

**Holy Cross College (Autonomous), Nagercoil**  
Kanyakumari District, Tamil Nadu.  
Accredited with A<sup>+</sup> by NAAC - IV cycle – CGPA 3.35

Affiliated to  
**Manonmaniam Sundaranar University, Tirunelveli**



**Semester I & II**

**Guidelines & Syllabus**

**DEPARTMENT OF BOTANY**



**2023-2026**

**(With effect from the academic year 2023-2024)**

**Issued from  
THE DEANS' OFFICE**

### **Vision**

To impart knowledge with professional zeal and devotion for plant science

### **Mission**

Providing student – centered and profession- oriented higher education that bestows academic environment to create intellectuals with scientific temperament, in the context of global issues and environmental challenges.

### **Programme Educational Objectives (PEOs)**

| <b>PEOs</b>  | <b>Upon completion of B.A/B.Sc. Degree Programme, the graduates will be able to:</b>   | <b>Mapping with Mission</b> |
|--------------|--|-----------------------------|
| <b>PEO 1</b> | apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise. | <b>M1&amp; M2</b>           |
| <b>PEO 2</b> | use practical knowledge for developing professional empowerment and entrepreneurship and societal services.  | <b>M2, M3, M4 &amp; M5</b>  |
| <b>PEO 3</b> | pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.   | <b>M3, M4, M5 &amp; M6</b>  |

### **Programme Outcomes (POs)**

| <b>POs</b> | <b>Upon completion of B.Sc. Degree Programme, the graduates will be able to:</b>   | <b>Mapping with PEOs</b> |
|------------|--|--------------------------|
| <b>PO1</b> | obtain comprehensive knowledge and skills to pursue higher studies in the relevant field of science.   | <b>PEO1</b>              |
| <b>PO2</b> | create innovative ideas to enhance entrepreneurial skills for economic independence.   | <b>PEO2</b>              |
| <b>PO3</b> | reflect upon green initiatives and take responsible steps to build a sustainable environment.  | <b>PEO2</b>              |
| <b>PO4</b> | enhance leadership qualities, team spirit and communication skills to face challenging competitive examinations for a better developmental career. | <b>PEO1 &amp;PEO3</b>    |
| <b>PO5</b> | communicate effectively and collaborate successfully with peers to become competent professionals.   | <b>PEO2&amp;PEO3</b>     |
| <b>PO6</b> | absorb ethical, moral and social values in personal and social life leading to highly cultured and civilized personality                           | <b>PEO2 &amp; PEO3</b>   |
| <b>PO7</b> | participate in learning activities throughout life, through self-paced and self-directed learning to improve knowledge and skills.                 | <b>PEO1&amp;PEO3</b>     |

### Program Specific Outcomes (PSOs)

| On successful completion of the B.Sc. Botany program, the students are expected to: |   | Mapping with Pos     |
|---|---|----------------------|
| <b>PSO1</b>   | implement the concept of science and technology to foster the traditional and modern techniques for solving the complex problems in Plant Biology.                | <b>PO4</b>           |
| <b>PSO2</b>   | ensure the use of contemporary tools and techniques in understanding the scope and significance of Botany   | <b>PO1&amp; PO3</b>  |
| <b>PSO3</b>   | develop the scientific problem solving skills during experimentation, research projects, analysis and interpretation of data                                      | <b>PO4 &amp; PO7</b> |
| <b>PSO4</b>   | design scientific experiments independently and to generate useful information to address various issues in Botany.   | <b>PO6 &amp; PO7</b> |
| <b>PSO5</b>   | enhanced capacity to think critically; ability to design and execute experiments independently and/or team under multidisciplinary settings                       | <b>PO2 &amp; PO5</b> |
| <b>PSO6</b>   | design and standardize protocols for public health and safety, and cultural, societal, and environmental considerations   | <b>PO6 &amp; PO3</b> |
| <b>PSO7</b>   | apply appropriate techniques, resources, and modern ICT tools for understanding plant resources.  | <b>PO2 &amp; PO7</b> |
| <b>PSO8</b>   | demonstrate the contextual knowledge in sustainable exploitation of medicinal, economically important and endangered plants as per the National Biodiversity Act. | <b>PO6</b>           |
| <b>PSO9</b>   | follow the concept of professional ethics and bioethics norms for practicing the value of plant kingdom.  | <b>PO6</b>           |
| <b>PSO10</b>  | communicate proficiently with various stakeholders and society, to comprehend and to write and present reports effectively  | <b>PO4 &amp; PO6</b> |

### Mapping of PO'S and PSO'S

| POs            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8  | PSO9  | PSO10 |
|----------------|------|------|------|------|------|------|------|-------|-------|-------|
| <b>PO 1</b>    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 2     | 2     | 3     |
| <b>PO 2</b>    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 2     | 3     | 3     |
| <b>PO 3</b>    | 3    | 3    | 2    | 3    | 3    | 3    | 3    | 3     | 3     | 3     |
| <b>PO4</b>     | 2    | 2    | 3    | 2    | 2    | 2    | 2    | 2     | 2     | 3     |
| <b>PO5</b>     | 3    | 2    | 3    | 3    | 2    | 3    | 2    | 3     | 2     | 3     |
| <b>PO6</b>     | 3    | 2    | 2    | 2    | 3    | 3    | 2    | 3     | 3     | 2     |
| <b>PO7</b>     | 3    | 3    | 2    | 2    | 3    | 2    | 3    | 2     | 2     | 2     |
| <b>Total</b>   | 20   | 18   | 18   | 18   | 19   | 18   | 18   | 17    | 17    | 19    |
| <b>Average</b> | 2.5  | 2.25 | 2.25 | 2.25 | 2.25 | 2.25 | 2.25 | 2.125 | 2.125 | 2.25  |

## Eligibility Norms for Admission

### Eligibility: 10 + 2 pattern

Those who seek admission to B.Sc. Botany Programme must have passed Higher Secondary Examination conducted by the Board of Higher secondary Examination, Tamil Nadu with Botany or Biology as one of the subjects or any other examinations recognized and approved by the Syndicate of Manonmaniam Sundaranar University, Tirunelveli.

**Duration of the Programme:** 3 years

**Medium of Instruction:** English

### Passing Minimum

A minimum of 40% in the external examination and an aggregate of minimum 40% is required. There is no minimum pass mark for the continuous internal assessment.

## Components of the B.Sc. Botany programme

### Part III (Core Courses and Elective Courses)

|                         |  |          |             |
|-------------------------|--|----------|-------------|
| <b>Core Courses</b>     | Core-Theory papers / Project               | 10 x 100 | 1000        |
|                         | Practical (Core Applied)                   | 7 x 100  | 700         |
|                         | Discipline Specific Elective-Theory Papers | 3 x 100  | 300         |
|                         | <b>Total Marks</b>                         |          | <b>2000</b> |
| <b>Elective Courses</b> | Theory                                     | 4 x 100  | 400         |
|                         | Practical                                  | 4 x 100  | 400         |
|                         | <b>Total Marks</b>                         |          | <b>800</b>  |
|                         | <b>Total Marks</b>                         |          | <b>2800</b> |

- **Core and Elective Practical Courses carry 100 marks each.**
- **Practical examination will be conducted at the end of each semester for Core and Elective Courses.**

### Course Structure

#### Distribution of Hours and Credits

#### Curricular Courses

| Course   | SI                 | S II               | S III          | S IV               | S V                | SVI                              | Total      |            |
|--|--------------------|--------------------|----------------|--------------------|--------------------|----------------------------------|------------|------------|
|  |                    |                    |                |                    |                    |                                  | Hours      | Credits    |
| <b>Part I</b> –Language                              | 6 (3)              | 6 (3)              | 6 (3)          | 6 (3)              | -                  | -                                | 24         | 12         |
| <b>Part II</b> -English                              | 6 (3)              | 6 (3)              | 6 (3)          | 6 (3)              | -                  | -                                | 24         | 12         |
| <b>Part-III</b>                                      |                    |                    |                |                    |                    |                                  |            |            |
| Core Course  | 5(5)               | 5(5)               | 5(5)           | 5(5)               | 6 (4) +<br>6 (4) + | 5 (3) +<br>5 (3) +<br>5 (3)<br>+ | 76         | 64         |
| Core Lab Course                                      | 3(3)               | 3(3)               | 3(3)           | 3(3)               | 4 (4)              | 5 (4)                            |            |            |
| Project  |                    |                    |                |                    | 4(4)               | 4 (3)                            |            |            |
| Elective /Discipline<br>Specific Elective<br>Courses | 4 (3)<br>2(2)      | 4(3)<br>2(2)       | 4 (3)<br>2(2)  | 4(3)<br>2(2)       | 4 (3)<br>4 (3)     | 4 (3)                            | 36         | 29         |
| <b>Part IV</b>                                       |                    |                    |                |                    |                    |                                  |            |            |
| Non Major Elective                                   | 2 (2)              | 2 (2)              | -              | -                  | -                  | -                                | 4          | 4          |
| Skill Enhancement<br>Course                          | -                  | 2 (2)              | 1 (1)<br>2 (2) | 1 (1)<br>2 (2)     | -                  | -                                | 8          | 8          |
| Foundation Course                                    | 2(2)               | -                  | -              | -                  | -                  | -                                | 2          | 2          |
| Value Education                                      | -                  | -                  | -              | -                  | 2 (2)              |                                  | 2          | 2          |
| Summer Internship<br>/Industrial Training            |                    |                    |                |                    | (2)                |                                  |            | 2          |
| Environmental<br>studies                             | -                  | -                  | 1              | 1 (2)              | -                  | -                                | 2          | 2          |
| Extension activity                                   | -                  | -                  | -              | -                  | -                  | (1)                              | -          | 1          |
| Professional<br>Competancy Skill                     |                    |                    |                |                    |                    | 2 (2)                            | 2          | 2          |
| <b>Total</b>   | <b>30<br/>(23)</b> | <b>30<br/>(23)</b> | <b>30 (22)</b> | <b>30<br/>(24)</b> | <b>30<br/>(26)</b> | <b>30<br/>(22)</b>               | <b>180</b> | <b>140</b> |

### Co-curricular Courses

| Course   | SI  | S II | S III | S IV | S V | S VI | Total |
|--|-----|------|-------|------|-----|------|-------|
| LST (Life Skill Training)                          | -   | (1)  | -     | (1)  |     |      | 2     |
| Skill Development Training<br>(Certificate Course) | (1) |      |       |      |     |      | 1     |
| Field Project                                      |     | (1)  |       |      |     |      | 1     |

|  |     |     |     |     |     |     |           |
|--|-----|-----|-----|-----|-----|-----|-----------|
| Specific Value-added Course                            | (1) |     | (1) |     |     |     | 2         |
| Generic Value-added Course                             |     |     |     | (1) |     | (1) | 2         |
| MOOC   |     | (1) |     | (1) |     | (1) | 3         |
| Student Training Activity:<br>Clubs & Committees / NSS |     |     |     | (1) |     |     | 1         |
| Community Engagement<br>Activity: RUN                  |     |     |     | (1) |     |     | 1         |
| Human Rights Education                                 |     |     |     |     | (1) |     | 1         |
| Gender Equity Studies                                  |     |     |     |     |     | (1) | 1         |
| <b>Total</b>   |     |     |     |     |     |     | <b>15</b> |

Total number of Compulsory Credits = Academic credits + Non-academic credits: 140 + 15  
**Courses Offered**

### Semester I

| Course          | Course Code | Title of the Course                                  | Credits   | Hours/Week |
|-----------------|-------------|--|-----------|------------|
| <b>Part I</b>   | TU231TL1    | Language:  | 3         | 6          |
|                 | FU231FL1    | Tamil<br>French                                      |           |            |
| <b>Part II</b>  | EU231EL1    | English  | 3         | 6          |
| <b>Part III</b> | BU231CC1    | Core Course I: Plant Diversity -I-<br>Algae          | 5         | 5          |
|                 | BU231CP1    | Core Lab Course I: Plant Diversity -I-<br>Algae      | 3         | 3          |
|                 | BU231EC1    | Elective Course I: Allied Botany -I                  | 3         | 4          |
|                 | BU231EP1    | Elective Lab Course I: Allied Botany<br>Practical    | 2         | 2          |
| <b>Part IV</b>  | BU231NM1    | Non Major Elective NME I:<br>Nursery and Landscaping | 2         | 2          |
|                 | BU231FC1    | Foundation Course: Basics of Botany                  | 2         | 2          |
| <b>Total</b>    |             |  | <b>23</b> | <b>30</b>  |

### Semester II

| Course          | Course Code | Title of the Course   | Credits | Hours/Week |
|-----------------|-------------|---|---------|------------|
| <b>Part I</b>   | TU232TL1    | Language:   | 3       | 6          |
|                 | FU232FL1    | Tamil<br>French   |         |            |
| <b>Part II</b>  | EU232EL1    | English   | 3       | 6          |
| <b>Part III</b> | BU232CC1    | Core Course II: Plant Diversity II-<br>Fungi, Bacteria, Viruses, Plant<br>Pathology and Lichens                 | 5       | 5          |
|                 | BU232CP1    | Core Lab Course II: Plant Diversity<br>II- Fungi, Bacteria, Viruses, Plant<br>Pathology and Lichens – Practical | 3       | 3          |

|                |          |  |           |           |
|----------------|----------|--|-----------|-----------|
|                |          | -II  |           |           |
|                | BU232EC1 | Elective Course II: Allied Botany -II                            | 3         | 4         |
|                | BU232EP1 | Elective Lab Course II: Allied Botany Practical                  | 2         | 2         |
| <b>Part IV</b> | BU232NM1 | Non Major Elective NME II: Mushroom Cultivation                  | 2         | 2         |
|                | BU232SE1 | Skill Enhancement Course SEC I: Botanical Garden and Landscaping | 2         | 2         |
|                |          | <b>Total</b>   | <b>23</b> | <b>30</b> |

#### Co-curricular Courses

| Part   | Semester               | Code   | Title of the Course                                   | Credit     |
|--------|------------------------|--|---|------------|
| Part V | I & II                 | UG232LC1   | Life Skill Training I: Catechism                      | 1          |
|        |                        | UG232LM1   | Life Skill Training I: Moral                          |            |
|        | I                      | UG231C01 – UG231C--                              | Skill Development Training (SDT) - Certificate Course | 1          |
|        | II                     | BU232FP1   | Field Project   | 1          |
|        | I & III                | BU231V01-<br>BU231V--/<br>BU233V01 –<br>BU233V-- | Specific Value-added Course                           | 1+1        |
|        | II, IV& VI<br>III & IV | -  | MOOC  | 1+1+1<br>1 |
|        |                        | UG234LC1   | Life Skill Training II: Catechism                     |            |
|        |                        | UG234LM1   | Life Skill Training II: Moral                         |            |
|        | IV & VI                | UG234V01-<br>UG234V--/<br>UG236V01-<br>UG236V--  | Generic Value-added Course                            | 1 +1       |
|        | I - IV                 | UG234ST1   | Student Training Activity – Clubs & Committees / NSS  | 1          |

#### Specific Value Added Course

| S. No. | Course code | Title of the course | Credits | Total hours |
|--------|-------------|---------------------|---------|-------------|
| I      | BU231V01    | Art of Bonsai       | 1       | 30          |

#### Examination Pattern

Each paper carries an internal component.

There is a passing minimum for external component.

A minimum of 40% in the external examination and an aggregate of 40% is required.

**a. Part I – Tamil, Part II – English, Part III - (Core Course/ Elective Course)**

Ratio of Internal and External= 25:75

**Continuous Internal Assessment (CIA)**

**Internal Components and Distribution of Marks**

| <b>Components</b>  | <b>Marks</b> |
|--|--------------|
| Internal test (2) (40 marks)   | 10           |
| Quiz (2) (20 marks)  | 5            |
| Assignment: (Model Making, Exhibition, Role Play, Seminar, Group Discussion, Problem Solving, Class Test, Open Book Test etc. (Minimum three items per course should be included in the syllabus & teaching plan) (30 marks) | 10           |
| <b>Total</b>   | <b>25</b>    |

**Question Pattern**

| <b>Internal Test</b>           | <b>Marks</b> | <b>External Exam</b>            | <b>Marks</b> |
|--------------------------------|--------------|---------------------------------|--------------|
| Part A 4 x 1 (No choice)       | 4            | Part A 10 x 1 (No choice)       | 10           |
| Part B 3 x 4 (Internal choice) | 12           | Part B 5 x 6 (Internal choice)  | 30           |
| Part C 3 x 8 (Internal choice) | 24           | Part C 5 x 12 (Internal choice) | 60           |
| <b>Total</b>                   | <b>40</b>    | <b>Total</b>                    | <b>100</b>   |

**Lab Course:**

Ratio of Internal and External= 25:75

Total: 100 marks

**Internal Components and Distribution of Marks**

| <b>Internal Components</b>                                  | <b>Marks</b> |
|---|--------------|
| Performance of the Experiments                              | 10           |
| Regularity in attending practical and submission of records | 5            |
| Record  | 5            |
| Model exam  | 5            |
| <b>Total</b>  | <b>25</b>    |

**Question pattern**

| <b>External Exam</b>                | <b>Marks</b> |
|-------------------------------------|--------------|
| Major Practical                     | 75           |
| Minor Practical / Spotters / Record |              |
| <b>Total</b>                        | <b>75</b>    |



## Core Project

Ratio of Internal and External = 25:75

| Components | Marks |
|------------|-------|
| Internal   | 25    |
| External   |       |
| Report     | 40    |
| Viva voce  | 35    |

## Part - IV

### i. Non-major Elective, Foundation Course, Skill Enhancement Course, Value Education, Professional Competency Skill

Ratio of Internal and External = 25: 75

#### Internal Components and Distribution of Marks

| Components  | Marks     |
|---|-----------|
| Internal test (2)   | 10        |
| Quiz (2)  | 5         |
| Assignment: (Model Making, Exhibition, Role Play, Album, Group Activity (Mime, Skit, Song) (Minimum three items per course) | 10        |
| <b>Total</b>  | <b>25</b> |

#### Question Pattern

| Internal Test   | Marks     | External Exam   | Marks     |
|---|-----------|---|-----------|
| Part A 2 x 2<br>(No Choice)                             | 4         | Part A 5 x 2<br>(No Choice)                                 | 10        |
| Part B 3 x 4 (open choice<br><b>Three out of Five</b> ) | 12        | Part B 5 x 5 (open choice any<br><b>Five out of Eight</b> ) | 25        |
| Part C 1 x 9 (open choice<br><b>One out of Three</b> )  | 9         | Part C 5 x 8 (open choice any<br><b>Five out of Eight</b> ) | 40        |
| <b>Total</b>  | <b>25</b> | <b>Total</b>  | <b>75</b> |

### ii. Environmental Studies

#### Internal Components

| Component      | Marks     |
|----------------|-----------|
| Project Report | 15        |
| Viva voce      | 10        |
| <b>Total</b>   | <b>25</b> |

#### Question Pattern

| Internal Test               | Marks | External Exam               | Marks |
|-----------------------------|-------|-----------------------------|-------|
| Part A 2 x 2<br>(No Choice) | 4     | Part A 5 x 2<br>(No Choice) | 10    |
| Part B 3 x 4                | 12    | Part B 5 x 5                | 25    |

|   |           |  |           |
|---|-----------|--|-----------|
| (Open choice <b>Three</b> out of <b>Five</b> )                |           | (Open choice any <b>Five</b> out of <b>Eight</b> )                 |           |
| Part C 1 x 9<br>(Open choice <b>One</b> out of <b>Three</b> ) | 9         | Part C 5 x 8<br>(Open choice any <b>Five</b> out of <b>Eight</b> ) | 40        |
| <b>Total</b>  | <b>25</b> | <b>Total</b>   | <b>75</b> |

### iii. Summer Internship/Industrial Training

| Components            | Marks |
|-----------------------|-------|
| Industry Contribution | 50    |
| Report & Viva-voce    | 50    |

### Co-Curricular Courses:

- i. **Life Skill Training: Catechism & Moral, Human Rights Education & Gender Equity Studies**

#### Internal Components

| Component                         | Marks     |
|-----------------------------------|-----------|
| Project - Album on current issues | 25        |
| Group Song/ Mime/ Skit            | 25        |
| <b>Total</b>                      | <b>50</b> |

#### External Components

| Component  | Marks     |
|--|-----------|
| Quiz   | 20        |
| Written Test: Open choice – 5 out of 7 questions (5 x 6) | 30        |
| <b>Total</b>   | <b>50</b> |

- ii. **Skill Development Training (SDT) - Certificate Course:**

| Components                 | Marks |
|----------------------------|-------|
| Attendance & Participation | 50    |
| Skill Test                 | 50    |

- iii. **Field Project:**

| Components         | Marks |
|--------------------|-------|
| Field Work         | 50    |
| Report & Viva-voce | 50    |

- iv. **Specific Value-Added Courses & Generic Value-Added Courses:**

| Components | Marks |
|------------|-------|
| Internal   | 25    |
| External   | 75    |

- v. **Community Engagement Activity: Reaching the Unreached Neighbourhood (RUN)**

| Programme | Assessment | Lower Order Thinking |   |   |    |   |   |    |   |   | Higher order thinking |   |   | Total number of questions |
|-----------|------------|----------------------|---|---|----|---|---|----|---|---|-----------------------|---|---|---------------------------|
|           |            | K1                   |   |   | K2 |   |   | K3 |   |   | K4, K5, K6            |   |   |                           |
|           | Part       | A                    | B | C | A  | B | C | A  | B | C | A                     | B | C |                           |
| I UG      | Internal   | 2                    | 2 |   | 1  | 1 | 1 | 1  | - | 2 | -                     | - | - | 10                        |
|           | External   | 5                    | 2 | 1 | 3  | 2 | 2 | 2  | 1 | 2 | -                     | - | - | 20                        |
| II UG     | Internal   | 1                    | - | 1 | 1  | 2 |   | 1  | - | 1 | 1                     | 1 | 1 | 10                        |
|           | External   | 5                    | 1 | 1 | 4  | 1 | 1 | -  | 3 | 1 | 1                     | - | 2 | 20                        |
| III UG    | Internal   | 1                    | 1 | - | -  | 1 | - | 1  | - | 1 | 2                     | 1 | 2 | 10                        |

| Components                 | Marks |
|----------------------------|-------|
| Attendance & Participation | 50    |
| Field Project              | 50    |

**vi. Student Training Activity: Clubs and Committees**

Compulsory for all I & II year students (1 credit).

| Component     | Marks     |
|---------------|-----------|
| Attendance    | 25        |
| Participation | 25        |
| <b>Total</b>  | <b>50</b> |

**Outcome Based Education (OBE)**

**(i) Knowledge levels for assessment of Outcomes based on Blooms Taxonomy**

| S. No | Level | Parameter                   | Description  |
|-------|-------|-----------------------------|--|
| 1     | K1    | Knowledge/Remembering       | It is the ability to remember the previously learned |
| 2     | K2    | Comprehension/Understanding | The learner explains ideas or concepts               |
| 3     | K3    | Application/Applying        | The learner uses information in a new way            |
| 4     | K4    | Analysis/Analysing          | The learner distinguishes among different parts      |
| 5     | K5    | Evaluation/Evaluating       | The learner justifies a stand or decision            |
| 6     | K6    | Synthesis /Creating         | The learner creates a new product or point of view   |

**(ii) Weightage of K – Levels in Question Paper**

**Number of questions for each cognitive level:**

**Evaluation**

- i. The performance of a student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade points.

- ii. Evaluation of each course shall be done by Continuous Internal Assessment (CIA) by the course teacher as well as by an end semester examination and will be consolidated at the end of the semester.
- iii. There shall be examinations at the end of each semester, for odd semesters in October/November; for even semesters in April/ May.
- iv. A candidate who does not pass the examination in any course(s) shall be permitted to reappear in such failed course(s) in the subsequent examinations to be held in October/ November or April/May. However, candidates who have arrears in practical examination shall be permitted to reappear for their areas only along with regular practical examinations in the respective semester.
- v. Viva-voce: Each project group shall be required to appear for Viva -voce examination in defence of the project.
- vi. The results of all the examinations will be published in the college website.

### **Conferment of Bachelor's Degree**

A candidate shall be eligible for the conferment of the Degree of Bachelor of Arts / Science / Commerce only if the minimum required credits for the programme thereof (140 + 18 credits) is earned.

### **Grading System**

#### **For the Semester Examination:**

#### **Calculation of Grade Point Average for End Semester Examination:**

$$\text{GPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the course}}{\text{Sum of the credits of the courses (passed) in a semester}}$$

#### **For the entire programme:**

$$\text{Cumulative Grade Point Average (CGPA)} \frac{\sum_n \sum_i C_{ni} G_{ni}}{\sum_n \sum_i C_{ni}}$$

$$\text{CGPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

Where

- $C_i$  - Credits earned for course i in any semester  
 $G_i$  - Grade point obtained for course i in any semester  
 n - semester in which such courses were credited

### **Final Result**

#### **Conversion of Marks to Grade Points and Letter Grade**

| <b>Range of Marks</b> | <b>Grade Points</b> | <b>Letter Grade</b> | <b>Description</b> |
|-----------------------|---------------------|---------------------|--------------------|
| 90-100                | 9.0-10.0            | O                   | Outstanding        |

|        |         |     |              |
|--------|---------|-----|--------------|
| 80-89  | 8.0-8.9 | D+  | Excellent    |
| 75-79  | 7.5-7.9 | D   | Distinction  |
| 70-74  | 7.0-7.4 | A+  | Very Good    |
| 60-69  | 6.0-6.9 | A   | Good         |
| 50-59  | 5.0-5.9 | B   | Average      |
| 40-49  | 4.0-4.9 | C   | Satisfactory |
| 00-39  | 0.0     | U   | Re-appear    |
| ABSENT | 0.0     | AAA | ABSENT       |

### Overall Performance

| CGPA                        | Grade | Classification of Final Result |
|-----------------------------|-------|--------------------------------|
| 9.5-10.0                    | O+    | First Class – Exemplary*       |
| 9.0 and above but below 9.5 | O     |                                |
| 8.5 and above but below 9.0 | D++   | First Class with Distinction*  |
| 8.0 and above but below 8.5 | D+    |                                |
| 7.5 and above but below 8.0 | D     |                                |
| 7.0 and above but below 7.5 | A++   | First Class                    |
| 6.5 and above but below 7.0 | A+    |                                |
| 6.0 and above but below 6.5 | A     |                                |
| 5.5 and above but below 6.0 | B+    | Second Class                   |
| 5.0 and above but below 5.5 | B     |                                |
| 4.0 and above but below 5.0 | C     | Third Class                    |
| 0.0 and above but below 4.0 | U     | Re-appear                      |

\*The candidates who have passed in the first appearance and within the prescribed semester are eligible for the same.

**SEMESTER --I**  
**CORE COURSE-I PLANT DIVERSITY I ALGAE**

| Course Code | L | T | P | S | Credits | Inst. Hours | Total Hours | Marks |          |       |
|-------------|---|---|---|---|---------|-------------|-------------|-------|----------|-------|
|             |   |   |   |   |         |             |             | CIA   | External | Total |
| BU231CC1    | 3 | 2 | - | - | 5       | 5           | 75          | 25    | 75       | 100   |

**Pre-requisites:**

Students should be familiar with the basics of different classes of algae.

**Learning Objectives**

1. To provide a comprehensive knowledge on the biology of algae and to understand the evolution higher of plants.
2. To understand the role of algae in ecosystems as primary producers of nutrition and also the importance of algae to animals and humans.

**Course Outcomes**

| On the successful completion of the course, student will be able to: |   |                    |
|--|---|--------------------|
| 1.   | relate to the structural organization, reproduction and significance of algae.  | <b>K2 &amp; K5</b> |
| 2.   | demonstrate knowledge in understanding the various life cycle patterns and the fundamental concepts in algal growth         | <b>K3 &amp; K1</b> |
| 3.   | explain the benefits of various algal technologies on the ecosystem.  | <b>K1</b>          |
| 4.   | compare and contrast the thallus organization and modes of reproduction in algae.   | <b>K4 &amp; K5</b> |
| 5.   | determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses. | <b>K5 &amp; K6</b> |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

| Unit       | Contents  | No. of Hours |
|------------|---|--------------|
| <b>I</b>   | General characters of algae, Classification (Fritsch-1935-1945), criteria for classification, algal distribution.   | <b>15</b>    |
| <b>II</b>  | Thallus organization (unicellular- <i>Chlorella</i> , Diatoms, colonial- <i>Volvox</i> , filamentous- <i>Anabaena</i> , <i>Oedogonium</i> , siphonous- <i>Caulerpa</i> , parenchymatous- <i>Sargassum</i> , <i>Gracilaria</i> ).      | <b>15</b>    |
| <b>III</b> | Reproduction-Vegetative, asexual, sexual reproduction and life histories (haplontic-, <i>Oedogonium</i> and <i>Chara</i> , diplontic-Diatoms and <i>Sargassum</i> , diplohaplontic- <i>Ulva</i> and diplobiontic- <i>Gracilaria</i> ) | <b>15</b>    |
| <b>IV</b>  | Algal cultivation methods, Algal production systems; indoor cultivation methods and large-scale cultivation of algae, harvesting of algae.  | <b>15</b>    |
|            | Algae as food and feed: Agar-agar, Alginic acid and Carrageenan;  | <b>15</b>    |

|   |  |  |
|---|--|--|
| V | Diatomite.<br>Resource potential of algae: Application of algae as fuel, agriculture and pharmaceutical. Phyco remediation. Role of algae in CO <sub>2</sub> sequestration, Algae as indicator of water pollution, algal bioinoculants, Bioluminescence. |  |
|---|--|--|

**Self-Study Portion:** Algal Distribution, Algae as indicator of pollution.

1. Edwardlee, R. 2018. Phycology. (Fifth Edition). Cambridge University Press, London.
2. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi.
3. Singh, Pandey and Jain. 2020) A text book of Botany. (Fifth Edition) Rastogi Publication, Meerut.
4. Vashishta, P.C. 2014. Botany for Degree Students – Algae. S.Chand & Company Ltd, New Delhi.
5. Ian Morris. 1977. An introduction to the algae. Hutchinson & Co Publishers Ltd., London.

**References Books:**

1. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. University of Sulaimani, Iraq.
2. Mihir Kumar, D. 2010. Algal Biotechnology. Daya Publishing House, New Delhi.
3. Chapman V.J. and Chapman D.J. 2013. The Algae. Alpha Numera, Delhi.
4. Fritsch, F.E. 1945. Structure and reproduction of Algae. Cambridge University Press, London.
5. Round, FE. 1984. The Ecology of Algae. Cambridge University Press, London.
6. Lee, R.D. 2008. Phycology. (4th Edition). London: Cambridge University Press, New York.
7. Bold, H.C and Wynne, M.J. 1978. Introduction to the Algae: Structure and Function. Prantice Hall of India, New Delhi.

**Web Resources:**

1. <https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382>
2. <https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382>
3. <https://www.crcpress.com/Algae-Anatomy-Biochemistry-and-Biotechnology-Second-Edition/Barsanti-Gualtieri/p/book/9781439867327>
4. <https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-Environmental-Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678>
5. <https://www.kopykitab.com/Botany-For-Degree-Students-ALGAE-by-B-R-Vashishta-Dr-A-K-Sinha-Dr-V-P-Singh>
6. <https://www.wileyindia.com/a-textbook-of-algae.html>
7. <https://www.kobo.com/in/en/ebook/algae-biotechnology>
8. <https://www.ikbooks.com/books/book/life-sciences/botany/a-textbook-algae/9788188237449/>

**Mapping with Programme Outcomes**

| COs            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1            | 3   | 3   | 3   | 3   | 3   | 3   | 3   |
| CO2            | 3   | 3   | 1   | 2   | 2   | 1   | 2   |
| CO3            | 3   | 3   | 3   | 1   | 2   | 1   | 2   |
| CO4            | 3   | 3   | 1   | 2   | 1   | 2   | 2   |
| CO5            | 3   | 3   | 2   | 1   | 2   | 2   | 2   |
| <b>Total</b>   | 15  | 15  | 10  | 9   | 10  | 9   | 11  |
| <b>Average</b> | 3   | 3   | 2   | 1.8 | 2   | 1.9 | 2.2 |

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

**Mapping with Programme Specific Outcomes**

| COs            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|----------------|------|------|------|------|------|------|------|------|------|-------|
| CO1            | 3    | 3    | 2    | 3    | 2    | 1    | 2    | 2    | 2    | 1     |
| CO2            | 3    | 3    | 2    | 2    | 3    | 3    | 2    | 1    | 2    | 3     |
| CO3            | 2    | 2    | 3    | 2    | 2    | 2    | 1    | 2    | 1    | 2     |
| CO4            | 3    | 3    | 3    | 3    | 3    | 2    | 2    | 2    | 2    | 3     |
| CO5            | 3    | 3    | 2    | 3    | 3    | 2    | 2    | 3    | 2    | 3     |
| <b>Total</b>   | 14   | 14   | 12   | 13   | 13   | 10   | 9    | 10   | 9    | 12    |
| <b>Average</b> | 2.8  | 2.8  | 2.4  | 2.6  | 2.6  | 2.0  | 1.8  | 2.0  | 1.8  | 2.4   |



**SEMESTER --I**  
**CORE LAB COURSE I - PLANT DIVERSITY I: ALGAE**

| Course Code     | L        | T        | P        | S        | Credits  | Inst. Hours | Total Hours | Marks     |           |            |
|-----------------|----------|----------|----------|----------|----------|-------------|-------------|-----------|-----------|------------|
|                 |          |          |          |          |          |             |             | Internal  | External  | Total      |
| <b>BU231CP1</b> | <b>1</b> | <b>-</b> | <b>2</b> | <b>-</b> | <b>3</b> | <b>3</b>    | <b>45</b>   | <b>25</b> | <b>75</b> | <b>100</b> |

**Pre-requisites:** Students should be familiar with the basics of algae.

**Learning Outcomes:**

1. To develop skills to identify micro and macroalgae based on habitat, thallus structure and the internal organization.
2. To develop skills to prepare the microslides of algae.

**Course Outcomes**

| On the successful completion of the course, student will be able to: |  |                    |
|--|--|--------------------|
| 1.   | recall and identify algae using key identification characters.   | <b>K1</b>          |
| 2.   | demonstrate practical skills in preparation of fresh mount and identification of algal forms from algal mixture. | <b>K3 &amp; K2</b> |
| 3.   | describe the internal structure of algae prescribed in the syllabus  | <b>K2</b>          |
| 4.   | decipher the algal diversity in fresh/marine water and their economic significance.                              | <b>K4 &amp; K6</b> |
| 5.   | evaluate the various techniques used to culture algae for commercial purposes                                    | <b>K5</b>          |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

| <b>EXPERIMENTS</b>   | <b>No. of Hours</b> |
|--|---------------------|
| . Micro-preparation of the types prescribed in the syllabus.<br>a. <i>Caulerpa</i> - Thallus<br>b. <i>Sargassum</i> – Stipe and Leaf<br>c. <i>Gracilaria</i> - Thallus<br>d. <i>Ulva</i> – Thallus<br>e. <i>Chara</i> - Thallus<br>2. Identifying the micro slides relevant to the syllabus.<br>a. <i>Chlorella</i><br>b. <i>Diatoms</i><br>c. <i>Volvox</i> with daughter colony, <i>Volvox</i> antheridia, <i>Volvox</i> archegonia<br>d. <i>Anabaena</i><br>e. <i>Oedogonium</i><br>f. <i>Sargassum</i> male conceptacle, <i>Sargassum</i> female conceptacle<br>g. <i>Gracilaria</i> Cystocarp<br>3. Identifying types of algal mixture.<br>4. Economic importance of Algae as: (i) Food (ii) Feed (iii) Biofertilizers (iv) Seaweed liquid fertilizer (v) Hydrogen production by algae (vi) SCP (vii) Agar Agar (viii) Alginate (ix) Diatomaceous earth.<br>5. Field visit to study fresh water/marine water algal habitats.<br>6. Visit to nearby industry actively engaged in algal technology. | 45                  |

**Text Books:**

1. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi.
2. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany-1 (Tenth Edition). Meerut: Rastogi Publications.
3. Round, FE. 1984. The Ecology of Algae. Cambridge University Press, London.
4. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. University of Sulaimani, Sulaymaniyah, Iraq.
5. Singh, Pandey and Jain. 2020. A text book of Botany. (Fifth Edition). Rastogi Publication, Meerut.

**References Books:**

1. Nancy Serediak and M. Huynh. 2011. Algae identification Lab Guide. Agriculture and Agri-Food, Canada.
2. Chapman, V.J and Chapaman, D.J. 1960. The Algae. ELBS & MacMillan, London.
3. Lee, R.D. 2008. Phycology. (Fourth Edition). Cambridge University Press, London.
4. Edwardlee, R. 2018. Phycology. (Fifth Edition). Cambridge University Press, London.

**Web Resources:**

1. <https://www.amazon.in/Practical-Manual-Algae-Sundara-Rajan/dp/8126106492>
2. [https://books.google.co.in/books/about/Practical\\_Manual\\_of\\_Algae.html?id=8d5DAAAACAAJ&redir\\_esc=](https://books.google.co.in/books/about/Practical_Manual_of_Algae.html?id=8d5DAAAACAAJ&redir_esc=)
3. [https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae-\(PDF-21P\).html](https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae-(PDF-21P).html)
4. <https://www.ebooks.com/en-in/book/210152662/algae/sachin-kumar-mandotra/>
5. [https://books.google.co.in/books/about/Algae.html?id=s1P855ZWc0kC&redir\\_esc=y](https://books.google.co.in/books/about/Algae.html?id=s1P855ZWc0kC&redir_esc=y)

**Mapping with Programme Outcomes**

| COs            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1            | 3   | 2   | 3   | 1   | 2   | 1   | 2   |
| CO2            | 3   | 3   | 2   | 1   | 3   | 2   | 2   |
| CO3            | 3   | 2   | 3   | 2   | 2   | 2   | 1   |
| CO4            | 3   | 3   | 3   | 2   | 3   | 1   | 3   |
| CO5            | 3   | 3   | 3   | 2   | 2   | 2   | 2   |
| <b>Total</b>   | 15  | 13  | 14  | 8   | 12  | 8   | 10  |
| <b>Average</b> | 3   | 2.6 | 2.8 | 1.6 | 2.4 | 1.6 | 2.0 |

**Mapping with Programme Specific Outcomes**

| <b>COs</b>     | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> | <b>PSO6</b> | <b>PSO7</b> | <b>PSO8</b> | <b>PSO9</b> | <b>PSO10</b> |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| <b>CO1</b>     | 2           | 3           | 3           | 3           | 3           | 3           | 2           | 2           | 2           | 3            |
| <b>CO2</b>     | 2           | 2           | 3           | 3           | 3           | 2           | 3           | 2           | 1           | 3            |
| <b>CO3</b>     | 3           | 2           | 3           | 3           | 3           | 3           | 3           | 2           | 2           | 3            |
| <b>CO4</b>     | 3           | 3           | 3           | 3           | 3           | 2           | 2           | 1           | 2           | 3            |
| <b>CO5</b>     | 2           | 2           | 3           | 3           | 3           | 3           | 2           | 1           | 2           | 3            |
| <b>Total</b>   | 12          | 12          | 15          | 15          | 15          | 13          | 12          | 8           | 9           | 15           |
| <b>Average</b> | 2.4         | 2.4         | 3           | 3           | 3           | 2.6         | 2.4         | 1.6         | 1.8         | 3            |

**S-Strong (3)      M-Medium (2)      L-Low(1)**

## SEMESTER –I

### ELECTIVE COURSE I: ALLIED BOTANY -I

| Course Code | L | T | P | S | Credits | Inst. Hours | Total Hours | Marks |          |       |
|-------------|---|---|---|---|---------|-------------|-------------|-------|----------|-------|
|             |   |   |   |   |         |             |             | CIA   | External | Total |
| BU231EC1    | 4 | - | - | - | 3       | 4           | 60          | 25    | 75       | 100   |

**Pre-requisites:** To study the basics of botany.

#### Learning Objectives

1. To study morphological and anatomical adaptations of plants of various habitats.
2. To demonstrate techniques and experiments in plant tissue culture, plant physiology and biochemistry.

#### Course Outcomes

| On the successful completion of the course, student will be able to: |  |           |
|--|--|-----------|
| 1.   | increase the awareness and appreciation of human friendly algae and their economic importance.                       | <b>K3</b> |
| 2.   | develop an understanding of microbes and fungi and appreciate their adaptive strategies                              | <b>K2</b> |
| 3.   | develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms. | <b>K2</b> |
| 4.   | compare the structure and function of cells and explain the development of cells.                                    | <b>K4</b> |
| 5.   | understand the core concepts and fundamentals of plant biotechnology and genetic engineering.                        | <b>K2</b> |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

| Unit | Contents   | No. of Hours |
|------|--|--------------|
| I    | <b>Algae:</b><br>General characters of algae - Structure, reproduction and life cycle of the following genera - <i>Anabaena</i> and <i>Sargassum</i> and economic importance of algae.   | <b>12</b>    |
| II   | <b>Fungi, Bacteria and Virus:</b><br>General characters of fungi, structure, reproduction and life cycle of the following genera - <i>Penicillium</i> and <i>Agaricus</i> and economic importance of fungi. Bacteria - general characters, structure and reproduction of <i>Escherichia coli</i> and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage | <b>12</b>    |
| III  | <b>Bryophytes, Pteridophytes and Gymnosperms:</b><br>General characters of Bryophytes, Structure and life cycle of <i>Funaria</i> . General characters of Pteridophytes, Structure and life cycle of <i>Lycopodium</i> .   | <b>12</b>    |

|    |   |    |
|----|---|----|
|    | General characters of Gymnosperms, Structure and life cycle of <i>Cycas</i> .   |    |
| IV | <b>Cell Biology:</b><br>Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis  | 12 |
| V  | <b>Genetics and Plant Biotechnology:</b><br>Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - In vitro culture methods. Plant tissue culture and its application in biotechnology. | 12 |

**Self Study:** General Characters of Algae, Fungi, Bacteria

**Text Books:**

1. Singh, V., Pande, P. C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
2. Bhatnagar, S.P. and Alok Moitra. 2020. Gymnosperms. New Age International (P) Ltd., Bengaluru.
3. Sharma, O.P. 2017. Bryophyta. MacMillan India Ltd, Delhi.
4. Lee, R.E. 2008. Phycology. (Fourth Edition). Cambridge University Press, New Delhi.
5. Rao, K. Krishnamurthy, K.V. and Rao, G.S. 1979. Ancillary Botany. S.Viswanathan Pvt. Ltd., Madras.

**Reference Books:**

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes. SurjeetPublications, New Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd, New Delhi.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, New Delhi.
4. Coulter, M. Jhon 2014. Morphology of Gymnosperms. Surjeet Publications, New Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. Chand & Company Ltd., New Delhi.
6. Parihar, N.S.2013. An introduction to Embryophyta –Bryophytes. Surjeet Publications, New Delhi.
7. Pandey, B.P. 1986. Text Book of Botany. Vol I &II. S. Chand and Co, New Delhi.

**Web Resources**

1. <https://www.kobo.com/us/en/ebook/the-algae-world>
2. [http://www.freebookcentre.net/biology-books-download/Fungi-\(PDF-15P\).html](http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html)
3. <http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm>

4. <https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/>
5. <https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf>
6. <https://www.us.elsevierhealth.com/medicine/cell-biology>
7. <https://www.us.elsevierhealth.com/medicine/genetics>
8. <https://www.kobo.com/us/en/ebook/plant-biotechnology-1>

### Mapping With Programme Outcomes

| COs            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1            | 3   | 3   | 2   | 2   | 2   | 1   | 2   |
| CO2            | 3   | 2   | 3   | 2   | 2   | 2   | 1   |
| CO3            | 3   | 2   | 3   | 3   | 2   | 2   | 2   |
| CO4            | 3   | 3   | 2   | 2   | 2   | 2   | 2   |
| CO5            | 3   | 2   | 3   | 2   | 2   | 1   | 2   |
| <b>Total</b>   | 15  | 12  | 13  | 11  | 10  | 8   | 9   |
| <b>Average</b> | 3   | 2.4 | 2.6 | 2.2 | 2.0 | 1.6 | 1.8 |

### Mapping with Programme Specific Outcomes

| COs            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|----------------|------|------|------|------|------|------|------|------|------|-------|
| CO1            | 3    | 3    | 3    | 2    | 2    | 2    | 2    | 2    | 2    | 3     |
| CO2            | 3    | 2    | 2    | 3    | 3    | 1    | 1    | 2    | 3    | 2     |
| CO3            | 2    | 3    | 3    | 2    | 2    | 2    | 1    | 2    | 2    | 2     |
| CO4            | 3    | 2    | 2    | 3    | 3    | 2    | 2    | 1    | 2    | 3     |
| CO5            | 3    | 3    | 2    | 3    | 2    | 1    | 2    | 2    | 1    | 3     |
| <b>Total</b>   | 14   | 13   | 12   | 13   | 12   | 8    | 8    | 9    | 10   | 13    |
| <b>Average</b> | 2.8  | 2.6  | 2.4  | 2.6  | 2.4  | 1.6  | 1.6  | 1.8  | 2.0  | 2.6   |

**S-Strong (3)**

**M-Medium(2)**

**L-Low(1)**

## SEMESTER – I

### ELECTIVE LAB COURSE I: ALLIED BOTANY PRACTICAL

| Course Code     | L | T | P | S | Credits | Inst. Hours | Total Hours | Marks |          |       |
|-----------------|---|---|---|---|---------|-------------|-------------|-------|----------|-------|
|                 |   |   |   |   |         |             |             | CIA   | External | Total |
| <b>BU231EP1</b> | - | - | 2 | - | 2       | 2           | 30          | 25    | 75       | 100   |

**Prerequisites:** Practical pertaining to above subjects is important to get knowledge on various aspects of plants.

#### Learning Outcomes

1. To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.
2. To understand the laws of inheritance, genetic basis of loci and alleles.

#### Course Outcomes

| <b>On the successful completion of the course, student will be able to:</b> |  |           |
|---|--|-----------|
| 1.  | to study the internal organization of algae and fungi.   | <b>K1</b> |
| 2.  | develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms. | <b>K2</b> |
| 3.  | to study the classical taxonomy with reference to different parameters.  | <b>K4</b> |
| 4.  | understand the fundamental concepts of plant anatomy and embryology  | <b>K2</b> |
| 5.  | to study the effect of various physical factors on photosynthesis.   | <b>K3</b> |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

|  | <b>Contents</b>  | <b>No. of Hours</b> |
|--|--|---------------------|
|  | <b>EXPERIMENTS</b>   |                     |
|  | 1. Make suitable micro preparation of<br>a. <i>Anabaena</i><br>b. <i>Sargassum</i> - Stipe, Leaf,<br>c. <i>Penicillium</i><br>d. <i>Agaricus</i><br>e. Structure of Bacteria<br>f. Structure of Bacteriophage<br>g. <i>Funaria</i> – Stem, Archegonial cluster, Antheridial cluster, Sporophyte L.S<br>h. <i>Lycopodium</i> – Stem, Cone | <b>30</b>           |

|  |  |
|--|--|
| i. <i>Cycas</i> – Leaflet, T.S Microsporophyll, T.S. of Megasporophyll, Ovule<br>L.S<br>2. Micro photographs of the cell organelles ultra structure – Chloroplast,<br>Mitochondria, Nucleus, Mitosis and Meiosis<br>3. Simple Genetic Problem<br>4. Biotechnology Spotters<br>a. Hot Air Oven<br>b. Laminar Air Flow Chamber<br>c. Autoclave |  |
|--|--|

**Textbooks:**

1. Sharma, O.P. 2017. Bryophyta. MacMillan India Ltd, New Delhi.
2. Sharma, O.P. 2012. Pteridophyta. Tata McGraw-Hills Ltd., New Delhi.
3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, England.
5. Noggle, G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

**Reference Books:**

1. Strickberger, M.W. 2005. Genetics (Third Edition). Prentice Hall, New Delhi.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide. Ottawa Agriculture and Agri food Canada Publisher, Canada.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing, New Delhi.
4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & Wiley Publications, London.
5. Steward, F.C. 2012. Plant Physiology. US Academic Press, United States.

**Web Resources:**

1. <https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883>
2. <https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover>
3. <https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ>
4. <https://medlineplus.gov/genetocs/understanding/basics/cell/>
5. <https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf>
6. [http://www.cuteri.eu/microbiologia/manuale\\_microbiologia\\_pratica.pdf](http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf)
7. <https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4>



**Mapping with Programme Outcomes and Programme Specific Outcomes**

| <b>Cos</b>     | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> |
|----------------|------------|------------|------------|------------|------------|------------|------------|
| <b>CO1</b>     | 3          | 3          | 2          | 2          | 2          | 1          | 2          |
| <b>CO2</b>     | 3          | 2          | 2          | 2          | 3          | 2          | 2          |
| <b>CO3</b>     | 3          | 3          | 3          | 2          | 2          | 1          | 2          |
| <b>CO4</b>     | 3          | 2          | 2          | 3          | 3          | 1          | 2          |
| <b>CO5</b>     | 3          | 3          | 2          | 2          | 3          | 2          | 3          |
| <b>Total</b>   | 15         | 13         | 11         | 11         | 13         | 7          | 11         |
| <b>Average</b> | 3          | 2.6        | 1.1        | 2.2        | 2.6        | 1.4        | 2.2        |

**Mapping with Programme Specific Outcomes**

| <b>COs</b>     | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> | <b>PSO6</b> | <b>PSO7</b> | <b>PSO8</b> | <b>PSO9</b> | <b>PSO10</b> |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| <b>CO1</b>     | 3           | 2           | 2           | 2           | 1           | 2           | 1           | 1           | 2           | 2            |
| <b>CO2</b>     | 2           | 3           | 2           | 1           | 1           | 1           | 1           | 2           | 1           | 2            |
| <b>CO3</b>     | 3           | 3           | 1           | 1           | 2           | 2           | 2           | 1           | 2           | 1            |
| <b>CO4</b>     | 3           | 2           | 2           | 2           | 1           | 2           | 2           | 2           | 2           | 2            |
| <b>CO5</b>     | 3           | 3           | 3           | 2           | 2           | 1           | 2           | 2           | 1           | 2            |
| <b>Total</b>   | 14          | 13          | 10          | 8           | 7           | 8           | 8           | 6           | 8           | 7            |
| <b>Average</b> | 2.8         | 2.6         | 2.0         | 1.6         | 1.4         | 1.6         | 1.6         | 1.2         | 1.6         | 1.4          |

**S-Strong (3)      M-Medium (2)      L-Low (1)**

**SEMESTER --I**  
**NON-MAJOR ELECTIVE NME I: NURSERY AND LANDSCAPING**

| Course Code | L | T | P | S | Credits | Inst. Hours | Total Hours | Marks |          |       |
|-------------|---|---|---|---|---------|-------------|-------------|-------|----------|-------|
|             |   |   |   |   |         |             |             | CIA   | External | Total |
| BU231NM1    | 2 | - | - | - | 2       | 2           | 30          | 25    | 75       | 100   |

**Pre-requisites:**

Students should know about the fundamental concepts of nursery and landscaping.

**Learning Objectives**

1. To recognize the importance of growing plants and practice the knowledge gained by developing kitchen garden and ornamental garden.
2. To be able to design gardens, learn the methods of propagation and become entrepreneur in Horticulture.

**Course Outcomes**

| On the successful completion of the course, student will be able to: |  |    |
|--|--|----|
| 1.   | recognize the basic principles and components of gardening.                                      | K2 |
| 2.   | explain about bio-aesthetic planning and conceptualize flower arrangement.                       | K1 |
| 3.   | apply techniques for design various types of gardens according to the culture and art of bonsai. | K3 |
| 4.   | compare and contrast different garden styles and landscaping patterns                            | K4 |
| 5.   | establish and maintain special types of gardens for outdoor and indoor landscaping.              | K2 |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

| Unit | Contents   | No. of Hours |
|------|--|--------------|
| I    | Introduction, prospects and scope of nursery and landscaping.  | 6            |
| II   | Methods of Propagation – cutting, layering, grafting, budding, Floriculture – Rose, Chrysanthemum, Jasmine – cultivation.      | 6            |
| III  | Gardening – formal garden, informal garden, vegetable garden, landscaped layout designing – formation and maintenance of lawn. | 6            |
| IV   | Nursery structures – Green house – Shade house, Mist chamber – Topiary, Bonsai culture.  | 6            |
| V    | Manures, composting – vermicomposting.   | 6            |

**Self Study Portion:** Cultivation of Rose

**Recommended Texts:**

1. Amarnath V. 2006. Nursery and Landscaping. M/s IBD Publishers, New Delhi.

- Butts, E. and Stensson, K. 2012. Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd., Canada.
- Mukherjee, D. 2002. Gardening in India, Oxford IBH publishing Co., New Delhi.
- Kumar, N. 1997. Introduction to Horticulture. Rajalakshmi Publications, Nagercoil.
- De, L. C. 2013. Nursery and Landscaping. Pointer Publishers, India.

#### References Books:

- Agrawal, P. K. 1993. Hand Book of Seed Technology. Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
- Janick Jules. 1979. Horticultural Science. (Third Edition), W.H. Freeman and Co., San Francisco, USA.
- Singh, J. 2018. Fundamentals of Horticulture. Kalyani Publishers, India.
- Sharma, V. K. 1999. Encyclopedia of Practical Horticulture. Deep and Deep Publ. Pvt. Ltd., New Delhi.
- Ingels J. and Smith A. F. 2018. Landscaping: principles & practices. Cengage Learning, United States.

#### Web Resources:

- <https://www.kopykitab.com/higher-education-ebooks/higher-education-ebooks/Agricultural-Industry-agriculture-eBooks/Nursery-And-Landscaping-by-V-Amarnath>
- <https://www.amazon.in/Nursery-Landscaping-Veena-Amarnath/dp/8177542788>
- <https://www.amazon.in/Gardening/b?ie=UTF8&node=1637077031>
- <https://in.pinterest.com/pin/496733033900458021/?lp=true>
- <https://www.gardenvisit.com/ebooks>

#### Mapping with Programme Outcomes

| COs            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1            | 3   | 2   | 1   | 3   | 2   | 2   | 2   |
| CO2            | 3   | 3   | 2   | 2   | 1   | 2   | 2   |
| CO3            | 3   | 3   | 3   | 3   | 2   | 3   | 2   |
| CO4            | 3   | 3   | 2   | 3   | 2   | 3   | 3   |
| CO5            | 3   | 3   | 2   | 3   | 2   | 2   | 3   |
| <b>Total</b>   | 15  | 14  | 10  | 14  | 9   | 12  | 12  |
| <b>Average</b> | 3   | 2.8 | 2   | 2.8 | 1.8 | 2.4 | 2.4 |

#### Mapping with Programme Specific Outcomes

| <b>COs</b>     | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> | <b>PSO6</b> | <b>PSO7</b> | <b>PSO8</b> | <b>PSO9</b> | <b>PSO10</b> |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| <b>CO1</b>     | 2           | 3           | 3           | 3           | 3           | 3           | 2           | 2           | 2           | 3            |
| <b>CO2</b>     | 2           | 2           | 3           | 3           | 3           | 2           | 3           | 2           | 1           | 3            |
| <b>CO3</b>     | 3           | 2           | 3           | 3           | 3           | 3           | 3           | 2           | 2           | 3            |
| <b>CO4</b>     | 3           | 3           | 3           | 3           | 3           | 2           | 2           | 1           | 2           | 3            |
| <b>CO5</b>     | 2           | 2           | 3           | 3           | 3           | 3           | 2           | 1           | 2           | 3            |
| <b>Total</b>   | 12          | 12          | 15          | 15          | 15          | 13          | 12          | 8           | 9           | 15           |
| <b>Average</b> | 2.4         | 2.4         | 3           | 3           | 3           | 2.6         | 2.4         | 1.6         | 1.8         | 3            |

**S-Strong (3)    M-Medium (2)    L-Low (1)**

**SEMESTER –I**  
**FOUNDATION COURSE: BASICS OF BOTANY**

| Course Code | L | T | P | S | Credits | Inst. Hours | Total Hours | Marks |          |       |
|-------------|---|---|---|---|---------|-------------|-------------|-------|----------|-------|
|             |   |   |   |   |         |             |             | CIA   | External | Total |
| BU231FC1    | 2 |   | - | - | 2       | 2           | 30          | 25    | 75       | 100   |

**Pre-requisites:**

To recall the students about the basic aspects of botany.

**Learning Objectives**

1. To learn about the classification and Salient features of algae, fungi, bryophytes, Pteridophytes and gymnosperms, viruses and bacteria.

2. To learn about cell biology, Plant Morphology, Genetics, and plant physiology.

**Course Outcomes**

| On the successful completion of the course, student will be able to: |   |    |
|--|---|----|
| 1.   | increase the awareness and appreciation of human friendly algae and their economic importance                       | K1 |
| 2.   | develop an understanding of microbes and fungi and appreciate their adaptive strategies                             | K1 |
| 3.   | develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms | K2 |
| 4.   | compare the structure and function of cells and explain the development of cells.                                   | K4 |
| 5.   | understand the core concepts and fundamentals of plant biotechnology and genetic engineering.                       | K2 |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

| Unit       | Contents  | No. of Hours |
|------------|---|--------------|
| <b>I</b>   | <b>BIODIVERSITY</b><br>Systematics: Two Kingdom and Five Kingdom systems - Salient features of various Plant Groups: Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms- Viruses - Bacteria.   | <b>6</b>     |
| <b>II</b>  | <b>CELL BIOLOGY</b><br>Cell as the basic unit of life - Prokaryotic and Eukaryotic Cell (Plant Cell) - Light Microscope and Electron Microscope Ultra Structure of Prokaryotic and Eukaryotic Cells - Cell Wall - Cell Membrane, Plastids, Ribosomes. | <b>6</b>     |
| <b>III</b> | <b>PLANT MORPHOLOGY</b><br>Structure and Modification of Root, Stem and Leaf - Structure and Types of Inflorescences - Structure and Types of Flowers, Fruits and Seeds.  | <b>6</b>     |
| <b>IV</b>  | <b>GENETICS</b><br>Concept of Heredity and Variation - Mendel's Laws of Inheritance.  | <b>6</b>     |

|          |   |          |
|----------|---|----------|
| <b>V</b> | <b>PLANT PHYSIOLOGY</b><br>Cell as a Physiological Unit : Water relations -Absorption and movement : Diffusion, Osmosis, Plasmolysis, Imbibition - Permeability, Water Potential - Transpiration - Movement - Mineral Nutrition | <b>6</b> |
|----------|---|----------|

**Self-Study Portion:** Prokaryotic and Eukaryotic Cell (PlantCell), Structure and Modification of Root, Stem and Leaf

**Recommended Texts:**

1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I and II, S.Chand and Co. New Delhi.
6. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany, S. Viswanathan Pvt. Ltd., Madras.

**References Books:**

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes. Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd., NEW Delhi.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. S. Chand & Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes. Surjeet Publications, Delhi.

**Web Resources:**

1. <https://www.kobo.com/us/en/ebook/the-algae-world>
2. [http://www.freebookcentre.net/biology-books-download/Fungi-\(PDF-15P\).html](http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html)
3. <http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm>
4. <https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/>
5. <https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf>
6. <https://www.us.elsevierhealth.com/medicine/cell-biology>
7. <https://www.us.elsevierhealth.com/medicine/genetics>  
<https://www.kobo.com/us/en/ebook/plant-biotechnology-1>

### Mapping with Programme Outcomes

| COs            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1            | 3   | 2   | 1   | 1   | 2   | 1   | 2   |
| CO2            | 3   | 2   | 2   | 2   | 2   | 2   | 2   |
| CO3            | 3   | 2   | 1   | 1   | 2   | 2   | 2   |
| CO4            | 3   | 2   | 2   | 1   | 2   | 1   | 3   |
| CO5            | 3   | 1   | 3   | 2   | 2   | 1   | 2   |
| <b>Total</b>   | 15  | 9   | 9   | 7   | 12  | 7   | 11  |
| <b>Average</b> | 3   | 1.8 | 1.8 | 1.4 | 2.4 | 1.4 | 2.2 |

### Mapping with Programme Specific Outcomes

| Cos            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|----------------|------|------|------|------|------|------|------|------|------|-------|
| CO1            | 3    | 3    | 3    | 3    | 3    | 1    | 2    | 2    | 2    | 1     |
| CO2            | 3    | 2    | 3    | 2    | 3    | 2    | 2    | 2    | 2    | 2     |
| CO3            | 2    | 2    | 2    | 1    | 2    | 2    | 1    | 3    | 2    | 1     |
| CO4            | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 3    | 3    | 2     |
| CO5            | 3    | 3    | 2    | 3    | 2    | 2    | 3    | 1    | 3    | 2     |
| <b>Total</b>   | 14   | 13   | 13   | 12   | 13   | 9    | 11   | 11   | 9    | 8     |
| <b>Average</b> | 2.8  | 2.6  | 2.6  | 2.4  | 2.6  | 1.8  | 2.2  | 2.2  | 1.8  | 1.6   |

**S-Strong (3)    M-Medium (2)    L-Low (1)**

**SEMESTER --I**  
**SPECIFIC VALUE ADDED COURSE – ART OF BONSAI**

| Course Code | Credit | Total Hours | Total Marks |
|-------------|--------|-------------|-------------|
| BU231V01    | 1      | 30          | 100         |

**Pre-requisites:**

Students should be familiar with growing plants.

**Learning Objectives**

1. Practitioners learn to appreciate the value of patience and the rewards it can bring when applied consistently, a lesson that can be valuable in various aspects of life.
2. Bonsai involves shaping and styling trees in aesthetically pleasing ways, allowing practitioners to express their creativity and artistic vision.

**Course Outcomes**

| <b>On the successful completion of the course, student will be able to:</b> |  |                    |
|---|--|--------------------|
| 1.  | develop the ability to analyze various tree species and create balanced and aesthetically pleasing bonsai designs.   | <b>K5</b>          |
| 2.  | will acquire hands-on skills in techniques such as pruning, wiring, and repotting.   | <b>K1 &amp; K4</b> |
| 3.  | maintain the health and vitality of their bonsai trees.  | <b>K2</b>          |
| 4.  | appreciate the philosophy behind bonsai and how it reflects harmony with nature and the passage of time.   | <b>K5</b>          |
| 5.  | compose different styling techniques, including branch placement, trunk positioning, and foliage arrangement, enabling them to create captivating bonsai compositions. | <b>K3 &amp; K6</b> |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

| Unit      | Contents   | No. of Hours |
|-----------|--|--------------|
| <b>I</b>  | Overview of Bonsai: History, philosophy, and cultural significance. Principles of Bonsai: Miniaturization, proportion, balance, and harmony. Basic Tools and Materials: Introduction to tools, soil, pots, wire, and other essentials. | <b>6</b>     |
| <b>II</b> | Plant Selection: Types of trees suitable for bonsai, characteristics, and seasonal considerations. Pruning and Shaping: Techniques for   | <b>6</b>     |



|            |   |          |
|------------|---|----------|
|            | shaping branches and foliage, understanding apical dominance. Wiring and Bending: Using wire to guide growth and create desired shapes, avoiding damage. Repotting and Root Pruning: Importance of repotting, timing, and proper techniques.  |          |
| <b>III</b> | Classic Bonsai Styles: Informal upright, formal upright, slanting, cascade, semi-cascade, and more. Elements of Design: Emphasis, balance, contrast, rhythm, and unity in bonsai composition. Pot Selection: Matching pots to tree styles, understanding pot aesthetics and sizes.  | <b>6</b> |
| <b>IV</b>  | Watering and Fertilizing: Proper watering techniques and balanced nutrition for bonsai health. Pest and Disease Management: Identifying common issues and preventive measures. Seasonal Care: Adjusting care routines for different seasons, winter protection. Display and Presentation: Creating captivating displays for different occasions and settings.             | <b>6</b> |
| <b>V</b>   | Air Layering and Grafting: Advanced propagation techniques to create unique bonsai. Deadwood Techniques: Carving and preserving deadwood features for artistic effect. Creating Miniature Landscapes (Saikei): Combining multiple trees and elements to tell a story. Bonsai Exhibition and Judging: Preparing bonsai for exhibitions, understanding evaluation criteria. | <b>6</b> |

**Text Books:**

1. Kawasumi, M. (2012). *The Secret Techniques of Bonsai: A Guide to Starting, Raising, and Shaping Bonsai*. Kodansha International, Tokyo, Japan.
2. Lewis, C. (1997). *Bonsai Survival Manual: Tree-by-Tree Guide to Buying, Maintaining, and Problem Solving*. Cassell, UK.
3. Prescott, D. (2009). *The Bonsai Handbook*. Firefly Books, Canada.

**References Books:**

1. Chan, P. (2019). *The Bonsai Bible: The Definitive Guide to Choosing and Growing Bonsai*. Octopus Publishing Group, UK.
2. Tomlinson, H. (2004). *The Complete Book of Bonsai: A Practical Guide to its Art and Cultivation*. Dorling Kindersley, New York, USA.
3. Gustafson, H. L. (1994). *The Bonsai Workshop*. Timber Press, USA
4. Naka, J. Y. (1984). *Bonsai Techniques I & II*. Bonsai Institute of California, USA
5. Koreshoff, D. R. (2007). *Bonsai: Its Art, Science, History, and Philosophy*. Tuttle Publishing, Vermont, USA.

**Web Resources:**

- <https://www.bonsaicare.com/care-guide>  
<https://www.absbonsai.org/history-of-bonsai/>  
<https://www.bonsaiworld.com/bonsai-techniques/>  
<https://www.bonsaienthusiastsblog.com/beginners-guide-to-getting-started-with-bonsai-trees/>

**SEMESTER --II**  
**CORE COURSE II: PLANT DIVERSITY II: FUNGI, BACTERIA, VIRUSES,**  
**PLANT**  
**PATHOLOGY AND LICHENS**

| Course Code | L | T | P | S | Credits | Inst. Hours | Total Hours | Marks |          |       |
|-------------|---|---|---|---|---------|-------------|-------------|-------|----------|-------|
|             |   |   |   |   |         |             |             | CIA   | External | Total |
| BU232CC1    | 3 | 2 | - | - | 5       | 5           | 75          | 25    | 75       | 100   |

**Pre-requisites:**

Students should be familiar with the basics of fungi, bacteria, viruses and lichens.

**Learning Objectives**

1. To describe the common characteristics of fungi, bacteria and viruses and to identify the main groups of plant pathogens, plant diseases and their symptoms.
2. To understand lichen structure, function, identification, and ecology; Comprehend the events of symbiosis and lichenization and to demonstrate the use of lichens as bioindicator species.

**Course Outcomes**

| <b>On the successful completion of the course, student will be able to:</b> |  |                    |
|---|--|--------------------|
| 1.  | recognize the general characteristics of microbes, fungi and lichens and disease symptoms.   | <b>K1</b>          |
| 2.  | develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies based on structural organization. | <b>K2 &amp;K1</b>  |
| 3.  | identify the common plant diseases, according to geographical locations and devise control measures.                               | <b>K3 &amp; K4</b> |
| 4.  | analyze the emerging trends in fungal biotechnology with special reference to agricultural and pharmaceutical applications.        | <b>K4</b>          |
| 5.  | determine the economic importance of microbes, fungi and lichens.  | <b>K2</b>          |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze

| <b>Unit</b> | <b>Contents</b>   | <b>No. of Hours</b> |
|-------------|---|---------------------|
| <b>I</b>    | <b>FUNGI</b><br>Classification of fungi - (Alexopoulos and Mims, 1979), criteria for classification, Characteristic features, thallus organization, mode of nutrition, structure, reproduction and life-history of classes, each with one suitable example: Zygomycotina ( <i>Mucor</i> ), Ascomycotina ( <i>Saccharomyces</i> ), Basidiomycotina ( <i>Agaricus</i> ) and Deuteromycotina ( <i>Alternaria</i> ). Importance of mycorrhizal association. | <b>15</b>           |

|            |  |           |
|------------|--|-----------|
| <b>II</b>  | <b>ECONOMIC IMPORTANCE OF FUNGI:</b><br>Cultivation of mushroom – <i>Pleurotus</i> (food). Fungi in agriculture application (biofertilizers): Mycotoxins (biopesticides), Production of industrially important products from fungi- alcohol (ethanol), organic acids (citric acid), enzymes (protease). Vitamins (Vitamin B-complex and Vitamin B-12), applications of fungi in pharmaceutical products (Penicillin). Importance of VAM fungi. Harmful effects of Fungi. Agriculture (Biofertilizers); Mycotoxins  | <b>15</b> |
| <b>III</b> | <b>BACTERIA, VIRUS:</b> Classification (Bergey's, 1994), structure and reproduction of bacteria- vegetative (budding, fragmentation and binary fission), sexual (transduction, transformation and conjugation) and asexual (endospore, conidia and zoospore), Mycoplasma, Virology -Viruses general characters, structure and reproduction (lytic and lysogenic cycle).  | <b>15</b> |
| <b>IV</b>  | <b>PLANT PATHOLOGY:</b> General symptoms of plant diseases; Geographical distribution of diseases; Etiology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of the following plant diseases. General characters of Bacteria and Viruses.<br><b>Bacterial diseases</b> – Citrus canker and Bacterial wilt of Banana<br><b>Viral diseases</b> – Tobacco Mosaic and Vein clearing of Papaya<br><b>Fungal diseases</b> – Blast disease in rice and Tikka disease  | <b>15</b> |
| <b>V</b>   | <b>LICHEN:</b> Classification (Hale, 1969). Habitat, nature of association, Structure, Nature of Mycobionts and Phycobionts, Study of growth forms of lichens (crustose, foliose and fruticose), types, distribution, thallus organization, reproduction and ecological significance of lichens with special reference to Usnea.<br>Economic importance of Lichens: food, fodder and nutrition, flavor, tanning and dyeing, cosmetics and perfumes, Brewing and distillation, minerals, Natural products, medicine (Ayurvedic, Siddha), pharmaceutical products, biodegradation agent, air pollution and biomonitoring, soil formation, nitrogen fixation, Harmful aspects, poison from lichens. | <b>15</b> |

|                   |   |
|-------------------|---|
| <b>Self-study</b> | Harmful effects of fungi, General characters of virus |
|-------------------|---|

**Text Books:**

1. Pandey, B.P. 2019. College Botany. Fungi & Pathology. Vol. I. S. Chand Publishers, New Delhi.
2. Mehrotra, R.S and Aneja, K.R. 2023. An introduction to Mycology. New Age International (P) Ltd, Publishers, New Delhi.
3. Satyanarayana T and Johri B.N. 2021. Microbial diversity, Current Perspectives and Potential Applications. IK International, New Delhi.
4. Nair, L.N. 2007. Topics in Mycology and Pathology. New Central Book Agency, Kolkata.
5. Sharma, P.D. 2016. Plant Pathology. Rastogi Publication, Meerut.
6. Mahendra Rai. 2013. Advances in Fungal Biotechnology. I.K. International Publishing House, New Delhi.

**References Books:**

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 2007. Introductory Mycology. (Fourth Edition).

John Wiley & Sons, Singapore.

2. Webster, J and Weber, R. 2007. Introduction to Fungi. (Third Edition). Cambridge University Press, London.
3. Sharma, O.P. 2017. Fungi and Allied microbes. The McGraw –Hill companies, New Delhi.
4. Burnett, J.H. 1976. The fundamentals of Mycology. ELBS Publication, London.
5. Bessey, E.A. 2015. Morphology and Taxonomy of Fungi. Vikas Publishing House Pvt. Ltd., New Delhi.
6. Dharani Dhar Awasthi. 2000. A Handbook of Lichens. Vedams eBooks (P) Ltd., New Delhi.
7. Pelzer, M.J., Chan, E.C.S and Krieg, N.R. 1985. Microbiology. Tata McGraw Hill Publishing House, New Delhi.
8. Pandey, P.B. 2014. College Botany- 1: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand Publishing, New Delhi.

**Web Resources:**

1. <https://www.amazon.in/Fungi-Sarah-C-Watkinson-ebook/dp/B0199YFDDE>
2. <http://www.freebookcentre.net/biology-books-download/A-text-book-of-mycology-and-plant-pathology.html>
3. <http://www.freebookcentre.net/Biology/Mycology-Books.html>
4. <https://www.kobo.com/us/en/ebook/introduction-to-fungi>
5. <http://www.freebookcentre.net/biology-books-download/Introductory-Mycology.html>
6. [http://www.freebookcentre.net/biology-books-download/Fungi-\(PDF-15P\).html](http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html)

**MAPPING WITH PROGRAMME OUTCOMES**

| COs            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1            | 3   | 2   | 2   | 1   | 2   | 1   | 2   |
| CO 2           | 2   | 3   | 2   | 2   | 3   | 2   | 1   |
| CO 3           | 3   | 3   | 3   | 1   | 2   | 1   | 2   |
| CO 4           | 3   | 2   | 3   | 2   | 3   | 1   | 2   |
| CO 5           | 3   | 3   | 2   | 1   | 2   | 2   | 2   |
| <b>Total</b>   | 14  | 13  | 12  | 7   | 12  | 7   | 9   |
| <b>Average</b> | 2.8 | 2.6 | 2.4 | 1.4 | 2.4 | 1.4 | 1.8 |

**MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

| COs            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|----------------|------|------|------|------|------|------|------|------|------|-------|
| CO1            | 3    | 3    | 2    | 1    | 1    | 2    | 1    | 2    | 1    | 2     |
| CO 2           | 2    | 3    | 2    | 2    | 1    | 1    | 1    | 2    | 1    | 2     |
| CO 3           | 2    | 2    | 1    | 1    | 1    | 1    | 2    | 1    | 2    | 2     |
| CO 4           | 3    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2     |
| CO 5           | 3    | 2    | 2    | 2    | 2    | 2    | 1    | 2    | 1    | 1     |
| <b>Total</b>   | 13   | 12   | 9    | 8    | 7    | 8    | 7    | 9    | 7    | 9     |
| <b>Average</b> | 2.6  | 2.4  | 1.8  | 1.6  | 1.4  | 1.6  | 1.4  | 1.8  | 1.4  | 1.8   |

**S-Strong (3)**

**M-Medium (2)**

**L-Low(1)**

**SEMESTER --II**  
**CORE LAB COURSE II: PLANT DIVERSITY II: FUNGI, BACTERIA, VIRUSES,**  
**PLANT PATHOLOGY AND LICHENS - PRACTICAL-II**

| Course Code | L | T | P | S | Credits | Inst. Hours | Total Hours | Marks    |          |       |
|-------------|---|---|---|---|---------|-------------|-------------|----------|----------|-------|
|             |   |   |   |   |         |             |             | Internal | External | Total |
| BU232CP1    | 1 | - | 2 | - | 3       | 3           | 45          | 25       | 75       | 100   |

**Pre-requisites:** Students should be familiar with the basics of fungi, bacteria, viruses and lichens

**Learning Outcomes**

1. To enable students to identify microscopic and macroscopic fungi and to prepare microslides of fungi and lichens.
2. To know the presence of pathogen inside the plant tissues through microscopic sections.

**Course Outcomes**

| On the successful completion of the course, student will be able to: |  |                    |
|--|--|--------------------|
| 1.   | identify microbes, fungi and lichens using key identifying characters        | <b>K1 &amp; K4</b> |
| 2.   | develop practical skills for culturing and cultivation of fungi.             | <b>K3</b>          |
| 3.   | identify and select suitable control measures for the common plant diseases. | <b>K1</b>          |
| 4.   | analyze the characteristics of microbes, fungi and plant pathogens           | <b>K2 &amp; K4</b> |
| 5.   | access the useful role of fungi in agriculture and pharmaceutical industry.  | <b>K2</b>          |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** – Analyze

| <b>EXPERIMENTS</b>   | <b>No. of Hours</b> |
|--|---------------------|
| <p><b>EXPERIMENTS</b></p> <ol style="list-style-type: none"> <li>1. Microscopic observation of vegetative and reproductive structures of types prescribed in the syllabus through temporary preparations and permanent slides.</li> <li>2. Identifying the micro slides relevant to the syllabus.</li> <li>3. Herbarium specimens of bacterial diseases/photograph.</li> <li>3. Protocol for mushroom cultivation.</li> <li>4. Inoculation techniques for fungal culture (Demonstration only).</li> <li>5. Study of economically important products obtained from fungi: Fungal biofertilizers, biopesticides, biofungicide (<i>Trichoderma</i>), edible mushroom/Yeast, organic acids (citric acid) enzymes (protease), antibiotics and vitamins.</li> <li>6. Mycorrhiza: ecto-mycorrhiza and endo-mycorrhiza (Photographs)</li> <li>7. Visit to fungal biotechnology laboratories.</li> <li>8. Ultra structure of bacteria.</li> <li>9. Structure of bacteriophage.</li> <li>10. Micro-preparation of <i>Usnea</i> to study vegetative and reproductive structures.</li> </ol> | 45                  |

|  |  |
|--|--|
| 11. Identifying the micro slides relevant to the syllabus.<br>12. Study of thallus and reproductive structures (apothecium) through permanent slides.<br>13. Economic importance of Lichens - Dye and perfume. |  |
|--|--|

**Text Books:**

1. Chmielewski, J.G and Krayesky, D. 2013. General Botany laboratory Manual. Author House, Bloomington, USA.
2. Das, S and Saha, R. 2020. Microbiology Practical Manual. CBS Publishers and Distributors (P) Ltd., New Delhi.
3. Webster, J and Weber, R. 2012. Introduction to Fungi. (Third Edition). Cambridge University Press, Cambridge.
4. Nair, L.N. 2007. Topics in Mycology and Pathology. New Central Book Agency, Kolkata.

**References Books:**

1. Alexopoulos, J and Mims, W. 2007. Introductory Mycology. Wiley Eastern Limited, New Delhi.
2. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany -1.(Tenth Edition). Rastogi Publications, Meerut.
3. Singh, R and U.C. Singh 2020. Modern mushroom cultivation. (Third Edition) Agrobios, Jodhpur.
4. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer, New Delhi.
5. Satyanarayana T and Johri B.N. 2023. Microbial diversity, Current Perspectives and Potential Applications. IK International, New Delhi.

**Web Resources:**

1. <https://www.amazon.in/Practical-Manual-Fungi-Fungicides/dp/B0025AEFP4>
2. [https://books.google.co.in/books/about/Practical\\_Mycology.html?id=5ycJAQAAMAAJ&redir\\_esc=y](https://books.google.co.in/books/about/Practical_Mycology.html?id=5ycJAQAAMAAJ&redir_esc=y)
3. <https://www.flipkart.com/colour-handbook-practical-plant-pathology/p/itmefsn6dyhfhs9b>
4. [https://books.google.co.in/books/about/Practical\\_Botany.html?id=T5narQEACAAJ&redir\\_esc=y](https://books.google.co.in/books/about/Practical_Botany.html?id=T5narQEACAAJ&redir_esc=y)
5. <https://www.kobo.com/us/en/ebook/introduction-to-fungi>

**MAPPING WITH PROGRAMME OUTCOMES**

| COs            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1            | 3   | 3   | 3   | 1   | 2   | 1   | 2   |
| CO 2           | 3   | 2   | 2   | 2   | 2   | 1   | 1   |
| CO 3           | 3   | 3   | 2   | 1   | 2   | 2   | 2   |
| CO 4           | 3   | 2   | 2   | 1   | 2   | 1   | 2   |
| CO 5           | 3   | 2   | 2   | 2   | 2   | 2   | 2   |
| <b>Total</b>   | 15  | 12  | 11  | 7   | 10  | 7   | 9   |
| <b>Average</b> | 3   | 2.4 | 2.2 | 1.4 | 2.0 | 1.4 | 1.8 |

**MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

| <b>COs</b>     | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> | <b>PSO6</b> | <b>PSO7</b> | <b>PSO8</b> | <b>PSO9</b> | <b>PSO10</b> |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| <b>CO1</b>     | 3           | 3           | 2           | 2           | 2           | 1           | 1           | 1           | 2           | 2            |
| <b>CO 2</b>    | 2           | 2           | 2           | 1           | 2           | 1           | 1           | 1           | 2           | 2            |
| <b>CO 3</b>    | 3           | 3           | 1           | 1           | 2           | 2           | 2           | 1           | 1           | 1            |
| <b>CO 4</b>    | 3           | 3           | 2           | 1           | 2           | 2           | 2           | 2           | 2           | 2            |
| <b>CO 5</b>    | 2           | 3           | 2           | 2           | 2           | 1           | 2           | 2           | 2           | 2            |
| <b>Total</b>   | 13          | 14          | 9           | 7           | 10          | 7           | 8           | 7           | 9           | 9            |
| <b>Average</b> | 2.6         | 2.8         | 1.8         | 1.4         | 2.0         | 1.4         | 1.6         | 1.4         | 1.8         | 1.8          |

**S-Strong (3)      M-Medium (2)      L-Low (1)**

**SEMESTER – II**  
**ELECTIVE COURSE II: ALLIED BOTANY - II**

| Course Code | L | T | P | S | Credits | Total Hours | Marks |          |       |
|-------------|---|---|---|---|---------|-------------|-------|----------|-------|
|             |   |   |   |   |         |             | CIA   | External | Total |
| BU232EC1    | 4 | - | - | - | 3       | 60          | 25    | 75       | 100   |

**Pre-requisites:** To study the basics of botany.

**Learning Objectives**

- To gain a solid grasp of plant systematics, acknowledging the pivotal role of plant anatomy in production systems, and comprehending the shift from vegetative to reproductive phases.
- To acquire knowledge in the physiological processes governing plant metabolism, energy production, and utilization.

**Course Outcomes**

| On the successful completion of the course, student will be able to: |   |           |
|--|---|-----------|
| 1  | understand the fundamental concepts of plant anatomy and embryology.                        | <b>K2</b> |
| 2  | analyze and recognize the different organs of plants and secondary growth.                  | <b>K4</b> |
| 3  | understand water relation of plants with respect to various physiological processes.        | <b>K2</b> |
| 4  | to know about the fundamental concepts of aerobic and anaerobic respiration.                | <b>K1</b> |
| 5  | classify plant systematics and recognize the importance of herbarium and virtual herbarium. | <b>K3</b> |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze

| Unit       | Contents  | No. of Hours |
|------------|---|--------------|
| <b>I</b>   | Morphology of Flowering Plants:<br>Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description. | <b>12</b>    |
| <b>II</b>  | Taxonomy:<br>Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae   | <b>12</b>    |
| <b>III</b> | Anatomy:<br>Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.   | <b>12</b>    |



|           |  |           |
|-----------|--|-----------|
| <b>IV</b> | Embryology:<br>Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.                                   | <b>12</b> |
| <b>V</b>  | Plant Physiology:<br>Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinin and their applications. | <b>12</b> |

|                   |  |
|-------------------|--|
| <b>Self-study</b> | Economic importance of families prescribed in the syllabus |
|-------------------|--|

### Recommended Texts:

1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition). The McGraw Hill Companies, New Delhi.
2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.
4. Salisbury, F. B.C.W. Ross.2001. Plant Physiology. Wass worth Pub. Co., Belmont, USA
5. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb., Philippines.

### References Books:

1. Lawrence. G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Pandey, B.P. 2012. Plant Anatomy, S. Chand & Co., New Delhi.
4. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand & Co., New Delhi.
5. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future, Vedams (P) Ltd. New Delhi.
6. Jain, V.K. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd., New Delhi.
7. Verma, S.K. 2006. A Textbook of Plant Physiology, S. Chand & Co., New Delhi.

### Web Resources:

1. [https://books.google.co.in/books/about/Plant\\_Taxonomy.html?id=0bYs8F0Mb9gC&redir\\_esc=y](https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_esc=y)
2. [https://books.google.co.in/books/about/PLANT\\_TAXONOMY\\_2E.html?id=Roi0lwSXFnuUC&redir\\_esc=y](https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnuUC&redir_esc=y)
3. <https://archive.org/EXPERIMENTS/plantanatomy031773mbp>
4. <https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG>
5. <https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692>

## MAPPING WITH PROGRAMME OUTCOMES

| <b>COs</b>     | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> |
|----------------|------------|------------|------------|------------|------------|------------|------------|
| <b>CO 1</b>    | 3          | 2          | 1          | 2          | 2          | 1          | 2          |
| <b>CO 2</b>    | 3          | 2          | 2          | 1          | 2          | 2          | 1          |
| <b>CO 3</b>    | 3          | 3          | 2          | 2          | 2          | 2          | 1          |
| <b>CO 4</b>    | 3          | 1          | 3          | 2          | 2          | 2          | 2          |
| <b>CO 5</b>    | 3          | 2          | 2          | 2          | 2          | 2          | 2          |
| <b>Total</b>   | 15         | 10         | 10         | 9          | 10         | 9          | 8          |
| <b>Average</b> | 3          | 2          | 2          | 1.8        | 2          | 1.8        | 1.6        |

### **MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

| <b>COs</b>     | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> | <b>PSO6</b> | <b>PSO7</b> | <b>PSO8</b> | <b>PSO9</b> | <b>PSO10</b> |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| <b>CO1</b>     | 2           | 3           | 3           | 2           | 2           | 1           | 2           | 2           | 2           | 3            |
| <b>CO 2</b>    | 3           | 2           | 3           | 3           | 2           | 2           | 2           | 2           | 2           | 3            |
| <b>CO 3</b>    | 3           | 3           | 3           | 3           | 2           | 2           | 2           | 3           | 3           | 3            |
| <b>CO 4</b>    | 3           | 3           | 3           | 2           | 2           | 2           | 2           | 2           | 3           | 2            |
| <b>CO 5</b>    | 3           | 3           | 3           | 3           | 3           | 3           | 3           | 2           | 2           | 2            |
| <b>Total</b>   | 14          | 14          | 15          | 13          | 11          | 10          | 11          | 11          | 12          | 13           |
| <b>Average</b> | 2.8         | 2.8         | 3           | 2.6         | 2.2         | 2           | 2.2         | 2.2         | 2.4         | 2.6          |

**S-Strong (3)    M-Medium (2)    L-Low (1)**

## SEMESTER – II

### ELECTIVE LAB COURSE II: ALLIED BOTANY PRACTICAL

| Course Code     | L | T | P        | S | Credits  | Inst. Hours | Total Hours | Marks     |           |            |
|-----------------|---|---|----------|---|----------|-------------|-------------|-----------|-----------|------------|
|                 |   |   |          |   |          |             |             | CIA       | External  | Total      |
| <b>BU232EP1</b> | - | - | <b>2</b> | - | <b>2</b> | <b>2</b>    | <b>30</b>   | <b>25</b> | <b>75</b> | <b>100</b> |

**Prerequisites:** Practical pertaining to above subjects is important to get knowledge on various aspects of plants.

#### Learning Outcomes

1. To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.
2. To Understand the laws of inheritance, genetic basis of loci and alleles.

#### Course Outcomes

| <b>On the successful completion of the course, student will be able to:</b> |  |           |
|---|--|-----------|
| <b>1.</b>   | study the internal organization of algae and fungi.  | <b>K2</b> |
| <b>2.</b>   | develop critical understanding on morphology, anatomy and reproduction of bryophytes, pteridophytes and gymnosperms. | <b>K4</b> |
| <b>3.</b>   | study the classical taxonomy with reference to different parameters.   | <b>K1</b> |
| <b>4.</b>   | understand the fundamental concepts of plant anatomy and embryology  | <b>K2</b> |
| <b>5.</b>   | study the effect of various physical factors on photosynthesis.  | <b>K2</b> |

**K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze**

|  | <b>Contents</b>   | <b>No. of Hours</b> |
|--|---|---------------------|
|  | <b>EXPERIMENTS</b>  |                     |
|  | <ol style="list-style-type: none"> <li>1. To describe in technical terms, plants belonging to all the families prescribed in the syllabus and to identify the plants to their family.</li> <li>2. To dissect a flower, construct floral diagram and write floral formula.</li> <li>3. Demonstration experiments               <ol style="list-style-type: none"> <li>1. Ganong's Light screen</li> <li>2. Ganong's Respiroscope</li> </ol> </li> <li>4. To make suitable micro preparations of anatomy materials prescribed in the syllabus.</li> </ol> | <b>30</b>           |

|  |   |  |
|--|---|--|
|  | 5. Spotters – Angiosperm, Anatomy and Embryology. |  |
|--|---|--|

**Textbooks:**

1. Sharma, O.P. 2017. Bryophyta. MacMillan India Ltd, New Delhi.
2. Sharma, O.P. 2012. Pteridophyta. Tata McGraw-Hills Ltd., New Delhi.
3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, England.
5. Noggle, G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

**Reference Books:**

1. Strickberger, M.W. 2005. Genetics (Third Edition). Prentice Hall, New Delhi.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide. Ottawa Agriculture and Agri food Canada Publisher, Canada.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing, New Delhi.
4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & Wiley Publications, London.
5. Steward, F.C. 2012. Plant Physiology. US Academic Press, United States.

**Web Resources:**

1. <https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883>
2. <https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover>
3. <https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ>
4. <https://medlineplus.gov/genetocs/understanding/basics/cell/>
5. <https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf>
6. [http://www.cuteri.eu/microbiologia/manuale\\_microbiologia\\_pratica.pdf](http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf)
7. <https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4>

**MAPPING WITH PROGRAMME OUTCOMES**

| Cos            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| <b>CO1</b>     | 3   | 3   | 2   | 2   | 2   | 1   | 2   |
| <b>CO2</b>     | 3   | 2   | 2   | 2   | 3   | 2   | 2   |
| <b>CO3</b>     | 3   | 3   | 3   | 2   | 2   | 1   | 2   |
| <b>CO4</b>     | 3   | 2   | 2   | 3   | 3   | 1   | 2   |
| <b>CO5</b>     | 3   | 3   | 2   | 2   | 3   | 2   | 3   |
| <b>Total</b>   | 15  | 13  | 11  | 11  | 13  | 7   | 11  |
| <b>Average</b> | 3   | 2.6 | 1.1 | 2.2 | 2.6 | 1.4 | 2.2 |

## MAPPING WITH PROGRAMME SPECIFIC OUTCOMES

| COs            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|----------------|------|------|------|------|------|------|------|------|------|-------|
| <b>CO1</b>     | 3    | 2    | 2    | 2    | 1    | 2    | 1    | 1    | 2    | 2     |
| <b>CO 2</b>    | 2    | 3    | 2    | 1    | 1    | 1    | 1    | 2    | 1    | 2     |
| <b>CO 3</b>    | 3    | 3    | 1    | 1    | 2    | 2    | 2    | 1    | 2    | 1     |
| <b>CO 4</b>    | 3    | 2    | 2    | 2    | 1    | 2    | 2    | 2    | 2    | 2     |
| <b>CO 5</b>    | 3    | 3    | 3    | 2    | 2    | 1    | 2    | 2    | 1    | 2     |
| <b>Total</b>   | 14   | 13   | 10   | 8    | 7    | 8    | 8    | 6    | 8    | 7     |
| <b>Average</b> | 2.8  | 2.6  | 2.0  | 1.6  | 1.4  | 1.6  | 1.6  | 1.2  | 1.6  | 1.4   |

**S-Strong (3)**

**M-Medium (2)**

**L-Low (1)**

## SEMESTER –II

### NON-MAJOR ELECTIVE NME II: MUSHROOM CULTIVATION

| Course Code | L | T | P | S | Credits | Inst. Hours | Total Hours | Marks |          |       |
|-------------|---|---|---|---|---------|-------------|-------------|-------|----------|-------|
|             |   |   |   |   |         |             |             | CIA   | External | Total |
| BU232NM1    | 2 | - | - | - | 2       | 2           | 30          | 25    | 75       | 100   |

#### Pre-requisites:

Basic knowledge on structure and function of various groups of mushrooms.

#### Learning Objectives

1. To learn and develop skills in mushroom cultivation and harvest technology.
2. To understand and appreciate the role of mushrooms in nutrition, medicine and health.

#### Course Outcomes

| On the successful completion of the course, student will be able to: |  |    |
|--|--|----|
| 1.   | recall various types and categories of mushroom.   | K1 |
| 2.   | explain about various types of food technologies associated with mushroom industry.                    | K2 |
| 3.   | apply techniques studied for cultivation of various types of mushrooms.                                | K3 |
| 4.   | analyze and decipher the environmental factors and economic value associated with mushroom cultivation | K4 |
| 5.   | develop new methods and strategies to contribute to mushroom production.                               | K3 |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze

| Unit       | Contents  | No. of Hours |
|------------|---|--------------|
| <b>I</b>   | Introduction: Morphology, Types of Mushrooms, identification of edible and poisonous mushroom, Nutritive values, life cycle of common edible mushrooms. | <b>6</b>     |
| <b>II</b>  | Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale Industry.  | <b>6</b>     |
| <b>III</b> | Life cycle of <i>Pleurotus</i> spp and <i>Agaricus</i> spp.   | <b>6</b>     |
| <b>IV</b>  | Spawn production, growth media, spawn running and harvesting of mushrooms and marketing.  | <b>6</b>     |
| <b>V</b>   | Diseases and post harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases.                         | <b>6</b>     |

|                   |   |
|-------------------|---|
| <b>Self-study</b> | Nutritive value of common edible mushrooms. |
|-------------------|---|

#### Text Books:

1. Gogoi, R, Rathaiah, Y and Borah, T. R. 2019. Mushroom cultivation technology. Scientific Publishers, India.
2. Suman, B. C, and Sharma, V. P. 2007. Mushroom cultivation in India. Daya Books, India.
3. Swaminathan, M. 2018. Food and Nutrition. The Bangalore Printing and Publishing Co. Ltd., Bangalore.

4. Reethi Singh and Singh, U.C. 2005. Modern Mushroom Cultivation. International Book Distributors, Dehradun.
5. Prasad Prem Kumar and Sahu Verma. 2013. Mushroom: Edible and medicinal: Cultivation conservation, strain improvement with their marketing. Daya Publishing House, New Delhi.

#### References Books:

1. Beetz A. E and Greer L. 2004. Mushroom cultivation and marketing. ATTRA publication, United States.
2. Marimuthu, T. Krishnamoorthy, A. S. Sivaprakasam, K. and Jayarajan, R. 1991. Oyster Mushrooms. Tamil Nadu Agricultural University, Coimbatore:
3. Miles, P. G and Chang, S. T. 2004. Mushrooms: cultivation, nutritional value, medicinal effect, and environmental impact. CRC press, United States.
4. Nita Bahl. 2002. Handbook on Mushroom. (Fourth Edition). Vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi.
5. Suman, B.C and Sharma, V.P. 2005. Mushroom Cultivation Processing and Uses M/s. IBD Publishers and Distributors, New Delhi.

#### Web Resources:

1. <https://www.amazon.in/Mushroom-Cultivation-India-B-C/dp/817035479X>
2. <http://nrcmushroom.org/book-cultivation-merged.pdf>
3. [http://agricoop.nic.in/sites/default/files/ICAR\\_8.pdf](http://agricoop.nic.in/sites/default/files/ICAR_8.pdf)
4. <http://www.agrimoon.com/mushroom-culture-horticulture-icar-pdf-book/>
5. [https://books.google.co.in/books/about/Mushroom\\_Cultivation\\_in\\_India.html?id=6AJx99O-GTKEC&redir\\_esc=y](https://books.google.co.in/books/about/Mushroom_Cultivation_in_India.html?id=6AJx99O-GTKEC&redir_esc=y)

### MAPPING WITH PROGRAMME OUTCOMES

| COs            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1            | 3   | 3   | 3   | 3   | 2   | 1   | 2   |
| CO 2           | 3   | 3   | 2   | 2   | 1   | 3   | 2   |
| CO 3           | 2   | 3   | 2   | 3   | 1   | 2   | 2   |
| CO 4           | 3   | 3   | 3   | 3   | 1   | 2   | 3   |
| CO 5           | 3   | 3   | 2   | 3   | 2   | 3   | 2   |
| <b>Total</b>   | 14  | 15  | 12  | 14  | 7   | 11  | 11  |
| <b>Average</b> | 2.8 | 3   | 2.4 | 2.8 | 1.4 | 2.2 | 2.2 |

#### Mapping with Programme Specific Outcomes

| COs            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|----------------|------|------|------|------|------|------|------|------|------|-------|
| CO1            | 3    | 2    | 2    | 2    | 3    | 3    | 1    | 2    | 1    | 1     |
| CO 2           | 3    | 3    | 2    | 2    | 3    | 3    | 2    | 2    | 1    | 3     |
| CO 3           | 3    | 3    | 2    | 2    | 3    | 3    | 3    | 2    | 1    | 2     |
| CO 4           | 3    | 3    | 3    | 3    | 3    | 3    | 2    | 1    | 1    | 3     |
| CO 5           | 3    | 3    | 3    | 2    | 3    | 3    | 2    | 1    | 1    | 3     |
| <b>Total</b>   | 15   | 14   | 12   | 11   | 15   | 15   | 10   | 8    | 5    | 12    |
| <b>Average</b> | 3    | 2.8  | 2.4  | 2.2  | 3    | 3    | 2    | 1.6  | 1    | 2.4   |

**S-Strong (3) M-Medium (2) L-Low (1)**

**SEMESTER -II**  
**SKILL ENHANCEMENT COURSE SEC I:**  
**BOTANICAL GARDEN AND LANDSCAPING**

| Course Code | L | T | P | S | Credits | Inst. Hours | Total Hours | Marks |          |       |
|-------------|---|---|---|---|---------|-------------|-------------|-------|----------|-------|
|             |   |   |   |   |         |             |             | CIA   | External | Total |
| BU232SE1    | 2 | - | - | - | 2       | 2           | 30          | 25    | 75       | 100   |

**Pre-requisites:** Students should know about the fundamental concepts of gardening and landscaping.

**Learning Objectives**

1. To know about the fundamental concepts of gardening and landscaping.
2. To inculcate entrepreneurial skills in students for creative landscaping design using CAD software.

**Course Outcomes**

| On the successful completion of the course, student will be able to: |  |                    |
|--|--|--------------------|
| 1.   | to know about the fundamental concepts of gardening and landscaping  | <b>K1</b>          |
| 2.   | to provide an overview of various gardening styles and its scope in recreation and bio-aesthetic planning. | <b>K2</b>          |
| 3.   | to illustrate the significance of garden adornments and propagation structures.                            | <b>K3 &amp; K6</b> |
| 4.   | to create the design outdoor and indoor gardens and inculcate entrepreneurial skills for landscaping.      | <b>K4</b>          |
| 5.   | to inculcate entrepreneurial skills in students for creative landscaping design using cad software.        | <b>K5 &amp; K6</b> |

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

| Unit       | Contents   | No. of Hours |
|------------|--|--------------|
| <b>I</b>   | Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, Vertical gardens, roof gardens, art of making bonsai. Greenhouse.   | <b>6</b>     |
| <b>II</b>  | Bioaesthetic planning, definition, need, round country planning, urban planning and planting at avenues, railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.                         | <b>6</b>     |
| <b>III</b> | Landscape designs, Styles of garden, formal, informal and free style gardens, Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporate. | <b>6</b>     |
| <b>IV</b>  | Establishment and maintenance - indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.  | <b>6</b>     |
| <b>V</b>   | Computer Aided Designing (CAD) for outdoor and indoor landscaping<br>Exposure to CAD (Computer Aided Designing).   | <b>6</b>     |

|                   |   |
|-------------------|---|
| <b>Self-Study</b> | Establishment and maintenance of gardens. |
|-------------------|---|

**Text Books**

1. Acquaah, J. 2019. Horticulture – principles and practices, (Fourth edition), PHI learning Pvt. Ltd., New Delhi.
2. Rao Manibhushan K. 2005. Textbook of horticulture. Mac Millan India Ltd., Kolkata.
3. Gangulee H. C. and Kar A. K. 2011. College Botany (Volume – II), New Central Book Agency, Kolkata
4. Sharma V. K. 2011. Encyclopedia of Practical Horticulture, (Volume - IV), Deep and Deep



Publ. Pvt. Ltd., New Delhi

5. Singh, J. 2018. Fundamentals of Horticulture. Kalyani Publishers, Chennai.

### References Books

1. Berry, F. and Kress, J. 1991. Heliconia: An Identification Guide. Smithsonian Books, Washington DC.
2. Butts, E. and Stensson, K. 2012. Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd., Canada.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands (Nature Guides).
4. Acquaah, J. 2009. Horticulture – principles and practices, (Fourth Edition), PHI learning Pvt. Ltd., New Delhi.
5. Edment Senn Andrews. 1994. Fundamentals of Horticulture. Tata. McGraw Hill Publishing Co., Ltd., New Delhi.

### Web Resources

1. [https://www.amazon.in/Gardening-Landscape-Design-and-Botanical-Garden/s?rh=n%3A1318122031%2Cp\\_27%3Aand+Botanical+Garden](https://www.amazon.in/Gardening-Landscape-Design-and-Botanical-Garden/s?rh=n%3A1318122031%2Cp_27%3Aand+Botanical+Garden)
2. <https://www.overdrive.com/subjects/gardening>
3. <https://www.scribd.com/book/530538456/Opportunities-in-Landscape-Architecture-Botanical-Gardens-and-Arboreta-Careers>
4. <https://www.scribd.com/book/305542619/Botanic-Gardens>
5. <https://www.overdrive.com/subjects/gardening>

### MAPPING WITH PROGRAMME OUTCOMES

| COs            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1            | 3   | 3   | 3   | 2   | 2   | 1   | 2   |
| CO 2           | 3   | 3   | 3   | 2   | 3   | 3   | 2   |
| CO 3           | 3   | 3   | 3   | 1   | 2   | 2   | 1   |
| CO 4           | 3   | 3   | 3   | 2   | 3   | 2   | 3   |
| CO 5           | 3   | 3   | 3   | 2   | 2   | 3   | 3   |
| <b>Total</b>   | 15  | 15  | 15  | 11  | 12  | 11  | 11  |
| <b>Average</b> | 3   | 3   | 3   | 2.2 | 2.4 | 2.2 | 2.2 |

### MAPPING WITH PROGRAMME SPECIFIC OUTCOMES

| COs            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|----------------|------|------|------|------|------|------|------|------|------|-------|
| CO1            | 3    | 3    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 3     |
| CO 2           | 3    | 3    | 2    | 3    | 3    | 3    | 3    | 2    | 3    | 3     |
| CO 3           | 2    | 3    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 3     |
| CO 4           | 3    | 3    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 3     |
| CO 5           | 3    | 3    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 3     |
| <b>Total</b>   | 15   | 15   | 14   | 15   | 15   | 15   | 15   | 10   | 15   | 11    |
| <b>Average</b> | 3    | 3    | 2.8  | 3    | 3    | 3    | 3    | 2    | 3    | 2.2   |

S-Strong (3)

M-Medium (2)

L-Low (1)

**SEMESTER I & II**  
**Life Skill Training I: Catechism**  
**Course Code: UG232LC1**

| Hours | Credit | Total Hours | Total Marks |
|-------|--------|-------------|-------------|
| 1     | 1      | 30          | 100         |

**Objectives:**

1. To develop human values through value education
2. To understand the significance of humane and values to lead a moral life
3. To make the students realize how values lead to success

| Course Outcome | Upon completion of this course the students will be able to  |
|----------------|--|
| CO-1           | understand the aim and significance of value education       |
| CO-2           | develop individual skills and act confidently in the society |
| CO-3           | learn how to live lovingly through family values             |
| CO-4           | enhance spiritual values through strong faith in God         |
| CO-5           | learn good behaviours through social values                  |

**Unit I**

**Value Education:**

Human Values – Types of Values – Growth – Components – Need and Importance

Bible Reference: Matthew: 5:3-16

**Unit II**

**Individual Values: Esther**

Vanishing Humanity – Components of Humanity – Crisis – Balanced Emotion – Values of Life

Bible Reference: Esther 8:3-6

**Unit III**

**Family Values: Ruth the Moabite**

Respecting Parents – Loving Everyone – Confession – True Love

Bible Reference: Ruth 2:10-13

**Spiritual Values: Hannah**

Faith in God – Wisdom – Spiritual Discipline – Fear in God – Spiritually Good Deeds

Bible Reference: 1 Samuel 1:24-28

**Unit IV**

**Social Values: Deborah**

Good Behaviour – Devotion to Teachers – Save Nature – Positive Thoughts – The Role of Youth in Social Welfare

Bible Reference: Judges 4:4-9

**Unit V**

**Cultural Values: Mary of Bethany**

Traditional Culture – Changing Culture – Food – Dress – Habit – Relationship – Media – The Role of Youth

Bible Reference: Luke 10:38-42

**Text Book**

Humane and Values. Holy Cross College (Autonomous), Nagercoil  
 The Holy Bible

**SEMESTER I & II**  
**Life Skill Training I: Moral**  
**Course Code: UG232LM1**

| Hours | Credit | Total Hours | Total Marks |
|-------|--------|-------------|-------------|
| 1     | 1      | 30          | 100         |

**Objectives:**

4. To develop human values through value education
5. To understand the significance of humane and values to lead a moral life
6. To make the students realize how values lead to success

| Course Outcome | Upon completion of this course the students will be able to  |
|----------------|--|
| CO-1           | understand the aim and significance of value education       |
| CO-2           | develop individual skills and act confidently in the society |
| CO-3           | learn how to live lovingly through family values             |
| CO-4           | enhance spiritual values through strong faith in God         |
| CO-5           | learn good behaviours through social values                  |

**Unit I**

**Value Education:**

Introduction – Limitations – Human Values – Types of Values – Aim of Value Education – Growth – Components – Need and Importance

**Unit II**

**Individual Values:**

Individual Assessment – Vanishing Humanity – Components of Humanity – Crisis – Balanced Emotion – Values of Life

**Unit III**

**Family Values:**

Life Assessment – Respecting Parents – Loving Everyone – Confession – True Love

**Unit IV**

**Spiritual Values:**

Faith in God – Wisdom – Spiritual Discipline – Fear in God – Spiritually Good Deeds

**Unit V**

**Social Values:**

Good Behaviour – Devotion to Teachers – Save Nature – Positive Thoughts – Drug Free Path – The Role of Youth in Social Welfare

**Unit VI**

**Cultural Values:**

Traditional Culture – Changing Culture – Food – Dress – Habit – Relationship – Media – The Role of Youth

**Text Book**

Humane and Values, Holy Cross College (Autonomous), Nagercoil