 | PSO1, PSO2 | C |
| CO. 2 | To understand the general characters and economic importance classification and lifecycle of Lichens and Bryophytes. | PO2, PO3 | PSO3, PSO4 | K, C |
| CO. 3 | To understand the general characters and economic importance classification and lifecycle of Pteridophytes and Gymnosperms. | PO2, PO3 | PSO3, PSO4 | K, C |
| CO. 4 | To understand the general characters and economic importance classification and Taxonomy of Angiosperms with selected families. | PO3, PO4, PO5 | PSO5, PSO6 | An |
| CO. 5 | To morphology of the useful parts and their medicinal and economic importance. | PO4, PO5 | PSO6, PSO7 | Ap, E |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| Core – 1: PLANT DIVERSITY AND MEDICINAL BOTANY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **2** | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 |
| **3** | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 |
| **4** | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | 3 |
| **5** | 2 | 3 | 2 | 1 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU/ 2021-2022 UG-Colleges /Part-Ill (B.Sc. Botany) / Semester-II/ Core –II**

**PLANT ANATOMY AND MICRO TECHNIQUES**

**(4 hrs / week)**

**UNIT – I** **12 Hours**

Meristems - Characteristics of meristematic tissues - Types, functions and Theories of meristems. Structure and functions of simple and permanent tissues - parenchyma, collenchyma, sclerenchyma, xylem and phloem.

**UNIT – II** **12 Hours**

Structure of dicot stem and root, structure of monocot stem and root, structure of dicot and monocot leaves.

**UNIT – III** **12 Hours**

Normal secondary thickening in dicot stem and root, anomalous secondary growth in the stem of *Boerhaavia* and Dracaena.

**UNIT – IV** **12 Hours**

Nodal anatomy: Types of nodes - unilocular, trilocular and multilocular; leaf traces and leaf gaps, epidermis tissue system: stomatal types, hair, trichomes and glands

**UNIT – V** **12 Hours**

Microscopy: Principle and working of simple and compound light microscopes and electron microscope (TEM only). Micro techniques - simple staining, double staining and preparation of permanent slides - Maceration

**REFERENCES:**


1. Cutter, 1978 - Plant Anatomy, Edward Arnold publishers, London,
2. Eames, A.J 1991-Morphofogy of Angiosperms. Mc Graw Hill Pub., New Delhi.
3. Esau, K.1953-PlantAnatomy, Wileypub. Co. Newyork.
4. Fahn, A. 1987- Plant Anatomy, Maxwell House New York.
5. Johensen,D.A 1940 -Plant Microtechnique. Mc Graw Hill Book Company Inc. New york.
6. Pandey B.P 1982-Plant Anatomy -S. Chand & company Ltd., New Delhi.
7. Vashista, B.R 1997 -The Plant Anatomy R. Chand & co. New Delhi.

**MSU/ 2021-2022 UG-Colleges /Part-Ill (B.Sc. Botany) / Semester-II/ Major Practical - II**
**PLANT ANATOMY AND MICRO TECHNIQUES – PRACTICAL**

1. To observe and identify the following slides showing
   a) Meristems - shoot apex and root apex
   b) Simple tissues
   c) Xylem elements
2. Primary structure of stem, root and leaves of dicot and monocot plant.
3. Normal secondary thickening in dicot stem and root.
4. Anomalous secondary growth in Boerhaavia and Dracaena.
5. Maceration technique (Xylem elements only)
6. Demonstration: Preparation of double stained permanent slides.

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To understand the Meristems – Characteristics and Types, functions and Structure and functions of simple and permanent tissues. | PO1, PO2 | PSO1, PSO2 | C |
| CO. 2 | To comprehend structure of dicot, monocot stem and root, structure of dicot and monocot leaves. | PO2, PO3 | PSO3, PSO4 | K, C |
| CO. 3 | To normal secondary thickening in dicot stem and root, anomalous secondary growth. | PO2, PO3 | PSO3, PSO4 | K, C |
| CO. 4 | To examine and analyse various plant Nodal anatomy: Types of nodes and describe about their leaf traces and leaf. | PO3, PO4, PO5 | PSO5, PSO6 | An |
| CO. 5 | To appraise the Microscopy and their application and Micro techniques – staining types and preparation of permanent slides – Maceration. | PO4, PO5 | PSO6, PSO7 | Ap, E |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| PLANT ANATOMY AND MICRO TECHNIQUES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 |
| **2** | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 |
| **3** | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 |
| **4** | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU/ 2021-2022 UG-Colleges /Part-Ill (B.Sc. Botany) / Semester-II / Allied -II**

**Semester II / IV**

**EMBRYOLOGY, PLANT ANATOMY, PHYSIOLOGY AND BIOTECHNOLOGY**

**(4 Hrs / Week)**

**UNIT – I** **12 Hours**

Structure and development of microsporangium; Structure, types and development of megasporangium; Development of male and female gametophyte; Double fertilization, Endosperm - types. Structure of dicot embryo.

**UNIT – II** **12 Hours**

Meristem - Structure and classification. Simple tissues, complex tissues; Primary structure of Dicot and Monocot stem and root; Structure of leaf; Normal secondary thickening in dicot stem.

**UNIT – III** **12 Hours**

Absorption of water - diffusion, osmosis, imbibition, mechanism of absorption of water; Ascent of sap - (cohesion theory only); Transpiration - Types, Mechanism of stomatal transpiration (Starch - sugar hypothesis); Photosynthesis - importance of photosynthesis, Mechanism of Photosynthesis - Light and dark reaction (Calvin cycle).

**UNIT – IV** **12 Hours**

Nostoc - Morphology, Use as Biofertilizer and Mass cultivation; Structure, multiplication (budding and fission) and Mass culture of Yeast.

**UNIT – V** **12 Hours**

Tissue Culture - Scope and importance - totipotency. Nutrient media (M.S medium) Callus and Meristem Culture; Applications of plant tissue culture.

**REFERENCES:**


1. Bojwani, S.S and Bhatnagar, S.P. 1987. The Embryology of Angiosperms, VikasPublications, New Delhi.
2. Dubey, R.C. 2002. A text Book of Biotechnology, S.Chand and Co; New Delhi
3. Jain, V.K. 2001. Fundamentals of Plant Physiology, S. Chand and Co; New Delhi
4. Pandey, B.P. 2002. Plant Anatomy, S. Chand and Co; Ram Nagar, New Delhi
5. Pandey, K.K. Sinha, B.K. 1988. Plant Physiology, Vikas Publications, New Delhi

**MSU/ 2021-2022 UG-Colleges/Part-Ill (B.Sc, Botany) / Semester - II/**
**Allied Practical-II**
**PRACTICAL - II**
**EMBRYOLOGY, PLANT ANATOMY, PHYSIOLOGY AND BIOTECHNOLOGY-PRACTICAL**

1. Dissect out young embryo from Tridax flower bud.
2. Make suitable micro-preparations of dicot and monocot stem, root and leaf.
3. Demonstrate the physiology experimental set up - Potato osmoscope, Ganong's light screen, Bell jar experiment.
4. Identify the Photograph/Slide/Specimen/setup slides showing mature anther, ovule, dicot embryo, (i) Nostoc (ii) Yeast (iii) Callus culture, (iv) Meristem culture.
5. Maintain a record note book for external and internal evaluation.

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To understand the structure and development of microsporangium and megasporangium and Endosperm – types. | PO1, PO2 | PSO1, PSO2 | C |
| CO. 2 | To meristem - structure and classification and Primary structure of Dicot and Monocot stem and root; Structure of leaf. | PO2, PO3 | PSO3, PSO4 | K, C |
| CO. 3 | To examine and analyse absorption of water and Ascent of sap and Transpiration and Photosynthesis. | PO2, PO3 | PSO3, PSO4 | An |
| CO. 4 | To examine and analyse Morphology, Use as Biofertilizer and Mass cultivation | PO3, PO4, PO5 | PSO5, PSO6 | An |
| CO. 5 | To appraise the Tissue Culture - Scope and importance and Nutrient media review their economic importance. | PO4, PO5 | PSO6, PSO7 | Ap, E |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| EMBRYOLOGY, PLANT ANATOMY, PHYSIOLOGY AND BIOTECHNOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO/PSO | PO | | | | | PSO | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| 2 | 2 | 1 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| 3 | 2 | 1 | 3 | 2 | 1 | 3 | 3 | 1 | 3 | 3 | 2 | 1 |
| 4 | 2 | 2 | 3 | 2 | 1 | 3 | 3 | 1 | 3 | 3 | 2 | 1 |
| 5 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation

**MSU/ 2021 - 2022 UG – Colleges/Part – III (B.Sc. Botany)**
**SEMESTER -III**
**CORE PAPER – III. FUNGI, PLANT PATHOLOGY AND LICHENOLOGY**
**(4 hrs/week)**

**Objectives**:

- To know the structure and economic importance of Fungi
- To identify the symptoms of Plant pathogens
- To know the structure and importance of Lichens

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**UNIT – I** **12 Hours**

General classification and characters of Fungi proposed by Alexopoulous and Mims (1979). Occurrence, systematic position, structure, reproduction and life cycle of Albugo and Aspergillus.

**UNIT – II** **12 Hours**

Occurrence, systematic position, structure, reproduction and life cycle of ***Peziza*** and ***Puccinia***. Economic importance of Fungi-Role of Fungi in medicine, industry, agriculture, food and food products.

**UNIT – III** **12 Hours**

Study of the following plant diseases with special reference to the symptoms, etiology, dissemination and control measures: Tikka disease of ground nut, Red rot of sugar cane, Paddy blast.

**UNIT – IV** **12 Hours**

Study of the following plant diseases with special reference to the symptoms, etiology, dissemination and control measures: Citrus canker, Bunchy top of Banana and Tobacco Mosaic virus.

**UNIT – V** **12 Hours**

Lichens: General account - Classification – Structure – Reproduction – Economic importance of Lichens. Type study: ***Usnea***.

**PRACTICALS**

1. Micro preparation and identification of ***Peziza***, ***Puccinia*** and ***Lichen*** thallus
2. Spotters:
   i. Slides – ***Albugo***-conidia, ***Aspergillus*** – conidia, ***Peziza*** -V.S. of apothecium, ***Puccinia***-uredosorus and Teleutosorus, Lichen – V.S. of apothecium.

   ii. Disease infected leaves showing ***Albugo, Puccinia, Usnea*** – Habit.

   iii. Observe and identify the following Plant diseases.

   a. Tikka disease of Ground nut
   b. Red rot of Sugarcane
   c. Paddy Blast

d. Citrus canker
e. Bunchy Top of Banana
f. Tobacco Mosaic Virus – disease

3. To maintain a record notebook for external evaluation.

**REFERENCES**


1. Alexopolous, C.J, Mims, C.W and Blackwell, M. 1996. Introductory Mycology, John Wiley and Sons, NewYork.
2. Dube, H.C. 2005. An Introduction to Fungi.Vikas Publishing House,New Delhi.
3. Mehrotta, R.S. 2000. Plant Pathology.Tata Mc Graw Hill Publishing Co.New Delhi.
4. Rangaswamy, G. 1992. Diseases of Crop Plants in India. Prentice Hall of India, New Delhi.
5. Sharma, O.P. 1986. Text Book of Fungi. Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.
6. Sing, R.S.1991. Plant diseases Oxford IBH, New Delhi.
7. The Biology of Lichens: Hale, M.E; Edward Arnold, Mayland 1983.
8. Vashista, B.R. 1990. Botany for Degree students – Fungi. S.Chand and Co., New Delhi
9. Vashista P.C; 1998. Plant Pathology – Pradeep Publication, Jalandhar.

https://www.youtube.com/watch?v=pA5AELdA2og
https://www.youtube.com/watch?v=aLcD1GaQr4g
https://www.youtube.com/watch?v=IMge9kF0M_Q
https://www.youtube.com/watch?v=AYNQuSCXVec
https://www.youtube.com/watch?v=B-ZADT2RhkM
https://www.youtube.com/watch?v=KAlvzK_391s
https://www.youtube.com/watch?v=WbRGi7dReM8\
https://www.youtube.com/watch?v=9jErPHfGz7s
https://www.youtube.com/watch?v=_a5VhAILNhU
https://www.youtube.com/watch?v=tOZlcuP2xso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**B.Sc Botany Programme Course Outcome (CO's)**
**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - III**
**CORE PAPER – III. FUNGI, PLANT PATHOLOGY AND LICHENOLOGY**
**(4 hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To understand the classification and lifecycle of fungi. | PO1, PO2 | PSO1, PSO2 | C |
| CO. 2 | To comprehend fungi's systematic position, structure, reproduction, and economic significance. | PO2, PO3 | PSO3, PSO4 | K, C |
| CO. 3 & 4 | To examine and analyse various plant diseases and describe about their control measures | PO3, PO4, PO5 | PSO5, PSO6 | An |
| CO. 5 | To appraise the lichens and their classification and review their economic importance. | PO4, PO5 | PSO6, PSO7 | Ap, E |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| FUNGI, PLANT PATHOLOGY AND LICHENOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **2** | 2 | 1 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 |
| **3** | 2 | 1 | 3 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 3 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 3 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU/2021 - 2022 UG – Colleges/Part-III (B.Sc. Botany)**
**SEMESTER-III**
**SKILL BASED SUBJECT – I (A)**
**MUSHROOM CULTURE TECHNOLOGY**
**(4hrs/week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

Objective:

- The subject enables the students
- To understand, appreciate, and develop self-confidence for involving self-employment.
- To identify the edible and poisonous mushroom.
- To learn the economic factors associated with mushroom cultivation.
- To gain knowledge on post harvesting procedures and preparation of recipes.

**UNIT – I** **13 Hours**

Introduction, Nutritional and medicinal value of Edible mushrooms, poisonous mushroom, Structure and Life cycle of Edible Mushroom - ***Pleurotus*** species. ***Agaricus bisporus, Volvariella volvacea***. Prospects of mushroom cultivation in small scale industry.

**UNIT – II** **14 Hours**

Mushroom Cultivation Technology - Infrastructure, substrates (locally available), Polythene bag, vessels, Inoculation hook, inoculation loop, mushroom unit (thatched house), water sprayer. Pure culture- Preparation of Medium (PDA and Oat Meal Agar Medium, Sterilization methods, Preparation of Test Tube slants to store mother culture. Culturing of Pleurotus mycelium on Petri plates, preparation of mother spawn in Saline bottle and Polypropylene Bag and their multiplication

**UNIT- III** **11 Hours**

Factors affecting the Mushroom bed preparation, spawn running and harvesting of Mushrooms - Button mushroom (***Agaricus bisporus***). Oyster mushroom (***Pleurotus*** sp.) and Paddy Straw Mushroom (***Volvariella*** sp.)

**UNIT – IV** **11 Hours**

Post Harvesting Technology - Farm Design and protection of Mushrooms from Pests and Diseases. Nutritional Value - Proteins, Amino acids, Mineral elements. Carbohydrates, Fibre content and Vitamins. Significance of Mushrooms.

**UNIT – V** **10 Hours**

Storage and Food Preparation - Short term storage (Refrigeration - up to 24 hours), Long term storage (Canning, Pickles, Papads), Drying, storage in salt solutions. Value added Food preparation: Types of Food prepared from Mushroom: Soup, Cutlet, Omelette, Samosa. Pickles, Curry.

**PRACTICALS**

- Demonstration
- Identification of edible mushrooms
- Cultivation of Paddy Straw Mushroom
- Preparation of recipes
- To maintain a record notebook for external evaluation.

**REFERENCES**


1. Bahl, N. (1984-1988). Hand book of Mushrooms, II Edition, and Vol. I & Vol. II.
2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan, R. (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
3. Swaminathan, M. (1990). Food and Nutrition. Bappco. The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
4. Tewari, P and Kapoor, S.C., (1998). Mushroom cultivation.Mittal Publications, Delhi.

https://www.youtube.com/watch?v=o4Z8CkChoZQ
https://www.youtube.com/watch?v=48yxiUrZrrM
https://www.youtube.com/watch?v=9JwkHjCTKtQ
https://www.youtube.com/watch?v=7b9MPjIDVj8
https://www.youtube.com/watch?v=AuxBrMXBXdc
https://www.youtube.com/watch?v=9J31WXxAEwY


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**Core course 2 Code: BO2CRT02**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER - III**
**SKILL BASED SUBJECT – I (A)**
**MUSHROOM CULTURE TECHNOLOGY**
**(4hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To discuss about nutritional and medicinal value of mushroom and their lifecycle | PO1, PO2, PO3 | PSO1, PSO2, PSO3 | C, An |
| CO. 2 | To demonstrate and transfer knowledge about the Mushroom Cultivation Technology | PO2, PO3, PO4 | PSO2, PSO3 | C, Ap |
| CO. 3 | To appraise the harvesting methods of mushroom. | PO4 | PSO4, PSO5 | C, An |
| CO. 4 | To criticize and illustrate about the protection techniques involved in mushroom cultivation | PO4, PO5 | PSO5 | E, C |
| CO. 5 | To understand the storage and preparation of food from mushroom | PO5 | PSO6, PSO7 | K, C |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| MUSHROOM CULTURE TECHNOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **3** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 2 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 1 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER - III**
**SKILL BASED SUBJECT - I (B) ORGANIC FARMING**
**(4hrs / week)**

Objectives:

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

- To enable the students to understand the role of organic manures in the improvement of soil fertility.
- To become aware of the importance of Biofertilizers, Green leaf manure, etc.,
- To learn the significance of Vermicompost and Panchagavya.

**Unit – I** **15 Hours**

Soil types based on texture, Formation of soil, Properties - Physical and Chemical, Soil profile, Fertility of soil, Water retentivity, Reclamation of acidic and alkaline soil.

**Unit – II** **13 Hours**

Organic manure: Farmyard manure, Cow dung, Cow urine, Green leaf manure, Poultry wastes and Fishery wastes.

**Unit – III** **10 Hours**

Humus formation, Composting methods, Advantages of composting, Mulching and its advantages.

**Unit – IV** **12 Hours**

Biofertilizers - Importance of biofertilizers, Rhizobium - Importance, mass production and application; ***Azolla*** - Importance, mass production and application.

**Unit – V** **10 Hours**

Vermicomposting - Importance, Production of vermicompost-pit method and heap method and Application of vermicompost. Panchagavya - Importance, preparation and application of Panchagavya.

**REFERENCES**:


1. Dubey. R.C., 2006, A Text Book of Biotechnology. S.Chand and Company Ltd., New Delhi.
2. John Jothi Prakash. E., 2006, Outlines of Biotechnology, Emkay Publications, New Delhi.
3. Mark Coyone., 2004, Soil microbiology - An Exploratory Approach, Delmar Publishers, Singapore.
4. Miller, C.E. and Turk, L.M., 2002, Fundamentals of soil Science, Biotech Books, Delhi.


https://www.youtube.com/watch?v=Ctn1hnv-Rck
https://www.youtube.com/watch?v=B89RpXlTJ5I
https://www.youtube.com/watch?v=aRyzvqjHxFA
https://www.youtube.com/watch?v=j-L-zzI5oQQ
https://www.youtube.com/watch?v=6Ejq4pbANww
https://www.youtube.com/watch?v=uRlNsnnUqsI

**Core course 3 Code: BO3CRT03**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER - III**
**SKILL BASED SUBJECT - I (B) ORGANIC FARMING**
**(4hrs / week)**
**(Theory54hrs; Practical 36 hrs; Credits 3+1)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To study about the description and types of soil | PO1, PO2 | PSO1, PSO2, PSO3 | K, C |
| CO. 2 | To infer about the preparation of organic manures | PO3, PO4 | PSO4, PSO5 | An, K |
| CO. 3 | To sketch and illustrate the advantages of composting. | PO4 | PSO4, PSO5 | E |
| CO. 4 | To criticize and realize the importance of bio-fertilizers | PO4 | PSO6, PSO7 | Ap, An |
| CO. 5 | To grade and develop about the importance and preparation of vermin-composting and punchagavya | PO4, PO5 | PSO6, PSO7 | An, E |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis ;** E: **Evaluation**

**Mapping**

| ORGANIC FARMING | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **3** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER - IV**
**CORE PAPER–IV: PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY**
**(4 hrs / week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

Objectives:

- To understand the structural organization and developmental study ofPteridophytes and Gymnosperms.
- To learn about evolutionary trends, students aware of the Preservation of Plant life of the Geological Period.

**UNIT – I** **12 Hours**

Pteridophytes: General characteristics and Classification of Pteridophytes (Sporne 1966), ***Psilotum*** and ***Lycopodium***: Distribution, Systematic Position, Structure, Reproduction and Life History (Need not study the development of gametophyte, sex organ and sporophyte).

**UNIT – II** **12 Hours**

***Selaginella, Adiantum***: Occurrence, Systematic Position, Structure, Reproduction and Life Cycle (Need not study the development of gametophytes, Sex organ and Sporophyte) Stelar Evolution in Pteridophytes.

**UNIT – III** **13 Hours**

Gymnosperms: General characteristics and Classification of Gymnosperms (David Bierhorst 1971), ***Pinus***: Distribution, Systematic Position, Structure, Reproduction and Lifecycle.

**UNIT – IV** **14 Hours**

**Gnetum**: Occurrence, Systematic Position, Structure, Reproduction and Life Cycle of Gnetum.(Need not study the Development of Sex Organs and Sporophyte).Economic Importance of Gymnosperms.

**UNIT – V** **10 Hours**

Paleobotany: Geological Time Scale, Methods of Fossilization; Brief Study of ***Rhynia***, ***Lepidodendron*** and ***Lyginopteris***.

**PRACTICALS**

To make suitable micro preparations of the following.

Stem T.S - **Lycopodium**, ***Selaginella*** and ***Adiantum*** rachis
T.S**:** ***Pinus*** stem and needle, ***Gnetum*** stem and leaf

To observe and identify specimens and Microslides.

***Psilotum:*** Habit, Stem - T.S and Synangium, Lycopodium cone L.S.
***Selaginella:*** Rhizophore T.S.
***Adiantum:*** Habit.
**Pinus:** L.S and Specimen - Male and Female cone

***Gnetum:*** L.S and Specimen - Male, Female cone and ovule

Paleobotany: Stem T.S – ***Rhynia, Lepidodendron*** and ***Lyginopteris***

To maintain a record notebook for external evaluation.

**REFERENCES**


1. Chamberlain, C.J. 2000. Gymnosperms. CBS Publishers and Distributors, New Delhi.
2. Chester A. Arnold. 2017. An Introduction to Paleobotany. Mc Graw Hill Co. Ltd. New Delhi.
3. Pandey, S.N-1995. A text Book of PeridophytaVikas Publishing House, Ghaisibad.
4. Parihar, N.S. 1967. An Introduction to EmbryophytaVol.II- Pteridophyta Central Book Depot. Allahabad.
5. Rashid, A1976. An Introduction to PteridophytaVikas Publishing House Ghaisibad.
6. Shukla, A.C. and Misra, P. 1982. Essentials of Paleobotany, Vikas Publishing House Pvt.LtdGhaisibad.
7. Sing, V, Pande, P.C. and Jain, D.K. 2002. A text Book of Botany – Vol: 4. Pteridophyta, Gymnosperms and Paleobotany. Rastogi Publications. Shivaji Road Meerut-230002.
8. Smith, G.M 1955. Cryptogamic Botany Vol: III Mc Graw Hill Co Ltd. New Delhi.
9. Vashista P.C. 1971. Botany for Degree Students Gymnosperms. Chand and Co New Delhi.
10. Vashista. P.C.1971. Botany for Degree student - Pteridophytes. Chand and Co New Delhi.


https://www.youtube.com/watch?v=L5Qn9lhI1y0
https://www.youtube.com/watch?v=4k9xIMgECVE
https://www.youtube.com/watch?v=tc-dllsGZT4
https://www.youtube.com/watch?v=mZFhtV2wYYA
https://www.youtube.com/watch?v=MxRINmAbAPs
https://www.youtube.com/watch?v=zDUCacewuAg
https://www.youtube.com/watch?v=QtlcbDWLEDo
https://www.youtube.com/watch?v=tumujWmtFj8

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**Core course 4 Code: BO4CRT04**

**PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY**
**(Theory 54hrs; Practical 36 hrs; Credits 3+1)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To explain the classification, distribution, structure, diversity inhabits, habitats , reproduction and life cycle and organization of Pteridophytes. (***Psilotum*** and ***Lycopodium***) | PO1, PO2 | PSO1, PSO2, PSO3 | K, C |
| CO. 2 | To impart an insight into the Occurrence, Systematic Position, Structure, Reproduction and Life Cycle of gametophytes. | PO2, PO3 | PSO3, PSO4 | K, C |
| CO. 3 | To argue about the General characteristics and Classification of Gymnosperms | PO1, PO2 | PSO1, PSO2, PSO3 | An, Ap |
| CO. 4 | To outline the anatomical variations in Gnetum. | PO3, PO4 | PSO4, PSO5, PSO6 | K |
| CO. 5 | To infer the significance of Paleobotany and its applications. | PO5 | PSO6, PSO7 | Ap, E |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| **3** | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 |
| **4** | 3 | 3 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER - III**
**NON - MAJOR ELECTIVE – I(A):GARDENING AND GARDEN MANAGEMENT**
**(2hrs/week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Objectives:**

- Enable the students to gain knowledge about crop production, plant propagation, plant

breeding, genetic engineering, preparation of soil biochemistry and simultaneously can work in various fields including floral design, garden centers, teaching, fruit and vegetable production, arboriculture and landscape construction.

**06 Hours**

**Unit – I**

Garden: Types – Formal & Informal Garden – English Garden, Mogul Garden, Principles of Ornamental Gardening, Advantage & disadvantages of Formal and Informal Garden.

**06 Hours**

**Unit – II**

Propagation Techniques: Soft Wood Cutting – stem, leaf and root, Simple and Air Layering. Pruning Garden
Implements – Digger, Pruning shears, Garden Rake, Patch budding, Whip Grafting.

**06 Hours**

**Unit – III**

Components of Ornamental Gardens: Hedges, Edges, Flower Beds, Arches, Rockery, Lawn and
Topiary

**06 Hours**

**Unit – IV**

Kitchen Garden: Compost Pits, Layout, Various features of Kitchen Garden, Preparation of Vermicompost and Panchakaviyas.

**06 Hours**

**Unit – V**

Indoor Gardening: Principles and Maintenance, Hanging baskets, Terrarium and Bonsai

**REFERENCES:**

1). Fundamentals of Horticulture and Plant Breeding. V. Kumaresan & N. Arumugam, Saras Publication, Nagercoil.
2). Horticultural updates; Krispa Shankar, Mohd Talha Ansari Md. Ramjan, Thejangulie Angami Vikashkumar, B.N Hazarika, New Vishal Publications.

https://www.youtube.com/watch?v=tyhjuZqjNDI
https://www.youtube.com/watch?v=aRtgOhMgC_c
https://www.youtube.com/watch?v=USNHQpwCrXw
https://www.youtube.com/watch?v=oglc8N-QTm0
https://www.youtube.com/watch?v=6Ejq4pbANww
https://www.youtube.com/watch?v=uRlNsnnUqsI
https://www.youtube.com/watch?v=yjTF0FI3lwM

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**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER - III**
**NON - MAJOR ELECTIVE – I (A): GARDENING AND GARDEN MANAGEMENT**
**(2hrs/week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To study about the types of garden | PO1, PO3 | PSO1, PSO2, PSO3 | K |
| CO. 2 | To realize the propagation techniques. | PO2 | PSO4 | C |
| CO. 3 | To revise the components of ornamental gardens | PO1, PO3 | PSO6 | Ap, K |
| CO. 4 | Application of kitchen garden | PO4, PO5 | PSO7 | Ap |
| CO. 5 | To apprehend the maintenance of indoor gardening | PO5 | PSO5, PSO6, PSO7 | Ap |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| GARDENING AND GARDEN MANAGEMENT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **3** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 3 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 3 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 1 | 3 | 3 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER - III**
**NON - MAJOR ELECTIVE I - (B)**
**HERBAL MEDICINE**
(2hrs/week)

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

Objectives:

- To develop skill in identification of medicinal plants.
- To enable the students to understand the medicinal value of some medicinal plants.
- To learn the cultivation and storage methods of medicinal plants.
- To enable the students to understand the conservation methods of medicinal plants.

**Unit – I** **8 Hours**

Traditional systems of medicine - Siddha, Ayurveda and Homoeopathy. Ethnomedicine with reference to Tamil Nadu. Classification of medicinal plants on the basis of morphology and pharmacology.

**Unit – II** **7 Hours**

Study of the following medicinal plants with special reference to Botanical name, Family, morphology, morphology of the useful part and medicinal uses of ***Ginger, Vetiver, Vembu, Kattalai, Saffron, Kattunelli*** and ***Kasakasa***.

**UNIT – III** **6 Hours**

Study of the following plants with reference to habit, morphology of the useful part and uses:
1) ***Hemides musindicus*** 2) ***Justicia adhatoda*** 3) ***Acalyphaindica*** 4) ***Andrographis paniculata*** 5) ***Gymnema sylvestre*** 6) ***Catharanthusroseus*** and 7) ***Piper nigrum***.

**UNIT – IV** **5 Hours**

Cultivation and methods of storage of ***Aloe*** and ***Catharanthus roseus***. Trading of medicinal plants. Conservation of medicinal plants: ***In situ*** and ***Ex situ*** methods.

**UNIT – V** **4 Hours**

Extraction methods and medicinal uses of following volatile oils: Jasmine oil, Sandal wood oil, Clove oil and Lemon grass oil.

**PRACTICAL:**

1. To identify and to study the medicinal value and the morphology of the useful parts in the plants specified in the syllabus.
2. To identify oils and their medicinal values specified in the syllabus.
3. To maintain a record notebook for external evaluation.

**REFERENCES:**

1. Gala, D.R. Dhiren Gala & Sanjay Gala. 2000. Nature cure for common diseases, Navneet Publications Ltd., Mumbai.
2. John Jothi Prakash.E. 2003, Medicinal and Aromatic plants. JPR publications, Neyyoor.
3. John Jothi Prakash.E. 2004, Medicinal Botany and Pharmacognosy. JPR publications, Neyyoor.
4. Vaidya Bhagwandush, B. 1999, Herbal cure. Jain publishers, New Delhi.
5. Yoganarasimhan. 2000, Medicinal plants of India, Cyber media, Bangalore.

https://www.youtube.com/watch?v=IguJZgpBg4U
https://www.youtube.com/watch?v=zV9X8IyK9e0
https://www.youtube.com/watch?v=xvakf3P3yoA
https://www.youtube.com/watch?v=zVMylD7GZ4o
https://www.youtube.com/watch?v=H_2et6m1AQM

**Core course 5 Code: BO5CRT05**

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER - III**
**NON - MAJOR ELECTIVE I - (B)**
**HERBAL MEDICINE**
(2 hrs / week)

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To discern the traditional medicinal system of Tamil Nadu and classification of medicinal plants based on morphology and pharmacology | PO1, PO2, PO3 | PSO1, PSO2, PSO3, PSO4 | C |
| CO. 2 | To know and understand the Botanical name, Family, morphology, useful part and medicinal uses of various spices. | PO1, PO2, PO3 | PSO2, PSO3 | K |
| CO. 3 | To illustrate and articulate the habit, morphology of the useful part and uses of various plants | PO2, PO3 | PSO4, PSO5 | An, Ap |
| CO. 4 | To transfer knowledge about the Cultivation, Storage and Conservation of medicinal plants | PO4, PO5 | PSO5, PSO7 | K |
| CO. 5 | To learn and infer about the extraction of medicinal oils | PO5 | PSO6, PSO7 | K, E |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| HERBAL MEDICINE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **3** | 3 | 2 | 2 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 2 |
| **4** | 3 | 2 | 2 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 2 |
| **5** | 3 | 2 | 1 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 1 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – IV**
**SKILL BASED SUBJECT - I (A)**
**FLORICULTURE**
**(4hrs/week)**

**Objectives:**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

- The course provides thorough knowledge about the commercial cultivation of flowers and different value added products prepared from it.
- It highlights the potential of these studies to become an entrepreneur.

**UNIT – I** **14 Hours**

Floriculture and its importance, cultivation of Jasmine, Rose, Chrysanthemum and Tulip.

**UNIT – II** **16 Hours**

Commercial production and cultivation techniques of Polyanthus, Marigold and Gerbera.

**UNIT – III** **17 Hours**

Cultivation techniques of ***Anthurium***, **Orchids** and ***Heliconia***, cut flower production, importance of cut flower production, package & export.

**UNIT – IV** **15 Hours**

Importance of flowers in perfumery, Extraction of Jasmine oil and Rose oil.

**UNIT – V** **13 Hours**

Introduction, General Principals of flower arrangement, Western and Japanese flower arrangement, Dry flower decoration.

**REFERENCES**:


1. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagarcoil.
2. Kumaresan, V. 2009. Horticulture, Saras Publication, Nagarcoil.
3. Randhawa, G.S. 1973. Ornamental Horticulture in India. Today and Tomorrow Printersand Publishers, New Delhi.
4. Vishnu Swarap, 1997. Garden flowers, National Book Trust, India.


https://www.youtube.com/watch?v=VIINZ1Q_CsY
https://www.youtube.com/watch?v=RCIkRHKdAbA
https://www.youtube.com/watch?v=LfeBAWbL6Ys
https://www.youtube.com/watch?v=a4WS0hfK1fI
https://www.youtube.com/watch?v=_T7HqeaolIg

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**Core course 6 Code: BO5CRT06**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – IV**
**SKILL BASED SUBJECT - I (A)**
**FLORICULTURE**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To understand the importance of floriculture | PO1, PO2 | PSO1, PSO2, PSO3 | K, C |
| CO. 2 | To appreciate the commercial production of *Polyanthus, Marigold* and *Gerbera*. | PO3, PO4 | PSO2, PSO3, PSO4 | C |
| CO. 3 | To know about the Cultivation techniques of ***Anthurium***, **Orchids** and ***Heliconia***, | PO2, PO4 | PSO4, PSO5 | K |
| CO. 4 | To study the importance of flowers in perfumery, Extraction of Jasmine oil and Rose oil. | PO4, PO5 | PSO5, PSO6, PSO7 | Ap, An |
| CO. 5 | To comprehend the general principles of flower arrangement in western ways. | PO5 | PSO6, PSO7 | C |

**(4hrs / week)**

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| FLORICULTURE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 |
| **2** | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 |
| **3** | 3 | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 1 |
| **4** | 3 | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – IV**
**SKILL BASED SUBJECT –I (B)**
**PRESERVATION OF FRUITS AND VEGETABLES**
**(4hrs/week)**

Objectives:

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

- Inspire regarding the principles of preservation of fruits and vegetables.
- Know the nutritive values, importance and factors affecting storage.
- Understand, methods of preservation of fruits and vegetables and preservation recipes.

**UNIT – I** **11 Hours**
Nutritive values of fruits and vegetables; factors affecting storage; spoilage - microbial, enzymatic and insects.

**UNIT – II** **13 Hours**
Importance and Methods of Preservation - Refrigeration, Freezing, Canning, Drying and Dehydration, Preservatives – Natural and Chemical.

**UNIT – III** **13 Hours**
Methods of preparation of Fruit Juice- Orange, Squashes- grape and Pine apple; Jam - Tomato and Mixed Fruit, Jellies - Guava.

**UNIT – IV** **11 Hours**
Preparation of Chutney- Mango, Sauce –Tomato, Pickles- Amla, Mango and Garlic, Ketchup- Tomato. Drying of fruits: Papaya, Grapes and Fig.

**UNIT – V** **12 Hours**
Canning of Mango, Cherry, Cucumber, Carrot, Bean and Mushrooms.

**REFERENCES**:


1. Alex.V and Ramani.2009. Food Chemistry, MPJ Publishers, Chennai.
2. Cruess W.V.1948. Commercial Fruits and Vegetables Products, McGraw Hill Book Company Inc, New York.
3. Girdhari Lal, G.S. Siddappa and G.L.Tandon, 1986, Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi.
4. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.
5. Kumaresan,V. 2009.Horticulture, Saras Publication, Nagercoil.
6. Usha Rani, C.K. and R. Mary Christi. 2010. Preservation of Fruits and Vegetables, Sheen Grafix, Nagercoil.

https://www.youtube.com/watch?v=xpf69aPuDS8
https://www.youtube.com/watch?v=sE6ABn7qbmY
https://www.youtube.com/watch?v=Q_MZkOCdUzc
https://www.youtube.com/watch?v=f141C9Kw3jo
https://www.youtube.com/watch?v=XKvo9_Jdjt4

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**Core course 7Code: BO5CRT07**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – IV**
**SKILL BASED SUBJECT – I(B)**
**PRESERVATION OF FRUITS AND VEGETABLES**
**(4hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | Acquire basic knowledge about the nutritive values of fruits and vegetables | PO1, PO2 | PSO1, PSO2 | K |
| CO. 2 | Familiarize with the basic skills in the methods of Preservation. | PO2, PO3 | PSO3, PSO4, PSO5 | Ap |
| CO. 3 | Understand the Methods of preparation of Fruit Juice. | PO3, PO4 | PSO5, PSO7 | C |
| CO. 4 | Understand the Preparation of Chutney, Ketchup and Drying of fruits. | PO3, PO4, PO5 | PSO5, PSO6 | K, C |
| CO. 5 | To know about the canning methods. | PO5 | PSO6, PSO7 | K |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| PRESERVATION OF FRUITS AND VEGETABLES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 |
| **2** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 |
| **3** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 2 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – IV**
**NON – MAJOR ELECTIVES II - (A) FOOD AND NUTRITION**
**(2hrs/week)**

**Objectives**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

Preamble: Facilitates understanding of the principles of food and nutrition. It provides the student to understand the nutritive values, importance, factors affecting storage and methods of preservation of food which make the students aware of application of different plants in various industries.

**UNIT – I** **06 Hours**

Food: Major Classes of Food – Carbohydrates, Proteins, Fats and Oils, Vitamins, Minerals – Energy value of food. Balanced Diet – Functions and deficiency Symptoms – Causes and Prevention.

**UNIT – II** **06 Hours**

Plants as Source of Food: Nutritive Value of Cereals and Millets (Rice, Wheat, Maize, Sorghum, and Ragi); Pulses (Bengal gram, Black gram, Green gram, Red gram and Peas); Nuts and Oil seeds (Ground nuts, Sesame, Coconut, Soyabeans, Sunflower); Fruits and Vegetables (Mango, Banana, Guava, Pomegranate, Grapes, Cucumber, Brinjal, Ladies finger, Tomato, Carrot)

**UNIT – III** **06 Hours**

Food Preservation: Importance of Preservation, Methods of Preservation. Low and High Temperatures, Uses of Oil and Spices, Use of Salt and Sugar. Preparation of Jam, Jelly, Pickles and Squashes.

**UNIT – IV** **06 Hours**

Food Additives: Definition and Types; Food Poisoning - Salmonellosis, Botulism; Food Adulteration -Harmful Effects, Simple Physical Tests for Detection of Food Adulterants

**UNIT – V** **06 Hours**

Fermentations and Beverages: Fermentation Types, Classification and Uses,

**REFERENCES:**


1. Basics of Food & Nutrition Mrs. Neeta baijal, Dr. Lalita Sharma Star publications.
2. Hand book of Food and Nutrition Dr. M. S. Swaminathan.
   https://www.youtube.com/watch?v=Wlq7H1xAoNc
   https://www.youtube.com/watch?v=sE6ABn7qbmY
   https://www.youtube.com/watch?v=zDzB5adcrKI
   https://www.youtube.com/watch?v=l0BthUI_MMA
   https://www.youtube.com/watch?v=PJF2BSmbFbM

**Core course 8 Code: BO5CRT08**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – IV**
**NON – MAJOR ELECTIVES II - (A) FOOD AND NUTRITION**
**(2hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To understand the energy value of food and balanced diet. | PO1, PO2, PO3 | PSO1, PSO2, PSO3 | K |
| CO. 2 | To make the students aware about the nutritive value of cereals, nuts and oil seeds. | PO2, PO3, PO4 | PSO PSO2, PSO3, PSO4 | K, C |
| CO. 3 | To help students to design novel mechanisms for the sustainable utilization of naturalresources. | PO2, PO3, PO4 | PSO3, PSO4, PSO5 | An, Ap |
| CO. 4 | To study about the importance of preservationand uses of oil and spices. | PO3, PO4 | PSO5, PSO6 | K, Ap |
| CO. 5 | To make the students aware about food poisoning. | PO3, PO4 | PSO6, PSO7 | K |
| CO. 6 | To know about the fermentation types. | PO5 | PSO6, PSO7 | K |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| FOOD AND NUTRITION | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | |
| **1** | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| **2** | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 1 | 2 |
| **3** | 3 | 3 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 2 | 1 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – IV**
**NON-MAJOR ELECTIVES II - (B)**
**BOTANY FOR COMPETITIVE EXAMINATION**
**(2hrs / week)**

**Objectives**:

- The basic Principles of Botany to the students which are vital role for facing competitive examinations.

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**UNIT – I** **06 Hours**

Basics of the Plant Kingdom: Brief Classification of Plant Kingdom; Diagnostic features of Algae, Fungi, Bryophyta, Pteridophyta, Gymnosperms, Bacteria, Viruses, Economic importance of these groups.

**UNIT – II** **06 Hours**

Basics of Angiosperm Taxonomy: A brief account of Natural systems of classification (Bentham and Hooker's system) and Phylogenetic system of classification (Engler and Prantl's system) Binomial Nomenclature. A Brief account of the following Families and their Economic Importance – Fabaceae, Cucurbitaceae, Poaceae.

**UNIT – III** **06 Hours**

Medicinal Importance: ***Zingiber officinale, Vetiveria zizanioides, Ocimum sanctum, Azadirachta indica, Solanum trilobatum, Phyllanthus emblica, Andrographis paniculata*** and ***Acalypha indica.***

**UNIT – IV** **06 Hours**

Basics of Plant physiology: Basics of Absorption of Water, Transpiration, Photosynthesis, Respiration,Protein synthesis.

**UNIT – V** **06 Hours**

**Cell Organelles**: Tissues and Tissue systems; An Introduction to Genetics - Mendelism, Monohybrid cross and Dihybrid Cross. **Genetic Engineering:** Enzymes used in Gene Cloning experiments. An introduction to Plant Tissue culture; Biofertilizers.

**REFERENCES**


1. Bhattacharya, Hait, Ghosh. 2014. A Text Book of Botany-(Volume:2),
2. New Central Book Agency (P) Ltd, Kolkata.
3. Pandey S.N, Misra, S.P, Trivedi, P.S- 2012. A Text Book of Botany – Vikas Publishing House Pvt Ltd, Noida
4. Soni, N.K and Vandana soni-2010 Fundamentals of Botany (Volume 1,2,3) Tata Mc Graw Hill Education Private Limited, New Delhi
5. Wallis, T.E. 2005 Text Book of Pharmacognosy C B S Publishers, New Delhi.
6. Yoganarasimhan.2000 Medicinal Plants of India Cyber media, Bangalore.

https://www.youtube.com/watch?v=0Uor8MxdOeU
https://www.youtube.com/watch?v=30pYa0-ppJI
https://www.youtube.com/watch?v=Kt0Lgy17I78
https://www.youtube.com/watch?v=EoUjXI4W2us
https://www.youtube.com/watch?v=M-qDzKG3RB0

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**Core course 8 Code: BO5CRT08**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – IV**
**NON-MAJOR ELECTIVES II - (B)**
**BOTANY FOR COMPETITIVE EXAMINATION**
**(2hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To make the students to understand the plant kingdom. | PO1, PO2 | PSO1, PSO2, PSO3 | K, C |
| CO. 2 | To study the Basics of Angiosperm Taxonomy. | PO1, PO2 | PSO1, PSO2, PSO4 | K |
| CO. 3 | To help the student to study the medicinal values of local plants. | PO3, PO4 | PSO5, PSO6, PSO7 | An, Ap |
| CO. 4 | To study about the basics of plant physiology. | PO1, PO2 | PSO1, PSO2, PSO3, PSO4 | K |
| CO. 5 | To create awareness tothestudents to understand in Tissue systems, Genetics, Genetic Engineering and Plant Tissue culture. | PO4, PO5 | PSO6, PSO7 | K, C |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| BOTANY FOR COMPETITIVE EXAMINATION | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **3** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – V**
**CORE PAPER–V: CELL BIOLOGY AND EMBRYOLOGY OF ANGIOSPERMS**
**(5 HRS/WEEK)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

Objectives:

- The structure of prokaryotic and eukaryotic cells including cell organelles and their function, and cell division.
- The complete details about the flower, sporogenesis, pollination, development of gametophytes, fertilization, embryogeny and other post-fertilization events, and apomixis.

**UNIT – I** **15 Hours**

Structure of Prokaryotic and Eukaryotic cells, Cell cycle, Amitosis, Mitosis, and Meiosis

**UNIT – II** **15 Hours**

Ultrastructure of cell organelles and function: Nucleus, Chloroplast, Mitochondria, Endoplasmic reticulum, Golgi complex, and Ribosomes

**UNIT – III** **15 Hours**

Morphological nature of Flower, Anther types and Structure, Microsporogenesis, Pollengrain structure, Ovule types, Megasporogenesis and Male Gametophyte Development, Female Gametophyte Development and its types

**UNIT – IV** **15 Hours**

Pollination, Pollen-pistil Interaction, Self-incompatibility, Double Fertilization, Post fertilization changes, Endosperm Development and types, Embryogeny in Dicots and Monocots and Structure of Dicot and Monocot embryos

**UNIT – V** **15 Hours**

Seed and Fruit Development, Parthenocarpy, Polyembryony, Apomixis, Basic concepts of Apogamy and Apospory, Agamospermy and Parthenogenesis

**PRACTICAL:**

**Cell Biology**

1. Study of Mitosis in the Onion root tip
2. Electro-micrographs of Cell organelles and Non-living Inclusions

**Embryology of Angiosperms**

1. Dissect and display the parts of a flower
2. Identification of anther types with the slides and photographs
3. Identification of ovules types with the slides and photographs
4. Dissect out anyone stage of embryo
5. Developmental stages of embryo photographs

To maintain a record notebook for external evaluation.

**REFERENCES:**


1. Batgina T.B., 2002. Embryology of Flowering Plants.Terminology and Concepts. Vol. 1.Generative Organs of Flower. Oxford & IBH.
2. Batgina T.B., 2005. Embryology of Flowering Plants.Terminology and Concepts. Vol. 2.Seed.CRC Press.
3. Batgina T.B.2009. Embryology of Flowering Plants.Terminology and Concepts.Vol 3. Reproductive Systems.CRC Press.
4. Bhojwani S.S., Bhatnagar S.P., Dantu P.K., 2018. The Embryology of Angiosperms.6th Ed. Vikas Publishing House Pvt. Ltd.
5. Gerald Karp. 2013. Cell Biology. 7th ed. Wiley.
6. Janet Iwasa and Wallace Marshall. 2018. Karp's Cell Biology. 8th Global Ed. John Wiley& Sons.
7. Johri B.M., 2011. Embryology of Angiosperms. Springer Softcover Reprint of the Original 1984.1sted.
8. Maheswari, P. (Panchanan). 2015. An Introduction to the Embryology of Angiosperms. Scholar Select.
9. VirendraBatra. 2009. Plant Cell Biology. Oxford Book Company.
10. William V. Dashek., Marcia Harrison. 2006. Plant Cell Biology. 1st ed. CRC Press.


https://www.youtube.com/watch?v=RQ-SMCmWB1s
https://www.youtube.com/watch?v=IA0DhWDTUpU
https://www.youtube.com/watch?v=ExuNJ_dKQaM
https://www.youtube.com/watch?v=gwykLmOsw6k
https://www.youtube.com/watch?v=i3BgMvJRo7E

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**Core course 8 Code: BO5CRT08**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – V**
**CORE PAPER–V: CELL BIOLOGY AND EMBRYOLOGY OF ANGIOSPERMS**
**(5 HRS/WEEK)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To study the structure of Prokaryotic and Eukaryotic cells. | PO1, PO2 | PSO1, PSO2, PSO3 | K |
| CO. 2 | To understand the ultrastructure of cell organelles and function. | PO1, PO2, PO3 | PSO1, PSO2, PSO3 | C |
| CO. 3 | To help the students to study the Morphological nature of Flower. | PO2, PO4 | PSO1, PSO2, PSO3 | K, C |
| CO. 4 | To aid the students to understand how the zygote is formed in plants. | PO1, PO2, PO3 | PSO4, PSO5, PSO6 | K |
| CO. 5 | To make the students to understand about the Seed and Fruit Development. | PO4, PO5 | PSO6, PSO7 | K |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| CELL BIOLOGY AND EMBRYOLOGY OF ANGIOSPERMS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 |
| **2** | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 |
| **3** | 2 | 1 | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 1 |
| **4** | 2 | 1 | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – V**
**CORE PAPER – VI: MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS**
**(5hrs / week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Objectives**:

- Understand the principles of systematics.
- Describe the distinctive features of selected families.
- Identify and preserve the plant species.
- Know the economic value of the plants in the cited families

**UNIT – I** **15 Hours**

Modifications: Root, stem and leaf; Phyllotaxy - types; Inflorescence: Racemose, Cymose, Mixed and Special types. Description of floral parts; Fruit - types.

**UNIT – II** **15 Hours**

Systems of classification of plants: Natural - Benthem and Hooker system Phylogenetic – Engler and Prantl's system - (with merits and demerits); Plant Nomenclature – Binomial Nomenclature and author citation, ICBN; Herbarium - techniques and importance.

**UNIT – III** **15 Hours**

Detailed study of the following families and their economic importance: Nymphaeaceae, Anonaceae, Rutaceae, Caesalpiniaceae, Cucurbitaceae and Apiaceae.

**UNIT – IV** **15 Hours**

Rubiaceae, Sapotaceae, Convolvulaceae, Asclepiadaceae and Lamiaceae.

**UNIT – V** **15 Hours**

Amaranthaceae, Euphorbiaceae, Liliaceae, Arecaceae and Poaceae.

**PRACTICAL**:

1. Morphological identification of plant parts and their modifications.
2. Technical description of plant parts and dissection of floral parts of plants with reference to the families prescribed in the syllabus.
3. Field trips (minimum 2days) to places under the guidance of teachers to study plants in their natural habitat and submit a report.
4. Identify and comment on the useful plant parts or plants prescribed in the syllabus.
5. Preparation and submission of 10 herbarium sheets.
6. To maintain a record notebook for external evaluation.

**REFERENCES:**


1. Ashok Bendre and Ashok Kumar (1984) – A Text Book of Practical Botany – Vol. II. Rastogi Publications, Shivaji Road, Meerut.
2. Davis P. H. and Heywood V.H. (1993) – Principles of Angiosperms Taxonomy.
3. Lawrence, G.H.M (1953) – Taxonomy of Vascular Plants, Oxford & IBH Publishes, New Delhi.
4. The flora of the Tamilnadu Carnatic / K.M. Matthew. Tiruchirapalli, India: Rapinat Herbarium, St. Josephs College, 1983. 3 v. (lxxxiv, 2154 p.).
5. Taxonomy of angiosperms. V N Naik. Publisher: New Delhi: Tata McGraw-Hill, ©1984.
6. Narayanaswamy, R.V &Rao, K. N (1976) – Outlines of Botany, S. Viswanathan Printers & Publishers, Madras.
7. Singh, G. 2005. Plant Systematics – Theory and Practice. Oxford & IBH, New Delhi.
8. Singh, V & Singh, D.K (1983) – Taxonomy of Angiosperms, Rastogi Publications,
9. Vashista, P.C (1997) – Taxonomy of Angiosperms, S. Chand & Co., (P) Ltd., New Delhi.
10. Verma, V (1974) – A Text Book of Economic Botany, Emkay Publications, New Delhi.


https://www.youtube.com/watch?v=1K_G4UXc3s0
https://www.youtube.com/watch?v=OU4_7DKmVCk
https://www.youtube.com/watch?v=0sRy8VbDXyY

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**Core course 8 Code: BO5CRT08**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – V**
**CORE PAPER – VI: MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS**
**(5hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To study the morphological modifications in plants. | PO1, PO2 | PSO1, PSO2, PSO3 | K |
| CO. 2 | To help the students to understand the Systems of classification of plants. | PO1, PO2, PO3 | PSO1, PSO2, PSO3 | K, C |
| CO. 3 | To understand the detailed study of the following families and their economic importance: Nymphaeaceae, Annonaceae, Rutaceae, Caesalpiniaceae, Cucurbitaceae and Apiaceae. | PO1, PO2, PO3 | PSO1, PSO2, PSO3 | K, C |
| CO. 4 | To study about the detailed study of the following families and their economic importance Rubiaceae, Sapotaceae, Convolvulaceae, Asclepiadaceae and Lamiaceae. | PO2, PO3, PO4, PO5 | PSO3, PSO4, PSO | K, C |
| CO. 5 | To make the students to understand detailed study of the following families and their economic importance Amaranthaceae, Euphorbiaceae, Liliaceae, Arecaceae and Poaceae. | PO2, PO3, PO4, PO5 | PSO3, PSO4 | Ap, An |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation.**

**Mapping**

| MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **3** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – V**
**CORE PAPER–VII: BIOCHEMISTRY AND BIOINFORMATICS**
**(5hrs / week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Objectives:**

- To enable the students to understand
- The fundamentals of Biochemistry and Bioinformatics.
- The structure of various biomolecules.
- To develop skill in detection and estimation of biomolecules in plant tissue.
- To develop skill in e-mail and internet, Library Information system and Virtual Reality.
- To become aware of the importance of computer applications in life sciences.

**UNIT – I** **15 Hours**

Brief account of atom. Bonds - Ionic, Covalent and Hydrogen bonds. Principles and uses of pH meter, Colorimeter, Centrifuge and Chromatography.

**UNIT – II** **14 Hours**

Carbohydrates: Basic structure and properties of Monosaccharides - Glucose and Fructose Disaccharides - Sucrose and Maltose. Polysaccharides - Cellulose and Starch.

**UNIT – III** **15 Hours**

Proteins: Primary, Secondary and Tertiary structure and properties of proteins. Lipids: Classification, Basic structure and properties of lipids.

**UNIT – IV** **15 Hours**

Enzymes: Classification, Nomenclature, Mechanism of enzyme action - Lock and Key hypothesis, Role of enzymes in food industry.

**UNIT – V** **18 Hours**

Introduction to Bioinformatics, Basic components of computer, Internet and Browsing Websites. Virtual library, Online literature, Nucleic acid sequence data bases, Protein sequence data bases and Enzyme data bases.

**PRACTICAL:**

1. Measurement of pH of a solution using pH meter.
2. Determination of complementary colour.
3. Verification of Beer's Law.
4. Estimation of starch in plant tissues by colorimetry.
5. Estimation of proteins in plant tissues by colorimetry.
6. Separation of dyes from a mixture by Circular paper chromatography.

**Spotters:**

Instruments: pH meter, Colorimeter, Centrifuge, Keyboard, CPU and Pen drive.
Chemicals: Glucose, Sucrose, Starch.
Charts: Mechanism of Enzyme action - Lock and key model & Induced fit model.
To maintain a record notebook for external evaluation.

**REFERENCES:**


1. Conn. E.J. and Stumpf. P.K., 1987, outlines of Biochemistry, Wiley Eastern Ltd., Bombay.
2. Jain. J.L., 2001, Fundamentals of Biochemistry, S.Chand and Co., New Delhi.
3. Lehninger. A.L., 1987, Biochemistry, CBS Publishers, New Delhi.
4. Stryer, L., 1986, Biochemistry, CBS Publishers, New Delhi.
5. Attwood. T.K. and Parry. S., 1999, Introduction to Bioinformatics, Addison Wesley Longman Ltd.


https://www.youtube.com/watch?v=AE5QcL4VfH4
https://www.youtube.com/watch?v=vqGqxSP_U7M
https://www.youtube.com/watch?v=PPJ7C3hcnPw
https://www.youtube.com/watch?v=ozdO1mLXBQE
https://www.youtube.com/watch?v=5BBYBRWzsLA
https://www.youtube.com/watch?v=w-uk-_TOgR0

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**Core course 8 Code: BO5CRT08**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – V**
**CORE PAPER – VII: BIOCHEMISTRY AND BIOINFORMATICS**
**(5hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To make the students aware about the basic chemical structure and basic instruments. | PO1, PO2 | PSO1, PSO2, PSO3 | K |
| CO. 2 | To study the structure and properties of carbohydrates. | PO1, PO2, PO3 | PSO1, PSO2, PSO3, PSO4 | K |
| CO. 3 | To help the students to understand the properties of proteins | PO2, PO3 | PSO1, PSO2 | K, C |
| CO. 4 | To study about the basics of enzyme function and its application. | PO1, PO2, PO3 | PSO1, PSO2, PSO6 | K |
| CO. 5 | To make the student's familiar with the bioinformatics tool and data bases for screening big data corresponding to the living organisms and its applications in genetic diversity, heredity and forensics. Also in the modeling of macromolecules and drug designs strategies. | PO2, PO3, PO4, PO5 | PSO1, PSO5, PSO6 | K, An |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis ;** E: **Evaluation**

**Mapping**

| BIOCHEMISTRY AND BIOINFORMATICS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **3** | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – V**
**ELECTIVE I (A) - PLANT ECOLOGY AND PHYTOGEOGRAPHY**
**(5hrs/week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Preamble**: To enable the students to understand biotic and abiotic factors in our ecosystem, to study the need of various ecosystems and vegetation. This course will enable the students to understand how environment influence the life of different organisms and vice versa.

**UNIT – I** **14 Hours**

Vegetation: Biotic and abiotic factors and their influence on vegetation, a brief account of microbes, plants, animals, soil, wind, light, temperature, rainfall and fire. Biogeochemical cycles – Nitrogen and Carbon.

**UNIT – II** **16Hours**

Ecosystem: Concept, processes and component: Types of ecosystems – Aquatic and Forest: Ecological Classification of Plants: Morphological, anatomical and physiological adaptations of plants with special reference to Hydrophytes and Xerophytes

**UNIT – III** **17Hours**

Autecology and Synecology: Definition (Species, Population, Community); Vegetation – Units of vegetation – Formation, Association, Consociation; Society – development of vegetation; Migration – ecesis, colonization; Methods of study of vegetation – Quadrat

**UNIT – IV** **15Hours**

Biomonitoring and Biodegradation: Xenobioticis using microbe, Types of Bioremediation – in situ and ex situ, phytoremediation, Biosensors and Bioindicators.

**UNIT – V** **13 Hours**

Phytogeography: Principles, continental drift and endemism. Vegetation in Tamil Nadu, Remote Sensing, Climate and climatic regions of India

**PRACTICAL:**

1. Analysis of herbaceous vegetation by using quadrat and line transect method to find out frequency, density, abundance and interpret the vegetation in terms of Raunkaier's frequency formula.
2. Morophological and anatomical adaptations of hydrophytes and xerophytes(each2) **Hydrophytes:** Hydrilla, Nymphea

**Xerophytes:** Nerium, Casuarina

3. Continental drift, Remote sensing, Vegetation in Tamil Nadu.
4. To maintain a record notebook for external evaluation.

**REFERENCES:**


1. A Text book of plant Ecology. 15th Edition R.S. Ambasht& N.K. Ambasht. C.B.S Publishers & distributors Pvt. Ltd.
2. Daubenmier, R.F. (1970), Plants and Environmental. A text book of Plant Autoecology, Wiley Eastern Private Limited
3. Daubenmier, R.F. (1970), Plant Communities, Wiley Easterh Private Limited.
4. Odum, E. (2008). Ecology, Oxford and IBH Publisher.
5. Plant Ecology, E.D Schulze E. Beck, K. Muller – Hohenstein, Springer.
6. Sharma P.D (2010) Ecology and Environment, (8th Ed.) Rastogi Publications, Meerut.
7. Kormondy, E.J. (1996). Concepts of Ecology, Prentice Hall, U.S.A 4th edition.
8. Singh,J.S, Singh, S.P. and Gupta,S. (2006). Ecology Environment and Resource Conservation. Anaamaya Publications, New Delhi.
9. Wilkinson D.M (2007), Fundamental Processes in Ecology. An Earth System Approach Oxford.

https://www.youtube.com/watch?v=rNfmew9C508
https://www.youtube.com/watch?v=C6YrPt1ygX8
https://www.youtube.com/watch?v=1LuvE8dYUjg
https://www.youtube.com/watch?v=6jgCsYEiVNA
https://www.youtube.com/watch?v=ZY8jz1dkFg8
https://www.youtube.com/watch?v=mc1V733uOho


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**Core course 8 Code: BO5CRT08**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – V**
**ELECTIVE I (A) - PLANT ECOLOGY AND PHYTOGEOGRAPHY**
**(5hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To enable the students to understand biotic and abiotic factors in various ecosystems and vegetation. | PO1, PO2 | PSO1, PSO2, PSO3, PSO4 | K |
| CO. 2 | To study the concept and types of ecosystem and adaptations | PO1, PO2, PO4 | PSO1, PSO6, PSO7 | K |
| CO. 3 | To help the students to analyze the vegetation by quadrant method | PO2, PO4 | PSO1, PSO2, PSO5, PSO6 | An |
| CO. 4 | To study about the Biosensors and Bio indicators. | PO2, PO4, PO5 | PSO1, PSO2, PSO3 | K, C |
| CO. 5 | Make the students to understand the principles of continental drift and endemism and to know about the vegetation in Tamil Nadu and uses of Remote Sensing. | PO2, PO4, PO5 | PSO6, PSO7 | An, Ap |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis ;** E: **Evaluation**

**Mapping**

| PLANT ECOLOGY AND PHYTOGEOGRAPHY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO/PSO | PO | | | | | PSO | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| 3 | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 1 |
| 4 | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| 5 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – V**
**ELECTIVE PAPER – I (B): MARINE BIOTECHNOLOGY**
(5hrs / week)

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Objectives**:

- To enable the students to have a broad knowledge about the marine environment.
- Phytoplanktons and their importance in the sea.
- Economic importance of organisms in the marine environment.
- Value of SCP and mass cultivation of algae.
- Pollution aspects and conservation methods.

**UNIT – I** **13 Hours**

Physical and Chemical properties of sea water
, zonation, characteristics and adaptation of planktonic, benthic and pelagic life.

**UNIT – II** **16 Hours**

Phytoplankton: characteristics, different groups, methods of floatation, algal bloom, toxins, Red tide, factors regulating phytoplankton, production and measurement, methods of collection and preservation.

**UNIT – III** **13 Hours**

Marine flora and its potential role in research, antibiotics, vitamins, confectionaries, food, dyes and agar agar.

**UNIT – IV** **15 Hours**

Laboratory and mass culture of algae, single cell protein - Spirulina, sea weed cultivation.

**UNIT – V** **18 Hours**

Marine pollution: pollution due to heavy metals, radioactive wastes, thermal and oils, possible remedies - oil eating bacteria - GMO, conservation of coastal ecosystem with special reference to coral reefs and mangrooves.

**PRACTICAL:**

1. Determination of pH.
2. Determination of acidity.
3. Determination of alkalinity.
4. Determination of salinity.
5. Measurement of dissolved $O_2$ content.
6. Collection and identification of phytoplanktons.
7. To maintain a record notebook for external evaluation.

**Reference:**


1. Clark, R.B.2001, Marine Pollution, published by Oxford University Press, USA.
2. Sharma, B.K. and Kaur.H.1994, water pollution, Krishna Prakashasn Media, Meerut, U.P.
3. Sharma, B.K. and Kaur.H.1994, Thermal and radioactive pollution. Krishna Prakashasn Media, Meerut, U.P.


https://www.youtube.com/watch?v=kqAB4aylt0A
https://www.youtube.com/watch?v=U734grD0xpQ
https://www.youtube.com/watch?v=z_DdIcGOEGI
https://www.youtube.com/watch?v=kTfT4VHjr2M
https://www.youtube.com/watch?v=Sp572udnPVg
https://www.youtube.com/watch?v=PGLTSRAjtPI

**Open course 2 Code: BO5OPT02**
**MSU / 2021 - 2022 UG – Colleges / Part - III (B.Sc. Botany)**
**SEMESTER – V**
**ELECTIVE PAPER – I (B): MARINE BIOTECHNOLOGY**
(5hrs / week)

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To understand the importance of benthic and lotic ecosystem and its life forms. | PO1, PO2 | PSO1, PSO2, PSO3, PSO4 | K |
| CO. 2 | To expertize the production, cultivation and value addition of phytoplanktons and its applications. | PO3, PO4, PO5 | PSO2, PSO3, PSO5, PSO7 | K, C |
| CO. 3 | To understand and infer the impact of marine flora. | PO2, PO4, PO5 | PSO1, PSO2, PSO3 | Ap |
| CO. 4 | To understand the basic concepts of sea weed cultivation. | PO1, PO2, PO5 | PSO1, PSO2, PSO3 | K |
| CO. 5 | To make the students to understand the things that affect the marine water and also about the conservation of coastal ecosystem especially mangroves. | PO2, PO4, PO5 | PSO1, PSO2, PSO3, PSO6 | E, An |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| MARINE BIOTECHNOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| **2** | 3 | 2 | 1 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 1 | 2 |
| **3** | 3 | 2 | 1 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 1 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**CORE PAPER–VIII - GENETICS, EVOLUTION AND BIOSTATISTICS**
**(5 hrs / week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Objectives**:

- To learn the pattern of inheritance.
- To understand the mechanism of gene action.
- To learn the concept of Biostatistics.
- To become aware of the importance of statistical tools in life sciences.

**UNIT – I** **16 Hours**

Mendel's laws of heredity with reference to Monohybrid and Dihybrid crosses. Test cross - Monohybrid and Dihybrid. Incomplete dominance - Monohybrid and Dihybrid. Lethal gene action in Maize and Mice.

**UNIT – II** **14 Hours**

Interaction of genes; Supplementary genes, Complementary genes and Duplicate factors. Polygenic inheritance with reference to ear length in corn. Linkage, crossing over and recombination

**UNIT – III** **15 Hours**

Molecular structure of DNA, Replication of DNA - Semi conservative method, Proof for DNA as genetic material, Genetic code, Sex determination in plants.

**UNIT – V** **13 Hours**

Evolutionary theories - Lamarckism, Darwinism, Mutation theory of Devries. Chemosynthetic theories – evidence any five; modern synthetic theory of evolution, speciation.

**UNIT – V** **17 Hours**

Collection and interpretation of data, Mean, Median, Mode, Standard deviation & Chi-square test.

**PRACTICAL:**

1. To work out simple genetic problem in Monohybrid, Dihybrid, Incomplete dominance, Lethal genes and Interaction of genes.
2. Using available data to find out the Mean and Standard deviation and to draw frequency curve / histogram.
3. To work out simple Chi-square problems.
4. To record variation: Intra / Inter specific.
5. Spotters: Models and Charts: DNA structure, Replication of DNA, use and disuse theory of Lamarck, Natural selection theory - Struggle for existence.

To maintain a record notebook for external evaluation.

**REFERENCES:**


1. Gupta. P.K., 1991, Genetics, Rastogi Publications, Meerut.
2. Gupta. P.K., 2004, Cell and Molecular Biology, Rastogi Publications, Meerut.
3. John Jothi Prakash. E. and David Paulraj M., 2007, Genetics and Biostatistics, JPR Publications, Neyyor.
4. Verma. P.S. and Agarwal. V.L., 1991, Genetics, S.Chand and Co., NewDelhi.


https://www.youtube.com/watch?v=xTOMgXeGizU
https://www.youtube.com/watch?v=YJHGfbW55l0
https://www.youtube.com/watch?v=6NiCeKP0wwU
https://www.youtube.com/watch?v=o_-6JXLYS-k
https://www.youtube.com/watch?v=TNKWgcFPHqw

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**Core course 9 Code: BO6CRT09**
**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**CORE PAPER–VIII - GENETICS, EVOLUTION AND BIOSTATISTICS**
**(5 hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To impart an insight into the principles of heredity and the mendelian concepts. | PO1, PO2, PO4 | PSO1, PSO2, PSO3 | An, C |
| CO. 2 | To understand the patterns of inheritance in different organisms and the modes of linkages and crossing over. | PO1, PO2, PO4 | PSO, PSO2, PSO3, PSO4 | K |
| CO. 3 | To study about the basics of genetic material and their expression in the determination of sex and other characteristics. | PO2, PO4, PO5 | PSO1, PSO2, PSO3, PSO4 | K |
| CO. 4 | To contrast and relate the theory of evolution and its applications. | PO4, PO5 | PSO6 | Ap, An |
| CO. 5 | To develop skills in biostatistics and its applications. | PO3, PO4, PO5 | PSO3, PSO4 | S, An |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| GENETICS, EVOLUTION AND BIOSTATISTICS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 |
| **2** | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 2 |
| **3** | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 1 |
| **4** | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**CORE PAPER – IX: PLANT PHYSIOLOGY**
**(5hrs / week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

Objectives:

- Understand the various functions of the plants.
- Know the mechanisms of the various activities.
- Relates the role of phytohormones on growth and development of plants.

**UNIT – I** **17 Hours**

Water Relations: Imbibition, Diffusion, Osmosis and Plasmolysis; Water Potential- Definition, Components, Absorption of Water –Mechanism and Factors affecting Water Absorption; Transpiration- Definition, Types, Significance and Mechanism of Stomatal Transpiration-steps and theories, Guttation

**UNIT – II** **17 Hours**

Ascent of Sap –Definition, Path of Ascent of Sap, Mechanism- Transpiration Pull and Cohesion Theory; Mineral nutrition: Macro and Micro-nutrients - Absorption of Mineral Salts – Mechanism; Translocation of Organic Solutes: Mechanism - Munch's Mass flow hypothesis.

**UNIT – III** **17 Hours**

Photosynthesis: Light and Dark Reactions - Photosynthetic Electron Transport Chain and Photophosphorylation (Cylic and Non cyclic); Carbon Assimilation - $C_3$, and $C_4$ Pathways and its Significance; Respiration: Types, Glycolysis, Kreb's cycle and Oxidative Phosphorylation.

**UNIT – IV** **12 Hours**

Growth Curve and phases of growth; Phytohormones: Physiological Effects and Practical applications - Auxin, Gibberellic acid, Cytokinin, Ethylene and Abscisic acid.

**UNIT – V** **12 Hours**

Seed dormancy: Causes and Methods of breaking seed dormancy; Photoperiodism and Vernalization.

**PRACTICAL:**

1. Water Potential by Falling Drop Method.
2. Osmotic Potential by Plasmolytic Method.
3. Rate of Photosynthesis in Different Concentrations of Bi-Carbonate – Bubble Method.
4. Determination of Respiratory Quotient (R.Q) using Ganong's Respirometer.
5. Effect of Temperature on Permeability of Plasma Membrane.
6. Separation of Chlorophyll Pigments by Ascending Paper Chromatography.

**DEMONSTRATION:**

1. Tissue Tension; 2. Suction due to Transpiration; 3. Fermentation; 4. Arc Auxanometer; 5. Clinostat; 6. Phototropism

**Spotters**

1. Absorption Spectrum of Chlorophylls
2. Growth curve.
3. Growth hormone

To maintain a record notebook for external evaluation.

**REFERENCES:**


1. Devlin, R.M. (1969). Plant Physiology. Holt, Rinehart & Winston & Affiliated East West Press (P) Ltd., New Delhi.
2. Dulsy Fatima, R.P. et al., (1994). Elements of Biochemistry. Saras Publications, Nagercoil, Tamil Nadu.
3. Jain, V.K. (1990). Fundamentals of Plant Physiology. S. Chand & Co., New Delhi. Noggle, R. and Fritz (1989). Introductory Plant Physiology. Prentice Hall of India. Pandey, S.N. (1991). Plant Physiology. Vikas Publishing House (P) Ltd., New Delhi.
4. Periyasamy, K. (1978). Cell Iyakka Viyal (Cell Physiology). Tamil Nadu text Book Society, Chennai.
5. Salisbury, F.B. and Ross, C.W. (1999). Plant Physiology. CBS Publishers and Printers, New Delhi.

https://www.youtube.com/watch?v=4to_4guDx50
https://www.youtube.com/watch?v=5jJLfwTkGe8
https://www.youtube.com/watch?v=S8XhuNlqbHQ
https://www.youtube.com/watch?v=zWO-bTi6u8M
https://www.youtube.com/watch?v=QRE9HAxgN4g


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**Core course 10 Code: BO6CRT10**
**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**CORE PAPER – IX: PLANT PHYSIOLOGY**
**(5hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To understand the relationship between water and plant cells. | PO1, PO2 | PSO1, PSO2, PSO3, PSO4 | C |
| CO. 2 | To transport water and food materials throughout the body of the plant. | PO1, PO2 | PSO1, PSO2, PSO3 | C |
| CO. 3 | To study about the various pathways for training to the photosynthetic activity and respiration. | PO3, PO4, PO5 | PSO1, PSO2, PSO3, PSO4, PSO5, PSO6 | K, An |
| CO. 4 | To understand in detail about the growth of the plant and the influence of plant growth regulators on its growth. | PO2, PO3, PO4 | PSO1, PSO2, PSO4, PSO5, PSO6 | An, Ap |
| CO. 5 | To know about the sea dormancy its application and photo periodic effects. | PO2, PO4 | PSO1, PSO2, PSO3, PSO4, PSO5, PSO6 | K, C |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| PLANT PHYSIOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **3** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER – VI**
**CORE PAPER – X: MICROBIOLOGY**
**(4 Hrs / Week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Objectives:**

- The paper aims to impart knowledge of Bacteriology and Virology including classification, structure, multiplication, transmission, food borne pathogens, water borne pathogens and microbial control.
- The paper aims to give the students broad theoretical knowledge in industrial microbiology and agricultural microbiology.

**12 Hours**

**UNIT – I**

Brief History and Development of Microbiology, classification of Microorganisms (Whittaker's five kingdom concept), Bacteria- outline of Bacterial classification (Bergey's manual); Ultra-structure, nutritional types and reproduction of Bacteria, Media preparation and Pure culture Techniques of Bacteria; staining Technique- Gram staining.

**12 Hours**

**UNIT – II**

Viruses: General characteristics, structure and reproduction of TMV, $T_4$ bacteriophages, Viroids, Virions, Prions; Transmission and control measures of plant viruses, Isolation and purification of Viruses.

**12 Hours**

**UNIT – III**

Microbes in Food production, spoilage, poisoning and preservation – Bacterial Flora in Milk, Pasteurization of Milk and milk products; Bacterial pathogens and water pollution; Drinking water as a vehicle of Diseases; purification of water.

**12 Hours**

**UNIT – IV**

Methods of Direct Gene Transfer – Ultra sonication, Electroporation, Liposome Mediated Gene transfer. Microscopy – Principles and Applications of Phase Contrast, Fluorescence, Polarization; Camera Lucida.

**12 Hours**

**UNIT – V**

Identification of Recombinants – Insertional inactivation, Immunochemical Method and colony Hybridization Technique, Selection of Recombinant using selective medium and reporter genes. Blotting Techniques – Southern, Northern and Western Blotting.

**PRACTICAL**

1. Preparation of Culture Media for Bacteria.
2. Demonstration of preparation of serial dilution and isolation of pure culture from soil.
3. Procedure for gram staining and identify the type of bacteria
4. Demonstration of analysis of milk – Methylene Blue Dye Reduction Test.

5. **Spotters:**

i. Ultra structure of bacterial cell wall \
ii. $T_4$ Phage
iii. HIV Virus
iv. Autoclave
v. Laminar Air Flow Chamber
vi. Hot Air Oven
vii. Inoculation needle
viii. Agar medium
ix. Streak Plate Method
x. Spoiled food
xi. Liposome mediated gene transfer in plants
xii. Colony hybridization technique
xiii. Blotting technique – Southern, Northern and Western Blotting

To maintain a record notebook for external evaluation.

**REFERENCES:**


1. Ananthanarayan R and Jayaram Paniker CK (2020). Textbook of Microbiology, Eleventh Edition. Universities Press (India) Pvt. Ltd.
2. Aneja K.R (2017). Fundamental Agricultural Microbiology. New Age International Private Limited.
3. Dubey RC and Maheshwari DK. (2010). A Textbook of Microbiology S Chand Publications.
4. Casida LEJR. (2019). Industrial Microbiology Paperback. New Age International Private Limited.
5. Pelczar MJ. Chan Noel ECS and Krieg R. (1986). Microbiology Hardcover, 5th edition. McGraw-Hill Inc., US.
6. Rangaswami G and Bagyaraj DJ. Agricultural Microbiology. 2nd Edition. Phi Learning.
7. BabuNarendra G, Girisham S, Reddy SM and Reddy B. Vijaypal. (2017). Applied Microbiology. Scientific Publishers.
8. William C. Frazier, Dennis C. Westhoff, Vanitha, N.M. (2017). Food Microbiology, 5th Edition. McGraw Hill Education.


https://www.youtube.com/watch?v=7AgJpLvAv6Q
https://www.youtube.com/watch?v=SAbYEYs-_ak
https://www.youtube.com/watch?v=fJwOhhaws_Y
https://www.youtube.com/watch?v=D5aEKiez_nw
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**Core course 11 Code: BO6CRT11**
**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER – VI**
**CORE PAPER – X: MICROBIOLOGY**
**(4 Hrs / Week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To understand the history of microbiology bacterial classification culture of bacteria and its predictive techniques. | PO1, PO2, PO4 | PSO1, PSO2, PSO3, PSO4 | C |
| CO. 2 | To study about virus, virions prions and why rights and their diseases in plants. | PO1, PO2, PO4 | PSO5, PSO6 | K |
| CO. 3 | To know about the importance of microbes in food as well as their pathogenic effects | PO3 | PSO1, PSO2, PSO3, PSO5, PSO6 | K, Ap |
| CO. 4 | To realize the need for gene transfer and its mechanism; also to know about different microscopy and its techniques. | PO4, PO5 | PSO2, PSO3, PSO4 | An, E |
| CO. 5 | To know about identification of recombinants marker systems and blotting techniques. | PO2, PO4, PO5 | PSO3, PSO4, PSO5, PSO6 | K, E |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis ;** E: **Evaluation**

**Mapping**

| MICROBIOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **3** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**ELECTIVE PAPER – 1 (A): HORTICULTURE & PLANT BREEDING**
**(4hrs/week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Objectives:**

- Develop skills in horticultural practices and techniques.
- Learn to construct kitchen garden and ornamental gardens.
- Gain a knowledge of the techniques of producing desirable plants through hybridization

**UNIT – I** **12 Hours**

Scope, importance and divisions of horticulture; Gardening: Definition and objectives – different types of gardening – Formal, informal and kitchen garden.

**UNIT – II** **14 Hours**

Propagation methods: Cutting – root, stem and leaf; Layering – ground and air layering, grafting – tongue and approach grafting; Budding – T budding and Patch budding; Vegetative propagules - bulb, sucker, corm. Seed Propagation: Preparation of Nursery beds, Transplantation – steps and Methods.

**UNIT – III** **12 Hours**

Garden components: Lawn, Hedges, Edges, Rockery, Topiary, water garden, Bonsai and Hanging basket. Garden implements - spade, water can, pruning scissors, digging fork

**UNIT – IV** **11 Hours**

Nature, Scope and Objectives of Plant Breeding; Plant introduction- selection methods (pure line and mass), Hybridization techniques, Heterosis breeding, Interspecific and intergeneric hybridization.

**UNIT – V** **11 Hours**

Mutation Breeding: Procedure and practices, Mutagens, Polyploidy breeding and its applications. Breeding for disease resistance.

**PRACTICALS:**

i. Vegetative methods of propagation.
    a. Cutting-Stem and Leaf cutting
    b. Layering-Simple and air layering.
    c. Grafting - Tongue grafting.
    d. Budding - T-budding.
ii. Garden components -Rockery, hanging baskets, and topiary.
iii. Garden implements - spade, water can, pruning scissors, digging fork
iv. Designing Kitchen Garden.
v. Plant Breeding: Emasculation and Bagging methods.

To maintain a record notebook for external evaluation.

**REFERENCES:**


1. Allard, R.W. (1960). Principles of Plant Breeding. John Wiley & Sons, NewYork.
2. Bose, T.K., Maiti, R.G., Dhua, R.S. and Das, P. (1999). Floriculture and Landscaping. Naya Prakash, Calcutta.
3. Chopra, V.L. (1989). Plant Breeding. Oxford IBH, New Delhi.
4. Kumar,N.(1997).Introduction to Horticulture. Rajalakshmi Publication, India. Manibhushan Rao, K. (1991). Text Book of Horticulture. MacMillan Publications, New Delhi.
5. Mukherjee, D. (1972). Gardening in India. Oxford & IBH Publishing Co., Kolkatta, Mumbai, New Delhi.
6. Roy Choudhry, N. and Mishra, H.P. (2001). Text book on Floriculture and Landscaping. Raja Info Tech Enterprise, India.
7. Sharma, J.R.(1994). Principles and Practice of Plant Breeding. Tata McGraw Hill, NewDelhi.

https://www.youtube.com/watch?v=2DED2nRPZUQ
https://www.youtube.com/watch?v=mQHzKIa-XDs
https://www.youtube.com/watch?v=USNHQpwCrXw
https://www.youtube.com/watch?v=0cZ-nsBo5D0
https://www.youtube.com/watch?v=ACaeM8djkCQ


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**Core course 11 Code: BO6CRT11**
**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**ELECTIVE PAPER – 1 (A): HORTICULTURE & PLANT BREEDING**
**(4hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To know about the different types of horticulture and its uses. | PO1, PO2 | PSO1, PSO2, PSO3, PSO4 | K |
| CO. 2 | To understand different propagation techniques and its steps and procedure. | PO1, PO2, PO4 | PS1, PSO2, PSO3, PSO4, PSO5 | C |
| CO. 3 | To learn and work with the different garden tools and components | PO1, PO2, PO4 | PSO2, PSO4, PSO5, PSO6 | K |
| CO. 4 | To Realize and revitalize the hybridization techniques both in theory and practical | PO3, PO4, PO5 | PSO2, PSO4, PSO5, PSO6 | E, An |
| CO. 5 | To apply mutation in the breeding of plants and tocreate various resistant varieties | PO3, PO4, PO5 | PSO2, PSO4, PSO5, PSO6 | Ap |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| HORTICULTURE & PLANT BREEDING | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO/PSO | PO | | | | | PSO | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 |
| 2 | 3 | 2 | 1 | 3 | 2 | 2 | 3 | 3 | 2 | 1 | 2 | 2 |
| 3 | 3 | 2 | 1 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 2 | 1 |
| 4 | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| 5 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**ELECTIVE PAPER – I (B) :FORESTRY**
**(4hrs/week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Objectives:**

1. To aware the knowledge of Forest
2. To learn about forest, forest Products and utilization and valuable Forest Products.

**UNIT – I** **12 Hours**

Forests - Introduction, physiography, vegetation, Forest types, Role of forests-distribution and classification. (Champion and Seth's Classification) Forest as balanced ecosystem, status of Indian Forests-Indian Forest policy.

**UNIT – II** **10 Hours**

Forest degradation – Damage caused by fire, climatic factors, and injuries by insects, plants, animals and diseases, activities of man including encroachment and shifting cultivation.

**UNIT – III** **12 Hours**

Forest management and Conservation-Regeneration Tending Operations – Sustainable utilization forest resources – Forest organizations. Role of remote Sensing in Forest management.

**UNIT – IV** **12 Hours**

Agro Forestry – objectives – advantages and disadvantages. Recreational forestry – role of botanical gardens, zoos, National Parks and sanctuaries.

**UNIT – V** **12 Hours**

Forest utilization – Harvesting, conservation, storage and Disposal of wood in Forest; major and minor Forest Products; Forest based Industries_ Paper and pulp industry; resin tapping and turpentine manufacture; Forest education in India.

**PRACTICAL**

1. Identify and find out the uses of wood samples of common timbers
2. Prepare maps showing forest types in India and Tamil Nadu.
3. Collect and study the remote sensing images showing forest vegetation in India and Tamil Nadu.
4. Prepare Photographs of different forest types.
5. Study the commonly used important forest Products.
6. To maintain a record notebook for external evaluation.

**REFERENCES**


1. Agarwal – Forest in India
2. Bore, N.C – Manual of Indian Forest Botany
3. DWivedi, A.P – Forestry in India.
4. Sagreiya, K.P – Forest and Forestry

5. Tribhawan Metha- A Hand book of Forest utilization.

https://www.youtube.com/watch?v=Z8jOcYEtyc0
https://www.youtube.com/watch?v=_xIOibiAC_s
https://www.youtube.com/watch?v=PHlBt8gipKI
https://www.youtube.com/watch?v=jLZ0KtNx354

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**Core course 11 Code: BO6CRT11**
**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**ELECTIVE PAPER – I (B): FORESTRY**
**(4hrs / week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To know about the forest ecosystem its classification and Indian forest policy | PO1, PO2, PO4 | PSO1, PSO2, PSO3, PSO4 | K |
| CO. 2 | To Know about the degradation of forest and its solution | PO2, PO4, PO5 | PSO1, PSO2, PSO3, PSO4 | K |
| CO. 3 | To study about the classical and modern forest management techniques | PO2, PO4 | PSO1, PSO2, PSO3, PSO4, PSO6 | K, C |
| CO. 4 | To realize the need for agro forestry and recreational forestry | PO2, PO4, PO5 | PSO1, PSO2, PSO4, PSO6 | An |
| CO. 5 | To critically analyze the various uses of forest and its manipulation for the betterment of the human kind | PO2, PO4, PO5 | PSO1, PSO2, PSO4, PSO6 | E, An |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| FORESTRY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| **2** | 3 | 2 | 1 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 |
| **3** | 3 | 2 | 1 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 1 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**ELECTIVE PAPER – II (A):**
**PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING**
**(4hrs/week)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Objectives**:

This paper helps the students to understand the totipotency of the cells and the tissue culture techniques, to learn the fundamental principles in gene cloning, various methods of gene transfer, screening and the use of vectors in gene transfer technology for the desired characteristics.

**UNIT – I** **14 Hours**

Tissue culture: Introduction, definition, history, scope and importance of plant tissue culture, Totipotency of cells, Tissue culture laboratory - organization and requirements, sterilization techniques, Nutrient media-composition and preparation. Apical meristem culture, callus culture, Embryo culture, Anther culture.

**UNIT – II** **15 Hours**

Protoplast culture: Protoplast isolation, culture and fusion, selection of hybrids and regeneration. Cybrids- production and applications. Artificial Seed - production, advantages and disadvantages. Tissue culture application including micropropagation, androgenesis, production of virus free plants, Secondary metabolite production, germplasm conservation, cryopreservation and usages.

**UNIT – III** **15 Hours**

Enzymes and Vectors for Genetic Manipulations: Restriction endonuclease - types, biological role, mechanism and usage in cloning; Restriction Mapping - linear and circular; Ligase enzymes. Cloning vectors -basic sequence of any vector; types of bacterial vector - Ti plasmid, pBR 322, BAC; Viral vector - Lambda page, phagemid, cosmid and Yeast vector.

**UNIT – IV** **16 Hours**

Gene Cloning and Methods of Gene transfer: Basic concept of Gene cloning, advantages of gene cloning, bacterial transformation methods and selection of recombinant clones using various strategies, PCR-mediated gene cloning; Gene Construct; Plant transformation vector, T-DNA and viral vector, Agrobacterium-mediated Transformation protocols, molecular mechanism of T-DNA transfer, direct gene transfer method by Electroporation, Microinjection, Micro projectile bombardment.

**UNIT – V** **15 Hours**

Major concerns and Applications of Transgenic Technology: Transgenic technology and sustainable agriculture, Biosafety concerns with transgenic technology. Applications as Pest resistant (BT-cotton); herbicide resistant plants (Roundup Ready Soybean); Transgenic crops with improved quality traits in major crops (FlavrSavr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug)

**PRACTICAL:** Spotters / Photographs

1. Callus culture from Carrot explant, apical meristem culture, embryo culture and anther culture
2. Protoplast Isolation
3. Plasmids-Ti plasmids
4. Gene cloning in E. coli
5. Agrobacterium mediated gene transfer
6. Direct gene transfer by electroporation, microinjection, micro projectile bombardment
7. Transgenic plants prescribed in the syllabus.
8. To maintain a record notebook for external evaluation.

**REFERENCES**


1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
2. Chrispeels, M.J. and Sadava, D.E. (1994). Plants, Genes and Agriculture. Jones & Barlett Publishers.
3. Glick, B.R., Pasternak, J.I. (2003). Molecular Biotechnology-Principles and Applications of recombinant DNA. ASM Press. Washington.
4. Santosh. N., and A. Madhavi. (2010). Practical Book of Biotechnology and Plant Tissue Culture. S. Chand &Co.
5. Slater A., N.W.Scott and M.R. Fowler (2008). Plant Biotechnology. Second Edition. Oxford.
6. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K.
7. Steward, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

https://www.youtube.com/watch?v=xuwV3ywCxW8
https://www.youtube.com/watch?v=utlKKvqxbWw
https://www.youtube.com/watch?v=iJTj8Y65Qlo
https://www.youtube.com/watch?v=hqs57VsSk7s
https://www.youtube.com/watch?v=D5aEKiez_nw
https://www.youtube.com/watch?v=fo2dI4leUfY


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**Core course 11 Code: BO6CRT11**
**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**ELECTIVE PAPER – II (A):**
**PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING**
**(4hrs/week)**

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To study about the various techniques pertaining to the plant tissue culture | PO1, PO2, PO3 | PSO1, PSO2, PSO3, PSO4 | K |
| CO. 2 | Understand the various applications of plant tissue culture in the production of hybrids as well as its aid in the preservation of indigenous species | PO3, PO4, PO5 | PSO1, PSO2, PSO3, PSO4 | C |
| CO. 3 | To know about the various enzymes and vectors used in the genetic engineering techniques | PO3, PO4 | PSO1, PSO2, PSO3, PSO4 | K |
| CO. 4 | To know about the various techniques involved in gene cloning and the use of polymerized chain reaction. | PO2, PO4, PO5 | PSO2, PSO3, PSO5, PSO6 | K |
| CO. 5 | To relate and criticize the different applications of GMOs and few of its examples | PO4, PO5, PO6 | PSO2, PSO3, PSO5, PSO6 | E, An |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis ;** E: **Evaluation**

**Mapping**

| PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 |
| **2** | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| **3** | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 2 | 3 | 2 | 2 | 1 |
| **4** | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 2 | 3 | 2 | 1 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 1 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)

**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**ELECTIVE PAPER - II (B):**
**ENVIRONMENTAL BIOTECHNOLOGY**
(4hrs / week)

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**Objectives:**

- To enable the students to understand and how to tackling environmental problems.
- To enable the students to understand the morphological, anatomical and physiological adaptations of hydrophytes, xerophytes and halophytes.
- To develop skills in identification of different forest types of Tamil Nadu.

**UNIT – I** **13 Hours**

Aims and scope of environmental biotechnology. Environmental spheres - Hydrosphere, Geosphere, Biosphere and Anthrosphere. Pollution measurement - Biotechnological methods for measurement of pollution. Role of Biosensors in pollution monitoring.

**UNIT – II** **14 Hours**

Biofuels: Biogas - production of biogas, uses of biogas, Hydrogen production - microbial production of hydrogen, uses of hydrogen. Petroleum plants: ***Calotropis procera, Euphorbia tirucalli, Jatropha curcas.***

**UNIT – III** **10 Hours**

Sewage treatment - Primary, secondary and tertiary treatment, water recycling, soil conservation and restoration. Sustainable agricultural management.

**UNIT – IV** **12 Hours**

Solid waste treatment and disposal, Biodegradation of hydrocarbons, pesticides and herbicides. Bioremediation: Types of Bioremediation, Genetically Engineered microorganisms in Bioremediation. Phytoremediation, Biosensors.

**UNIT – V** **11 Hours**

Greenhouse effect, Global warming, Ozone depletion and Acid rain - Causes, effects and control measures. Remote sensing and its applications in ecology.

**PRACTICAL:**

Photographs / model: Biogas plant, Biosensor, Sewage treatment, Acid rain, and Greenhouse effect.

**Spotters:** Petro plants, ***Calotropis procera, Euphorbia tirucalli*** and ***Jatropha curcas***

To maintain a record notebook for external evaluation.

**REFERENCES**

1. Mishra. D.D.2008. Fundamental concepts in Environmental Studies. S. Chand and Company Ltd., New Delhi.

2. Saha. T.K. 2008. Ecology and Environmental Biology. Books and Allied (P) Ltd., Kolkatta.
3. Shukla. R.S., and Chandel. P.S. 2007. A text book of plant Ecology, S. Chand and Company Ltd., New Delhi.
4. Singh. H.R. Environmental Biology. S. Chand and Company Ltd, New Delhi.
5. Vijaya Ramesh. K. 2004. Environmental Microbiology, MJP Publishers, Chennai.

https://www.youtube.com/watch?v=GxwmuXqhJqE
https://www.youtube.com/watch?v=NZRJtS6xopc
https://www.youtube.com/watch?v=8J7yL9Tfijo
https://www.youtube.com/watch?v=foXhalIITPQ
https://www.youtube.com/watch?v=XHi7kV-ZMT0
https://www.youtube.com/watch?v=d7Ci_EooW-k
https://www.youtube.com/watch?v=Nf8cuvl62Vc

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**Core course 11 Code: BO6CRT11**
**MSU / 2021 - 2022 UG – Colleges / Part – III (B.Sc. Botany)**
**SEMESTER - VI**
**ELECTIVE PAPER - II (B):**
**ENVIRONMENTAL BIOTECHNOLOGY**
(4hrs / week)

| CO. NO | Description | PO Addressed | PSO Addressed | CL |
|---|---|---|---|---|
| CO. 1 | To know about the aim and scope of environmental technology and application of biotechnological methods to bio remediate the present environment | PO1, PO2, PO3, PO4 | PSO1, PSO2, PSO3, PSO4 | K, C |
| CO. 2 | To know and understand in detail about the biofuels and its production | PO2, PO3 | PSO1, PSO2, PSO3, PSO4 | K, C |
| CO. 3 | To evaluate the successful treatment of sewage through biotechnology. | PO2, PO4, PO5 | PSO1, PSO2, PSO3, PSO4 | E |
| CO. 4 | To study about the solid waste treatment and in detail about bioremediation. | PO1, PO4, PO5 | PSO2, PSO3, PSO5, PSO6 | K |
| CO. 5 | To know in detail about the greenhouse effects and remote sensing techniques. | PO1, PO4, PO5 | PSO2, PSO3, PSO5, PSO6 | K |

K: **Knowledge;** C: **Comprehension;** Ap: **Application;** An: **Analysis;** S: **Synthesis;** E: **Evaluation**

**Mapping**

| ENVIRONMENTAL BIOTECHNOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO/PO/PSO** | **PO** | | | | | **PSO** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **2** | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **3** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **4** | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| **5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1); No Correlation (0)