PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014

REGULATIONS AND CURRICULUM
for
B.Sc. (Hons.) HORTICULTURE DEGREE PROGRAMME
(Effective from 2019-20 batch onwards)

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE
AND RESEARCH INSTITUTE (PAJANCOA&RI)
(A Govt. of Puducherry Institution, Accredited by ICAR, New Delhi and Affiliated to Pondicherry University)
KARAIKAL – 609 603
1. Course for which the consideration is made: B.Sc.(Hons.) Horticulture

2. Aims, Objectives and Programme Outcomes:

- Imparting subject-related knowledge along with developing a connection between practical solutions and theory.
- Encouraging personal growth among students and boosting their self-confidence, which will give them opportunities to be an integral part of the horticulture-industry.
- Making the horticulture-related subjects interesting through scientific and experimental evidence.
- Developing problem-solving skills through practical applications and research.

3. Eligibility Criteria for Admission

a) H.Sc./Equivalent - Academic Stream

A pass in the Higher Secondary Course (10+2) or any other examination recognized as equivalent there to and fulfilling the following requirements.

Eligible subjects of study in the Qualifying Examination

<table>
<thead>
<tr>
<th>10+2 or Intermediate with any of the following three subjects from a recognized Board / University</th>
<th>B.Sc.(Hons.) Horticulture</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Physics, Chemistry, Mathematics, Biology</td>
<td></td>
</tr>
<tr>
<td>b) Physics, Chemistry, Biology / Botany &amp; Zoology</td>
<td></td>
</tr>
<tr>
<td>c) Physics, Chemistry, Agriculture</td>
<td></td>
</tr>
<tr>
<td>d) Physics, Chemistry, Forestry</td>
<td></td>
</tr>
</tbody>
</table>

b) Eligible Minimum Qualifying Marks (U.T. of Puducherry)

| Open competition (OC)/ Open General | 50% aggregate of all the three subjects |
| Other Backward Class (OBC) / Backward Class Muslim (BCM) / Most Backward Class (MBC) / Extreme Backward Class (EBC) / Backward Tribe (BT) / Scheduled Caste (SC) | 40% aggregate of all the three subjects |


c) Eligible Minimum Qualifying Marks (Other State / Other U.T.s)

| Scheduled Caste (SC) / Scheduled Tribe (ST) | 40% aggregate of all the three subjects |
| All Other Communities | 50% aggregate of all the three subjects |
d) Number of Attempts to pass

For the purpose of qualifying examination marks, the maximum number of attempts to pass and maximum number of improvement examination for admission to B.Sc. (Hons.) Horticulture courses are as follows:

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Community</th>
<th>Maximum number of attempts to pass*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Scheduled Castes/ Scheduled Tribes</td>
<td>Three</td>
</tr>
<tr>
<td>2.</td>
<td>All other Communities</td>
<td>Two</td>
</tr>
</tbody>
</table>

* including first appearance

4. Academic year of the course implementation : 2019-20

5. Course Structure :

➢ The system of education followed for B.Sc. (Hons.) Horticulture degree programme is **Semester System** with a duration of four academic years (8 Semesters). The maximum duration permissible for a student shall be 14 consecutive semesters (seven years).

➢ **Credit requirements:** The minimum credit requirement for B.Sc. (Hons.) Horticulture Degree Programme is 183 (including 5 credits of non-gradial courses).

➢ **Maximum credit load:** A student can register a maximum of 25 credits including non-gradial courses during a semester.

### ABSTRACT OF NUMBER OF COURSES AND CREDIT REQUIREMENTS

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>No. of Courses</th>
<th>Theory</th>
<th>Practical</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>I</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>10</td>
<td>14</td>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td>Second</td>
<td>III</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>24</td>
</tr>
<tr>
<td>Third</td>
<td>V</td>
<td>9</td>
<td>14</td>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>VI</td>
<td>9</td>
<td>15</td>
<td>9</td>
<td>24</td>
</tr>
<tr>
<td>Fourth</td>
<td>VII</td>
<td>3</td>
<td>0</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>VIII</td>
<td>2</td>
<td>0</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>66</td>
<td>80</td>
<td>103</td>
<td>183</td>
</tr>
</tbody>
</table>

6. Break up of internal marks / University examinations, as per CBCS University Regulations except for program covered under Statutory Bodies / Councils :

**Distribution of marks**

i. The weightage of marks shall be in the ratio of 50:50 respectively for external and internal examination.

ii. Each course shall carry a maximum of 100 marks. The distribution of marks is indicated below.
7. Learning outcomes (Course outcomes): Enclosed in the Syllabus

8. Syllabus (Course content): Enclosed in the Syllabus

9. Instructional materials: Enclosed in the Syllabus

10. Text books and Reference books: Enclosed in the Syllabus

11. Question paper pattern for all papers:

11.1. Question paper pattern:

i. The question paper pattern for mid-semester (Internal) examination (regular/arrear) is indicated below:

### For course with theory and practical (1+1 or 2+1 courses)

**(30 Marks & 1 hour duration)**

<table>
<thead>
<tr>
<th>Part</th>
<th>Type of question</th>
<th>Number of questions</th>
<th>Number of questions to be answered</th>
<th>Mark per question</th>
<th>Total marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Objective*</td>
<td>40</td>
<td>40</td>
<td>0.5</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>Short answers</td>
<td>6</td>
<td>5</td>
<td>2.0</td>
<td>10</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### For course with only theory (1+0 or 2+0 courses)

**(40 marks & duration 1.5 hours)**

<table>
<thead>
<tr>
<th>Part</th>
<th>Type of question</th>
<th>Number of questions</th>
<th>Number of questions to be answered</th>
<th>Mark per question</th>
<th>Total marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Objective*</td>
<td>40</td>
<td>40</td>
<td>0.5</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>Definitions / Concepts</td>
<td>8</td>
<td>6</td>
<td>1.0</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>Short answers</td>
<td>9</td>
<td>7</td>
<td>2.0</td>
<td>14</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

* Questions should be Fill-up the blanks, Choose the best option, True / False and Match the following type with equal number of questions in each type
ii. The question paper pattern for external theory examination (regular/arrear) is indicated below:

<table>
<thead>
<tr>
<th>Part</th>
<th>Type of question</th>
<th>Number of questions</th>
<th>Number of questions to be answered</th>
<th>Mark per question</th>
<th>Total marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Objective*</td>
<td>40</td>
<td>40</td>
<td>0.5</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>Short answers</td>
<td>6</td>
<td>5</td>
<td>2.0</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>Essay type answers (either or type)</td>
<td>5</td>
<td>5</td>
<td>4.0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>

* Questions should be Fill-up the blanks, Choose the best option, True / False and Match the following type with equal number of questions in each type.

iii. For conducting practical examinations, the type and number of questions can be decided by the concerned internal and external examiners. Choice may be given to the extent of 20% under subjective type questions.

11.2 Evaluation of Final Practical Examination: For courses with theory and practical, the following distribution of marks shall be adopted in conducting the final practical examinations. The assignment marks shall be added to practical marks.

<table>
<thead>
<tr>
<th>Part</th>
<th>Mid-semester (1 ½ hrs.)</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical Field work / Lab Work / Written exam</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>Continuous evaluation and record</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Viva Voce</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15.0</strong></td>
<td></td>
</tr>
<tr>
<td>Assignment</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>20.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

11.3 Evaluation of courses with only practical credits:

i. The evaluation of courses with only practicals is grouped and mark distribution is given hereunder. The pattern of questions is to be decided by the course teacher (internal examiner) and External Examiner.

ii. In the event of difference of opinion between internal and external examiner, the Dean shall decide the pattern of examination.

11.3.1 Practicals involving only field work / lab work / Class room activities

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Mid-semester (1 ½ hrs.)</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field evaluation / Lab practical/ Written test</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Viva – voce</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Continuous evaluation and Record</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Assignment / Specimen or insect collection</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>
11.3.2 Evaluation pattern for Student READY
a) B.Sc. (Hons.) Horticulture – Rural Horticultural Work Experience Programme – Placement in Villages (0+10)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Details</th>
<th>Daily Observation Note</th>
<th>Practical Knowledge gained and interaction</th>
<th>Feedback from farmers /official</th>
<th>Total Marks (100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Village Attachment (40)</td>
<td>20</td>
<td>15</td>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>2.</td>
<td>Attachment with Dept. of Agri. /KVK/Res. Station (10)</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Attachment with Plant Clinic/ NGO (10)</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Special activities/initiatives/ creativity under Sl.No. 1-4</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>5.</td>
<td>Overall conduct and discipline during the programme</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>Report writing and presentation</td>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

b) B.Sc. (Hons.) Horticulture – Rural Horticultural Work Experience Programme – Placement in Industries (0+10)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Particulars</th>
<th>Max. Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Continuous evaluation</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Exhibition and record submission</td>
<td>30</td>
</tr>
<tr>
<td>4.</td>
<td>Project preparation</td>
<td>20</td>
</tr>
<tr>
<td>5.</td>
<td>Presentation</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>Viva voce</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

c) Evaluation pattern for Experiential Learning programme

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Parameters</th>
<th>Max. Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Project Planning and Writing</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>Presentation</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Regularity</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Monthly Assessment</td>
<td>10</td>
</tr>
<tr>
<td>5.</td>
<td>Output delivery</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>Technical Skill Development</td>
<td>10</td>
</tr>
<tr>
<td>7.</td>
<td>Entrepreneurship Skills</td>
<td>10</td>
</tr>
<tr>
<td>8.</td>
<td>Business networking skills</td>
<td>10</td>
</tr>
<tr>
<td>9.</td>
<td>Report Writing Skills</td>
<td>10</td>
</tr>
<tr>
<td>10.</td>
<td>Final Presentation</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
11.3.3. PED* (Non-Gradial course)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>I Sem.</th>
<th>II Sem.</th>
<th>III Sem.</th>
<th>IV Sem.</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine activities</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Behaviour</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Participation in tournaments</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

*Evaluation shall be done for 100 marks at the end of each semester and the Grade Satisfactory (50 marks and above)/Not Satisfactory (less than 50 marks) shall be awarded at the end of IV semester based on average performance over four semesters.

11.3.4. NCC** / NSS (Non-Gradial course)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>I Sem.</th>
<th>II Sem.</th>
<th>III Sem.</th>
<th>IV Sem.</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine activities</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Behaviour</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Participation in campus</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Written test</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

** Evaluation shall be done for 100 marks at the end of each semester and the Grade Satisfactory (50 marks and above)/Not Satisfactory (less than 50 marks) shall be awarded at the end of IV semester based on average performance over four semesters.

11.3.5. Study tours (Non-Gradial courses) ***

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written test for 2 hours</td>
<td>40</td>
</tr>
<tr>
<td>Behaviour (Punctuality and discipline)</td>
<td>25</td>
</tr>
<tr>
<td>Record (15 marks ) and Pocket Note Book (10 marks)</td>
<td>25</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

*** Evaluation shall be done after the completion of tour and the Grade Satisfactory (50 marks and above)/Not Satisfactory (less than 50 marks) shall be awarded.

Separate documents:

1) List of Examiners for valuation : Enclosed
2) Question paper setters : Enclosed
PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014

UNDER GRADUATE DEGREE PROGRAMME
(Agricultural Sciences)
(SEMESTER SYSTEM)

ACADEMIC RULES AND REGULATIONS
(Effective from 2019-20 Batch)

01. REGULATIONS
The Regulations provided herein shall apply to B.Sc. (Hons.) Agriculture/Horticulture Degree Programmes offered by the Pondicherry University.

The system of instructions and education in the University shall be SEMESTER COURSE CREDIT SYSTEM.

02. SHORT TITLE AND COMMENCEMENT
These regulations shall be called “Under Graduate (Agricultural Sciences) Academic Rules and Regulations 2019.” They shall come into force from the academic year 2019-2020.

03. DEFINITIONS
3.1 ‘University’ means the Pondicherry University, Puducherry

3.2 ‘College’ means the Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA&RI), Karaikal

3.3 ‘Dean’ means the Dean of Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA&RI), Karaikal

3.4 ‘Coordinator’ means a Faculty who has been nominated by the Dean to look after the academic matters of the different years of the B.Sc. (Hons.) Agriculture/Horticulture Degree programme. He / She will attend to registration, preparation of time table, distribution of courses, regulation of credit load and maintenance of individual student’s records of the concerned batch.

3.5 ‘Academic Counsellor’ means a Faculty who has been nominated by the Dean for counseling a group of students in academic matters. The Dean of the college will arrange to allot not less than five students to the nominated Academic Counsellor. The Academic Counsellor will counsel the group of students in curricular and co-curricular activities for the entire period of course programme by conducting periodical meetings.

3.6 ‘Curriculum’ is a group of courses and other specified requirements for the fulfilment of the Degree Programme.

3.7 ‘Curricula and Syllabi’ are a list of approved courses for the Degree Programme wherein each course is identified with a three-letter code, a three digit course number, outline of syllabus and credit assigned.
3.8 ‘Semester’ means a period consisting of 110 working days inclusive of the mid-semester and practical examinations but excluding the study holidays and final theory examinations. For a short (condensed) semester, the number of classes shall be increased proportionately so as to complete the syllabus.

3.9 ‘Academic Year’ means a period consisting of two consecutive semesters including the inter-semester break as announced by the University/Dean of the College. The first year of study shall be the first and second semesters following a student’s admission. The second year of study shall be the third and fourth semesters, the third year, the fifth and sixth semesters and the fourth year, the seventh and eighth semesters.

3.10 ‘Course’ is a teaching unit of a discipline to be covered within a semester as detailed in the Curricula and Syllabi issued by the University.

3.11 ‘Core Course’ means the list of courses specified by the University in the curricula and syllabi to be registered compulsorily by the students of B.Sc. (Hons.) Agriculture / Horticulture degree programme.

3.12 ‘Elective Course’ means the list of specified courses offered by various disciplines from which the students can have the option of selecting the courses to complete the credit requirements for the degree programme. Elective courses are offered in IV, V and VI semesters.

3.13 ‘Experiential Learning Course’ means that learning and development are achieved through personally determined experience and involvement, rather than on received teaching or training typically in group, by observation, study of theory or hypothesis, and bring in innovation or some other transfer of skills or knowledge. Experiential learning is a business curriculum – related endeavour which is interactive. Experiential Learning courses are the list of specified courses offered by various disciplines from which the students can have the option of selecting the courses to complete the credit requirements for the degree programme. Experiential Learning courses are offered in VIII semester (IV year).

3.14 ‘Remedial (Biology) course’ means a course (Biology) which shall be offered to those students admitted through ICAR and not studied biology/agriculture/forestry in their HSC/ intermediate programme and shall be offered in I semester.

3.15 ‘Non-Gradial course’ means a course which is compulsorily registered by the student for the completion of B.Sc. (Hons.) Agriculture / Horticulture degree programme. The non-gradial course will be evaluated as Satisfactory or Not-satisfactory. The marks obtained by the student in a non-gradial course will not be taken into account for calculating OGPA.

3.16 ‘Credit Load’ of a student during a semester is the total number of credits of all the courses including non-gradial courses, a student registers during that particular semester.
3.17 ‘A credit’ in theory means one hour of class room lecture and a credit in practical means two and half hours of laboratory or workshop or field work per week.

Explanation: A 1+1 course (2 credits) means 1 hour theory and 2½ hours practical per week.
A 0+1 course (1 credit) means 2½ hours practical per week
A 1+0 course (1 credit) means 1 hour theory per week

3.18 ‘Grade Point’ means the total marks in percentage obtained in a course divided by 10 and rounded to two decimal places.

3.19 ‘Credit Point’ means the grade point multiplied by the credit load of the course.

3.20 ‘Overall Grade Point Average (OGPA)’ means the total credit point of the courses completed by the student divided by total credits of the courses studied. The OGPA is to be worked out by rounding to nearest two decimals.

3.21 ‘Arrear examination’ is an examination written for the failed courses by a student without undergoing regular classes.

3.22 ‘Statement of marks’ means a report of grades, credit points and OGPA obtained by a student in a particular semester.

3.23 ‘Transcript Card’ is the consolidated report of academic performance of a student issued by the University on completion of the curriculum fulfilment.

04. ELIGIBILITY FOR ADMISSION TO B.Sc. (Hons.) Agriculture/Horticulture DEGREE PROGRAMME

4.1 H.Sc. / Equivalent - Academic Stream
A pass in the Higher Secondary Course (10+2) or any other examination recognized as equivalent there to and fulfilling the following subject requirements.

B.Sc. (Hons.) Agriculture:

a) : Physics, Chemistry, Mathematics, Biology
b) : Physics, Chemistry, Biology / Botany & Zoology
c) : Physics, Chemistry, Agriculture

B.Sc. (Hons.) Horticulture:

a) : Physics, Chemistry, Mathematics, Biology
b) : Physics, Chemistry, Biology / Botany & Zoology
c) : Physics, Chemistry, Agriculture
d) : Physics, Chemistry, Forestry

For drawing the merit of the candidate, the marks scored in three subjects viz., physics, chemistry and biology (or mean of botany and zoology) shall be considered. If a candidate had studied four subjects in 10+2 or intermediate viz., physics, chemistry, biology and agriculture/forestry the marks scored in physics, chemistry and biology shall be considered for drawing merit list.
4.2 **H.Sc. - Vocational Stream (For U.T. of Puducherry candidates only)**

Two seats are exclusively reserved for candidates under Vocational Stream (Agriculture) for admission to B.Sc. (Hons.) Agriculture degree programme only. They are not considered under general merit and any of the reservation categories. Candidates who studied any one of the subjects, namely Biology or Chemistry or Economics or Home Science and Vocational subjects including theory and practical indicated below are eligible to apply for the degree of B.Sc.(Hons.) Agriculture.


Other State Vocational stream students are not eligible to apply.

4.3. **Eligible Minimum Qualifying Marks** (Academic Stream)

i) **U.T. of Puducherry:**

   For Open Competition:
   
   OC / Open General 50% in aggregate of all three subjects

   For Other Backward Class:

   OBC / Backward Class Muslim (BCM) / Most Backward Class (MBC) / Extreme Backward Class (EBC) / Backward Tribe (BT)/Scheduled Caste (SC) / Scheduled Tribe (ST) 40% aggregate of all the subjects

ii) **Other State / Other U.Ts.:**

   For SC/ST – 40% aggregate of all the three subjects
   All Other Communities – 50% aggregate of all the three subjects

4.4. **Number of Attempts to pass**

For the purpose of qualifying examination marks, the maximum number of attempts to pass and maximum number of improvement examination for admission to B.Sc. (Hons.) Agriculture/Horticulture course are as follows:

<table>
<thead>
<tr>
<th>Community</th>
<th>Maximum number of attempts to pass*</th>
<th>Maximum number of improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduled Castes/ Scheduled Tribes</td>
<td>Three</td>
<td>One</td>
</tr>
<tr>
<td>All other Communities</td>
<td>Two</td>
<td>One</td>
</tr>
</tbody>
</table>

* including first appearance

4.5. **Age limit**

A candidate should not have completed the age of 21 years on the first day of July of the admission year. However, for Scheduled Castes / Scheduled Tribes, physically challenged and NRI candidates the upper age limit is 25.

05. **SYSTEM OF EDUCATION**

5.1 The system of education followed for B.Sc. (Hons.) Agriculture/Horticulture degree programme is **Semester System** with a duration of four academic years (8 Semesters). The maximum duration permissible for a student shall be 14 consecutive semesters (seven years).
5.2 **Credit requirements:** The minimum credit requirement for B.Sc. (Hons.) Agriculture/Horticulture Degree Programme is 183 (including 5 credits of non-gradual courses).

5.3 **Maximum credit load:** A student can register a maximum of 25 credits including non-gradual courses during a semester.

5.4 **Condensation of semesters:** The Dean has the responsibility to adhere to the Academic Calendar. However, under extraordinary situation and with the permission of the University condensation of semester may be made up to a maximum of 10 days to cope up for examination schedule. The loss of classes in such cases should have to be compensated by special time table.

### ATTENDANCE REQUIREMENTS

6.1 **Minimum Attendance requirement:**

i. A minimum of 75 per cent attendance separately in theory and practical of the concerned course is required, failing which the student shall not be permitted to appear for both final theory and final practical examinations in the course concerned and grade ‘E’ (incomplete) will be awarded.

ii. For Student READY programme offered during VII and VIII semesters, 100 per cent attendance is compulsory. However, the attendance may be condoned up to 15 per cent, under extra-ordinary situations, by the Dean based on the genuineness of the case and upon the recommendation of the concerned course teacher and Head of the Department.

iii. When the grade ‘E’ is awarded in a course, the student must re-register the course again along with juniors or whenever that particular course is offered, with the permission of the University.

6.2 The students failing to attend the classes / examinations on non-official ground will be treated as absent.

6.3 Students deputed for sports, cultural meets, etc. with prior permission of the Dean of the college shall be given attendance for the period of absence. However, students under this category must have attended a minimum of 50 per cent classes in the total theory and practical classes conducted.

6.4 **Calculation of Attendance**

**a) THEORY:**

i. Number of classes conducted for a course from the first working day as per the time table to the last theory class of that semester is to be construed as the total number of theory classes conducted by the course teacher.

ii. The mid-semester examinations are normally conducted during class hours.

iii. The attendance for mid semester examination will be counted as a theory class for calculating attendance.
b) PRACTICAL:
   i. Number of practical classes conducted for a course from the first working day as per the time table to the last practical class of that semester is to be construed as the total number of practical classes conducted by the course teacher.
   ii. The final practical examination will be conducted after the completion of 96 working days.
   iii. The attendance for practical examination will not be counted for calculating the attendance for practical.
   iv. The student belonging to a batch will attend classes and earn attendance in the particular batch only as per the time table. No student shall be permitted to attend along with another batch to gain attendance either in theory or in practical.

6.5 For calculating 75 percent attendance, the number of working days may be calculated only from the date of joining of the student for first year first semester only.

07. EVALUATION OF STUDENT’S PERFORMANCE

7.1 i. It shall be the responsibility of the teacher(s) to ensure that the topics to be covered in the theory and practical in each course are recorded through a lecture/practical schedule distributed to the students at the beginning of each course.
   ii. The Head of the Department/Dean shall ensure that the schedule is adhered to and alternate arrangements are made to cover up the loss in case of any eventualities of unavoidable reasons that lead to non-adherence of the above schedule.

7.2 The examination shall be conducted to assess whether the student has been able to achieve a level of competence in the course concerned.

7.3 Grade Point:
   i. Each course shall carry a maximum of 100 marks. The results of the course shall be indicated by the grade points ranging from 0 to 10. The total marks in percentage obtained by the student in a course shall be divided by 10 and rounded to two decimal places to get the grade point.
   ii. The minimum Grade Point to be secured for the successful completion of a course shall be 5.00.
   iii. In case of courses with theory and practical, minimum of 50% mark separately in theory and practical with an aggregate of 50 per cent is essential. Also, the student should secure a minimum of 50 per cent mark in the final theory examination conducted by the University for securing a pass in a course.

7.4 Securing a grade point less than 5.00 in a course will be treated as ‘F’ (Failed) and the Grade Point will be 0.00 for calculating the GPA/OGPA. The following symbols may be used:
   E - INCOMPLETE (Lack of 75 % Attendance)
   F - FAILED
   RR - RE-REGISTRATION
7.5 Distribution of marks
i. The weightage of marks shall be in the ratio of 50:50 respectively for external and internal examination.

ii. Each course shall carry a maximum of 100 marks. The distribution of marks is indicated below.

<table>
<thead>
<tr>
<th>Examination</th>
<th>Courses with theory and practical</th>
<th>Courses with only theory</th>
<th>Courses with only practical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-semester Examination</td>
<td>30</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Practical Examination</td>
<td>15</td>
<td>--</td>
<td>50</td>
</tr>
<tr>
<td>Assignment/submission of specimens</td>
<td>5</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>External</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Theory Examination</td>
<td>50</td>
<td>50</td>
<td>--</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

7.6 Mid Semester Examination (Internal):
i. Writing the mid-semester examination is a pre-requisite for writing the final theory and final practical examinations. Student failing to write mid-semester examination, will not be permitted to attend the classes further in the course concerned and the student will be awarded ‘E’ grade.

ii. The duration of mid-semester examinations will be one hour for courses with theory and practical (30 marks), one and half hours for courses with only theory (40 marks) and the mid-semester for courses involving only practical will be conducted in the regular practical class (40 marks).

iii. The Dean with the help of the concerned year coordinator shall prepare and announce the schedule of mid-semester examinations.

iv. The mid-semester examinations shall be conducted from the 56th working day of the semester.

v. The mid-semester examination shall be conducted and evaluated internally by the concerned course teacher(s).

vi. The mid-semester examination mark list should be sent by the course teacher to the office of the Dean within ten days from the date of conduct of mid semester examination.

vii. The marks for assignment shall be included in mid semester mark for the courses with only theory.

7.7 Missing Mid-semester Examination:
i. A student missing mid-semester examination(s) with prior approval of the Dean due to unavoidable circumstances shall be permitted to take up missing examination of the particular course, subject to payment of the prescribed fee for each missing mid-semester examination.

ii. Students deputed for official programmes of the College/University are exempted from paying the fee for missing test.

iii. Such missing examinations should be completed outside regular class hours within 15 working days after the respective examinations.

iv. Attendance will not be given for taking up missing examinations.
v. The missing tests are allowed only for mid-semester examinations and not for final theory and final practical examinations.

7.8 Final Theory Examination: External
   i. An examination schedule prepared by the University for Final Theory Examinations shall be the final.
   ii. The theory examinations shall be conducted for 50 marks for a duration of two and half hours.
   iii. The final theory examinations shall be conducted by inviting question paper from appointed paper setters (external examiners).
   iv. The final theory examinations shall be conducted on such dates, time and places as per the schedule and must be completed so that the results are announced before the onset of the ensuing semester.
   v. The schedule of examinations shall be adhered to strictly. No re-examinations shall be allowed in the event of students’ strike, boycott, walkouts and medical grounds or what-so-ever may be the reason.

7.9 Postponement of Final Theory Examination:
The postponement of final theory examination(s) on account of unexpected Government holidays or natural calamities shall be done as per the norms of the University.

7.10 Final Practical Examination (Internal):
   i. The Controller of Examinations shall announce the schedule of final practical examinations.
   ii. The final practical examinations shall be conducted after the completion of minimum of 96 working days. During the days of practical examination, the theory classes shall not be conducted.
   iii. For conducting final practical examination in each course, an external examiner (faculty of the Department other than the course teacher) shall be nominated by the Dean and the course teacher will be the internal examiner. In the event of external / internal examiner nominated for practical examination could not conduct the examination, then the Dean shall nominate an alternative examiner to conduct practical examination.
   iv. Submission of bonafide practical records in complete form and certified by the Course Teacher is a pre-requisite for appearing in a practical examination failing which ‘F’ grade will be awarded.
   v. The duration of final practical examination shall be two and half hours.
   vi. The practical and oral (viva-voce) examinations shall be conducted by the internal and external examiners with mutual co-operation. They shall evaluate the candidates appearing at the examination according to their performance. The mark sheets so prepared shall be signed by both the examiners.
   vii. The practical marks should be communicated to Dean / Controller of Examinations within 10 days after the conduct of respective final practical examinations.
   viii. The marks for assignment/specimen collection shall be included in final practical examination for the courses with theory and practical and courses with practical only.
ix. If a student could not attend the NSS/NCC camp along with his batch, he/she may be permitted to attend the camp along with juniors if the student has secured more than 75% attendance in the course.

7.11 **Arrear examination:**

i. The students are permitted to write the arrear examinations along with the regular semester examinations for the failed courses.

ii. The prescribed arrear examination fee is to be paid on or before the date specified by the University.

iii. Arrear examination is permitted for mid-semester, final theory or practical or their combinations

iv. Arrear examination is not applicable to Student READY, Study tour and Crop production courses. If a student secures ‘F’ grade in these courses, he/she has to re-register the course along with the juniors as and when the course is offered with the approval of the University. For the courses involving only practical (other than Student Ready, Study tour and Crop Production), the arrear practical examination will be conducted for 100 marks and shall be reported as 40 marks (arrear mid semester = Marks scored x 40/100 ) and 60 marks (arrear final practical = Marks scored x 60/100).

v. A student is permitted to write arrear examination any number of times during six years duration since the Experiential Learning programme (ELP) is to be completed within the stipulated time period of seven years (refer Rule 5.1).

vi. If the student appears for arrear examination in practical, marks scored by the student, during his/her original semester of study, for assignment and record will be retained as such and student must produce the evaluated record.

vii. The registration for the arrear examination shall be done on the date specified by the University.

7.12 **Latecomer in Examinations:** The latecomer to final theory examination shall be dealt as per the norms of the University.

7.13 The student should necessarily come to the examination hall(s) with Identity card and hall tickets and produce the same to the examiner(s)/invigilator(s), failing which the student shall not be allowed to write the examinations.

7.14 The final theory examination (regular/arrear) answer book(s) shall be evaluated by the external examiner appointed by the University.

7.15 **Question paper pattern:**

i. The question paper pattern for mid-semester (Internal) examination (regular/arrear) is indicated below:

   **For course with theory and practical (1+1 or 2+1 courses)**

   **(30 Marks & 1 hour duration)**

<table>
<thead>
<tr>
<th>Part</th>
<th>Type of question</th>
<th>Number of questions</th>
<th>Number of questions to be answered</th>
<th>Mark per question</th>
<th>Total marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Objective*</td>
<td>40</td>
<td>40</td>
<td>0.5</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>Short answers</td>
<td>6</td>
<td>5</td>
<td>2.0</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>
For course with only theory (1+0 or 2+0 courses)

(40 marks & duration 1.5 hours)

<table>
<thead>
<tr>
<th>Part</th>
<th>Type of question</th>
<th>Number of questions</th>
<th>Number of questions to be answered</th>
<th>Mark per question</th>
<th>Total marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Objective*</td>
<td>40</td>
<td>40</td>
<td>0.5</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>Definitions / Concepts</td>
<td>8</td>
<td>6</td>
<td>1.0</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>Short answers</td>
<td>9</td>
<td>7</td>
<td>2.0</td>
<td>14</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>40</strong></td>
<td><strong>40</strong></td>
<td><strong>0.5</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

* Questions should be Fill-up the blanks, Choose the best option, True / False and Match the following type with equal number of questions in each type

ii. The question paper pattern for external theory examination (regular/arrear) is indicated below:

**External Theory Examination (50 Marks & 2.5 hours duration)**

<table>
<thead>
<tr>
<th>Part</th>
<th>Type of question</th>
<th>Number of questions</th>
<th>Number of questions to be answered</th>
<th>Mark per question</th>
<th>Total marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Objective*</td>
<td>40</td>
<td>40</td>
<td>0.5</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>Short answers</td>
<td>6</td>
<td>5</td>
<td>2.0</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>Essay type answers (either or type)</td>
<td>5</td>
<td>5</td>
<td>4.0</td>
<td>20</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>50</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Questions should be Fill-up the blanks, Choose the best option, True / False and Match the following type with equal number of questions in each type

iii. For conducting practical examinations, the type and number of questions can be decided by the concerned internal and external examiners. Choice may be given to the extent of 20% under subjective type questions.

7.16 Evaluation of Final Practical Examination: For courses with theory and practical, the following distribution of marks shall be adopted in conducting the final practical examinations. The assignment marks shall be added to practical marks.

| Practical Field work / Lab Work / Written exam | 10.0  |
| Continuous evaluation and record             | 2.5  |
| Viva Voce                                    | 2.5  |
| **Total**                                    | **15.0** |
| Assignment                                   | 5.0  |
| **Grand Total**                              | **20.0** |

7.17 Evaluation of courses with only practical credits:

i. The evaluation of courses with only practicals is grouped and mark distribution is given hereunder. The pattern of questions is to be decided by the course teacher (internal examiner) and External Examiner.

ii. In the event of difference of opinion between internal and external examiner, the Dean shall decide the pattern of examination.
7.17.1 Practicals involving only field work / lab work / Class room activities

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Mid- semester (1 ½ hrs.)</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field evaluation / Lab practical/ Written test</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Viva – voce</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Continuous evaluation and Record</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Assignment / Specimen or insect collection</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

7.17.2. Evaluation pattern for Student READY

a) B.Sc. (Hons.) Agriculture – Rural Agricultural Work Experience and Agro-Industrial Attachment (0+20)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Details</th>
<th>Daily Observation Note</th>
<th>Practical knowledge gained and interaction</th>
<th>Feedback from farmers /official</th>
<th>Total Marks (100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Village Attachment (30)</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Attachment with Dept. of Agri./KVK/Res. Station (10)</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Attachment with Plant Clinic/ NGO (10)</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Attachment with Agro-Industry (10)</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Special activities/initiatives/ creativity under Sl.No. 1-4</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Overall conduct and discipline during the programme</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>Report writing and presentation</td>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

b) B.Sc. (Hons.) Horticulture – Rural Horticultural Work Experience Programme – Placement in Villages (0+10)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Details</th>
<th>Daily Observation Note</th>
<th>Practical knowledge gained and interaction</th>
<th>Feedback from farmers /official</th>
<th>Total Marks (100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Village Attachment (40)</td>
<td>20</td>
<td>15</td>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>Attachment with Dept. of Agri./KVK/Res. Station (10)</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Attachment with Plant Clinic/ NGO (10)</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Special activities/initiatives/ creativity under Sl.No. 1-4</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Overall conduct and discipline during the programme</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Report writing and presentation</td>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
c) B.Sc. (Hons.) Horticulture – Rural Horticultural Work Experience Programme – Placement in Industries (0+10)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Particulars</th>
<th>Max. Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Continuous evaluation</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Exhibition and record submission</td>
<td>30</td>
</tr>
<tr>
<td>4.</td>
<td>Project preparation</td>
<td>20</td>
</tr>
<tr>
<td>5.</td>
<td>Presentation</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>Viva voce</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

d) Evaluation pattern for Experiential Learning programme

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Parameters</th>
<th>Max. Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Project Planning and Writing</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>Presentation</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Regularity</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Monthly Assessment</td>
<td>10</td>
</tr>
<tr>
<td>5.</td>
<td>Output delivery</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>Technical Skill Development</td>
<td>10</td>
</tr>
<tr>
<td>7.</td>
<td>Entrepreneurship Skills</td>
<td>10</td>
</tr>
<tr>
<td>8.</td>
<td>Business networking skills</td>
<td>10</td>
</tr>
<tr>
<td>9.</td>
<td>Report Writing Skills</td>
<td>10</td>
</tr>
<tr>
<td>10.</td>
<td>Final Presentation</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

7.17.4. PED* (Non-Gradial course)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>I Sem</th>
<th>II Sem</th>
<th>III Sem</th>
<th>IV Sem</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine activities</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Behaviour</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Participation in tournaments</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

*Evaluation shall be done for 100 marks at the end of each semester and the Grade Satisfactory (50 marks and above)/Not Satisfactory (less than 50 marks) shall be awarded at the end of IV semester based on average performance over first four semesters.

7.17.5. NCC** / NSS (Non-Gradial course)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>I Sem</th>
<th>II Sem</th>
<th>III Sem</th>
<th>IV Sem</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine activities</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Behaviour</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Participation in campus</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Written test</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

** Evaluation shall be done for 100 marks at the end of each semester and the Grade Satisfactory (50 marks and above)/Not Satisfactory (less than 50 marks) shall be awarded at the end of IV semester based on average performance over four semesters.
7.17.6. Study tours (Non-Gradial courses) ***

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written test for 2 hours</td>
<td>40</td>
</tr>
<tr>
<td>Behaviour (Punctuality and discipline)</td>
<td>25</td>
</tr>
<tr>
<td>Record (15 marks ) and Pocket Note Book (10 marks)</td>
<td>25</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

***Evaluation shall be done after the completion of tour and the Grade Satisfactory (50 marks and above)/Not Satisfactory (less than 50 marks) shall be awarded.

7.18 Return of valued answer papers:

i. The valued answer papers of mid-semester and final practical examination shall be shown to the students after the examination. Discrepancies if any, in awarding marks, the student can approach the teacher concerned immediately for rectification.

ii. The answer paper should be retained with the course teacher for six months and then disposed off. Evaluated final theory papers may be retained up to six months by the University/Controller of Examinations after the conduct of examination and then disposed off.

7.19 Revaluation / Re-totalling:

The revaluation / re-totalling is allowed as per the norms of Pondicherry University in force from time to time.

i. Revaluation is not allowed for passed courses.

ii. Revaluation can be demanded only if a candidate has failed in not more than two courses in that session.

iii. The prescribed revaluation fee per course has to be paid by the student.

iv. The application for revaluation must be sent to the Controller of Examinations through the Head of the Institution.

v. The application for revaluation should be made within 15 days from the date of declaration of results / publication of marks/grade.

vi. A student may be allowed to get his/her answer book(s) re-totaled for which the student shall have to apply to Controller of Examination / Coordinator of Examinations within 15 days from the declaration of result and after paying the prescribed fee.

vii. The controller of examinations/Coordinator of examinations shall arrange for the re-totalling of answer book(s).

8. REGISTRATION OF ELECTIVE / EXPERIENTIAL LEARNING PROGRAMME (ELP) COURSES:

8.1 (i) The elective courses are to be registered by B.Sc. (Hons.) Agriculture students.

(ii) A student can select three elective courses offered during IV, V and VI semesters from the list of elective courses offered by the institute.

(iii) A minimum of 30 and a maximum of 40 students shall be allowed to register a particular elective course offered during a particular semester. If more number of students opt for a particular Elective Course during a semester, then OGPA of the student is to be considered.
8.2 (i) To get the eligibility for registering of ELP, the students should have completed all the courses, offered up to sixth semester, successfully. No student shall be allowed to take up the ELP with backlog/repeat courses.

Note: Students who register for the ELP in anticipation of obtaining the eligibility at the end of VII semester may do so at their own risk. Registration of ELP will automatically be cancelled if the student is found ineligible subsequently and the fee paid for the semester shall be adjusted for the ensuing registration.

(ii) A minimum of 10 and maximum of 40 students shall be allowed to register for a particular Experiential Learning Course. If more number of students opt for a single Experiential Learning Course, then OGPA of the student is to be considered.

09. MALPRACTICES IN EXAMINATION
The students found indulging in malpractices in examinations will be dealt as per the norms of the University in force from time to time.

10. STUDY TOURS
10.1 All study tours are compulsory and those who miss the study tours for any reason, however valid may the reason be, must re-register and undertake the tour(s) along with juniors to complete the degree programme.

10.2 The study tour(s) shall be conducted as per the schedule notified by the Dean. The evaluation of the study tour shall be done by the course teacher(s) concerned by following the evaluation procedure applicable for study tours.

10.3 The Dean is empowered to organize all study tours and field trips.

11. DISCONTINUANCE AND READMISSION
11.1 The student who discontinues without getting permission from the Dean will not be re-admitted.

11.2 A student discontinuing studies temporarily on valid and genuine grounds with prior permission of the Dean will be re-admitted with the permission of the University at the beginning of same semester along with junior batch of students, over and above the sanctioned strength. For re-admission, the student has to pay the prescribed re-registration fee and semester fee of junior batch in which the student is re-admitted.

11.3 In case of revision of curricula and syllabi, the student has to complete all the course work in the original syllabus in which he/she has been admitted, by registering equivalent/special semester courses (or) the student has to forgo all the courses registered so far in the original curricula and syllabi and register all the courses from first semester in the new syllabus along with juniors.

11.4 A student shall not be allowed to temporarily discontinue consecutively, beyond a period of two semesters. If the temporary discontinuance period exceeds two semesters, the name of the student will be removed from the roll.

11.5 A student, who has discontinued and obtained the Transfer Certificate (TC) from the college, is not eligible for admission again to the College. An undertaking to this effect shall be obtained from the concerned student by the Dean at the time of discontinuation.
12. **CALCULATION OF OGPA:**

   i. To arrive at the Overall Grade Point Average (OGPA) at the end of the semester, the Grade Point of each course is multiplied by the credit hours of the course to obtain the credit points.

   ii. The sum of the credit points secured by the student in all the courses taken till the end of semester is divided by the total number of credit hours of the courses, provided that the credit hour and credit points of courses which are repeated are not counted more than once for this purpose.

   iii. The marks obtained by the student in a non credit course will not be taken in to account for calculating OGPA.

   iv. While calculating OGPA, the credit hours of courses in which the student secured ‘E’ grade (for lack of 75% attendance) will be deducted since it will be repeated by re-registration.

   v. The Credit Points, GPA and OGPA shall be rounded to nearest two decimals.

13. **AWARD OF DEGREE**

   13.1 **Eligibility for the Award of the Degree:** The successful completion of all the prescribed courses as per the Curricula and Syllabi shall be the minimum requirement for the award of the Degree. In the degree certificate declaration of class shall be made.

   13.2 **Class Ranking:** In calculation of Class equivalent for OGPA the following classification will be adopted.

<table>
<thead>
<tr>
<th>OGPA</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.00 and above</td>
<td>I class with distinction</td>
</tr>
<tr>
<td>7.00 to 7.99</td>
<td>I class</td>
</tr>
<tr>
<td>6.00 to 6.99</td>
<td>II class</td>
</tr>
<tr>
<td>5.00 to 5.99</td>
<td>Pass</td>
</tr>
</tbody>
</table>

   13.3 **Percentage conversion:** For obtaining the percentage equivalent to the OGPA, the OGPA secured by the student shall be multiplied by 10.

14. **REMOVAL OF DIFFICULTIES:**

   14.1 If any difficulty arises in giving effect to the Provisions of these regulations, the Vice-Chancellor may issue necessary orders which appear to him/her to be necessary or expedient for removing the difficulty.

   14.2 Every order issued by the Vice-Chancellor under this provision shall be laid before the Academic Council of the University immediately after the issuance.

   14.3 Notwithstanding anything contained in the rules and regulations, the Board of Studies or Academic Council shall make changes whenever necessary.
GUIDELINES FOR SETTING THE QUESTION PAPER FOR EXTERNAL THEORY EXAMINATION

(FOR COURSES INVOLVING THEORY AND PRACTICAL/ ONLY THEORY)

1. Please prepare the question papers for 50 marks in such a way that the question paper shall contain Part A (objective type questions) for 20 marks and Part B, & C (descriptive type questions) for 30 marks as per the template enclosed.

2. Please see that questions are set within the course syllabus covering entire syllabus WITH EQUAL DISTRIBUTION FROM ALL THE FIVE UNITS IN EACH PART.

3. Question papers should be computer generated only.

4. Please give continuous question numbers for all the sub-questions under each part as given in question paper template.

5. Please provide key answers for objective type questions. While providing key answers, please mention the answer number and the answer.

6. Remuneration of Rs. ------------ (--------only) for setting question paper with key answers and actual postal expenses will be paid to the examiner.

7. Please fill the remuneration form completely and send it along with question paper.
PONDICHERRY UNIVERSITY
PUDUCHERRY

B.Sc. (Hons.) Agriculture/Horticulture Degree Programme

QUESTION PAPER PATTERN FOR EXTERNAL THEORY EXAMINATION

Time: Two and half hours
Maximum Marks : 50

PART – A

40 x 0.5 = 20

No. of Questions : 40 (Question No.1 to 40)
Nature of Questions :
Multiple Choice Questions (with four options) (Q.No. 01 to 10) 10 x 0.5 Marks = 5
True or False (Q.No. 11 to 20) 10 x 0.5 Marks = 5
Match the Columns (Q.No. 21 to 30) 10 x 0.5 Marks = 5
Fill in the blanks (Q.No. 31 to 40) 10 x 0.5 Marks = 5

PART – B

5 x 2 = 10

No. of Questions : 6 (Question No. 41 to 46)
No. of Questions to be answered : 5
Nature of Questions : Half page answer / paragraph

PART – C

5 x 4 = 20

No. of Questions : 5 (Question No. 47 to 51)
No. of Questions to be answered : 5 (either or type. one question shall be from each unit)
Nature of Questions : Not less than one and half page answer
QUESTION PAPER TEMPLATE

B.Sc. DEGREE EXAMINATION, ------------------------ (Month, Year)

----------------- Semester

Agriculture / Horticulture

Course Title -------------------------------------

Time: Two and half hours                      Maximum Marks: 50

PART A (40 x 0.5 = 20 marks)

Answer all questions

I. Choose the correct answer

1. a) b) c) d)

2. a) b) c) d)

3. a) b) c) d)

4. a) b) c) d)

5. a) b) c) d)

6. a) b) c) d)

7. a) b) c) d)

8. a) b) c) d)

9. a) b) c) d)

10. a) b) c) d)
II. State True or False
11
12.
13.
14.
15.
16.
17.
18.
19.
20.

III. Match the following
21. (a)
22. (b)
23. (c)
24. (d)
25. (e)
26. (f)
27. (g)
28. (h)
29. (i)
30. (j)

IV. Fill in the blanks
31.
32.
33.
34.
35.
36.
37.
38.
39.
40.
PART B (5 x 2 = 10 marks)

Answer any FIVE questions in brief

41.
42.
43.
44.
45.
46.

PART C (5 x 4 = 20 marks)

Answer all the questions in detail

47. a (or) 47. b (Unit I)
48. a (or) 48. b (Unit II)
49. a (or) 49. b (Unit III)
50. a (or) 50. b (Unit IV)
51. a (or) 51. b (Unit V)
**Key Answers for OBJECTIVE QUESTIONS**

**PART - A**

<table>
<thead>
<tr>
<th>Choose the appropriate answer</th>
<th>Match the following</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>7</td>
<td>27</td>
</tr>
<tr>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>State True or false</th>
<th>Fill in the blanks</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>31</td>
</tr>
<tr>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>13</td>
<td>33</td>
</tr>
<tr>
<td>14</td>
<td>34</td>
</tr>
<tr>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td>16</td>
<td>36</td>
</tr>
<tr>
<td>17</td>
<td>37</td>
</tr>
<tr>
<td>18</td>
<td>38</td>
</tr>
<tr>
<td>19</td>
<td>39</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>
PAJANCOA&RI UG ACADEMIC RULES AND REGULATIONS
(Effective from 2019-20)

01. REGULATIONS
The Regulations provided herein shall apply to B.Sc. (Hons.) Agriculture/Horticulture Degree Programmes offered by Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal.

02. SHORT TITLE AND COMMENCEMENT
These regulations shall be called “PAJANCOA&RI UG Academic Rules and Regulations 2019.” They shall come into force from the academic year 2019-20.

03. DEFINITIONS
3.1 Course Teacher: The Dean in consultation with respective Heads of Department will nominate the course teacher for each course at the beginning of the semester. The course teacher shall be responsible in all matters connected with the conduct of the course. The Dean/Head of the Department will monitor the progress of the course(s).

3.2 Academic Counsellor: The Dean of the college will arrange to allot not less than five students to the nominated Academic Counsellor. The Academic Counsellor will counsel the group of students in curricular and co-curricular activities for the entire period of course programme by conducting periodical meetings.

3.3 Class Time Table: At the beginning of each semester, the Dean will prepare the class time table with the help of Coordinator of the respective admission year (batch of students) and announce the same.

3.4 Working days: Except Sundays and other listed holidays, all other days of a week including Saturdays are working days for the students.

3.5 Working Hours: The normal working hours is 8.00 a.m. to 5.00 p.m. including lunch break. Depending upon the need, the Dean will decide the timings. Afternoon of Saturdays shall be set apart for NCC, NSS and other student activities.

3.6 Commencement and Closure of Semesters: The date of commencement and closure of semesters as well as inter-semester break and schedule of final theory examinations shall be announced by the Dean. The first semester of respective academic year should commence preferably in July or August of every year.
3.7 **Inter-semester Break:** A break of about 15 (fifteen) days shall normally be allowed between any two consecutive semesters. A longer inter-semester break during summer (May and June) may be allowed every year, subject to a maximum of 30 days.

3.8 **Academic Calendar:** A common academic calendar shall be prepared by the Dean every semester indicating the date of registration, date of mid semester examinations, final practical and theory examinations, inter semester break and summer holidays. The Dean shall schedule the academic activities within the specified period without deviation.

04. **REGISTRATION OF COURSES**

4.1 A course shall be offered only once in an academic year during the semester as listed in the course curricula and syllabi.

4.2 All eligible candidates shall register the requisite courses in the beginning of each semester **IN PERSON** under the guidance of the Coordinator. **IN ABSENTIA registration is not permitted under any circumstances.**

4.3 The student should produce mess clearance certificate from the hostel warden in the beginning of each semester, failing which the student will not be permitted to register his/her courses in a semester.

4.4 **Registration cards:**
   i. A student shall register the courses offered in a semester by writing all the courses in registration card in duplicate.
   ii. The Dean shall approve the registration cards.
   iii. The approved registration cards shall be maintained by the Year coordinator and the student concerned.
   iv. The list of students and courses registered in each semester shall be sent by the Dean to the Controller of Examinations for conducting final theory examinations, preparation of Report Cards.

4.5 **Registration without fine:** The courses prescribed for a semester can be registered on the date scheduled in the academic calendar. The registration is also permitted on the second day (which is the commencement of the first working day of the semester) without fine.

4.6 **Registration with fine:** Late registration shall be permitted by the Dean up to seven working days inclusive of the date of registration on payment of prescribed late registration fee.

4.7 **Procedure to get permission for late registration:** The student concerned shall apply with proper reason to the Dean through the Academic Counsellor and Coordinator to get the permission of the Dean for the late registration of the courses. Beyond the prescribed time limit, no student shall be permitted to register the courses for the particular semester.
ILLUSTRATION:
Date of Registration : 05.08.2019 (Monday - 1st Day)
Last date for Registration without fine : 06.08.2019 (Tuesday - 2nd Day)
 : 07.08.2019 (Wednesday - 3rd Day)
 : 08.08.2019 (Thursday - 4th Day)
 : 09.08.2019 (Friday - 5th Day)
 : 10.08.2019 (Saturday - 6th Day)
 : 11.08.2019 (Sunday - 6th Day)
Last date for Registration with fine : 12.08.2019 (Monday - 7th Day)

For calculating instructional days for a semester, the second day of registration will be counted as the first instructional day of the semester, 06.08.2019 in above case.

05 ISSUE OF HALL TICKETS
5.1. The students shall be issued with separate hall tickets for writing their mid-semester examinations and final theory/practical examinations.
5.2 The coordinator shall prepare the hall tickets, get the approval of the Dean and issue to the students.
5.3 In case of loss of hall tickets by the students, duplicate hall ticket shall be issued on payment of a fine. The students who have lost/missed their hall tickets shall apply to the Dean for getting a duplicate hall ticket.
5.4 The mess due clearance certificate has to be produced by every student before taking the final examinations.

06 DETAILS OF FEES TO BE PAID BY THE STUDENT
The fees to be paid by the student other than admission and semester fee are given below.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Late registration fee</td>
<td>1000.00</td>
</tr>
<tr>
<td>2.</td>
<td>Missing mid semester examination fee per course</td>
<td>1000.00</td>
</tr>
<tr>
<td>3.</td>
<td>Duplicate hall ticket fee</td>
<td>200.00</td>
</tr>
<tr>
<td>4.</td>
<td>Transfer and conduct certificate fee</td>
<td>200.00</td>
</tr>
<tr>
<td>5.</td>
<td>Re-registration fee with juniors*</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Examination fee per course (regular / arrear)*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>i. Mid-semester</td>
<td>50.00</td>
</tr>
<tr>
<td></td>
<td>ii. Final practical</td>
<td>50.00</td>
</tr>
<tr>
<td></td>
<td>iii. Final theory</td>
<td>200.00</td>
</tr>
<tr>
<td>7.</td>
<td>Revaluation fee per course*</td>
<td>500.00</td>
</tr>
<tr>
<td>8.</td>
<td>Re-totaling fee per course*</td>
<td>250.00</td>
</tr>
<tr>
<td>9.</td>
<td>Mark sheet*</td>
<td>50.00</td>
</tr>
<tr>
<td>10.</td>
<td>Provisional certificate*</td>
<td>150.00</td>
</tr>
<tr>
<td>11.</td>
<td>Degree certificate*</td>
<td>500.00</td>
</tr>
<tr>
<td>12.</td>
<td>Transcript card*</td>
<td>500.00</td>
</tr>
<tr>
<td>13.</td>
<td>Migration certificate*</td>
<td>80.00</td>
</tr>
</tbody>
</table>

* As fixed by the University from time to time
## B.Sc. (Hons.) HORTICULTURE DEGREE PROGRAMME

### DEPARTMENT WISE DISTRIBUTION OF COURSES

#### ABSTRACT

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Department / Discipline</th>
<th>No. of courses</th>
<th>Credit hours</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agricultural Economics and Extension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Agricultural Economics</td>
<td>2</td>
<td>4+1</td>
<td>5</td>
</tr>
<tr>
<td>2.</td>
<td>Agricultural Extension</td>
<td>3</td>
<td>3+3</td>
<td>6</td>
</tr>
<tr>
<td>3.</td>
<td>Computer Science</td>
<td>1</td>
<td>0+1</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Statistics</td>
<td>1</td>
<td>1+1</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>English</td>
<td>1</td>
<td>0+1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Agricultural Entomology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Agricultural Entomology</td>
<td>4</td>
<td>7+4</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Agronomy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Agronomy</td>
<td>5</td>
<td>6+5</td>
<td>11</td>
</tr>
<tr>
<td>8.</td>
<td>Agricultural Engineering</td>
<td>1</td>
<td>1+1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Horticulture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Basic Horticulture</td>
<td>4</td>
<td>6+4</td>
<td>10</td>
</tr>
<tr>
<td>10.</td>
<td>Floriculture and Landscape Gardening</td>
<td>4</td>
<td>6+4</td>
<td>10</td>
</tr>
<tr>
<td>11.</td>
<td>Fruit Science</td>
<td>4</td>
<td>6+4</td>
<td>10</td>
</tr>
<tr>
<td>12.</td>
<td>Post Harvest Technology</td>
<td>3</td>
<td>4+4</td>
<td>8</td>
</tr>
<tr>
<td>13.</td>
<td>Spices, Plantation, Medicinal &amp; Aromatic crops</td>
<td>3</td>
<td>6+3</td>
<td>9</td>
</tr>
<tr>
<td>14.</td>
<td>Vegetable Science</td>
<td>4</td>
<td>5+5</td>
<td>10</td>
</tr>
<tr>
<td>15.</td>
<td>Forestry</td>
<td>1</td>
<td>1+1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Plant Breeding and Genetics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Genetics and Plant Breeding</td>
<td>3</td>
<td>5+3</td>
<td>8</td>
</tr>
<tr>
<td>17.</td>
<td>Seed Science and Technology</td>
<td>1</td>
<td>2+1</td>
<td>3</td>
</tr>
<tr>
<td>18.</td>
<td>Crop Physiology</td>
<td>2</td>
<td>2+2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Plant Pathology and Agricultural Microbiology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Plant Pathology</td>
<td>3</td>
<td>6+3</td>
<td>9</td>
</tr>
<tr>
<td>20.</td>
<td>Agricultural Microbiology</td>
<td>1</td>
<td>1+1</td>
<td>2</td>
</tr>
<tr>
<td>21.</td>
<td>Nematology</td>
<td>1</td>
<td>1+1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Soil Science &amp; Agrl. Chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Biochemistry</td>
<td>1</td>
<td>1+1</td>
<td>2</td>
</tr>
<tr>
<td>24.</td>
<td>Environmental Science</td>
<td>1</td>
<td>2+1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>57</td>
<td>80+58</td>
<td>138</td>
</tr>
</tbody>
</table>

#### Student READY

<table>
<thead>
<tr>
<th></th>
<th>Rural Horticultural Work Experience (RHWE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.</td>
<td>RHWE – Placement in Villages</td>
</tr>
<tr>
<td>26.</td>
<td>RHWE – Placement in Industries</td>
</tr>
<tr>
<td>27.</td>
<td>Experiential Learning Programme</td>
</tr>
</tbody>
</table>

<p>|                | Total                                     | 4              | 0+40         | 40            |</p>
<table>
<thead>
<tr>
<th>Non Gradial courses</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>28. Mathematics</td>
<td>1</td>
<td>0+1</td>
</tr>
<tr>
<td>29. NSS /NCC</td>
<td>1</td>
<td>0+1</td>
</tr>
<tr>
<td>30. PED</td>
<td>1</td>
<td>0+1</td>
</tr>
<tr>
<td>31. Educational Tour</td>
<td>2</td>
<td>0+2</td>
</tr>
<tr>
<td><strong>Total Non-Gradial courses</strong></td>
<td><strong>5</strong></td>
<td><strong>0+5</strong></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>66</strong></td>
<td><strong>80+103</strong></td>
</tr>
<tr>
<td>Remedial Course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introductory Biology</td>
<td>1</td>
<td>0+1</td>
</tr>
</tbody>
</table>
## DEPARTMENT WISE DISTRIBUTION OF COURSES

### DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Agricultural Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>AEC 111</td>
<td>Economics and Marketing</td>
<td>2+1</td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>AEC 311</td>
<td>Horti-Business Management</td>
<td>2+0</td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>4 + 1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agricultural Extension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>AEX 111</td>
<td>Fundamentals of Extension Education</td>
<td>1+1</td>
<td>II</td>
</tr>
<tr>
<td>2.</td>
<td>AEX 301</td>
<td>Communication Skills and Personality</td>
<td>1+1</td>
<td>V</td>
</tr>
<tr>
<td>3.</td>
<td>AEX 302</td>
<td>Entrepreneurship Development and Business</td>
<td>1+1</td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>3 + 3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Computer Science, Statistics and English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>COM 211</td>
<td>Computer Applications in Horticulture</td>
<td>0+1</td>
<td>III</td>
</tr>
<tr>
<td>2.</td>
<td>STA 201</td>
<td>Statistical Methods</td>
<td>1+1</td>
<td>III</td>
</tr>
<tr>
<td>3.</td>
<td>ENG 101</td>
<td>Comprehension &amp; Communication Skills in</td>
<td>0+1</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>English</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>1 + 3</td>
<td>4</td>
</tr>
</tbody>
</table>

### DEPARTMENT OF AGRICULTURAL ENTOMOLOGY

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEN 101</td>
<td>Fundamentals of Entomology</td>
<td>2+1</td>
<td>II</td>
</tr>
<tr>
<td>2.</td>
<td>AEN 211</td>
<td>Apiculture, Sericulture and Lac culture</td>
<td>1+1</td>
<td>III</td>
</tr>
<tr>
<td>3.</td>
<td>AEN 212</td>
<td>Insect Pests of Fruit, Plantation, Medicinal &amp; Aromatic Crops</td>
<td>2+1</td>
<td>IV</td>
</tr>
<tr>
<td>4.</td>
<td>AEN 311</td>
<td>Insect Pests of Vegetable, Ornamental and Spice Crops</td>
<td>2+1</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>7 + 4</td>
<td>11</td>
</tr>
</tbody>
</table>

### DEPARTMENT OF AGRONOMY

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Agronomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>AGR 111</td>
<td>Weed Management in Horticultural Crops</td>
<td>1+1</td>
<td>II</td>
</tr>
<tr>
<td>2.</td>
<td>AGR 211</td>
<td>Agro-meteorology and Climate Change</td>
<td>1+1</td>
<td>III</td>
</tr>
<tr>
<td>3.</td>
<td>AGR 212</td>
<td>Water Management in Horticultural Crops</td>
<td>1+1</td>
<td>IV</td>
</tr>
<tr>
<td>4.</td>
<td>AGR 311</td>
<td>Introduction to Major Field Crops</td>
<td>1+1</td>
<td>VI</td>
</tr>
<tr>
<td>5.</td>
<td>AGR 312</td>
<td>Organic Farming</td>
<td>2+1</td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>6 + 5</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agricultural Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>AEG 211</td>
<td>Farm Power and Machinery</td>
<td>1+1</td>
<td>III</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>1 + 1</td>
<td>2</td>
</tr>
</tbody>
</table>

# Team teaching course
### DEPARTMENT OF HORTICULTURE

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Basic Horticulture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>HOR 101</td>
<td>Fundamentals of Horticulture</td>
<td>2+1</td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>HOR 102</td>
<td>Plant Propagation and Nursery Management</td>
<td>1+1</td>
<td>II</td>
</tr>
<tr>
<td>3.</td>
<td>HOR 201</td>
<td>Dry land Horticulture z</td>
<td>1+1</td>
<td>IV</td>
</tr>
<tr>
<td>4.</td>
<td>HOR 302</td>
<td>Precision Farming and Protected Cultivation</td>
<td>2+1</td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>6 + 4=10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Floriculture and Landscape Architecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>FLA 201</td>
<td>Commercial Floriculture</td>
<td>2+1</td>
<td>III</td>
</tr>
<tr>
<td>2.</td>
<td>FLA 202</td>
<td>Ornamental Horticulture</td>
<td>1+1</td>
<td>IV</td>
</tr>
<tr>
<td>3.</td>
<td>FLA 301</td>
<td>Principles of Landscape Architecture</td>
<td>1+1</td>
<td>V</td>
</tr>
<tr>
<td>4.</td>
<td>FLA 302</td>
<td>Breeding and Seed Production of Flower and Ornamental Plants</td>
<td>2+1</td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>6 + 4=10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fruit Science</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>FSC 101</td>
<td>Orchard and Estate Management</td>
<td>1+1</td>
<td>II</td>
</tr>
<tr>
<td>2.</td>
<td>FSC 102</td>
<td>Tropical and Subtropical Fruits</td>
<td>2+1</td>
<td>II</td>
</tr>
<tr>
<td>3.</td>
<td>FSC 201</td>
<td>Temperate Fruit Crops</td>
<td>1+1</td>
<td>III</td>
</tr>
<tr>
<td>4.</td>
<td>FSC 202</td>
<td>Breeding of Fruit and Plantation Crops</td>
<td>2+1</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>6 + 4=10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post Harvest Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>PHT 201</td>
<td>Fundamentals of Food Technology</td>
<td>1+1</td>
<td>III</td>
</tr>
<tr>
<td>2.</td>
<td>PHT 302</td>
<td>Postharvest Management of Horticultural Crops</td>
<td>2+1</td>
<td>V</td>
</tr>
<tr>
<td>3.</td>
<td>PHT 303</td>
<td>Processing of Horticultural Crops</td>
<td>1+2</td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>4 +4=8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spices, Plantation, Medicinal &amp; Aromatic crops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>SPC 201</td>
<td>Plantation Crops</td>
<td>2+1</td>
<td>IV</td>
</tr>
<tr>
<td>2.</td>
<td>SPC 202</td>
<td>Spices and Condiments</td>
<td>2+1</td>
<td>IV</td>
</tr>
<tr>
<td>3.</td>
<td>SPC 301</td>
<td>Medicinal and Aromatic crops</td>
<td>2+1</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>6 + 3=9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vegetable Science</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>VSC 101</td>
<td>Tropical and Subtropical Vegetables</td>
<td>2+1</td>
<td>II</td>
</tr>
<tr>
<td>2.</td>
<td>VSC 201</td>
<td>Temperate Vegetable Crops</td>
<td>1+1</td>
<td>III</td>
</tr>
<tr>
<td>3.</td>
<td>VSC 301</td>
<td>Crop Production in Vegetable Crops</td>
<td>0+2</td>
<td>V</td>
</tr>
<tr>
<td>4.</td>
<td>VSC 302</td>
<td>Breeding of Vegetable, Tuber and Spice Crops</td>
<td>2+1</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>5 + 5=10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forestry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>FOR 111</td>
<td>Introductory Agroforestry</td>
<td>1+1</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>1 + 1=2</td>
<td></td>
</tr>
</tbody>
</table>

# Team teaching course
## DEPARTMENT OF PLANT BREEDING AND GENETICS

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Genetics and Plant Breeding</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>GPB 101</td>
<td>Fundamentals of Genetics</td>
<td>2+1</td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>GPB 201</td>
<td>Fundamentals of Plant Breeding</td>
<td>2+1</td>
<td>III</td>
</tr>
<tr>
<td>3.</td>
<td>GPB 211</td>
<td>Elementary Plant Biotechnology</td>
<td>1+1</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>5+3</td>
<td></td>
</tr>
</tbody>
</table>

|        |            | **Seed Science and Technology**          |        |          |
|        |            | 1. SST 311 Seed production of Vegetable, Tuber and Spice Crops | 2+1 | VI       |
|        |            | **TOTAL**                                 | 2+1    | 3        |

|        |            | **Crop Physiology**                      |        |          |
|        |            | 1. CRP 111 Introductory Crop Physiology   | 1+1    | I        |
|        |            | 2. CRP 112 Growth and Development of Horticultural Crops | 1+1 | II       |
|        |            | **TOTAL**                                 | 2+2    | 4        |

## DEPARTMENT OF PLANT PATHOLOGY & AGRICULTURAL MICROBIOLOGY

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Plant Pathology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>PAT 111</td>
<td>Fundamentals of Plant Pathology</td>
<td>2+1</td>
<td>II</td>
</tr>
<tr>
<td>2.</td>
<td>PAT 211</td>
<td>Diseases of Fruit, Plantation, Medicinal and Aromatic Crops and Their Management</td>
<td>2+1</td>
<td>III</td>
</tr>
<tr>
<td>3.</td>
<td>PAT 311</td>
<td>Diseases of Vegetable, Ornamental and Spice Crops and Their Management</td>
<td>2+1</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>6+3</td>
<td>9</td>
</tr>
</tbody>
</table>

|        |            | **Agricultural Microbiology**                                               |        |          |
|        |            | 1. AGM 111 Introductory Microbiology                                        | 1+1    | I        |
|        |            | **TOTAL**                                                                   | 1+1    | 2        |

|        |            | **Nematology**                                                             |        |          |
|        |            | 1. ANM 211 Nematode Pests of Horticultural Crops and Their Management      | 1+1    | IV       |
|        |            | **TOTAL**                                                                   | 1+1    | 2        |
### DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Soil Science and Agricultural Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>SAC 101</td>
<td>Fundamentals of Soil Science</td>
<td>2+1</td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>SAC 211</td>
<td>Soil, Water and Plant Analysis</td>
<td>0+1</td>
<td>IV</td>
</tr>
<tr>
<td>3.</td>
<td>SAC 301</td>
<td>Manures, Fertilizers and Soil Fertility Management</td>
<td>2+1</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>4 + 3 = 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Biochemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>BIC 101</td>
<td>Fundamentals of Biochemistry</td>
<td>1+1</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>1 + 1 = 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environmental Science</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>ENS 301</td>
<td>Environmental Studies and Disaster Management#</td>
<td>2+1</td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>2 + 1 = 3</td>
<td></td>
</tr>
</tbody>
</table>

### STUDENT READY

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rural Horticultural Work Experience Programme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>AEX 411</td>
<td>Placement in Villages</td>
<td>0+10</td>
<td>VII</td>
</tr>
<tr>
<td>2.</td>
<td>HOR 401</td>
<td>Placement in Industries</td>
<td>0+10</td>
<td>VII</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>0 + 20 = 20</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Experiential Learning Programme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>ELP 4XX</td>
<td>Experiential Learning Programme-1</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>2.</td>
<td>ELP 4XX</td>
<td>Experiential Learning Programme-2</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>0 + 20 = 20</td>
<td></td>
</tr>
</tbody>
</table>

### LIST OF EXPERIENTIAL LEARNING PROGRAMME COURSES

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ELP 401</td>
<td>Commercial Beekeeping</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>2.</td>
<td>ELP 402</td>
<td>Commercial Sericulture</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>3.</td>
<td>ELP 403</td>
<td>Urban Entomology and Pest Management</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>4.</td>
<td>ELP 404</td>
<td>Production Technology for Bio-control Agents#</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>5.</td>
<td>ELP 405</td>
<td>Organic Production Technology</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>6.</td>
<td>ELP 408</td>
<td>Commercial Horticulture</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>7.</td>
<td>ELP 409</td>
<td>Floriculture and Landscape Architecture</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>8.</td>
<td>ELP 411</td>
<td>Plant Tissue Culture</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>9.</td>
<td>ELP 413</td>
<td>Mushroom Cultivation Technology</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>10.</td>
<td>ELP 414</td>
<td>Bio-inoculants Production Technology</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>11.</td>
<td>ELP 416</td>
<td>Agriculture Waste Management</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>Sl.No.</td>
<td>Course No.</td>
<td>Course Title</td>
<td>Cr.Hr.</td>
<td>Semester</td>
</tr>
<tr>
<td>-------</td>
<td>------------</td>
<td>---------------------------------------------------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>12.</td>
<td>ELP 417</td>
<td>Protected Cultivation of High Value Horticulture Crops</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>13.</td>
<td>ELP 418</td>
<td>Processing of Fruits and Vegetables for Value Addition</td>
<td>0+10</td>
<td>VIII</td>
</tr>
</tbody>
</table>

**NON-GRADIAL COURSES**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MAT 101</td>
<td>Elementary Mathematics</td>
<td>0+1</td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>NCC101 / NSS101</td>
<td>National Cadet Corps / National Service Scheme</td>
<td>0+1</td>
<td>I</td>
</tr>
<tr>
<td>3.</td>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices</td>
<td>0+1</td>
<td>I</td>
</tr>
<tr>
<td>4.</td>
<td>PJN 201</td>
<td>Educational tour - I (State)</td>
<td>0+1</td>
<td>IV</td>
</tr>
<tr>
<td>5.</td>
<td>PJN 401</td>
<td>Educational tour - II (All India)</td>
<td>0+1</td>
<td>VII</td>
</tr>
</tbody>
</table>

**TOTAL** 0 + 5 = 5

**REMEDIAL COURSE**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>REM 101</td>
<td>Introductory Biology</td>
<td>0+1</td>
<td>I</td>
</tr>
</tbody>
</table>

**TOTAL** 0 + 1 = 1

# Team Teaching
SEMESTER WISE DISTRIBUTION OF COURSES

SEMESTER I

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEC 111</td>
<td>Economics and Marketing</td>
<td>2+1</td>
</tr>
<tr>
<td>2.</td>
<td>AGM 111</td>
<td>Introductory Microbiology</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>CRP 111</td>
<td>Introductory Crop Physiology</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>ENG 101</td>
<td>Comprehension and Communication Skills in English</td>
<td>0+1</td>
</tr>
<tr>
<td>5.</td>
<td>FOR 111</td>
<td>Introductory Agroforestry</td>
<td>1+1</td>
</tr>
<tr>
<td>6.</td>
<td>GPB 101</td>
<td>Fundamentals of Genetics</td>
<td>2+1</td>
</tr>
<tr>
<td>7.</td>
<td>HOR 101</td>
<td>Fundamentals of Horticulture</td>
<td>2+1</td>
</tr>
<tr>
<td>8.</td>
<td>SAC 101</td>
<td>Fundamentals of Soil Science</td>
<td>2+1</td>
</tr>
<tr>
<td>9.</td>
<td>MAT 101</td>
<td>Elementary Mathematics*</td>
<td>0+1</td>
</tr>
<tr>
<td>10.</td>
<td>NSS 101 /</td>
<td>National Social Service / National Cadet Corps*</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td>NCC 101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong> 11+11=22</td>
<td></td>
</tr>
</tbody>
</table>

*Non-Gradial Courses

SEMESTER II

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEN 101</td>
<td>Fundamentals of Entomology</td>
<td>2+1</td>
</tr>
<tr>
<td>2.</td>
<td>AEX 111</td>
<td>Fundamentals of Extension Education</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>AGR 111</td>
<td>Weed Management in Horticultural Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>BIC 101</td>
<td>Fundamentals of Biochemistry</td>
<td>1+1</td>
</tr>
<tr>
<td>5.</td>
<td>CRP 112</td>
<td>Growth and Development of Horticultural Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>6.</td>
<td>FSC 101</td>
<td>Orchard and Estate Management</td>
<td>1+1</td>
</tr>
<tr>
<td>7.</td>
<td>FSC 102</td>
<td>Tropical and Subtropical Fruits</td>
<td>2+1</td>
</tr>
<tr>
<td>8.</td>
<td>HOR 102</td>
<td>Plant Propagation and Nursery Management</td>
<td>1+1</td>
</tr>
<tr>
<td>9.</td>
<td>PAT 111</td>
<td>Fundamentals of Plant Pathology</td>
<td>2+1</td>
</tr>
<tr>
<td>10.</td>
<td>VSC 101</td>
<td>Tropical and Subtropical Vegetables</td>
<td>2+1</td>
</tr>
<tr>
<td></td>
<td>NSS 101 /</td>
<td>National Social Service / National Cadet Corps*</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td>NCC 101</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong> 14+10=24</td>
<td></td>
</tr>
</tbody>
</table>

*Non-Gradial Course continued from first semester
### SEMESTER III

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEG 211</td>
<td>Farm Power and Machinery</td>
<td>1+1</td>
</tr>
<tr>
<td>2.</td>
<td>AEN 211</td>
<td>Apiculture, Sericulture and Lac Culture</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>AGR 211</td>
<td>Agro-meteorology and Climate Change</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>COM 211</td>
<td>Computer Applications in Horticulture</td>
<td>0+1</td>
</tr>
<tr>
<td>5.</td>
<td>FLA 201</td>
<td>Commercial Floriculture</td>
<td>2+1</td>
</tr>
<tr>
<td>6.</td>
<td>FSC 201</td>
<td>Temperate Fruit Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>7.</td>
<td>GPB 201</td>
<td>Fundamentals of Plant Breeding</td>
<td>2+1</td>
</tr>
<tr>
<td>8.</td>
<td>PAT 211</td>
<td>Diseases of Fruit, Plantation, Medicinal and Aromatic Crops &amp; Their Management</td>
<td>2+1</td>
</tr>
<tr>
<td>9.</td>
<td>PHT 201</td>
<td>Fundamentals of Food Technology</td>
<td>1+1</td>
</tr>
<tr>
<td>10.</td>
<td>STA 201</td>
<td>Statistical Methods</td>
<td>1+1</td>
</tr>
<tr>
<td>11.</td>
<td>VSC 201</td>
<td>Temperate Vegetable Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>NSS 101 / NCC 101</td>
<td>National Social Service / National Cadet Corps*</td>
<td>0+1</td>
<td></td>
</tr>
<tr>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
<td>0+1</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL 13+11=24

*Non-Gradial Course continued from first semester

### SEMESTER IV

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEN 212</td>
<td>Insect Pests of Fruit, Plantation, Medicinal &amp; Aromatic Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>2.</td>
<td>AGR 212</td>
<td>Water Management in Horticultural Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>ANM 211</td>
<td>Nematode Pests of Horticultural Crops and Their Management</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>FLA 203</td>
<td>Ornamental Horticulture</td>
<td>1+1</td>
</tr>
<tr>
<td>5.</td>
<td>FSC 202</td>
<td>Breeding of Fruit and Plantation Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>6.</td>
<td>GPB 211</td>
<td>Elementary Plant Biotechnology</td>
<td>1+1</td>
</tr>
<tr>
<td>7.</td>
<td>HOR 201</td>
<td>Dry land Horticulture</td>
<td>1+1</td>
</tr>
<tr>
<td>8.</td>
<td>SAC 211</td>
<td>Soil, Water and Plant Analysis</td>
<td>0+1</td>
</tr>
<tr>
<td>9.</td>
<td>SPC 201</td>
<td>Plantation Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>10.</td>
<td>SPC 202</td>
<td>Spices and Condiments</td>
<td>2+1</td>
</tr>
<tr>
<td>11.</td>
<td>PJN 201</td>
<td>Education Tour - I (State Tour)#</td>
<td>0+1</td>
</tr>
<tr>
<td>NSS 101 / NCC 101</td>
<td>National Social Service / National Cadet Corps*</td>
<td>0+1</td>
<td></td>
</tr>
<tr>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
<td>0+1</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL 13+11=24

*Non-Gradial Course continued from first semester

# Non-Gradial Course
### SEMESTER V

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEN 311</td>
<td>Insect Pests of Vegetable, Ornamental and Spice Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>2.</td>
<td>AEX 301</td>
<td>Communication Skills and Personality Development</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>FLA 301</td>
<td>Principles of Landscape Architecture</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>PAT 311</td>
<td>Diseases of Vegetable, Ornamental and Spice Crops &amp; Their Management</td>
<td>2+1</td>
</tr>
<tr>
<td>5.</td>
<td>PHT 302</td>
<td>Postharvest Management of Horticultural Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>6.</td>
<td>SPC 301</td>
<td>Medicinal and Aromatic crops</td>
<td>2+1</td>
</tr>
<tr>
<td>7.</td>
<td>SAC 301</td>
<td>Manures, Fertilizers and Soil Fertility Management</td>
<td>2+1</td>
</tr>
<tr>
<td>8.</td>
<td>VSC 301</td>
<td>Crop Production in Vegetable Crops</td>
<td>0+2</td>
</tr>
<tr>
<td>9.</td>
<td>VSC 302</td>
<td>Breeding of Vegetable, Tuber and Spice Crops</td>
<td>2+1</td>
</tr>
</tbody>
</table>

**TOTAL** 14+10=24

### SEMESTER VI

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEC 311</td>
<td>Horti-Business Management</td>
<td>2+0</td>
</tr>
<tr>
<td>2.</td>
<td>AEX 302</td>
<td>Entrepreneurship Development and Business Management</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>AGR 311</td>
<td>Introduction to Major Field Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>AGR 312</td>
<td>Organic Farming</td>
<td>2+1</td>
</tr>
<tr>
<td>5.</td>
<td>ENS 301</td>
<td>Environmental Studies and Disaster Management</td>
<td>2+1</td>
</tr>
<tr>
<td>6.</td>
<td>FLA 301</td>
<td>Breeding and Seed Production of Flower and Ornamental Plants</td>
<td>2+1</td>
</tr>
<tr>
<td>7.</td>
<td>PHT 303</td>
<td>Processing of Horticultural Crops</td>
<td>1+2</td>
</tr>
<tr>
<td>8.</td>
<td>HOR 302</td>
<td>Precision Farming and Protected Cultivation</td>
<td>2+1</td>
</tr>
<tr>
<td>9.</td>
<td>SST 311</td>
<td>Seed Production of Vegetable, Tuber and Spice Crops</td>
<td>2+1</td>
</tr>
</tbody>
</table>

**TOTAL** 15+9=24
### SEMESTER VII

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEX 411</td>
<td>Rural Horticultural Work Experience (RHWE)-Placement in Villages</td>
<td>0+10</td>
</tr>
<tr>
<td>2.</td>
<td>HOR 401</td>
<td>Rural Horticultural Work Experience (RHWE)-Placement in Industries</td>
<td>0+10</td>
</tr>
<tr>
<td>3.</td>
<td>PJN 401</td>
<td>Educational Tour - II (All India)*</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>0+21</td>
</tr>
</tbody>
</table>

* Non-Gradial Course

### SEMESTER VIII

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ELP ---</td>
<td>Experiential Learning Programme 1</td>
<td>0+10</td>
</tr>
<tr>
<td>2.</td>
<td>ELP ---</td>
<td>Experiential Learning Programme 2</td>
<td>0+10</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>0+20</td>
</tr>
</tbody>
</table>

### ABSTRACT

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>No. of Courses</th>
<th>Theory</th>
<th>Practical</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>I</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>10</td>
<td>14</td>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td>Second</td>
<td>III</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>24</td>
</tr>
<tr>
<td>Third</td>
<td>V</td>
<td>9</td>
<td>14</td>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>VI</td>
<td>9</td>
<td>15</td>
<td>9</td>
<td>24</td>
</tr>
<tr>
<td>Fourth</td>
<td>VII</td>
<td>3</td>
<td>0</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>VIII</td>
<td>2</td>
<td>0</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>66</strong></td>
<td><strong>80</strong></td>
<td><strong>103</strong></td>
<td><strong>183</strong></td>
</tr>
</tbody>
</table>
# SEMESTER I

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEC 111</td>
<td>Economics and Marketing</td>
<td>2+1</td>
</tr>
<tr>
<td>2.</td>
<td>AGM 111</td>
<td>Introductory Microbiology</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>CRP 111</td>
<td>Introductory Crop Physiology</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>ENG 101</td>
<td>Comprehension and Communication Skills in English</td>
<td>0+1</td>
</tr>
<tr>
<td>5.</td>
<td>FOR 111</td>
<td>Introductory Agroforestry</td>
<td>1+1</td>
</tr>
<tr>
<td>6.</td>
<td>GPB 101</td>
<td>Fundamentals of Genetics</td>
<td>2+1</td>
</tr>
<tr>
<td>7.</td>
<td>HOR 101</td>
<td>Fundamentals of Horticulture</td>
<td>2+1</td>
</tr>
<tr>
<td>8.</td>
<td>SAC 101</td>
<td>Fundamentals of Soil Science</td>
<td>2+1</td>
</tr>
<tr>
<td>9.</td>
<td>MAT 101</td>
<td>Elementary Mathematics*</td>
<td>0+1</td>
</tr>
<tr>
<td>10.</td>
<td>NSS 101 /</td>
<td>National Social Service / National Cadet Corps*</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td>NCC 101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
<td>0+1</td>
</tr>
</tbody>
</table>

TOTAL 11+11=22

*Non-Gradial Courses
Outcomes:

- In-depth understanding the nature and scope of Economics, consumer behavior, production and Tax
- Understanding the importance of market distribution, marketing analysis and finance.

Theory

Unit-1: Scope of Economics and consumer behaviour

Nature and scope of economics, definition and concepts, divisions of economics, economic systems, approaches to the study of economics. Consumption – theory of consumer behaviour, laws of consumption, classification of goods. Wants – their characteristics and classification,

Unit-I1: Theory of Consumption


Unit-II1: Factors production and Macro Economic theory


Unit-IV: Theory of Distribution and Marketing


Unit-V: Marketing Analysis and Finance

Market intelligence – Basic guidelines for preparation of project reports- Bank norms – Insurance – SWOT analysis – Crisis management. Agricultural Finance – meaning, Agricultural credit: meaning, definition, need, classification. Institutional and non-institutional sources,
commercial banks and nationalization of commercial banks, Micro financing including KCC. RRBs, RBI, NABARD, World Bank, Credit analysis: 3R’s, 7P’s and 3C’s of credits.

Practical


Theory schedule

1. Nature and scope of economics, definition and concepts, Divisions of economics
2. Economic systems, approaches to the study of economics.
4. Wants – their characteristics and classification,
5. Utility and its measurement, cardinal and ordinal,
6. law of diminishing marginal utility, law of equi-marginal utility,
7. Indifference curve and its properties, consumer equilibrium.
8. Theory of demand, demand schedule, market demand.
9. Elasticity of demand- Price, income and cross elasticities,
10. Engil’s law of family expenditure – consumer’s surplus.
11. Law of supply – supply schedule and curve elasticities.
14. National Income: Meaning and Importance, concepts of National income accounting and approaches to measurement
15. Money: Meaning and functions of money, classification of money, inflation
16. Tax: meaning, direct and indirect taxes, VAT/GST
17. Mid Semester Examination
19. Price determination under various market structures.
21. Marketing functions – Classification of markets
22. Marketing of various channels for fruits – Price spread – Marketing Efficiency
23. Marketing of various channels for Vegetables – Price spread – Marketing Efficiency
24. Integration – Constraints in marketing of agricultural produce, Market intelligence – Basic guidelines for preparation of project reports
26. Agricultural Finance- meaning, Agricultural credit: meaning, definition, need, classification.
27. Institutional and non-institutional sources of credit-Merits and demerits
28. Co-operative credit institutions/RRB
29. Commercial banks and nationalization of commercial banks
30. Micro financing including KCC, SHG
31. Higher financing institutions- RBI, NABARD, World Bank,
32. Credit analysis: 3 R’s, 7P’s and 3C’s of credits.

Practical Schedule

1. Law of Diminishing Marginal Utility.
2. Law of Equi - Marginal Utility.
3. Indifference Curve analysis - Properties, budget line and consumer equilibrium.
4. Individual and market demand - Graphical derivation of individual and market demand.
5. Estimation of Consumer surplus.
6. Computation of National Income
7. Types and functions of money
8. Market Structure and Price determination-Perfect competition
11. Identification of marketing channel for the horticultural commodities
12. Calculation of Price Spread
13. Visit to various markets
14. Visit to various markets
15. Visit to PACCS/RRB
16. Visit to Commercial Bank
17. Practical Examination

References


**E-References:**

1. [www.pajancoa.ac.in](http://www.pajancoa.ac.in)
2. [www.tawn.tnau.ac.in](http://www.tawn.tnau.ac.in)
3. [www.usbr.gov/pn/agri.met](http://www.usbr.gov/pn/agri.met)
AGM 111 INTRODUCTORY MICROBIOLOGY (1+1)

Outcomes:

- In-depth understanding the history and scope of microbiology, the principles and types of microscopy and microbial physiology
- Understanding the importance of Virology and Microbial Genetics, Soil Microbiology and Applied Microbiology

Theory

Unit I: History and Scope of Microbiology

Contributions of Anton Von Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Beijerinck, Winogradsky and Waksman; Position of microorganisms in living world; Spontaneous Generation theory; Germ theory of disease.

Unit II: Microscopy and Microbial physiology

Microscopy – principles and types. Prokaryotes Vs Eukaryotes; Bacterial size, shape, arrangement and morphology; Structure and organization of a bacterial cell; Bacterial growth, reproduction; Growth curve.

Unit III: Virology and Microbial Genetics

Viruses, Bacteriophages – Lytic and Lysogenic cycles; Genetic recombination – Transformation, Conjugation and Transduction.

Unit IV: Soil Microbiology

Microbial interactions; Rhizosphere:Plant growth promoting rhizobacteria; Biological nitrogen fixation; Types and importance of biofertilizers.

Unit V: Applied Microbiology

Industrially important microorganisms, common microbial fermentations-silage, saurkraut. Mushroom-types and production.

Practical

Microscopy - light microscopes; Staining techniques - simple and differential staining; Sterilization – Principles and techniques, equipment and apparatus used for sterilization; Media preparation; Isolation and enumeration of soil microorganisms; Purification of microorganisms; Saurkraut production. Organic matter decomposition – measurement of CO₂ evolution; Demonstration of antibiosis. Isolation of N₂ fixing and phosphate solubilizing microorganisms; Mass production of bacterial biofertilizers and method of application. Mushroom cultivation techniques.
Theory schedule

1. Definition and scope of Microbiology ; Composition of Microbial world
2. History and development of Microbiology-Contributions of Anton Van Leeuwenhoek, Louis Pasteur, John Tyndall, Edward Jenner, Joseph Lister, Beijerinck, Winogradsky and Waksman
4. Microscopy: principles - different types of microscopy
5. Prokaryotes Vs Eukaryotes.
6. Bacterial morphology - arrangement of cells, structures and reproduction in bacteria.
9. Mid semester examination
11. Microbial interactions in soil - neutralism, positive and negative interactions.
12. Rhizosphere:Plant growth promoting rhizobacteria
14. Types of biofertilizers and their importance.
15. Industrially important microorganisms-silage, saurkraut production
16. Mushroom importance, types and production techniques.

Practical schedule

1. Microscopy- principles - handling light microscope.
2. Staining - principles and techniques-Simple and Gram staining
3. Sterilization- principles and techniques - equipment and apparatus used for sterilization
4. Media preparation for bacteria, fungi and actinomycetes
5. Enumeration of soil microorganisms- serial dilution plate technique.
6. Purification of bacteria
7. Purification of fungi
10. Demonstration of antibiosis – crowded plate assay
11. Isolation of symbiotic N₂ fixing bacteria – Rhizobium
12. Isolation of associative and non symbiotic N₂ fixer: Azospirillum and Azotobacter
13. Isolation of phosphate solubilizing microorganisms.
14. Mass production of biofertilizers and method of application of Biofertilizers
15. Saurkraut production.
16. Mushroom cultivation techniques.
17. Final practical examination.
References


Web resources

http://www.microbes.info
http://aem.asm.org
http://microbelibrary.com
http://www.rapidmicrobiology.com
Kenneth Todar, U. of Wisconsin-Madison, Department of Bacteriology. URL (http://www.textbookofbacteriology.net/).

CRP 111    INTRODUCTORY CROP PHYSIOLOGY (1+1)

Outcomes:

- In-depth understanding the role and significance of water in plants metabolism, nutrition and Photosynthesis.
- Understanding physiological function of Phytohormones, Secondary metabolites and different types of Stress Physiology.

Theory

Unit I: Water Relations in Plants

Unit II: Plant Nutrition

Essentiality of nutrients – Arnons and Leibieg; classification – based on requirement, biochemical function and mobility in plants – macro, secondary and micronutrients; Mechanism of absorption and its role in plant metabolism. Deficiency and toxicity symptoms; sand, hydroponics and aeroponic culture; Foliar nutrition and fertigation – significance and relevance. Biological nitrogen fixation.

Unit III: Photosynthesis

Photosynthesis – significance - structure and function of chloroplast; Electromagnetic radiation - Photosynthetically active radiation – resonance transfer; dark and light reactions, cyclic and non-cyclic electron transfer, CO₂ fixation – C₃, C₄ and CAM metabolism, advantages of C₄ pathway. Photorespiration and its implications, factors affecting photosynthesis. Mode of herbicide action

Unit IV: Phytohormones and Secondary metabolites


Unit V: Stress Physiology

Different types of Abiotic stresses - water stress - deficit and excess - physiological changes – adaptation – drought escape, avoidance and tolerance; Temperature stress - Physiological changes - low and high temperature – adaptation – mechanism of tolerance; Cold stress - Chilling and freezing injury – tolerance; Salt stress - physiological changes- adaptation – extrusion, compartmentalization and exclusion - mechanism of tolerance.

Practical:

Solution preparation; Measurement of water potential, osmosis, root pressure, structure of the stomata, Distribution, opening and closing of the stomata, measurement, transpiration measurement Nutritional disorders - Importance of light and chlorophyll in photosynthesis, pigment identification in horticultural crops and studying the enzyme activity of catalase, estimation of phenols, estimation of tolerance indices – proline, Chorophyll stability index, relative water content (RWC), studying plant movements.

Lecture Schedule

1. Introduction of Crop Physiology.
2. Role of water – process and significance – osmosis, imbibitions, diffusion, water potential - n - field capacity, water holding capacity of soil and permanent wilting point.
3. Stomata structure, distribution, classification – mechanism of opening and closing of stomata
6. Foliar diagnosis - nutritional and physiological disorders - sand, hydroponics and aeroponic culture - Foliar nutrition and fertigation – significance and relevance.


8. Differences between C₃, C₄ and CAM pathways - Factors affecting photosynthesis.

9. MID SEMESTER EXAMINATION


11. Mode of herbicide action in photosynthesis.

12. Phytohormones – physiological role of auxin, cytokinin, GA, ABA, ethylene


15. Temperature stress - Physiological changes - low and high temperature – adaptation Cold stress - Chilling & Freezing injury - tolerance mechanism


Practical Schedule

1. Preparation of solutions
3. Estimation of RWC
4. Estimation of stomatal index and stomatal frequency.
5. Nutritional disorders in crops plants
6. Rapid tissue testing
7. Estimation of chlorophyll content
8. Estimation of Carotenoid content
9. Separation of pigments in horticultural crops
10. Determination of photosynthetic efficiency.
11. Determination of transpiration rate
12. Estimation of proline accumulation to assess the water stress in crop plants.
13. Estimation of chlorophyll stability index
14. Estimation of catalase activity
15. Estimation of Phenols
16. Bioassay for hormones
17. FINAL PRACTICAL EXAMINATION

References:
ENG 101 COMPREHENSION AND COMMUNICATION SKILLS IN ENGLISH (0+1)

Outcomes:

- Understanding the concepts of listening comprehension, oral communication.
- Understanding the principles and practice of presentation skills, writing skills and interview skills.

Practical


Practical Schedule:

1. Listening - Introduction - Listening vs Hearing - listening modes - types of listening - Intensive and Extensive Listening – practice
2. Process of Listening - methods of enhancing listening - barriers to listening and ways to overcomethem – practice
3. Oral communication - organs of speech – English phonemes (consonant table, vowel table) - practice
5. Conversation techniques and practice
6. Rate of speech (slow pace, medium pace, rhetoric)
7. Reading - types - skimming and scanning - SQ4R - critical reading - analytical reading – exercises
8. Principles and practice of presentation skills - PowerPoint preparation and presentation
10. Writing skills - note taking – precise writing – abstract writing – practice
11. Mind-mapping and article writing
12. Letter writing and rejoinder writing
13. Text writing - practice on table to text conversion
15. Practice on speaking skills – welcome address - vote of thanks - short extemporal speech
16. Group discussion – techniques – types and practice
17. Final Practical Examination

References


E-references:

www.orwell.ru/library/articles/spirit/english/e_spirit
www.essays.com
www.onestopenglish.com
www.bogglesworld.com
www.eltweb.com
www.reportingskills.com
www.writing-skills.com
www.negotiation.com
www.teachersdesk.com
www.flexbilelearning.net.an
Outcomes:

- In-depth understanding the history, classification and role of forestry and agroforestry.
- Understanding the difference between social and agro forestry, silviculture practices of tree species.

Theory

Unit-I: Indian Forest and classification
Definition of Forest – Indian forest – Status – Classification of forest and forestry – Role of forest – Silvics and silviculture – Locality factors – Regeneration factors

Unit-II: Agroforestry and its history

Unit-III: Classification of agroforestry

Unit-IV: Social forestry
Social forestry- Definition, concept and history-JFM- TNAP concept- Difference between social forestry and agroforestry- Agroforestry and social forestry projects- foreign funding agencies – success stories

Unit-V: Silviculture practices of tree species
Selection of tree species for Agroforestry - Choice of species - Modern silvicultural techniques in site selection- Land preparation- Planting- Tending and cultural operation- Economics of cultivation in Multipurpose Tree Species (MTP) viz.,Acacia catechu, Dalbergia sissoo, Teak, Eucalyptus spp, Casuarina, Bamboo, Ailanthus, Neem.

Practical
Identification of seeds and seedlings of multipurpose tree species – Lay out of tree nursery – Seed treatment practices for various agroforestry tree species – Clonal propagation in tree species - Nursery practices for Eucalyptus, Casuarina, Meliadubia, Gemlina, Teak and Bamboos. Visit to agroforestry fields to study the compatibility of MPTs with agricultural crops – Estimation of light under different agroforestry systems viz. agrisilviculture, silvipasture - Visit to social forestry plantations – Canal bank plantations - Roadside plantations - Industrial plantations and windbreaks – Estimation of nutritive values of major fodder tree species -Estimation of girth, height and volume of trees in agroforestry – Study of Non Wood Forest Produce in agroforestry.
References

Lecture Schedule
1. Introduction – Definition of forest and forestry – Branches of forestry – History of forests in India - Status of Indian forests.
2. Role of Forest- Silvics and Silviculture - Locality factors and regeneration factors - Natural regeneration and artificial regeneration.
3. Agroforestry – Definition - Objectives - Potential and need – Role of trees in agroforestry systems
4. Planning of Agroforestry - Constraints- Diagnosis and design
5. Classification of Agroforestry systems - Functional - Structural - Socio economic - Ecological basis and others
6. Agrisilviculture systems - Improved fallow species in shifting cultivation -Taungya system, Multi species tree garden and alley cropping
7. Agrisilviculture systems - Multipurpose trees and shrubs on farm lands –Windbreaks and shelterbelts - Crop combinations with plantation crops - Fuel wood plantations
9. **MID SEMESTER EXAMINATION**

10. Agroforestry systems and their applications for different agro climatic zones of Tamil Nadu.

11. Social forestry concepts, history, objectives and applications - JFM, TNAP concepts, Difference between social forestry and agro forestry - Different projects under social forestry and agro forestry- funding agencies for social forestry – success stories


14. Nursery, silvicultural characters, regeneration techniques, management practices, rotation and use of Eucalyptus and Casuarina

15. Nursery, silvicultural characters, regeneration techniques, management practices, rotation and use of *Melia dubia* and Neem

16. Nursery, silvicultural characters, regeneration techniques, management practices, rotation and use of Ailanthus and bamboos

**Practical Schedule**

1. Identification and collection of seeds of multipurpose tree species
2. Lay out of tree nursery and its management
3. Seed treatment practices of important agroforestry tree species
4. Identification of pasture species and their seeds
5. Clonal propagation in forest tree species
6. Nursery techniques for Eucalyptus, *Casuarina* and *Acacia catechu*,
7. Nursery techniques for *Dalbergia sissoo, Melia dubia, Gmelina arborea*
8. Nursery techniques for *Teak, Bamboo, Ailanthus*
9. Visit to agroforestry fields to study compatibility of agricultural crops with tree crops
10. Estimation of light under different agroforestry systems
11. Estimation of nutritive values of major fodder tree species
12. Estimation of girth, height and volume of trees in agroforestry
13. Study on Non Wood Forest Produce in agroforestry
14. Visit to social forestry plantations
15. Visit to canal bank plantations and roadside plantations
16. Visit to industrial plantations and windbreaks

**17. PRACTICAL EXAMINATION**
Outcomes:

- In-depth understanding of the Definition of genetics, heredity, inheritance, cytology, cytogenetics, Mendelian laws, Quantitative inheritance, Linkage and Crossing over.

- Understanding the Sex determination, sex linkage and cytoplasmic inheritance, Modern concept of genetics and mutation

THEORY

Unit I: Cytology

Unit II: Mendelian laws and modifications of Mendelian laws

Unit III: Quantitative inheritance, Linkage and Crossing over
Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Linkage - coupling and repulsion; Experiment on Bateson and Punnet. Chromosomal theory of linkage of Morgan – Complete and incomplete linkage - Linkage group. Crossing over – significance of crossing over; cytological proof for crossing over - Stern’s experiment - Factors controlling crossing over. Strength of linkage and recombination; Two point
and three point test cross. Double cross over, interference and coincidence; genetic map, physical map.

Unit IV: Sex determination, sex linkage and cytoplasmic inheritance

Unit V: Modern concept of genetics and mutation
DNA, the genetic material – Griffith’s experiment, Avery, McLeod and McCarthy Experiment – confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment. Structure of DNA – Watson and Crick model. Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication. RNA types - mRNA, tRNA, rRNA. Protein synthesis - Regulation of gene expression – Operon model of Jacob andMonad – *Lac* and *Trp* operons. Fine structure of gene; *r^IL* locus. Benzer experiments, Concept of Cistron, muton and recon. Mutation – characteristics of mutation – micro and macro mutation – ClB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

PRACTICAL

Theory schedule
1. Definition of genetics, heredity, inheritance, cytology, cytogenetics; Brief history of developments in genetics and cytogenetics, Ideas of heredity.
2. Physical basis of heredity, Meaning of the term genome and C- valus: Structure and function of cell and cell organelles –Differences between Prokaryotes and Eukaryotes. Cell division – mitosis
3. Cell division - meiosis and their significance
4. Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram
5. Types of chromosomes based on position of centromere, based on structure and function: normal and special chromosomes - polytene, lampbrush, B chromosomes, ring and isochromosomes.
11. Duplicate dominant epistasis (15:1), Duplicate recessive epistasis (9:7), Dominant and recessive epistasis (13:3); Summary of epistatic ratios.
12. Lethal genes, Pleiotrophy, penetrance and expressivity, Multiple alleles, blood group in humans, coat colour in rabbits, self-incompatibility in plants; pseudo alleles, isoalleles.
15. Linkage - coupling and repulsion; Experiment of Bateson and Punnet

17. MID SEMESTER EXAMINATION
18. Crossing over – significance of crossing over; cytological proof for crossing over - Stern’s experiment; Factors controlling crossing over.
19. Strength of linkage and recombination; Two point and three point test cross. Double cross over, interference and coincidence; genetic map, physical map.
21. Genic balance theory of Bridges - Gynandromorphs
22. Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex limited inheritance - Genetic disorders
23. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in Mirabilis jalapa - cytoplasmic male sterility in maize, kappa particles of paramecium
24. DNA, the genetic material – Griffith’s experiment, experiment of Avery, McCleod and McCarthy.
25. Confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment.
27. DNA replication: steps involved in DNA replication. Transcription: RNA types - mRNA, tRNA, rRNA.
28. Translation: Steps involved in protein synthesis
29. Regulation of gene expression – Operon model of Jacob and Monad – Lac and Trp operons.
30. Fine structure of gene; r" locus. Benzer experiments, Concept of Cistron, muton and recon.
32. Molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

Practical Schedule
1. Microscopy & Principles of killing and fixing; preparation of stains and preservatives.
2. Mitosis in root tip of Onion/Aloe sp.
3. Mitosis in root tip of Onion/Aloe sp.
4. Procedure for fixing and observing different meiotic phases in the inflorescence of rice, maize
5. Procedure for fixing and observing different meiotic phases in the inflorescence in pearl millet, sorghum, maize and making temporary slides permanent.
6. Monohybrid genetic ratio with dominance, incomplete dominance, co-dominance and test cross, back cross and lethal genes.
7. Dihybrid ratio with dominance, with incomplete dominance and test cross
8. Simple interaction of genes-comb character in fowls; Dominant epistasis. Recessive epistasis, Duplicate and additive epistasis.
9. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
10. Multiple alleles and polygenic inheritance
11. Estimation of linkage with F2 and test cross data; Coupling and repulsion.
12. Problems on three point test cross; working out interference, coincidence and drawing genetic maps.
13. Problems in cytoplasmic/ maternal inheritance.
15. Problems in DNA replication, transcription and translation.
16. Problems in gene regulation/ Mutation.
17. FINAL PRACTICAL EXAMINATION

References

E- References
1. www.nmsu.edu
2. www.biology200.gsu.edu
Outcomes:
- In-depth understanding the economic importance and classification of horticultural crops, Orchard and kitchen garden layout, Nursery and canopy management
- Understanding the types and use of cropping systems and orchard management, Rejuvenation of orchards and organic farming

Theory

Unit-I: Basics of horticulture
Economic importance and classification of horticultural crops - their nutritive value, area and production, exports and imports, fruit and vegetable zones of India and Tamil Nadu, nursery management practices, soil and climate for horticultural crops.

Unit-II: Orchard and kitchen garden layout
Vegetable gardens, nutrition and kitchen garden and other types of gardens – principles, planning and layout, management of orchards, planting systems and planting densities.

Unit-III: Nursery and canopy management
Propagation practices for fruit, vegetable and floriculture crops, nursery techniques and their management. Principles and methods of pruning and training of fruit crops.

Unit-IV: Cropping systems and orchard management
Types and use of growth regulators in horticulture, water management, weed management, fertility management in horticultural crops, cropping systems, intercropping, multi-tier cropping, mulching, bearing habits, factors influencing the fruitfulness and unfruitfulness.

Unit-V: Rejuvenation of orchards and organic farming
Rejuvenation of old orchards, top working, frame working, principles of organic farming.

Practical
Features of orchard, planning and layout of orchard, tools and implements, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits and vegetables, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.
References

Lecture Schedule
1. Definition, scope, importance and divisions of Horticulture
2. Horticultural crops classification and nutritive value of horticultural crops
3. National and Global status on area, production, export and import of horticultural crops
4. Horticulture zones of India and Tamil Nadu
5. National and state level organisations involved in horticultural research and development
6. Nursery – Definition lay out and types
7. Nursery techniques for production of healthy planting materials in vegetable crops
8. Asexual propagation techniques in horticultural crops
9. Role of climatic factors in horticultural crop production
10. Physical and chemical properties of soil in relation to horticultural crop production
11. Types of vegetable garden
12. Principles and method of laying out kitchen garden / Nutrition garden
13. Site selection and planning for orchard establishment
14. Orchard layout and different planting systems and planting of horticultural crops
15. High Density planting in orchards
16. Clonal orchard – definition and functions
17. MID SEMESTER EXAMINATION
18. Growth regulators – definition and types
19. Role of growth regulators in horticulture crops
20. Irrigation – Definition, methods, merits and demerits
21. Weed and weed management in horticultural crops
22. Manures and fertilizers in horticultural crops – role and methods of application
23. Mulching- Definition, objective and types of mulching in horticultural crops
Practical Schedule
1. Study of various features in Orchard and identification of horticultural crops
2. Study of tools and implements used in Horticulture
3. Planning and layout of orchard
4. Studies on seed treatment in horticultural crops
5. Preparation of nursery beds and protray nursery rising for horticultural crops
6. Layout of Kitchen garden / nutrition garden
7. Studies on planting systems in fruit trees
8. Growth regulator preparation and application in horticultural crops
9. High density planting in fruit crops
10. Study of irrigation methods in horticultural crops
11. Study of fertilizers application methods in horticultural crops
12. Studies on nutritional disorders and their management in horticultural crops
13. Canopy management in horticultural crops
14. Studies on bearing habit, maturity indices and harvesting techniques in horticultural crops
15. Composting techniques for organic horticulture
16. Visit to private orchards
17. PRACTICAL EXAMINATION

SAC 101 FUNDAMENTAL OF SOIL SCIENCE (2+1)

Outcomes:
- In-depth understanding the origin of earth, rocks, minerals, soil genesis and soil taxonomy
- Understanding soil physical, chemical and biological properties and Soil survey, Soil pollution

Theory

Unit – I – Study of origin of earth, rocks and minerals
Soil as a natural body, Pedological and edaphological concepts, Origin of the earth, Earth’s crust; Composition: Formation and classification of Rocks and minerals.
Unit – II – Soil genesis and soil taxonomy
Weathering, Soil genesis-soil forming factors and processes. Components of soils; Soil profile. Elementary knowledge of soil taxonomy classification

Unit – III& IV - Soil Physical properties
Soil physical properties, Soil physical properties: Soil-texture, structure, density and porosity, soil colour, soil consistency and plasticity; soil crusting and compaction, Soil water-Retention and potentials, Soil moisture constants, Movement of soil water, Infiltration, percolation, permeability, conductivity. Soil air, composition, gaseous exchange, problem and effect on plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth

Unit – V- Soil Chemical, Biological properties and Soil survey, Soil pollution
Soil reaction - pH, soil acidity and alkalinity, buffering effect of pH on nutrient availability; EC and its impact on plant growth, soil colloids inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation of soil.
Soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and microorganisms, their beneficial and harmful effects
Soil survey- types and methods, soils of India. Soil degradation pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

References
Web resources
1. http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V67-4C837XP&_user=2945072&_coverDate=01/31/2005&_rdoc=1&_fmt=high&_origepubdate=01/31/2005&_sort=d&_docanchor=&_sectionstart=1&_sectionend=&_version=1&_acct=C000000001&_version=1&_urlVersion=0&_userid=2945072&md5=01f16c3e6359fed85945ccf0130027a3

Theory Schedule
1. Soil Science- Introduction, importance, scope, branches of soil science, soil definition, pedological and edaphological concepts.
2. Origin of earth- theories of earth formation- division of earth sphere
3. Composition of earth crust
4. Minerals- definition, occurrence, classification based on abundance, specific gravity, mode of origin and chemical composition
5. Study of silicate and non-silicate minerals
6. Rocks- definition, formation, composition, classification of rocks – igneous, sedimentary and metamorphic rocks and their classification
7. Weathering of rocks and minerals-definition, types- physical, chemical and biological weathering.
8. Factors influencing weathering, products of weathering and weathering sequence.
10. Soil forming processes- Fundamentals and specific processes.
11. Soil profile- description- master horizons – pedon, polypedon
12. Elementary knowledge of soil taxonomy- USDA classification
13. Soil physical properties-soil texture- soil separates and their properties. Particle size analysis
14. Textural classes- triangular textural diagram, significance of soil texture on soil properties and plant growth
15. Soil structure- genesis, mechanism of aggregate formation, classification based on types, class and grade
17. Mid-semester Examination
18. Soil porosity- definition, types of pores, factors affecting porosity and its importance.
22. Soil colour - causes, measurement- munsell colour chart- factors influencing soil colour- significance
23. Soil air- composition, importance, mechanism of gaseous exchange and their management.
27. Soil reaction - pH, soil acidity and alkalinity, buffering effect of pH on nutrient availability, EC and their effect on plant growth
28. Soil colloids inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation of soil.
30. Humic substances - nature and properties; soil organisms: macro and microorganisms, their beneficial and harmful effects.
31. Soil survey- types, methods and purpose of soil survey and Soils of India.
32. Soil degradation pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

**Practical Schedule:**

1. Soil analytical techniques and concepts. Common laboratory apparatus. Do’s and don’ts in a soil chemistry laboratory
2. Preparation of standard solutions and indicators.
3. Standardization of an acid (Acidimetry).
4. Standardization of a base (Alkalimetry)
5. Identification of rocks and minerals.
6. Study of soil profile in the field.
7. Study of soil sampling tools, collection of representative soil sample, its processing and storage
8. Determination of bulk density and particle density and per cent porosity.
9. Determination of soil texture by feel method
10. Determination of soil texture by Bouyoucos method.
11. Determination of Soil colour and soil temperature
12. Estimation of Soil moisture content and Soil moisture potential
13. Determination of saturated Hydraulic conductivity of soil
14. Determination of Infiltration rate in soil
15. Determination of soil pH and EC.
17. Practical Exam
MAT 101    ELEMENTARY MATHEMATICS     (0+1)

Outcomes:

- Understanding the concepts of matrices, determinants, analytical geometry and differential calculus.
- Skill to apply mathematical models in Agricultural systems.

UNIT 1
Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation. Permutation and Combination - meaning of nPr and nCr (simple problems).

UNIT 2
Analytical Geometry: Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two straight lines, Angles between two straight lines, Parallel lines, Perpendicular lines. Angle of bisectors between two lines, Area of triangle and quadrilateral. Tangent and Normal to a given circle at a given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$
Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points $(x_1, y_1)$ and $(x_2, y_2)$.

UNIT 3
Differential Calculus: Definition of function, limit and Continuity, Simple problems on limit and Continuity. Differentiation of $x^n$, $e^x$, $\sin x$ & $\cos x$ from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form $y = f(x)$ (Simple problems based on it).

UNIT 4
Integral Calculus: Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).

UNIT 5
Mathematical Models: Agricultural systems - Mathematical models - classification of mathematical models - Fitting of Linear, quadratic and exponential models to experimental data.
Practical Schedule:
1. Simple problems in Permutation and Combination.
2. Problems in Addition, Subtraction, Multiplication and Transpose of a matrix
3. Problems in determinants and Inverse up to 3\textsuperscript{rd} order by adjoint method.
4. Problems in Straight lines using distance formula, section formula (internal and external division), Change of axes (only origin changed) - Equation of co-ordinate axes- Equation of lines parallel to axes.
5. Problems in Slope-intercept form of equation of line, Slope-point form of equation of line, two point forms of equation of line, Intercept form of equation of line.
6. Problems in Normal form of equation of line, General form of equation of line, Point of intersection of two straight lines.
7. Problems in Angles between two straight lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines.
8. Problems in Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x1, y1) & (x2, y2).
9. MID SEMESTER
10. Simple problems in limit and continuity. Problems in differentiation of x^n, e^x, sin x & cos x, derivatives of sum, difference.
12. Problems in Maxima and Minima of the functions of the form y=f(x).
13. Problems in integration of simple functions and product of two functions using integration by parts-Definite Integral.
14. Integration by substitution method-Problems in Area under simple well-known curves
15. Problems in fitting linear models to experimental data.
16. Problems in fitting Quadratic and Exponential models to experimental data.

17. Final Practical Examination.

References:
NSS 101 NATIONAL SERVICE SCHEME (0+1)

Outcomes:

- Understanding organizational set up of NSS at Central, State University and college levels
- Understanding NSS programme planning and implementation, awareness campaign, campus development activities and NSS special camp of villages.

I Year

II Year

Practical Schedule:
I Semester
1. Orientation of NSS volunteers and programme coordinator and Programme officers.
2. Origin of NSS in India and its development
3. NSS motto, symbol and NSS awards
4. Organizational set up of NSS at Central, State University and college levels.
5. Programme planning – Theme of the year – planning implementation at PC, PO and NSS volunteer level.
6. Visit to selected village - gathering basic data on socio economic status.
7. Participatory rural appraisal – studying the needs of the target group.
8. Visit of urban slum and gathering data on socio economic status.
9. Self involvement and methods of creating rapport with the target group.
10. Awareness campaign on welfare schemes of the central and state government.
11. Formation career guidance group with NSS volunteers and students welfare unit
12. Cycle rally on environmental protection.
13. Campus development activities – clean environment campaign, formation of plastic free zones.
14. Campus development, tree planting maintenance and greening the campus cleaning.
15. Final Examination.
II SEMESTER
1. 1–3: Motivation of rural and urban youth for formation of SHG (Self Help Groups) in collaboration with Government machineries and NGOs.
2. Campaign on ill effects of plastics in the adjoining campus areas – Villages / urban areas.
3. Campaign on *Parthenium* eradication.
5. Popularization of biogas and smokeless chulah.
6. Demonstration on the use of wind energy and solar energy.
7. Demonstration of water harvesting techniques.
8. Demonstration on soil conservation techniques wherever possible.
9. Campaign on Community health programmes of central and state Government – involving Health department officials.
10. AIDS awareness campaign; campaign on diabetes and healthy food habits and drug abuse.
11. Planning formation of blood donors club – involving NGOs.
12. Campaign on gender equality and women empowerment.
13. Campaign on child health care – immunization, food habits and child labour abolition.

III SEMESTER
1. Conducting field days with KVK to popularize improved agro techniques.
2. Conducting seminar / workshop in a nearby village to motivate the youth on agribusiness (involving DEE, KVK, NGO and local agro-entrepreneurs).
3–5  Campaign on self-employment opportunities like Apiculture, mushroom cultivation, Food processing and value addition, production of biocontrol agents and biofertilizers, nursery techniques, seed production, tissue culture, vermicompost, manufacture of small gadgets and agricultural implements as per local needs and feasibility.
7. Training the NSS volunteers on road safety measures in involving traffic wardens and RTO.
8. Training NSS volunteers on First AID and emergency call involving NGOs and organizations like St.John’s Ambulance, Red Cross, etc.,
10. Motivating NSS Volunteers on small savings concept and conveying the message to the public through them.
12. Observation of National integration and communal harmony.
14 – 16: Campus development and greening activities
17. Final Examination.

IV SEMESTER
1. Visit to orphanages and old age homes to look after their needs.
2. Personality development programmes – Building up self confidence in youth.
3. Teaching NSS volunteers on mediation Yoga and art of healthy living with trained teachers.
4. Visit of nearby National Monument / Places of tourist importance and campaign on cleanliness and preservation.
5. Exploration of hidden talents of village youth and public on folklore, traditional art, sports, martial arts and cultural heritage. Campus improvement activities Visit to special camp village and pre camp planning.

6. Final Examination.

Besides the above, NSS volunteers will attend work during important occasions like Convocation, Farmers day, Sports meet and other University / College functions. NSS Volunteers will attend one special camp in the selected village for a duration of 7 days and undertake various activities based on the need of that village. For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (cycle able distance) Special camp activity will be conducted in a village situated within a radius of 15 – 20 KM.

NCC 101 National Cadet Corps 0+1

Outcomes

- Understanding principles of NCC, NCC system of training, Arms drill, Guard of honour and Ceremonial Drill
- Skill in weapon training, First-Aid, self Defense mechanisms, adventure training and camps.


Specialised subject-Navy-Naval Orientation -Naval communication-Navigation-Seamanship - Oceanic wealth-Gunnery-Fire Fighting and Damage control &Safety- Ship and Boat modelling-Submarine-Search and Rescue-Antisubmarine-Swimming

<table>
<thead>
<tr>
<th>Practical schedule</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General - Military History -Historical – geographical – Customs and Traditions of India -Defence services</td>
</tr>
<tr>
<td>2</td>
<td>Introduction to NCC – NCC Song-Aims of NCC – Principles of NCC-NCC organization-Duties of good citizen</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>System of NCC training – Drill – Foot drill – Arms drill - Word of command</td>
</tr>
<tr>
<td>4</td>
<td>Arms drill – Guard of Honour – Ceremonial Drill</td>
</tr>
<tr>
<td>5</td>
<td>Weapon Training &amp; Equipment – Parts of weapon – Communication – Different types</td>
</tr>
<tr>
<td>6</td>
<td>National Integration – Leadership – Civil affairs – Civil defence – Disaster management – Social service</td>
</tr>
<tr>
<td>7</td>
<td>First Aid – Health &amp; Hygiene</td>
</tr>
<tr>
<td>8</td>
<td>Environment and Ecology – Conservation – Pollution and its control</td>
</tr>
<tr>
<td>9</td>
<td>Self Defence Mechanisms – Boat pulling</td>
</tr>
<tr>
<td>10</td>
<td>Camps &amp; Adventure training/activities – Boat pulling</td>
</tr>
<tr>
<td>11</td>
<td>Changing trends in Technology – Personality development – Communication Skills – Group Discussion – Public Speaking, etc</td>
</tr>
<tr>
<td>12</td>
<td>Specialised subject – Navy – Naval Orientation – Naval communication – Navigation</td>
</tr>
<tr>
<td>13</td>
<td>Seamanship – Rigging – Oceanic wealth – Gunnery</td>
</tr>
<tr>
<td>14</td>
<td>Fire Fighting and Damage control &amp; Safety</td>
</tr>
<tr>
<td>15</td>
<td>Ship and Boat modelling – Submarine – Search and Rescue – Antisubmarine – Swimming – Boat pulling</td>
</tr>
<tr>
<td>16</td>
<td>Final Examination</td>
</tr>
</tbody>
</table>

Besides the above schedule, NCC cadets will be involved during important occasions during convocation, Independence Day, Republic day, College days, etc.

Regular Classes will be conducted on the afternoon of Saturdays from I Year to III Year. Evaluation will be conducted during I, II, III and IV as detailed below. Class grade chart will be sent at the end of V semester.
PED 101 Physical Education & Yoga Practices (0+1)

Outcomes

- Understanding importance of exercises for strength, agility, co-ordination, flexibility and endurance
- Skill development in games
- Learning different asana and yoga practices.

Practical

(17 Practical classes – 2½ hours each class – 17 classes will be converted into 40 practical hours and 2½ hours for evaluation)

I Semester (20 Hours)
Exercises for strength, agility, co-ordination, flexibility, co-operation, vitalcapacity endurance, speed and for various systems of our body and team spirit.
Exercise for Good Posture – Conditioning and calisthenics for various Athletic activities i.e (a) Before start – Arm stretch, hand stretch and cat stretch (b) Loosening up jogging, bending and twisting (c) Standing – Lateral Arc, triangle and hands to feet pose (d) Sitting – camel kneel, spinal twist and supine knee bend (e) Relaxation – The corpse pose, quick and deep relaxation. Basic gymnastic exercises – participation of athletic events – running, throwing and jumping events.

Skill development in anyone of the following games
Warming up, suitable exercise, lead up games, advance skill for all the games.

Basket Ball: Dribbling, pass, two or three men pass, pivot, lay up shot, shooting, pass break, hook pass, screening, positional play, defence and offence tactics.

Volley Ball: Fingering, under arm pass, over head pass, setting, spiking, back pass, jump pass, stunts, elementary dive, flying dive, roll, blacking and various types of services.

Ball Badminton: Grip, service, foot work, fore hand stroke, back hand stroke, lob, smash, volley, wall practice, spin service and defence tactics.

Foot ball: Dribbling, passing, dodging, kicking, heading, screening, chest pass, throwing, dragging, goal kick, defence and offence tactics.

Hockey: Grip, bully, dribbling, hitting, drive, push strokes, scoop, flick, stopping, various types of passes, dodging, defence and offence tactics.

Kho-Kho: Quadra ped, bi-ped, how to given kho, taking a direction, recede, parallel toe method, bullet tow method, distal method, foot out, dive, ring game, chains and persue and defence skills.
Chess: Moves, move of king, move of pawns, move of rooks, move of bishops, move of queen, move of knights, en passant, castling, check and notation.

Kabaddi: Raid, touch, cant, catch, struggle, various types of defence and offence tactics.

Cricket: Grip, bowling, spin, leg spin, off spin, medium, batting, dive, sweep, mode of delivery, fielding, rolling etc.

Tennis: Grip, forehand drive, back hand drive, stroke, backhand ground stroke, service, volley, smash, wall practice, foot work, defence and offence tactics.

Table Tennis: Grip, tossing and serving, spin serve, rally, smash, flick, defence and offence tactics.

Shuttle Badminton: Grip, foot work, service, setting, smash, volley, forehand and back hand stroke, backhand serve and defence.

Gymnastics: Balanced walk, execution, floor exercise, tumbling/acrobatics, grip, release, swinging, parallel bar exercise, horizontal bar exercise, flic-flac-walk and pyramids.

ATHLETICS

(a) Sprint: Medium start, long start, bunch start, set, pick up, finish, upsweep, downsweep, placement, receiving and exchanging.

(b) Jumps: Western roll, belly roll, eastern cut off, fass ferry flop, approach, take off, straddle, hitch-kick, handging, clearance, landing, strides etc.

(c) Throws: Grip, momentum, pre shift, sub phase, the wind up, foot work, entry to the turn, shift, angle of release, follow throw, delivery, front cross step, rear cross step, hop step, fuck method paryobraine, discoput, rotation, carry and glide.

(d) Hurdles: Finding lead leg, use of lead leg and trial leg, flight, clearing, finish.

Lead up games, advance skills and game for any one of the above games.

II Semester (20+ 2½ hours)

Rules and regulations of anyone of the games and athletic events.

Aims and objectives of yoga – asanas: ie. padmasana, pujankasana, sarvangasana, chakrasana, dhanurasana, halasana, mayurasana and savasana, asanas for ailments, back pain, arthritis, abdominal problems, stress, fatigue, Insomnia, obesity, circulation, hypertension, varicose veins, respiration, heart, digestion, headaches, depression, addiction and eye problems.

Mental balance and importance – development of concentration suriyanamaskar – advance skills of any one of the games which were taught in the I Semester.
### SEMESTER II

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEN 101</td>
<td>Fundamentals of Entomology</td>
<td>2+1</td>
</tr>
<tr>
<td>2.</td>
<td>AEX 111</td>
<td>Fundamentals of Extension Education</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>AGR 111</td>
<td>Weed Management in Horticultural Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>BIC 101</td>
<td>Fundamentals of Biochemistry</td>
<td>1+1</td>
</tr>
<tr>
<td>5.</td>
<td>CRP 112</td>
<td>Growth and Development of Horticultural Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>6.</td>
<td>FSC 101</td>
<td>Orchard and Estate Management</td>
<td>1+1</td>
</tr>
<tr>
<td>7.</td>
<td>FSC 102</td>
<td>Tropical and Subtropical Fruits</td>
<td>2+1</td>
</tr>
<tr>
<td>8.</td>
<td>HOR 102</td>
<td>Plant Propagation and Nursery Management</td>
<td>1+1</td>
</tr>
<tr>
<td>9.</td>
<td>PAT 111</td>
<td>Fundamentals of Plant Pathology</td>
<td>2+1</td>
</tr>
<tr>
<td>10.</td>
<td>VSC 101</td>
<td>Tropical and Subtropical Vegetables</td>
<td>2+1</td>
</tr>
<tr>
<td></td>
<td>NSS 101 /</td>
<td>National Social Service / National Cadet Corps*</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td>NCC 101</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
<td>0+1</td>
</tr>
</tbody>
</table>

**TOTAL** 14+10=24

*Non-Gradial Course continued from first semester*
AEN 101    FUNDAMENTALS OF ENTOMOLOGY   (2+1)

Outcomes:
- In-depth understanding the importance of entomology in agriculture, animal kingdom and their relationship, morphology, anatomy and physiology.
- Understanding the classification and nomenclature of insects, Distinguishing characters of agriculturally important families of endopterygota

Theory

Unit –I: History and importance
Entomology as a science - its importance in Agriculture. History of Entomology in India, Position of insects in the animal kingdom and their relationship with other classes of Arthropoda, Reasons for insect dominance.

Unit-II: Morphology
General organisation of insect body wall - structure and function, cuticular appendages, moulting. Body regions - insect head, thorax and abdomen, their structures and appendages

Unit-III: Anatomy and physiology

Unit-IV: Taxonomy of apterygota and exopterygota
Taxonomy, Classification and nomenclature of insects. Distinguishing characters of agriculturally important orders and families of Apterygotes- Collembola and Thysanura, Exopterygotes - Ephemeroptera, Odonata, Orthoptera, Phasmida, Dictyoptera, Embioptera, Dermaptera, Hemiptera, Isoptera, Psocoptera, Mallophaga, Siphunculata and Thysanoptera.

Unit-V: Taxonomy of endopterygota
Distinguishing characters of agriculturally important families of Lepidoptera, Coleoptera, Diptera, Hymenoptera, Siphonaptera, Strepsiptera and Neuroptera.

Practical:
References

Lecture schedule
1. Study of insects and their importance in Agriculture. History of Entomology in India - Position of insects in the animal kingdom - relationship with other members of Arthropoda.
2. Insect dominance - structural, morphological and physiological factors responsible for dominance.
3. Insect body wall - its structure and function cuticular appendages.
5. Structure of insect head and its appendages.
7. Structure of insect abdomen and its appendages.
15. Types of reproduction - oviparous, viviparous, paedogenesis, polyembryony, ovoviporous and parthenogenesis.
17. Mid semester examination
18. Structure of sense organs - types of sensilla - photoreceptors; chemoreceptors and mechanoreceptors
19. Exocrine and endocrine glands and their function - effect on metamorphosis and reproduction
20. Tropism and Biocommunication in insects — Sound and light production.
22. Distinguishing characters of insect orders — Apterygota - Collembola and Thysanura
23. Exopterygota — Ephemeroptera, Odonata and Phasmida
24. Dictyoptera, Dermaptera, Embioptera
25. Orthoptera (Families of Agricultural Importance) and Isoptera — social life in termites
26. Hemiptera (Families of Agricultural Importance) and Thysanoptera.
27. Pscoptera, Mallophaga and Siphunculata.
28. Endopterygota — Lepidoptera and families of agricultural importance.
29. Coleoptera and families of agricultural importance.
30. Diptera and families of agricultural importance.
31. Hymenoptera and families of agricultural importance.
32. Neuroptera (Families of Agricultural Importance), Strepsiptera and Siphonaptera.

**Assignment**
Each student has to submit a minimum of 100 preserved insects representing various orders and families

**Practical schedule**
1. Observations on external features of grasshopper / cockroach
2. Methods of insect collection, preservation, pinning, labelling, display and storage
3. Types of insect head and antenna
4. Mouth parts of cockroach, modifications in the mouth parts in plant bug, female mosquito, honeybee, thrips, antlion grub, housefly, moths and butterflies
5. Structure of thorax and abdomen and their appendages — modifications in insect legs and wings — wing venation, regions and angles — wing coupling.
6. Types of immature stages of insects.
7. Study of digestive system.
8. Study of male and female reproductive systems.
9. Observing the characters of Apterygota - Collembola and Thysanura and Exopterygota - Odonata and Ephemeroptera and Phasmida
10. Dictyoptera, Dermaptera, Embioptera, Orthoptera (Acrididae, Tettigoniidae, Gryllidae and Gryllotalpidae), Mallophaga and Siphunculata
11. Exopterygota — Isoptera and Hemiptera — **Homoptera** (Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerridae and Psyllidae); **Heteroptera** (Reduviidae, Pentatomidae, Miridae, Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belastomatidae, Gerridae, Cimicidae, Tingidae),
12. Observing the characters of orders Thysanoptera and Diptera (Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae)


16. Observing the characters of Neuroptera (Chrysopidae, Myrmeleonidae, Mantispidae, Ascalaphidae), Siphonoptera. Identification and naming of collected insects based on characters — order and family.

17. Practical examination

AEX 111  FUNDAMENTALS OF EXTENSION EDUCATION (1+1)

Outcomes:

- Understanding the meaning, definition, nature, scope, objectives, principles, approaches and history of horticultural extension, rural development and TOT, ITC, PRA, RRA
- Understanding the meaning, definition, elements and selected models of extension programme in communication and adoption

Theory

Unit I: Extension Education and Horticultural Extension

Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Horticulture extension: process, principles and selected programmes of leading national and international forest institutes. People’s participation in Horticulture programmes. Motivation of Farmers, rural youth and voluntary organizations for Horticulture extension work.

Unit II: Rural Development and TOT

Rural Development: meaning, definition, objectives and genesis. Transfer of technology programmes like Lab to Land Programme (LLP) National Demonstration (ND), Front Line Demonstration (FLD) Krishi Vigyan Kendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR.

Unit III: Communication and Adoption

Unit IV: Programme Planning and PRA

Unit V: Management and ICT in Horticulture
Management and administration: meaning, definition, principles and functions. Concepts of human resource development (HRD), rural leadership. ICT in Extension education, ICT use in rural India.

Lecture Schedule:
1. Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history.
2. Horticulture extension: process, principles
3. Selected programmes of leading national and international forest institutes.
4. People’s participation in Horticulture programmes.
5. Motivation of Farmers, rural youth and voluntary organizations for Horticulture extension work.
6. Rural Development: meaning, definition, objectives and genesis.
7. Transfer of technology programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD) Krishi Vigyan Kendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR.
9. Mid Semester
10. Audio – visual aids: importance, classification and selection.
11. Adoption and innovation - diffusion process, adopter categories
12. Teaching and learning-concepts and principles. Teaching steps
14. Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA) and Rural leadership.
15. Management and administration: meaning, definition, principles and functions. Concepts of human resource development (HRD),
16. ICT in Extension education, ICT use in rural India.

Practical
Visits to study structure, functions, linkages and extension programmes of ICFRE institutes/voluntary organizations/Mahila Mandal, Village Panchayat, State Dept. of Horticulture. Exercises on distortion of message, script writing for farm broadcasts and telecasts, planning, preparation & use of NPVA like poster, chart, flash cards, folders etc. LCD Projectors, mobile phones. Identification of local leaders to study their role in extension work. Evaluation of some selected case studies of forestry extension programmes. Preparation of Village Agricultural productions plan.
Practical Schedule:
1. Understanding the extension system of stakeholders of horticulture.
2. Visit to ADH
3. Visit to Department of forestry
4. Visit to village panchayat to study about the development programmes
5. Visit to NGO to study about the functioning and programmes.
6. Discussion and presentation about the understanding of the visits-I
7. Discussion and presentation about the understanding of the visits-I
8. Understanding the communication process.
10. Preparation and presentation of Leaflet, folder and charts.
11. Preparation and presentation of script for radio and preparation of TV script.
12. Evaluation of case studies in forestry extension
13. Visit to village to identify village leaders
14. Visit to village to discuss about the prospects and problems of the village.
15. Preparation and Presentation of village horticultural production plan.
16. Presentation of village horticultural production plan.
17. Final Practical Examination

Suggested Reading:
Outcomes:

- In-depth understanding the character, classification, biology, ecology, prevention, physical, chemical and biological methods of weed
- Understanding the advantages and limitations of herbicide, application and management of weed, mode and mechanism of herbicides.

Theory:

Unit I: Introduction to Weeds
Weeds: Introduction, harmful and beneficial effects, characteristics of weeds, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy.

Unit II: Methods of Weed control
Concepts of weed prevention, eradication and control; Methods of weed control: preventive, physical, cultural, chemical and biological methods. Integrated weed management.

Unit III: Herbicides

Unit IV: Selectivity and activity of herbicides

Unit V: Weed management
Weed management in major field and horticultural crops, shift of weed flora in cropping systems, aquatic, parasitic and problematic weeds and their control.

Practical:
Identification and preparation of herbarium of weeds; Survey of weeds in crop fields and other habitats; Biology of nut sedge, bermuda grass, parthenium and celosia. Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Economics of weed control practices; Tours and visits of problem areas.
References

Lecture schedule:
1. Weeds-Definition, harmful and beneficial effects of weeds; Characteristics of weeds
2. Classification of weeds.
5. Principles of weed management- Prevention, eradication and control. Methods of weed management- Preventive, physical, cultural
8. Herbicide formulations and methods of application.
9. MID-SEMESTER EXAMINATION.
10. Introduction to adjuvants and herbicide antidotes and their use.
13. Herbicide mixtures, rotations and interactions with other agro chemicals.
14. Weed management in major field and horticultural crops
15. Management of aquatic and problematic weeds.
16. Weed Shift- Causes and management options for weed shift in cropping systems

Practical schedule:
1. Collection, preservation and preparation of weed herbarium
2. Identification and study of wetland weeds
3. Identification and study of gardenland weeds
4. Identification and study of dryland weeds
5. Identification and study of aquatic and problematic weeds
6. Weed survey and weed vegetation analysis- density, frequency, SDR and IVI
7. Study on biology of nut sedge, bermuda grass, Echinochloa and parthenium
8. Practicing Skill development on mechanical and non chemical weed management
9. Calculations on weed control efficiency and weed index
10. Herbicide label information and preparation of list of commonly available herbicides
11. Computation of herbicide doses
12. Study of herbicide application equipment and calibration
13. Demonstration of methods of herbicide application
14. Study of phytotoxicity symptoms of herbicides in different crops
15. Economics analysis of different weed management practices in crops
16. Visit to Problem and parasitic weed infestation areas/ herbicide industries

17. FINAL PRACTICAL EXAMINATION

BIC 101  FUNDAMENTALS OF BIOCHEMISTRY (1+1)

Outcomes:
- In-depth understanding the occurrence and classification, Physical and chemical properties of carbohydrates, lipids and proteins.
- Understanding the Properties, classification and nomenclature of Enzymes and Function, classification, structure, replication of Nucleic acids

Theory
Unit I: Carbohydrates
Carbohydrates - occurrence and classification. Structure of monosaccharides, oligosaccharides and polysaccharides.Physical and chemical properties of carbohydrates – optical isomerism, optical activity, mutarotation, reducing property, reaction with acids and alkalis.

Unit II: Lipids
Unit III: Proteins

Unit IV: Enzymes

Unit V: Nucleic acids

Practical:

References:

E-References:
Theory Lecture schedule:
1. Introduction to Biochemistry, Carbohydrates – occurrence and classification
2. Structure of monosaccharides, oligosaccharides and polysaccharides
6. Sterols - basic structure and their importance.
7. Amino acids – Classification, structure and properties (amphoteric nature, isomerism, Zwitter ion, colour reactions), essential amino acids.
8. Proteins- Importance and classification based on function and solubility.
9. **Mid-semester Examination.**
10. Structure of protein - Primary, secondary, tertiary and quaternary structure
11. Physical and chemical properties of proteins.
12. Enzymes - Properties, classification and nomenclature. Coenzymes, cofactors and isoenzyme
13. Mechanism of enzyme action; Michaelis & Menten and Line Weaver Burk equation & plots.
16. Replication, transcription and translation.

Practical Schedule:
1. Qualitative analysis of carbohydrates
2. Estimation of starch
3. Estimation of amylose
4. Determination of reducing sugars
5. Qualitative analysis of amino acids
6. Sorensen’s formal titration of amino acids
7. Estimation of amino acids by Ninhydrin method
8. Estimation of protein by Biuret method
9. Extraction of oil from oil seeds
10. Determination of free fatty acid of an oil
11. Determination of iodine number of an oil
12. Estimation of ascorbic acid by dye method
13. Assay of amylase
14. Extraction and estimation of lycopene and carotenoids
15. Separation of amino acids by paper chromatography
16. Thin layer chromatography
17. **Final Practical Examination**
CRP 112 GROWTH AND DEVELOPMENT OF HORTICULTURAL CROPS (1+1)

Outcomes:
- In-depth understanding the crop development and dynamics, growth analysis in horticultural crops and plant growth regulators.
- Understanding the factors affecting the physiology of flowering, post harvest storage, seed development & maturation, seed and bud dormancy, causes and breaking methods in horticultural crops

Theory

Unit I - Basics of Growth and Development
  Growth and development - definitions, components, photosynthetic productivity, Canopy photosynthesis and productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, Crop development and dynamics, growth analysis in horticultural crops.

Unit II - Plant Growth Regulators
  Plant bio-regulators - auxin, gibberellin, cytokinin, ABA, ethylene, inhibitors and retardants - basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening.

Unit III - Physiology of Flowering
  Flowering - factors affecting flowering, physiology of flowering, Theories of flowering - photoperiodism-long day, short day and day neutral plants, vernalisation and its application in horticulture, pruning and training - physiological basis of training and pruning-source and sink relationship, translocation of assimilates.

Unit IV - Physiology of fruit growth and development
  Fruit growth and development, fruit setting, factors affecting fruit set and development, physiology of ripening of fruits-climatic and non-climacteric fruits. Physiology of fruits under post-harvest storage.

Unit V - Seed Physiology
  Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and breaking methods in horticultural crops. Seed viability and seed germination – physiological changes associated with seed germination.

Practical
  Estimation of photosynthetic potential of horticultural crops, leaf area index, growth analysis parameters including harvest index, bioassay of plant hormones, identification of synthetic plant hormones and growth retardants, preparations of hormonal solution and induction of rooting in
cuttings, ripening of fruits and control of flower and fruit drop. Important physiological disorders and their remedial measures in fruits and vegetables, seed dormancy, seed germination and breaking seed dormancy with chemicals and growth regulators.

**Theory – Lecture Schedule**

1. Growth, differentiation and Development – Definitions, concept and components – different stages of growth, growth curves
2. Photosynthetic productivity, canopy photosynthesis and productivity, optimum Leaf Area Index for Horticultural Crops, Crop development and dynamics
3. Growth analysis in horticultural crops – determinate and indeterminate growth
5. Cytokinin, ethylene and Abscisic acid - biosynthesis, and physiological role in growth and development.
6. Mechanisms of Abscission and senescence of leaves
8. Photomorphogenesis - Physiology of flowering - factors affecting flowering – major & Minor factors - Photoperiodism in relation to flowering – short day, long day & day neutral plants and vernalisation
9. **MIDSEMESTER EXAMINATION**
10. Theories of flowering
11. Physiology of training and pruning – source and sink relationship – source strength and sink strength
12. Translocation of assimilates in crop plants
13. Fruit setting – physiology of fruit growth and development – factors affecting fruit set and development
15. Seed development and maturation in plants – seed viability – seed germination – stages of seed germination - physiological changes associated with seed germination.

**Practical Schedule**

1. Estimation on Leaf area (LA) and Leaf Area Index (LAI) in horticultural crops
2. Growth analysis
3. Study of Growth regulators and formulations
4. Preparation of hormonal solution
5. Crop response to growth regulators
6. Bioassay for Auxin
7. Bioassay for Gibberellic Acid
8. Bioassay for Cytokinin
9. Bioassay for Ethylene
10. Role of GA in breaking seed dormancy
11. Influence of growth regulators for promotion of rooting
12. Influence of growth regulators on flower and fruit drop
13. Physiological disorders in fruit crops and their control
14. Physiological disorders in vegetable crops and their control
15. Estimation of TSS and Total sugar content in fruits
16. Seed Viability test
17. FINAL PRACTICAL EXAMINATION

Suggested reading

FSC 101 ORCHARD AND ESTATE MANAGEMENT 1+1

Outcomes:
- In-depth understanding the importance, objectives and merits & demerits of orchard management, Mulching, cropping systems, Irrigation and soil management.
- Understanding the factors influencing the fruitfulness and unfruitfulness, Crop model and crop regulation

Theory

Unit-I: Orchard management – importance and objectives; cultivation methods and their merits and demerits

Unit-II: Mulching and cropping systems
Orchard and estate management, importance, objectives, merits and demerits, clean cultivation, sod culture, Sod mulch, herbicides and inorganic and organic mulches. Tropical, subtropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems.

Unit-III: Irrigation and soil management
Biological efficiency of cropping systems in horticulture, systems of irrigation. Soil management in relation to nutrient and water uptake and their effect on soil environment, moisture, organisms and soil properties.
Unit-IV: Unfruitfulness, rejuvenation of orchards and resource utilisation

Factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, Integrated nutrient and pest management. Utilization of resources, constraints in existing systems.

Unit-V: Crop model and crop regulation

Crop model and crop regulation in relation to cropping systems. Climate aberrations and mitigation measures of Horticultural crops.

Practical

Layout of different systems of orchard and estate, soil management, clean, inter, cover and mixed cropping, fillers. Use of mulch materials, organic and inorganic, moisture conservation, weed control. Layout of various irrigation systems.

References


Lecture Schedule

1. Definition of orchard – Objectives of orchard management – Importance of orchard management – merits and demerits – Methods of soil management
2. Planning - Layout of orchard- Planting methods - Vertical Row planting- Alternate row planting- Planting distance- Planting season
4. Weed management in orchard – Cultural (mechanical) methods – Biological methods - Chemical methods – Guidelines for using herbicides in orchard – Herbicides used for weed control


7. Plant Interaction – Types of Interactions in cropping systems – Competitive interaction – above ground and below ground – Complimentary Interactions – Annidation in space and time Allelopathy and its effects.


9. MID SEMESTER EXAMINATION


13. Rejuvenation of old orchard, top working, and frame working – Utilization of resources constraints in existing systems.


15. Climate aberration and mitigation measures of horticultural crops – Crop regulations in relation to cropping systems – Crop regulation in pine apple – fig – Aonla – Bahar treatment – Citrus – Guava – Pomegranate

Practical Schedule
1. Planning and layout of orchard - Orchard components- Records maintenance in orchard
2. Planting and lay out of different planting systems of orchard
3. Study of clean cultivation
4. Study of Inter-cropping systems in orchards
5. Study of cover cropping with suitable examples
6. Study of mixed – cropping with suitable examples
7. Study of filler crops in orchards-characteristics of a filler plant
8. Visit to different local fruit orchards
9. Study of use of organic mulches in fruit orchard
10. Study of use of inorganic mulches in fruit orchard
11. Study of moisture conservation methods and observations on soil moisture contents under mulches
12. Observations on weed growth under different systems of management
13. Use of different weedicides in orchards
14. Study on layout of surface irrigation system
15. Study on layout of sub-surface irrigation system
16. Study on layout of overhead irrigation system
17. PRACTICAL EXAMINATION

FSC 102 TROPICAL AND SUB TROPICAL FRUITS 2+1

Outcomes:
- In-depth understanding the importance of Horticulture, climate requirements, special techniques, Spacing, Planting, cropping systems, water & weed management of fruits.
- Training and Pruning, Flowering, Pollination, plant growth regulators, disorders and remedies, harvest, Post harvest handling, Ripening and Storage

Theory
Unit-I: Scope and importance of fruit crops
Definition of Horticulture – Importance of Horticulture – Horticultural classification of fruits- Climatic Zones of horticultural crops – Scope and importance of tropical and sub-tropical fruits cultivation – Overview on global, national and regional level – Area, production and export potential – Horticultural zones of India and Tamil Nadu with emphasis on tropical and sub tropical fruits.

Unit-II: Production technology of Mango, Banana, Grapes, Citrus

Unit–III: Production technology of Papaya, Sapota, Guava, Pomegranate, bael, ber, amla

Unit-IV: Production technology of annona, fig, pineapple, jackfruit, avocado, mangosteen, litchi, carambola.

Unit-V: Production technology of durian, rambutan, loquat, passion fruit

Practical
Description and identification of varieties of mango, banana, grapes, citrus, papaya, sapota, guava, pineapple, pomegranate, bael, ber, amla, litchi, mangosteen. Training and pruning of grape, mango, guava and citrus. Pretreatment of banana suckers. Use of plastics in fruit production. Visit to commercial orchards. Manures and fertilizer application to fruit crops. Use of plant growth regulators in major fruits. Seed production in Papaya, latex extraction and preparation of crude papain.

References

Lecture schedule
1. Scope and importance of tropical and sub-tropical fruits cultivation - Horticultural classification of fruits including genome classification - Horticultural zones of India - Different fruit growing zones. Area, production and export potential of tropical and sub-tropical fruits.


13. Latex extraction and crude papain production, economics of production -Export- Value added products.


17. **MID SEMESTER EXAMINATION**


of plant growth regulators — Harvesting - Methods of harvesting - Post harvest handling - Value added products.


31. Durian, Rambutan: Composition and uses – Origin and distribution – Species and cultivars – Types & Varieties - Soil and climatic requirements – Propagation techniques – Main field
practical schedule

1. Description and identification of varieties of mango, banana and grapes
2. Description and identification of varieties of citrus, papaya, sapota
3. Description and identification of varieties of guava, pine apple, pomegranate
4. Description and identification of varieties of bael, ber, amla
5. Description and identification of varieties of litchi, mangosteen
6. Training and Pruning of Grapes
7. Training and Pruning of Mango, Guava and Citrus
8. Pre-treatment of banana suckers, de suckering in banana and study of sex forms in Papaya
9. Use of plastics in fruit production viz., in propagation, mulching, irrigation, packaging, storage etc.
10. Visit to commercial orchards and diagnosis of maladies
11. Manure and fertilizer application including bio fertilizers in different fruit crops
12. Preparation and application of growth regulators in banana, grapes and mango.
13. Seed production in Papaya, latex extraction and preparation of crude papain
14. Production economics for major tropical and sub-tropical fruits
15. Botanical description of ber, fig, jamun, pomegranate, carissa and phalsa
16. Botanical description of wood apple, West Indian cherry, tamarind, aonla, bael and annona

17. PRACTICAL EXAMINATION
Outcomes:
- Understanding the basics of propagation, seed germination, seed dormancy, tools and implements and growth regulators.
- Understanding methods and physiology of propagation, micro progration nursery registration act.

Theory

Unit-I: Basics of propagation
Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages.

Unit-II: Seed germination and seed dormancy
Seed dormancy types of dormancy, internal and external factors, methods of breaking dormancy, nursery techniques nursery management, apomixes – mono embrony and polyembrony in seed, types and stages of seed germination with examples.

Unit-III: Propagation structures, tools / implements and growth regulators
Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons, cost of establishment of propagation structures nursery tools and implements, use of growth regulators in propagation.

Unit-IV: Methods and physiology of vegetative propagation
Vegetative propagation, methods and techniques of division - stolons, pseudo bulbs, offsets, runners, cutting, layering, grafting, formation of graft union, factor affecting healing of graft age and budding, physiological and bio chemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Anatomical studies of bud union, selection and maintenance of mother trees, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification, techniques of propagation through specialized organs, corm, runners, suckers, chimera and bud sport

Unit-V: Micro propagation
Micro grafting, meristem culture, callus culture, anther culture, organogenesis, somaclonal variation hardening of plants in nurseries. Nursery registration act. Insect pest / disease control in nursery.

Practical
plants in the nursery. Practicing different types of cuttings, layering, grafting and budding including top grafting and bridge grafting etc. Use of mist chamber in propagation and hardening of plants. Preparation of plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Uprooting, labeling and packing of nursery fruit plants. Maintenance of nursery records. Use of different types of nursery tools and implements for general nursery and virus tested plant material in the nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, poly house and their maintenance. Nutrient and plant protection applications during nursery.

Suggested Reading


Lecture Schedule

1. Plant propagation – definition, need and potential for commercial nursery activities
2. Sexual Vs Asexual methods of propagation, its prospects and constraints
3. Pollination, fertilization and seed development, seed – definition, germination requirements, types of germination, viability and longevity
4. Dormancy in seeds, dormancy mechanism, types of dormancy mechanism of breaking dormancy in seeds
5. Plant propagation structures – principles and uses
6. Application of growth regulators in propagation
7. Vegetative propagation through cutting and physiological basis of rooting
8. Methods of layering in horticultural crops
9. MID SEMESTER EXAMINATION
10. Mother plant selection, maintenance, bud wood certification and nursery registration act
11. Propagation through grafting
12. Propagation through budding
13. Grafting incompatibility and stock-scion relationship
14. Propagation through specialized plant organs
15. Tissue culture techniques in horticultural crops and micro grafting
16. Plant protection in horticultural nursery

Practical Schedule
1. Study of nursery records, tools and implements
2. Studies on media and containers for propagation,
3. Practice in potting and repotting of plants
4. Preparation of different types of nursery beds and seed sowing
5. Studies on seed treatment methods in horticultural crops
6. Establishment of mother plant nursery and bud wood certification
7. Raising of root stocks and preparation of scion for fruit plants
8. Preparation and use of growth regulators
9. Practice on propagation through different types of cuttings
10. Practice on propagation through ground and air layering
11. Studies on techniques of grafting in horticultural crops
12. Studies on techniques of budding in horticultural crops
13. Studies on propagation through specialised plant organs
14. Studies on the role of shade nets, mist chamber and poly house in propagation
15. Nutrient management and plant protection in horticultural nursery
16. Visit to tissue culture laboratory
17. PRACTICAL EXAMINATION
Outcomes:

- In-depth understanding objectives, scope, history, terms, diseases, Fungi, Bacteria, Viruses, Viroids, Algae and Phanerogamic parasites of plants.
- Understanding the epidemiology of crop diseases and Plant Disease Management

THEORY

Unit I: Plant Pathogenic Organisms


Unit II: Phylogenetic Classification of Fungi


Unit III: Bacteria, Viruses, Viroids, Algae and Phanerogamic parasites

Unit IV: Plant Disease Epidemiology

Epidemiology of crop diseases - Types of disease epidemics - Role of host, pathogen and weather factors in disease epidemics - Disease surveillance and assessment.

Unit V: Plant Disease Management


PRACTICAL

Isolation and Identification of Plant pathogens – Koch Postulates - General characters of fungi - Study of Disease symptoms / Signs, Systematic position, Important taxonomic characters and Host parasite relationship of Plasmodiophora (Club root), Pythium (Damping off), Phytophthora (Late blight and Bud rot), Albugo (White blister), Plasmopara, Peronospora, Pseudoperonospora (Downy mildew), Rhizopus (Fruit rot), Taphrina (Leaf curl), Protomyces (Stem gall), Capnodium (Sooty mould), Mycosphaerella (Leaf spot), Alternaria (Leaf blight), Botryosphaeria (Die back and stem end rot), Venturia (Scab), Erysiphe, Leveillula, Phylactinia Uncinula, Podosphaeria and Sphaeroteca (Powdery mildew), Fusarium (Wilt), Verticillium (Wilt), Glomerella (Anthracnose), Pestalosphaeria (grey blight), Macrophomina (Dry root rot), Puccinia, Uromyces, Hemileia (Rust), Urocystis (Smut), Ganoderma (Basal stem rot), Exobasidium (Blister blight), and Athelia (Wet root rot), Symptoms of plant Bacterial, Candidatus Phytoplasmal, Spiroplasma, Fastidious vascular bacterial, Viral, Viroids, Algal diseases and Phanerogamic parasitic plants - Various groups of fungicides and antibiotics - Preparation of fungicidal solution – Methods of application - Mass production and Methods of application of - Trichoderma and Pseudomonas - Production of immunized seedlings in citrus - Survey and assessment of plant diseases.

THEORY SCHEDULE

1. Definition, objectives and Scope of Plant Pathology, history of Plant Pathology, economic importance of plant diseases and socio-economic changes due to plant diseases.
3. Classification of plant diseases - Koch’s Postulate
4. General characters of fungi - Types of mycelia, resting structures, asexual and sexual reproduction
5. Types of parasitism, infection process, survival and dispersal of plant pathogenic fungi.
7. Classification of and important taxonomic characters of Kingdom: Chromista. Life cycle and symptoms caused by Pythium and Phytophthora.
8. Taxonomic characters and symptoms caused by Albugo, Peronospora, Pseudoperonospora and Plasmodura. Life cycle of Plasmodura.
10. Classification and important taxonomic characters of Phylum: Ascomycota
14. Classification and important taxonomic characters of Phylum: Basidiomycota
15. Important taxonomic characters and symptoms caused by rust fungi. Life cycle Uromyces.
16. Important taxonomic characters and symptoms caused by smut fungi.
17. Mid semester Exam
19. Classification, general characters and symptoms of phytopathogenic bacteria.
20. Infection process, mode of entry, survival and dispersal of Phytopathogenic bacteria.
22. General characters and symptoms caused by virus, viroid, algae and phanerogamic parasitic plants.
23. Epidemiology of crop diseases - Role of host, pathogen and weather factors in disease epidemics.
24. Disease surveillance and assessment.
26. Avoidance, Exclusion: Crop inspection, Seed certification and Plant quarantine.
27. Eradication: Mechanical, Physical and cultural methods.
29. Protection: Chemical, cultural and Biological methods.
30. Fungicides-groups of fungicides - contact fungicides, systemic fungicides and antibiotics.
31. Methods of application of fungicides - seed treatment, dry and wet, soil drenching, foliar spray, post harvest treatment, corm injection, root feeding, capsule application and acid delinting and Precautions and safety measures in storage and handling of fungicides.
PRACTICAL SCHEDULE

1. Handling and care of microscopes and Preparation of temporary mounts
2. General characters of fungi - Types of mycelium, special somatic structures and resting structures.
3. Asexual and sexual reproduction.
4. Study of disease symptoms, systematic position, important taxonomic characters and host parasite relationship of *Plasmodiophora*, *Pythium*, *Phytophthora*, *Albugo*, *Peronospora*, *Pseudoperonospora*, and *Plasmopara*
5. Study of disease symptoms, systematic position, important taxonomic characters and host parasite relationship of *Rhizopus*, *Taphrina*, *Protomyces*, *Capnodium*, *Mycosphaerella*, *Lewia*, *Botryosphaeria* and *Venturia*
6. Study of disease symptoms, systematic position, important taxonomic characters and host parasite relationship of *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula*, *Podosphaera* and *Sphaeroteca*
7. Study of disease symptoms, systematic position, important taxonomic characters and host parasite relationship of *Fusarium*, *Verticillium*, *Glomerella*, *Pestalosphaeria* and *Macrophomina*
8. Study of disease symptoms, systematic position, important taxonomic characters and host parasite relationship of *Puccinia*, *Uromyces*, *Hemileia*, *Urocystis*, *Ganoderma*, *Exobasidium* and *Athelia*.
10. Study of symptoms caused by viruses, viroids, algae and phanerogamic parasitic plants.
11. Isolation of fungal and bacterial plant pathogens and proving Koch's postulates.
12. Study of various groups of fungicides.
13. Preparation of fungicidal solution and methods of application.
14. Mass production of *Trichoderma viride* and *Pseudomonas fluorescens*.
15. Cross protection – demonstration of production of immunized seedling against citrus triseza.

Assignment: Students should submit 50 well preserved diseased specimens in 2 installments during the semester.

References

Outcomes:
- In-depth understanding the scope and importance of tropical and sub tropical vegetables, Solanaceous and Malvaceous, Cucurbitaceous of vegetable crops.
- Understanding Legumes and greens, Bulbous and Tuber of vegetable crops.

Theory
Unit-I: Scope and importance of tropical and sub tropical vegetables
Scope and importance- area and production, global and national scenario, industrial importance - export potential - institutions involved in vegetable crops research - Classification of vegetable crops - vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden, floating garden - Types of vegetable farming - rice fallow vegetable production, river bed cultivation, rainfed cultivation, contract farming- Organic vegetable production - GAP for vegetable production, export standards of vegetables

Unit-II: Solanaceous and Malvaceous vegetable crops

Unit-III: Cucurbitaceous vegetable crops
Unit-IV: Legumes and greens


Crops: Cluster beans, vegetable cowpea including yard long bean, lab-lab, broad bean, moringa bean, yam bean, amaranthus, basella, portulaca, chekkurmanis, roselle (*Hibiscus sabdariffa*), sorrel, moringa

Unit-V: Bulbous and Tuber crops


Crops: Onion, cassava, sweet potato, colocasia, Chinese potato (vegetable coleus), elephant foot yam, edible dioscorea, Colacasia and arrow root.

Practical:

Identification and description of tropical and sub-tropical vegetable crops, nursery practices and transplanting, preparation of field and sowing/planting for direct sown and planted vegetable crops. Herbicide use in vegetable culture; top dressing of fertilizers and interculture, use of growth regulators, identification of nutrient deficiencies, physiological disorder. Harvest indices and maturity standards, post-harvest handling and storage, marketing, seed production and seed extraction (cost of cultivation for tropical and sub-tropical vegetable crops).

References

Lecture Schedule

1. Scope and importance of vegetable crops. Area, production, global and national scenario, industrial importance, export potential of tropical and subtropical vegetable crops and institutions involved in vegetable crops research. Classification of vegetable crops.

2. Vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden and floating garden. Types of vegetable farming - rice fallow cultivation, river bed cultivation, rainfed cultivation and contract farming. Organic vegetable production, GAP in vegetable production and export standards of vegetables.


9. Bitter gourd snake gourd- Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing

10. Snake gourd- Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing

11. Ribbed gourd and bottle gourd - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing

12. Ivy gourd and chow-chow - Area and production, composition and uses, climate and soil requirements, season, varieties, propagation, preparation of field, spacing, planting systems, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing

13. Ash gourd and pumpkin - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices, harvest and yield, post harvest handling, storage and marketing

14. Watermelon - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices, harvest and yield, post harvest handling, storage and marketing

15. Musk melon - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient management, water and weed
management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth
regulators, constraints in production, maturity indices, harvest and yield, post harvest
handling, storage and marketing
16. Cucumber, long melon, snap melon and gherkin - Area and production, composition and
uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation
of field, spacing, planting systems, sowing, sex expression, manuring and nutrient
management, water and weed management, mulching, fertigation, nutrient deficiencies,
physiological disorders, growth regulators, constraints in production, maturity indices,
harvest and yield, post harvest handling, storage and marketing

17. MID SEMESTER EXAMINATION

18. Cluster beans - Area and production, composition and uses, climate and soil requirements,
season, varieties, seed rate, preparation of field, spacing, sowing, manuring and nutrient
management, water and weed management, mulching, fertigation, nutrient deficiencies,
physiological disorders, growth regulators, constraints in production, maturity indices
harvest, yield, post harvest handling, storage and marketing

19. Vegetable cowpea - Area and production, composition and uses, climate and soil
requirements, season, varieties, seed rate, preparation of field, spacing, sowing, manuring
and nutrient management, water and weed management, mulching, fertigation, nutrient
deficiencies, physiological disorders, growth regulators, constraints in production, maturity
indices harvest, yield, post harvest handling, storage and marketing

20. Lab lab - Area and production, composition and uses, climate and soil requirements,
season, varieties, seed rate, preparation of field, spacing, sowing, manuring and nutrient
management, water and weed management, mulching, fertigation, nutrient deficiencies,
physiological disorders, growth regulators, constraints in production, maturity indices
harvest, yield, post harvest handling, storage and marketing

21. Broad bean, moringa bean and yam bean - Area and production, composition and uses,
climate and soil requirements, season, varieties, seed rate, preparation of field, spacing,
sowing, manuring and nutrient management, water and weed management, mulching,
nutrient deficiencies, physiological disorders, growth regulators, constraints in production,
maturity indices harvest, yield, post harvest handling, storage and marketing

22. Amaranthus and chekkurmanis- Composition and uses, climate and soil requirements,
season, varieties, seed rate, preparation of field, spacing, sowing, manuring and nutrient
management, water and weed management, nutrient deficiencies, physiological disorders,
growth regulators, constraints in production, maturity indices harvest, yield, post harvest
handling, storage and marketing

23. Basella, portulaca, roselle and sorrel - Composition and uses, climate and soil
requirements, season, varieties, propagation, seed rate, preparation of field, spacing,
sowing / planting, manuring and nutrient management, water and weed management,
nutrient deficiencies, physiological disorders, growth regulators, constraints in production,
maturity indices harvest, yield, post harvest handling, storage and marketing

24. Moringa - Area and production, composition and uses, climate and soil requirements,
season, perennial and annual moringa varieties, propagation, seed rate, preparation of
field, spacing, sowing/planting, manuring and nutrient management, water and weed
management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth
regulators, off season production, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing

25. Onion (Aggregatum and Common) - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, specialities of seed propagated aggregatum onion, propagation methods, seed rate, nursery practices, sowing / transplanting- preparation of field, spacing, planting systems

26. Onion (Aggregatum and common) - Manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing

27. Cassava - Area and production, composition and uses, significance of HCN in tubers, climate and soil requirements, season, varieties, propagation, single bud cuttings, production of CMD free planting materials – true cassava seed production , nursery practices, preparation of field, spacing, planting systems

28. Cassava - Manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, harvest, yield, post harvest handling, storage, marketing and starch estimation in tubers by relative density method and price fixation

29. Sweet potato - Area and production, composition and uses, climate and soil requirements, season, varieties, propagation, preparation of field, spacing, planting systems, manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, -post harvest handling, storage and marketing

30. Colocasia and Chinese potato (vegetable coleus) - Composition and uses, climate and soil requirements, season, varieties, propagation, preparation of field, spacing, planting systems, manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, -post harvest handling, storage and marketing

31. Elephant foot yam and colacasia - Area and production, composition and uses, climate and soil requirements, season, varieties, propagation, preparation of field, spacing, planting systems, manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, -post harvest handling, storage, effect of calcium oxalate in tubers on storage and cooking and marketing

32. Edible Dioscorea, xanthosoma and arrow root - Area and production, composition and uses, climate and soil requirements, season, varieties, propagation, preparation of field, spacing, planting systems, staking and training vines, manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, -post harvest handling, storage and marketing.

**Practical Schedule**

1. Planning and lay out of kitchen/ nutrition garden.
2. Preparation of nursery, containerized transplant production and sowing of seeds for solanaceous vegetable crops.
3. Preparation of field, sowing of cucurbitaceous, perennial and leafy vegetable crops and tuber crops.
4. Identification and description of species and varieties of tomato, brinjal and chilli. Working out cost-benefit ratio.
5. Identification and description of species and varieties of bhendi and leguminous vegetables. Working out cost-benefit ratio.
7. Identification and description of species and varieties of amaranth moringachekkurmanis and other leafy vegetables.
8. Identification and description of cultivars and wild relatives of tuber crops. Working out cost–benefit ratio.
9. Study of drip and fertigation, basal dressing, top dressing and foliar spray of fertilizers for vegetable crops.
10. Identification of weeds, preparation of herbicide spray fluids and their usage in the field. Working with the economics of weed management.
11. Preparation of growth regulator spray solution— their usage in tropical vegetable crops.
12. Identification of nutrient deficiencies, physiological disorders and corrective measures in vegetable crops.
13. Maturity indices, harvesting and post harvest management of tropical and subtropical vegetable crops.
14. Seed production in tropical and subtropical vegetable crops.
15. Seed extraction in vegetable crops.
16. Visit to commercial vegetable growing area / markets.
17. PRACTICAL EXAMINATION
<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEG 211</td>
<td>Farm Power and Machinery</td>
<td>1+1</td>
</tr>
<tr>
<td>2.</td>
<td>AEN 211</td>
<td>Apiculture, Sericulture and Lac Culture</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>AGR 211</td>
<td>Agro-meteorology and Climate Change</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>COM 211</td>
<td>Computer Applications in Horticulture</td>
<td>0+1</td>
</tr>
<tr>
<td>5.</td>
<td>FLA 201</td>
<td>Commercial Floriculture</td>
<td>2+1</td>
</tr>
<tr>
<td>6.</td>
<td>FSC 201</td>
<td>Temperate Fruit Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>7.</td>
<td>GPB 201</td>
<td>Fundamentals of Plant Breeding</td>
<td>2+1</td>
</tr>
<tr>
<td>8.</td>
<td>PAT 211</td>
<td>Diseases of Fruit, Plantation, Medicinal and Aromatic Crops &amp; Their Management</td>
<td>2+1</td>
</tr>
<tr>
<td>9.</td>
<td>PHT 201</td>
<td>Fundamentals of Food Technology</td>
<td>1+1</td>
</tr>
<tr>
<td>10.</td>
<td>STA 201</td>
<td>Statistical Methods</td>
<td>1+1</td>
</tr>
<tr>
<td>11.</td>
<td>VSC 201</td>
<td>Temperate Vegetable Crops</td>
<td>1+1</td>
</tr>
<tr>
<td></td>
<td>NSS 101 / NCC 101</td>
<td>National Social Service / National Cadet Corps*</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
<td>0+1</td>
</tr>
</tbody>
</table>

**TOTAL 13+11=24**

*Non-Gradial Course continued from first semester*
Outcomes:

- Understanding basic concepts of energy, power, engines, tractors and motors.
- Understanding definition, objectives and method of ploughing, Sowing and intercultural implements, Crop harvesting equipments.

Theory:

Unit I: Farm power and mechanization

Basic concepts of various forms of energy, unit and dimensions of force, energy and power, calculations with realistic examples. Farm Power, sources of farm power, status of farm power in India and farm mechanization its advantages and limitations

Unit II: IC engines, tractors and motors


Unit III: Tillage implements


Unit IV: Sowing and intercultural implements


Unit V: Harvesting equipments

Crop harvesting equipments – potato diggers, fruit pluckers, tapioca puller and hoists

Practical:

Calculation on force, power and energy. IC engines - showing the components of dismantled engines and motors. Primary and secondary tillage implements - hitching, adjustments and
operations. Spraying equipments - calibration and operation. Plant protection equipments - calculation of dilution ratio and operation.

References:


Lecture schedule:

1. Basic concepts of various forms of energy, unit and dimensions of force, energy and power, calculations with realistic examples.
2. Farm power - sources of farm power and farm mechanization, its advantages and limitations; status of farm power in India.
3. Engine - Types of engines; components of IC engine - working principles of IC Engines.
4. Basic principles of operation of compression ignition and spark ignition engines, Comparison of two stroke and four stroke cycle engines.
5. Different systems of IC engine - cooling, lubricating and power transmission system; broad understanding of performance and efficiency.
6. Tractors, power tillers and their types and uses.
8. Tillage: definition, objectives, types, methods of ploughing, field capacity and field efficiency.
9. MID SEMESTER EXAMINATION
10. Primary tillage implements: construction and function of indigenous ploughs, improved indigenous ploughs, mould board ploughs, disc and rotary ploughs.
12. Sowing methods - seed drills and potato planters- components and functions-calibration - Seedling transplanters - types and working principles.
13. Intercultural equipments – sweep, cultivators, junior hoe, weeders, long handle weedersand power operated weeders.
15. Crop harvesting equipments - tuber crops, potato digger, tapioca puller.
16. Harvesting machineries for fruits and vegetables, fruit plucker, green leaf harvester vegetable harvester and hoists.

Practical schedule:
1. Calculation on force, power and energy.
2. IC engines - showing the components of dismantled engines.
3. Study of working of two and four stroke IC engines.
4. Study of motors
5. Study of tractors and power tillers - their operation and maintenance.
7. Learning to operate a power tiller.
8. Study of primary tillage implements (mould board plough, disc plough, chisel plough and subsoiler) and their components.
9. Study of secondary tillage implements (cultivator, disc harrows, rotavator, bund former, ridger, leveller) and their components.
10. Acquiring skill in hitching of implement, adjustments and operations
11. Study of spraying equipments
12. Calibration, calculation of dilution ratio and safety requirements of plant protection equipments.
14. Study of fruit harvesters.
15. Problems on cost of operation of tractor operated machinery.
16. Problems on field capacity and field efficiency.
17. **FINAL PRACTICAL EXAMINATION.**
AEN 211  APICULTURE, SERICULTURE AND LAC CULTURE (1+1)

Outcomes:

- In-depth understanding the importance, history of honey bee species, equipments and apiary management.

- Understanding the importance, history and development of mulberry silkworm and grainage, Silkworm rearing and byproducts, Lac insects.

Theory

Unit –I: Honey bee species

Introduction to beneficial insects.Importance and History of apiculture. Species of honey bees, Rock bee, Little bee, Indian bee, European bee, Italian bee and Dammar bee, lifecycle and caste determination.

Unit –II: Equipments and apiary management

Bee colony maintenance, bee colony activities, starting of new colony, location site, transferring colony, replacement of queen, combining colonies, swarm prevention, colony management in different seasons, Equipment for apiary, types of bee hives and their description. Bee pasturage. Honey extraction, honey composition and value, bee wax and tissues.

Unit –III: Mulberry silkworm and grainage

Importance, History and development in India, mulberry cultivation, silkworm kinds and their hosts, systematic position, distribution, lifecycles in brief, Silk glands. Mulberry silkworm-morphological features, races, rearing house and equipments, disinfection and hygiene. Grainage acid treatment, packing and transportation of eggs, Incubation, black boxing, hatching of eggs.

Unit –IV: Silkworm rearing and byproducts


Unit –V: Lac insects

Lac growing areas in India, Lac insects, biology, behaviour, lac cultivation, food plants, pruning, inoculation, cropping, kinds of lac. Enemies of lac-insects.
Practical


References

Lecture schedule:
1. Introduction and importance of beneficial insects
2. Bee species – comparison – castes of bees – bee behaviour and bee dance
4. Different types hives - Bee products - bee pasturage – medicinal properties of honey
5. Honey extraction, honey composition and value, bee wax and tissues
6. Bee enemies – predators and parasites
7. Bee diseases – bacteria, virus, fungi and protozoan
8. Equipments used in bee keeping
9. Mid semester examination
11. Pests and diseases of mulberry
12. Importance, History and development in India, silkworms kinds and their hosts, systematic position, distribution, lifecycles in brief, Silk glands. Mulberry silkworm-morphological and biological features
13. Rearing house and equipments, disinfection and hygiene. Grainage acid treatment, packing and transportation of eggs, Incubation, black boxing, hatching of eggs Incubation, black boxing, hatching of eggs.
14 Methods of chawki and late age silkworm rearing- disinfections- pests and diseases of silkworms. Cocoon characters colour, shape, hardiness and shell ratio. Defective cocoons and stifling of cocoons.

15 Uses of silk and byproducts - economics of silk production

16 Lac insect- biology-strains-Natural enemies of lac insect and lac products

Practical schedule:
1. Identification, morphology and structural adaptations in honey bees
2. Different species of honey bees – honey bee colonies
3. Bee keeping appliances and seasonal management
4. Rearing of queen, worker and drone cell and colony organization
5. Bee enemies and diseases
6. Maintenance of commercial bee colonies
7. Honey extraction and bottling- bee products
8. Morphology and botanical aspects of mulberry plants
9. Mulberry cultivation- mulberry nursery bed preparation – methods of planting - Pruning methods – leaf / shoot harvest– preservation of leaves-
10. Morphology and biology of mulberry silkworm
11. Different species of silkworms- Chawki and late age silkworm rearing
12. Rearing house, appliances and disinfection in silkworm rearing
13. Pests and diseases of mulberry
14. Pests and diseases of mulberry silkworm
15. Lac insect-life history, hosts and culturing of lac, natural enemies and lac products
16. Visit to local apiary, sericulture unit and mulberry fields

17. Practical examination
Outcomes:

- Understanding the definition of Agricultural meteorology, Weather parameters, weather forecasting and climate change.
- Understanding the importance of CO₂ and its role in climate change, Climatic mitigation

Theory:

Unit I: Agro meteorology and atmosphere

Agricultural Meteorology- Introduction, definition of meteorology, scope and practical utility of Agricultural meteorology. Composition and structure of atmosphere and definition of weather and climate, aspects involved in weather and climate,

Unit II: Weather parameters

Atmospheric temperature, soil temperature, solar radiation, atmospheric pressure, atmospheric humidity, evaporation and transpiration, monsoons, rainfall, clouds, drought, weather disasters and their management atmospheric pollution and role of meteorology.

Unit III: Weather forecasting and climate change


Unit IV: CO₂ and its role in climate change

Plants sense and respond to changes in CO₂ concentration. Measurement of short-term effects and mechanisms underlying the observed responses in C3 and C4 species. Plant development affected by growth in elevated CO₂. Physiology of rising CO₂ on nitrogen use and soil fertility, its implication for production. Methodology for studying effect of CO₂. Change in secondary metabolites and pest disease reaction of plants. The mechanisms of ozone and UV damage and tolerance in plants. Increased temperature and plants in tropical/sub-tropical climates- effect on growing season, timing of flowering, duration of fruit development and impacts on crop yields and potential species ranges, interaction of temperature with other abiotic/biotic stress.

Unit V: Climatic mitigation

Mitigation strategies and prospects for genetic manipulation of crops to maximize production in the future atmosphere. Modifying Rubisco, acclimation, metabolism of oxidizing radicals, and sink capacity as potential strategies.
Practical:

Site selection for Agromet observatory; Measurement of rainfall; Measurement of evaporation (atmospheric/soil); Measurement of atmospheric pressure; Measurement of sunshine duration and solar radiation; Measurement of wind direction and speed and relative humidity; Study of weather forecasting and synoptic charts. Visit to Meteorological observatory, Visit to IMD meteorological observatory-Lay out plan of standard meteorological observatory. Recording of air and soil temperature. Measurement of radiation and component. Synoptic charts and weather reports, symbols, etc.

References:

E-References:
1. www.pajancoa.ac.in
2. www.tawn.tnau.ac.in
3. www.usbr.gov/pn/agri.met
4. www.imd.gov.in
Lecture schedule:

1. Agricultural Meteorology- Introduction, definition of meteorology, scope and practical utility of Agricultural meteorology.
2. Composition and structure of atmosphere and definition of weather and climate, aspects involved in weather and climate.
3. Concepts of Atmospheric temperature and soil temperature, solar radiation and atmospheric pressure
4. Atmospheric humidity, evaporation and transpiration, monsoons, rainfall and clouds,
5. Drought, weather disasters and their management
6. Atmospheric pollution and role of meteorology.

9. Mid Semester Exam
11. Plants sense and respond to changes in CO2 concentration. Measurement of short-term effects and mechanisms underlying the observed responses in C3 and C4 species.
13. Change in secondary metabolites and pest disease reaction of plants. The mechanisms of ozone and UV damage and tolerance in plants.
14. Increased temperature and plants in tropical/sub-tropical climates- effect on growing season, timing of flowering, duration of fruit development and impacts on crop yields and potential species ranges, interaction of temperature with other abiotic/biotic stress.
15. Mitigation strategies and prospects for genetic manipulation of crops to maximize production in the future atmosphere.
16. Modifying Rubisco, acclimation, metabolism of oxidizing radicals, and sink capacity as potential strategies.

Practical schedule:

1. Visit to Agromet observatory-Site selection & layout of Agromet observatory.
2. Calculation of local time - Time of observation of different weather elements - Reviewing agromet registers.
3. Measurement of air temperature
4. Measurement of soil temperature
5. Measurement of rainfall
6. Measurement of evaporation
7. Measurement of atmospheric pressure
8. Measurement of sunshine duration and solar radiation
9. Measurement of wind direction and velocity
10. Measurement of relative humidity
11. Measurement of dewfall
12. Measurement of grass minimum temperature
13. Study of weather forecasting.
14. Study of Synoptic charts
15. Agromet Advisory Bulletins & weather reports
16. Visit to IMD meteorological observatory

17. FINAL PRACTICAL EXAMINATION

COM 211 COMPUTER APPLICATIONS IN HORTICULTURE (0+1)

Outcomes:
- Understanding computer applications like trash, Copy, Move, Rename, & Delete File/Folder using files.
- Understanding Libreoffice writer, calc, animation, multimedia, GIMP, Visual programming, GUI.

Practical

Block diagram of a computer, Trash, Copy, Move, Rename, & Delete File/Folder using Linux File Manager Files / Nautilus, LibreOffice Writer - Creating, editing, saving document, changing font, font size, font color, LibreOffice Writer - bold, italic, underline, align left, right, center, justify, cut, copy, paste, LibreOffice Calc - formula for sum and average, creating graphs, LibreOffice Impress - Creating slide, Animation, & Transition, Multimedia - Introduction to GIMP and Inkscape, Multimedia - Introduction to Audacity and Avidemux, Python Programming – input, print, if, elif, else, list, for in list, R Console, R Prompt > , Assignment operator = or <- , Creating dataframe using data.frame(), Edit dataframe using edit() function, Import dataset from clipboard to dataframe using read. table(), Using R find Sum, Mean, Standard deviation and Correlation, Introduction to Visual Programming using Qt – Creating simple GUI with Push Button, Label, Line Edit

Computer and Information Technology for Horticulture (0+1)

References
2. Sarah Stowell, Using R for Statistics
7. Python Tutorial of w3schools.com - https://www.w3schools.com/python/
9. FLOSS Manuals - https://www.flossmanuals.net/
Practical Schedule
1. Block diagram of a computer
2. Trash, Copy, Move, Rename, & Delete File/Folder using Linux File Manager Files / Nautilus
3. LibreOffice Writer - Creating, editing, saving document, changing font, font size, font color
4. LibreOffice Writer - bold, italic, underline, align left, right, center, justify, cut, copy, paste.
5. LibreOffice Calc - formula for sum and average, creating graphs.
6. LibreOffice Impress - Creating slide, Animation, & Transition.
7. Multimedia - Introduction to GIMP and Inkscape
8. Multimedia - Introduction to Audacity and Avidemux
9. Python Programming – input, print
10. Python Programming – if, elif, else
11. Python Programming – list, for in list
12. R Console, R Prompt >, Assignment operator = or <-,
13. Creating dataframe using data.frame(), Edit dataframe using edit() function,
14. Import dataset from clipboard to dataframe using read. table(),
15. Using R find Sum, Mean, Standard deviation and Correlation

Outcomes:
- In-depth understanding the importance of commercial floriculture, export to national & international.
- Understanding soil, climate, Planting systems, methods, production, cultivation, harvest of species.

Theory
Unit–I: Importance of Commercial Floriculture
Unit-II: Production technology of gladiolus, tuberose, bird of paradise, China aster, dahlia.


Unit-III: Production technology of Gerbera


Unit–IV: Production technology of cut rose, cut chrysanthemum, Orchid


Unit–IV: Production technology of anthurium, Asiatic lily, alstroemeria, carnation


Unit–V: Production technology of Foliage and Flowering Fillers


Practical

Description and identification of species and varieties in rose, jasmine, crossandra, chrysanthemum, tuberose, marigold, cut rose, carnation, gerbera, gladiolus, orchids and anthurium – sowing of seeds and raising of seedlings of annuals- Propagation by cutting, layering and budding - Training and pruning of roses. Use of chemicals and other compounds for prolonging the vase life of cut flowers. Drying and preservation of flowers. Flower arrangement practices. Visit to commercial fields, extraction units and flower markets.

References

2. Bhattacharjee, S.K., 2004 – Landscape gardening and design with plants.

Lecture Schedule
1. Scope and importance of commercial floriculture in India – area and production – export statistics – Cropping systems in flower crops.
2. Industrial importance – floriculture industry in India and Tamil Nadu – Institutions and developmental agencies involved in promotion of floriculture – TANFLORA, NHM, NHB, APEDA.
17. MID SEMESTER EXAMINATION
training and pruning practices – nutrient and water management – role of growth regulators – Harvest and yield - Post harvest management.

25. Carnation : Protected cultivation - Soil sterilization – factors influencing protected cultivation – species and varieties – propagation – planting systems – pinching, disbudding, training (Netting) and pruning practices


27. Flower forcing and factors affecting flower production under controlled atmospheric conditions.


30. Drying techniques of dry flowers.


32. Export potential of dry flowers.

Practical Schedule

6. Visit to flower market and flower growing areas to get expertise in loose flowers and cut flowers.
13. Sowing and raising of annuals.
14. Use of chemicals and other compounds for prolonging the vase life of cut flowers.
15. Practice in drying and preservation of flowers.
17. PRACTICAL EXAMINATION

FSC 201 TEMPERATE FRUIT CROPS 1+1

Outcomes:
- In-depth understanding the scope and importance of Temperate fruits cultivation, spacing, planting density and cropping systems, nutrients, water and weed management
- Understanding the pollination, plant growth regulators, disorders and remedies, Post harvest handling, Ripening and storage and Plant protection measures

Theory
Unit-I: Temperate horticulture and classification
Definition of temperate fruit crops- Temperate horticulture – Temperate fruits- Climatic conditions of temperate zone- Scope and importance of Temperate fruits cultivation – Classification- An overview on global, national economy - Area, production and export potential – Horticultural zones of India and Tamil Nadu with emphasis on temperate fruits.

Unit-II: Production technology for Apple, pear, peach, plum, Cherry

Unit-III: Production technology for Strawberry, Apricot, Persimmon, Kiwi, Almond
Unit-IV: Production technology for Walnut, Queens land nut, pecan nut, pistachio nut, hazel nut and chest nut.


Unit-V: Production problems

Re-planting problems - Rejuvenation and special production problems - control of pre-harvest fruit drop - Plant protection measures in temperate fruit crops.

Practical

Nursery management practices for temperate fruit crops- Planting systems and root stock characteristics - Training and pruning practices followed in temperate fruit crops- Description and identification of varieties of Apple, pear, peach, plum, Cherry, Strawberry, Apricot, Persimmon, Kiwi, Almond, Walnut, Queens land nut, pecan nut, pistachio nut, hazel nut and chest nut- Use of growth regulators- Nutrient management- Physiological disorders- Physiological disorders- Visit to private temperate fruit orchards

References


e - books

Lecture Schedule

1. Temperate fruits and its classification- Area, production, productivity of temperate fruits - Scope, importance-industrial importance, export potential of temperate fruit crops – institutions involved in temperate fruit crop research
2. **Apple:** Introduction- Origin and distribution - Composition and uses - Area and production – Varieties - Climate and soil requirements - Root stocks (Dwarf, Semi-dwarf, Vigorous and other root stocks) – Propagation - Planting methods - Training and Pruning
3. Manures and fertilizers - After care - Flowering - Induction of early flowering - Use of growth regulators in flowering - Pre harvest drop - Blossom and fruit thinning - Factors effecting colour development - Maturity indices - Harvesting - Post- harvest handling Different grades - Storage - Physiological disorders
5. **Peach:** Introduction – origin and distribution – composition and uses- species and varieties - soil and climate requirements - propagation - rootstocks- main field preparation - spacing, planting density and cropping systems. planting and after care - nutrients, water and weed management - training and pruning – canopy management- incompatibility - pollinizers - use of plant growth regulators, physiological disorders and remedies, maturity indices and harvest - post harvest handling and storage.
6. **Plum:** Introduction- Origin and distribution - Species and varieties- Difference between European plums and Japanese plums - Types of European plums, - Composition and uses- Area and production - Climate and soil requirements - Root stocks- Propagation Training and pruning - Flowering - Pollination and fruit set - Maturity indices- Harvesting - Post-harvest handling and storage- Physiological disorders.
8. **Strawberry:** Introduction- Origin and distribution - Species and varieties- Composition and uses- Ploidy series - Climate and soil requirements - Vegetative propagation- Rising of runners- Different systems of planting-Matted rows -Spaced beds and Hill system -Mulching Flowering - Pollination - Defoliation - Deblossoming operation - Fruit set - Maturity indices - Harvesting and Post harvest management - Physiological disorder
9. **MID SEMESTER EXAMINATION**
10. **Apricot:** Introduction – origin and distribution – composition and uses- species and varieties - soil and climate requirements - propagation - rootstocks- main field preparation - spacing, planting density and cropping systems. planting and after care - nutrients, water and weed management - training and pruning – canopy management- incompatibility - pollinizers - use
of plant growth regulators, physiological disorders and remedies, maturity indices and harvest - post harvest handling and storage.


13. **Almond:** Origin and distribution - Composition and uses - Area and production - Varieties- Climate and soil requirements - Root stocks -Propagation- Planting methods-Training and Pruning- Manures and fertilizers - After care - Flowering - Pollination and fruit set - Use of growth regulators in flowering - Maturity indices - Harvesting(Mechanical)- Post- harvest handling - Storage - Physiological disorders - Kernel use - Shelling yield- Grades of kernels for the international trade.


15. **Queensland nut (Macadamia nut) and pecan nut:** Introduction – origin and distribution – composition and uses- species and varieties - soil and climate requirements - propagation - rootstocks- main field preparation - spacing, planting density and cropping systems. planting and after care - nutrients, water and weed management - training and pruning – canopy management- incompatibility - pollinizers - use of plant growth regulators, physiological disorders and remedies, maturity indices and harvest - post harvest handling and storage.


**Practical Schedule**

1. Nursery management practices for temperate fruit crops
2. Planting systems and root stock characteristics of temperate fruit crops
3. Training and pruning practices followed in temperate fruit crops
4. Description and identification of varieties of apple
5. Description and identification of varieties of pear and peach
6. Description and identification of varieties of plum and cherries
7. Description and identification of varieties of strawberry
8. Description and identification of varieties of apricot and almond
9. Description and identification of varieties of Kiwi and persimmon
10. Description and identification of varieties of walnut, pistachio nut and pecan nut
11. Description and identification of varieties of hazel nut, chest nut and Queens land nut
12. Use of growth regulators in growth and development of temperate fruit crops
13. Nutrient management in temperate fruit crops
14. Physiological disorders in temperate fruit crops
15. Plant protection and its control measures in temperate fruit crops
16. Visit to private temperate fruit orchards
17. PRACTICAL EXAMINATION

GPB 201 FUNDAMENTALS OF PLANT BREEDING (2+1)

Outcomes:

- In-depth understanding the role, origin, law of series, types of conservation, modes of reproduction, method, procedure, application, merits & demerits.
- Understanding the special breeding methods and clonally propagated crops, Varietal Release, Maintenance Breeding, Markers and IPR

THEORY

Unit I: Reproductive systems in plant breeding

Unit II: Breeding methods of self pollinated crops


Unit III: Breeding methods of cross pollinated crops and clonally propagated crops


Unit IV: Special breeding methods

Unit V: Varietal Release, Maintenance Breeding, Markers and IPR


PRACTICAL


Theory schedule

7. EGMS - TGMS, PGMS, Gametocides, Transgenic Male sterility and applications.
9. Polygenic variation-components of variance - phenotypic, genotypic and environmental variance-heritability and genetic advance


17. **Mid Semester examination**


23. Synthetics and composites - steps in development of synthetics and composites – achievements – merits and demerits


26. Wide hybridization-importance-barriers and techniques for overcoming barriers-utilization- Pre-breeding.


30. Procedure for release of new varieties-stages in seed multiplication-steps in nucleus and breeder seed production.


**Practical schedule**

4. Germplasm collection and conservation.
5. Breeder’s kit and its components
6. Basic techniques for selfing and crossing in crop plants.
7. Emasculation and pollination techniques in field crops.
8. Emasculation and pollination techniques in horticultural crops.
9. Study of male sterility system – CMS, GMS and CGMS
10. Mutagenesis study using physical and chemical mutagens
12. Experimental designs used in plant breeding-RBD analysis
13. Calculation of mean, range, PCV, GCV, heritability, genetic advance
14. Estimation of heterosis and prediction performance of double cross hybrids
15. Phenotyping techniques for biotic stresses and abiotic stresses
16. Marker techniques, Genotyping and QTL mapping software
17. Procedure for marker assisted selection
18. **Final Practical examination**

**References**

- D. N. Bharadwaj. 2012. Breeding Field Crops. Agrobios (India), Jodhpur
Outcomes:

- In-depth understanding the Symptoms, etiology, mode of spread, survival, epidemiology, integrated management strategies of tropical and temperate fruit, plantation, Medicinal and aromatic crops
- Understanding the Medicinal and nutritional values of mushroom, Constraints in mushroom cultivation - Post harvest diseases of fruits and plantation crops and their management.

THEORY

Unit I: Tropical Fruit Crops
Symptoms, etiology, mode of spread, survival, epidemiology and integrated management strategies of important diseases of mango, banana, grapes, citrus, guava, sapota, papaya, jackfruit, pineapple, pomegranate and ber.

Unit II: Temperate Fruit Crops
Symptoms, etiology, mode of spread, survival, epidemiology and integrated management strategies of important diseases of apple, plum, pear, peach, almond, walnut and strawberry.

Unit III: Plantation Crops
Symptoms, etiology, mode of spread, survival, epidemiology and integrated management strategies of important diseases of coconut, arecanut, oilpalm, coffee, tea, rubber, cocoa, cashew and betelvine.

Unit IV: Medicinal and aromatic crops
Symptoms, etiology, mode of spread, survival, epidemiology and integrated management strategies of important diseases of gloriosa, coleus, stevia, aloe, senna, pyrethrum, mint, periwinkle, belladonna, opium poppy, cinchona, neem, lemon grass, palmarosa and vettiver.

Unit V: Mushroom cultivation and post harvest diseases of fruits and plantation crops and their management
Medicinal and nutritional values of mushroom - Mushroom spawn preparation - Cultivation of oyster mushroom, milky mushroom, paddy straw mushroom and button mushroom - Constraints in mushroom cultivation - Post harvest diseases of fruits and plantation crops and their management.

PRACTICAL
Study of symptoms and host parasite relationship of the following crops: Tropical fruits - mango, banana, grapes, citrus, guava, sapota, papaya, jackfruit, pineapple, pomegranate and ber
Temperate fruits - apple, plum, pear, peach, almond, walnut and strawberry; Plantation crops - coconut, arecanut, oilpalm, coffee, tea, rubber, cocoa, cashew and betelvine; Medicinal and...
Aromatic crops - gloria, coleus, stevia, aloe, senna, pyrethrum, mint, periwinkle, belladonna, opium poppy, cinchona, neem, lemon grass, palmarosa and vettiver. Mushroom cultivation - Medicinal and nutritional values of mushroom - Mushroom spawn preparation - Cultivation of oyster mushroom, milky mushroom, paddy straw mushroom and button mushroom - Constraints in mushroom cultivation - Post harvest diseases of fruits and plantation crops and their management.

THEORY SCHEDULE
Symptoms, etiology, mode of spread, survival, epidemiology and integrated management strategies for the important diseases of the following crops
1. Mango
2. Banana
3. Grapes
4. Citrus
5. Guava
6. Sapota and Papaya
7. Jack fruit and Pineapple
8. Pomegranate and Ber
9. Apple
10. Pear and Peach
11. Plum and Almond
12. Walnut and Strawberry
13. Areca nut
14. Coconut
15. Oil palm
16. Coffee
17. Mid semester Exam
18. Tea
19. Cocoa
20. Rubber
21. Betelvine and cashew
22. Gloriosa, coleus, stevia and aloe
23. Senna, pyrethrum, mint and periwinkle
24. Belladonna, opium poppy, cinchona and neem
25. Lemongrass, palmarosa and vettiver
26. Medicinal and nutritional values of mushroom
27. Mushroom spawn preparation
28. Cultivation of oyster and milky mushroom
29. Cultivation of paddy straw mushroom
30. Cultivation of button mushroom
31. Constraints in mushroom cultivation
32. Post harvest diseases of fruits and plantation crops and their management
PRACTICAL SCHEDULE
Observation of symptoms in the field and laboratory, examination of causal organism by cross sections, scrapings and cultures of important pathogens and study of host parasite relationship of important diseases of the following crops.

1. Mango
2. Banana
3. Grapes and Citrus
4. Guava, sapota, papaya, jack fruit, pineapple, pomegranate and ber
5. Apple, plum, pear and peach
6. Almond, walnut and strawberry
7. Areca nut, coconut and oil palm
8. Coffee, tea, cocoa and rubber
9. Betelvine and Cashew
10. Gloriosa, coleus, stevia, aloe, senna, pyrethrum, mint and periwinkle
11. Belladonna, opium poppy, cinchona, neem, lemongrass, palmorosa and vetiver
12. Post harvest diseases of fruits and plantation crops
13. Mushroom spawn preparation
14. Cultivation of oyster and milky mushroom
15. Cultivation of paddy straw mushroom
16. Field visit to hot spot areas for observation and collection of diseased specimens

Assignment: Students should submit 50 well preserved diseased specimens in 2 installments during the semester.

References
PHT 201

FUNDAMENTALS OF FOOD TECHNOLOGY

Outcomes:
- In-depth understanding the food processing technology, principles, methods, preservation, need, scope, status at national and global level.
- Understanding the importance of classification and role of preservatives, methods and equipment required, Non thermal preservation technology.

Theory

Unit-I: Introduction to food technology

Food processing technology – definition, need, scope, scenario and status of food processing at national and global level. General properties of fruits and vegetables - chemical composition, nutrient composition, activation of living system and structural features. Fruits and vegetables – changes during cooking – effect of acid and alkali on cooking. Deterioration factors and their control – enzymatic, chemical, physical and biological causes and types of food spoilage.

Unit-II: Principles and methods of food preservation

Technical methods of reducing food deterioration - principles and procedure in reduction of moisture - drying and dehydration, methods and types of driers. Reduction of moisture by concentration – principles and equipments required. Thermal processing – pasteurization, sterilization, blanching and canning process. General consideration in establishing commercial fruits and vegetable cannery unit.

Unit-III: Preservation by low temperature

Preservation by use of low temperature – principles and procedures involved - equipment required. Preservation by irradiation - principle, methods and equipment required – advantages and disadvantages.
Unit-IV: Food additives

Food additives - classification and role of preservatives, antioxidants, chelating agents, flour improvers, artificial sweeteners, flavours, colours, stabilizers, emulsifiers, firming agent, leavening and clarifying agent. Food fortification and enrichment - application in foods.

Unit-V: Preservation by fermentation and non thermal preservation technology

Preservation by fermentation - principle, methods and equipment required. Principles of hurdle technology – shelf stable foods. Non thermal preservation technology – pulse electric field, ultraviolet and ionizing radiation, high pressure processing and microwave processing.

Practical


References

5. Journal of Food Science and Technology
6. Indian Food Industry

Lecture Schedule

1. Definition, need, scope and scenario and status of food processing at national and global level.
2. General properties of fruits and vegetables - chemical and nutrient composition, activation of living system and structural features.
4. Deterioration factors and their control – enzymatic, chemical, physical and biological causes and types of food spoilage.
5. Technical methods of reducing food deterioration.
6. Principles and procedure by reduction of moisture - drying, and dehydration, methods and types of driers.
7. Reduction of moisture- concentration – principle and equipment required.
8. Thermal processing – pasteurization, sterilization, blanching and canning process.
9. MID SEMESTER EXAMINATION
10. General consideration in establishing commercial fruits and vegetable cannery unit.
12. Preservation by irradiation and fermentation - principle, methods and equipment required - advantages and disadvantages.
13. Role of food additives in food preservation - antioxidants, chelating agents, artificial sweeteners, flavours, colours, stabilizers, emulsifiers, firming agent, leavening, clarifying agents, food fortification and enrichment - application in foods.
15. Non-thermal preservation technology - pulse electric field, ultraviolet and ionizing radiation - principles and equipment required.
16. Preservation by high pressure processing and microwave processing - principles and equipment required.

**Practical Schedule**

1. Perishable and non perishable foods - demonstration of degree of spoilage.
2. Equipments and machineries used in the fruits and vegetables processing industry.
4. Preservation of food by heat treatment - fortified fruit bar.
5. Preservation of food by sugar - preparation of jam, jelly and marmalade.
9. Preservation of food by using chemical preservatives - squash.
11. Preparation of dehydrated fruit slices, cluster beans and green leafy vegetables in cabinet drier.
12. Processing of fruit powder in foam mat drier.
13. Processing of fruit powder in spray drier.
15. Preservation by adopting hurdle technology - shelf stable fruit/vegetable spreads and minimally processed foods.
16. Visit to fruit and vegetable canning unit.

**17. PRACTICAL EXAMINATION**
STA 201  STATISTICAL METHODS (1+1)

Outcomes:
- Understanding the statistics applications in agriculture, measures, probability distribution and sampling methods.
- Understanding the correlation and Analysis of Variance

UNIT 1
Statistics- Definition, Data- types and sources, Applications in Agriculture. Graphical representation of data- frequency distribution, Bar plots, gives, histogram, frequency polygon and curves. Measures of Central Tendency-Arithmetic Mean, Median, Mode for grouped and ungrouped data, Geometric Mean, Harmonic Mean, Quartiles, deciles and Percentiles. Measures of Dispersion- Standard deviation, Variance, Coefficient of Variation. Moments-Skewness & Kurtosis

UNIT 2
Probability- Definition, basic concepts, Addition and Multiplication Theorem of probability. Probability Distributions- Binomial, Poisson and Normal Distributions and properties

UNIT 3
Sampling Methods, Sampling theory , population , sample, sampling vs complete enumeration, parameter and statistic , need for sampling , sampling distribution , standard error. Simple random sampling with and without replacement. Test of Significance-Null hypothesis and Alternate hypothesis, Types of errors, Level of significance, degrees of freedom, t test for means, f test, chi square test

UNIT 4
Correlation- Definition, Scatter Diagram. Types, Karl Pearson’s Coefficient of Correlation, Properties. Linear Regression - simple linear regression, Coefficient of determination. fitting of simple linear regression equation, properties

UNIT 5
Analysis of Variance-Definition, Analysis of One Way Classification, Analysis of Two Way Classification

Theory
1. Introduction to Statistics-Definition, Data- types and sources, Applications of in Agriculture.
2. Graphical Representation of Data- frequency distribution, gives, Bar plots, histogram, frequency polygon and frequency curves.
3. Measures of Central Tendency-Arithmetic Mean, Median, Mode for grouped and ungrouped data
4. Measures of Central Tendency -Geometric Mean, Harmonic Mean, Quartiles, deciles and Percentiles
5. Measures of Dispersion - Standard deviation, Variance, Coefficient of Variation for grouped and ungrouped data. Moments, Measures of Skewness & Kurtosis
6. Probability - Definition, basic concepts, Addition and Multiplication Theorem of probability
7. Probability Distributions - Binomial & Poisson Distributions
8. Probability Distributions - Normal distribution and its properties

9. MID SEMESTER EXAMINATION
10. Introduction to Sampling Methods, Sampling theory, population, sample, sampling vs complete enumeration, parameter and statistic, need for sampling, sampling distribution, standard error. Simple random sampling with and without replacement
11. Introduction to Test of Significance - Null hypothesis and Alternate hypothesis, Types of errors, Level of significance, degrees of freedom, steps in test of hypothesis
12. T test - One sample & two sample test t for Means, paired t test
13. F test for comparison of variances, Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table.
15. Linear Regression - simple linear regression, fitting of simple linear regression equation, properties
16. Introduction to Analysis of Variance - Analysis of One Way Classification
17. Analysis of Two Way Classification

Practical
1. Construction of frequency distribution, cumulative frequency
2. Diagrammatic representation – simple, multiple, component and percentage bar diagrams,. Graphical representation – frequency polygon, frequency curve and histogram
3. Measures of Central Tendency - Arithmetic Mean, Median, Mode, for grouped ungrouped data
4. Measures of Central Tendency - Geometric Mean, harmonic Mean, Quartiles, deciles and percentiles
5. Measures of Dispersion - Standard deviation, Variance, Coefficient of Variation for grouped and ungrouped data.
6. Simple Problems on Probability
7. Problems on addition and multiplication theorem of probability
8. Simple Problems on Binomial & Poisson Distributions
9. Simple Problems on Normal distribution
10. t test for single sample t test for comparison
11. paired t test & F test for variances
12. Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for 2 ×2 contingency table
13. Simple problems on Correlation
14. Simple problems on regression
15. One way analysis of variance
16. Two way analysis of variance
17. Final Practical examination
Outcomes:
- In-depth understanding the importance of cool season vegetable crops, area, production, export, varieties and hybrids.
- Understanding the importance of climate, soil and production technologies of vegetable crops, post-harvest technology and Marketing

Theory
Unit-I: Introduction and production technology for potato

Importance of cool season vegetable crops in nutrition and national economy. Area, production, export potential. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and Marketing of potato.

Unit-II: Production technology for cabbage, cauliflower, knol-khol. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and marketing of cabbage, cauliflower and knol-khol.

Unit-III: Production technology for sprouting broccoli, Brussels’ sprout, lettuce, palak, Chinese cabbage, spinach. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and Marketing of sprouting broccoli, Brussels’ sprout, lettuce, palak, Chinese cabbage, spinach.

Unit-IV: Production technology for garlic, onion, leek, radish, carrot, turnip and beet root. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and Marketing of garlic, onion, leek, radish, carrot, turnip and beet root.

Unit-V: Production technology for peas and broad beans, rhubarb, asparagus, globe artichoke, Vegetable kale. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and Marketing of rhubarb, asparagus, globe artichoke, Vegetable kale.

Practical
Identification and description of varieties/hybrids; propagation methods, nursery management; preparation of field, sowing/transplanting; identification of physiological and nutritional disorders and their corrections; post-harvest handling; cost of cultivation and field visits to commercial farms.

References

Lecture Schedule
1. Area, production, world scenario, industrial importance, export potential of temperate vegetable crops
2. Potato: Composition and uses - area and production- climate and soil requirements – season – warm winter types- varieties and hybrids -seed rate – nursery practices – containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting – water and weed management


9. MID SEMESTER EXAMINATION


14. Peas, French beans and Broad beans: Composition and uses - area and production - climate and soil requirements – season – warm winter types- varieties and hybrids - seed rate – preparation of field - spacing - planting systems - planting – water and weed management - Nutrient

**Practical Schedule**

1. Nursery preparation and sowing for transplanted temperate vegetables
2. Nursery preparation, seed rate, spacing for direct sown temperate vegetables
3. Soil water conservation, contour planting, crop geometry
4. Use of herbicides, preparation of solution and its application
5. Water management practices
6. Nutritional requirement, including major and micro nutrients
7. Scheduling of nutrients for temperate vegetables through drip fertigation
8. Use of growth regulators, preparation of solution and application in temperate vegetables
9. Identification of physiological disorders and nutritional disorders
10. Maturity indices and harvesting
11. Protected cultivation of temperate vegetables
12. Organic practices and GAP.
13. Precision farming in temperate vegetables
14. Visit to commercial farms in hills
15. Visit to cold storage / markets / processing centres
16. Project preparation and working out economics
17. **FINAL PRACTICAL EXAMINATION**
<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEN 212</td>
<td>Insect Pests of Fruit, Plantation, Medicinal &amp; Aromatic Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>2.</td>
<td>AGR 212</td>
<td>Water Management in Horticultural Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>ANM 211</td>
<td>Nematode Pests of Horticultural Crops and Their Management</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>FLA 203</td>
<td>Ornamental Horticulture</td>
<td>1+1</td>
</tr>
<tr>
<td>5.</td>
<td>FSC 202</td>
<td>Breeding of Fruit and Plantation Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>6.</td>
<td>GPB 211</td>
<td>Elementary Plant Biotechnology</td>
<td>1+1</td>
</tr>
<tr>
<td>7.</td>
<td>HOR 201</td>
<td>Dry land Horticulture</td>
<td>1+1</td>
</tr>
<tr>
<td>8.</td>
<td>SAC 211</td>
<td>Soil, Water and Plant Analysis</td>
<td>0+1</td>
</tr>
<tr>
<td>9.</td>
<td>SPC 201</td>
<td>Plantation Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>10.</td>
<td>SPC 202</td>
<td>Spices and Condiments</td>
<td>2+1</td>
</tr>
<tr>
<td>11.</td>
<td>PJN 201</td>
<td>Education Tour - I (State Tour)#</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td>NSS 101 / NCC 101</td>
<td>National Social Service / National Cadet Corps*</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
<td>0+1</td>
</tr>
</tbody>
</table>

TOTAL 13+11=24

*Non-Gradial Course continued from first semester

# Non-Gradial Course
Outcomes:

- In-depth understanding the insect ecology, Principles & components of pest management, method of pest control, management strategies of insect and non insect pests of fruits.
- Understanding the importance of Pests of plantation crops, medicinal and aromatic plants, stored product pests and their tolerance limits.

Theory

Unit – I: Insect ecology and components of pest management
Insect Ecology- Effect of abiotic and biotic factors on insect population. Pest – definition, categories of pests, factors governing pest outbreaks. Concept of economic threshold level and economic injury level. Principles and components of pest management

Unit –II: Methods of pest control

Unit – III: Pests of fruits
Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Mango, Guava, Sapota, Citrus, Banana, Grapevine, Jack, Jamun, Aonla, Pomegranate, Papaya, Ber, Apple, Pear, Peach and Plum, Pineapple.

Unit –IV: Pests of plantation crops, medicinal and aromatic plants
Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of coconut, arecanut,oilpalm, cinchona, coffee, tea, cashew, rubber, cocoa, cardamom, pepper, betel vine, aswagantha,senna, hemp, belladonna, pyrethrum,camphor,costus, crotalaria, datura, dioscorea, mint,opium,Solanumkhasianum,Tephrosia, neem, teak, subabul, eucalyptus.

Unit –V: Stored product pests
Storage insects, distribution, host range, bioecology, injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed products. Insecticide residue problem in fruits, plantations, medicinal and aromatic crops and their tolerance limits.

Practical
Study of symptoms of damage , collection, identification, preservation, assessment of damage and population of important insect pests affecting fruits, plantation, medicinal and aromatic crops in field and storage.
References

Assignment
Collection and submission of 50 pests of horticultural crops
Rearing a minimum of 15 insect pests
Preparation of two riker mounts of pests of horticultural crops

Lecture schedule
1. Insect ecology –Role of biotic (food, competition, parasitoids and predators, host plants) and abiotic factors (temperature, humidity, rainfall, microclimate etc) on pest abundance.
2. Pest – definition, categories and causes of outbreak, Economic injury level (EIL) and economic threshold level (ETL). Principles of integrated pest management- methods.
3. Cultural, physical, mechanical and legal methods of pest control - different components
4. Host plant resistance – types and mechanisms of resistance
5. Biological control – definition, parasitoids and predators and entomopathogens and their role in pest management.
6. Chemical control – classification of insecticides and their role in pest management
7. Semiochemicals – definition, Interspecific (allomone, kairomone and synomone), Intraspecific (pheromones) –Pheromones in pest management.
8. Insect growth regulators (IGRs)- moult inhibitors, JH mimics, insect antifeedants, repellents and botanicals in pest management
9. Biotechnological approaches in pest management
10. Pests of mango and guava
11. Pests of citrus and sapota
12. Pests of grapevine and banana
13. Pests of jack and pomegranate
14. Pests of jamun, papaya and ber
15. Pests of apple, pear, peach and plum
16. Pests of pine apple and aonla
17. Mid semester examination
18. Pests of coconut and arecanut
19. Pests of coffee and tea
20. Pests of cashew and rubber
21. Pests of oil palm and cocoa
22. Pests aswagamtha, senna, hemp
23. Pests of cardamom, pepper and betel vine
24. Pests of belladonna and pyrethrum
25. Pests of camphor and costus
26. Pests of crotolaria and datura
27. Pests of mint and opium
28. Pests of Solanum khasianum and dioscorea
29. Pests of Tephrosia, neem, subabul and eucalyptus
30. Pests of dry fruits, nuts and other horticultural products
31. Storage pests of medicinal, aromatic plants and processed products
32. Insecticide residue problem in fruit, plantation, medicinal and aromatic crops and their tolerance limits.

Practical schedule

Identification of symptoms of damage and life stages of important

1. Pests of mango and citrus
2. Pests of guava and sapota
3. Pests of banana, grapevine, and jamun
4. Pests of Pomegranate and jack
5. Pests of aonla, ber, pine apple and papaya
6. Pests of apple, pear, peach and plum
7. Pests of coconut, arecanut and oil palm
8. Pests of coffee and tea
9. Pests of cashew, rubber and cocoa
10. Pests of aswagantha, senna, hemp
11. Pests of cardamom, pepper and betelvine
12. Pests of belladonna, pyrethrum, camphor and costus
13. Pests of crotolaria, datura, dioscorea, mint, opium and Solanum khasianum
14. Pests of Tephrosia, neem, subabul and eucalyptus
15. Pests of dry fruits, nuts and other horticultural products
16. Tolerance limit of insecticide in fruits, plantation, medicinal and aromatic crops
17. Practical examination

AGR 212  WATER MANAGEMENT IN HORTICULTURAL CROPS  (1+1)

Outcomes:
- In-depth understanding the role of water in plant growth, Irrigation systems of India and Tamil Nadu, Soil-plant-water relationship and water requirement of crops
- Understanding the importance of Scheduling and methods of irrigation, tank irrigation, well irrigation, agricultural drainage, importance and methods of drainage.

Theory

Unit I: Irrigation- History and importance
Role of water in plant growth - Hydrological cycle - Water resources and irrigation potential of India and Tamil Nadu - Importance of scientific water management – Irrigation systems of India and Tamil Nadu
Unit II: Soil-water-plant relationship

Water relations – Soil-plant-water relationship - Soil water movement – soil moisture constants - Moisture extraction pattern – Absorption of water – Evapotranspiration – Plant water stress and its effect and methods to overcome stress

Unit III: Crop water requirement

Crop water requirement – Effective rainfall - Potential evapotranspiration (PET) and consumptive use – Definition and estimation – Factors affecting water requirement – Critical stages for irrigation and water requirement of crops.

Unit IV: Scheduling and methods of irrigation


Unit V: Quality of irrigation water and drainage

Quality of irrigation water – irrigation management under limited water supply – Agronomic practices for use of poor quality water (saline, effluent and sewage water) for irrigation – tank irrigation, well irrigation. Agricultural drainage, importance and methods of drainage.

Practical

Estimation of soil physical parameters and moisture – Measurement of irrigation water through water measuring devices (flumes and weirs) – Calculation of irrigation water requirement (problems) – Acquiring skill in land shaping for different surface irrigation methods – Operation and economics of sprinkler and drip irrigation systems – Estimation of crop water requirement – Scheduling of irrigation based on different approaches – Irrigation efficiency - Irrigation water quality – On-farm irrigation structures – Visit to irrigation command area (Reservoirs and tanks) - Methods of drainage and observation of drainage structures.

References

Lecture Schedule:
2. Hydrological cycle – Role of water in plant growth
3. Soil-plant-water relationship
4. Soil water movement
5. Soil moisture constants and Moisture extraction pattern
6. Absorption of water and Evapotranspiration
7. Plant water stress and its effect and methods to overcome stress
9. **MID-SEMESTER EXAMINATION**
10. Scheduling of irrigation – Approaches
11. Methods of irrigation: surface irrigation methods: layout, suitability, merits and scope
12. Methods of irrigation: Micro irrigation: layout, suitability, merits and scope
13. Water use efficiency – Methods to improve WUE – Conjunctive use of water
14. On farm water management – Conveyance and distribution – water budgeting
15. Quality of irrigation water – Agronomic practices for use of poor quality water (saline, effluent and sewage water)
16. Agricultural drainage, importance and methods of drainage.

Practical Schedule:
1. Estimation of soil moisture by direct methods
2. Estimation of soil moisture by indirect methods
3. Estimation of soil physical parameters and soil moisture constants
4. Measurement of irrigation water through water measuring devices (flumes and weirs)
5. Calculation of irrigation water requirements
6. Acquiring skill in land shaping: Border, Check basin/ Ring basin
7. Acquiring skill in land shaping: Ridges and furrows, BBF
8. Operation and maintenance of sprinkler irrigation systems
9. Operation and maintenance of drip irrigation systems
10. Estimation of crop water requirements
11. Scheduling of irrigation based on different approaches
12. Water use and Irrigation use efficiencies
13. Irrigation water quality and management
14. On-farm irrigation structures
15. Visit to irrigation command area (Reservoirs and tanks)

17. **PRACTICAL EXAMINATION**
ANM 211  Nematode Pests of Horticultural Crops and Their Management  1 + 1

Outcomes:

- Understanding the economic importance of nematodes, Morphology, anatomy and taxonomy of nematodes, symptom and interaction Life cycle of important nematodes.
- Understanding principles of nematode management, physical methods, cultural methods, biological control, chemical control and Nematode diseases of crops.

Theory

Unit I Introduction and economic importance Introduction to nematology – economic importance of nematodes – beneficial nematodes

Unit II Morphology, anatomy and taxonomy Morphology of nematodes. Anatomy of nematodes – digestive, excretory, nervous and reproductive system of nematodes. Biochemical/molecular tools for nematode identification - Taxonomy of nematodes upto super family and classification of nematodes based on parasitism.

Unit III Lifecycle, symptom and interaction Life cycle of important nematodes – Meloidogyne, Globodera, Rotylenchulus Tylenchulus, Radopholus and Pratylenchus. Symptoms of nematode damage – interaction of nematodes with other microorganisms.

Unit IV Nematode management Principles of nematode management - legislative (plant quarantine); physical methods (soil solarisation, hot water treatment, seed cleaning); cultural methods (deep ploughing, fallowing, crop rotation, antinemic plants, other land management practices); host plant resistance to nematodes; Improved techniques for nematode resistance breeding; biological control (nematode trapping fungi, egg parasitic fungi, obligate parasites, PGPR bacteria and predators); chemical control. Integrated nematode management.

Unit V Nematode diseases of crops

Nematode diseases of fruits (banana, citrus, grapevine, papaya) – vegetables (tomato, brinjal, bhendi, chilli, potato) - spices (turmeric, pepper, cardamom) flowers (crossandra, rose, jasmine, tuberose) plantation crops (tea, coffee, betelvine) - mushroom, medicinal and aromatic plants and nematode problem in protected cultivation.

Practical

Sampling techniques for nematode assay. Processing of soil samples for extraction of active nematodes - Extraction of nematodes by centrifugal floatation method and separation of cyst nematodes - Extraction of nematodes from plant samples. Staining techniques, direct examination of nematodes and warring blender technique. Killing, fixing, preservation and counting of nematodes - Processing and mounting of nematodes. Observation of morphological characters of Tylenchida (Hoplolaimus) and Dorylaimida (Xiphinema)- Identification of nematodes Holicotylenchus and Tylenchorhynchus -PratylenchusLongidorus, Xiphinema–Hemicriconemoides, Aphelenchoids, Tylenchulus. Study of life stages of Meloidogyne, Globoder -Rotylenchulusand
Radopholus. Nematode disease symptoms in fruits, vegetables, spices, flower crops and medicinal and aromatic plants. Nematicides, biocontrol agents, application methods and calculation of dosages

**Lecture schedule**

1. Introduction to nematology
2. Economic importance of nematodes
3. Beneficial nematodes – predatory, entomopathogenic nematodes etc.
4. Morphology and anatomy of nematodes – digestive and excretory system of nematodes.
5. Morphology and anatomy of nematodes (Contd.) – nervous and reproductive system of nematodes.
6. Taxonomy of nematodes up to super family and classification of nematodes based on parasitism. 7. Biochemical/molecular tools for nematode identification.
8. Life cycle of important nematodes – Meloidogyne, Globodera, Rotylenchulus, Tylenchulus, Radopholus and Pratylenchus.
9. Mid semester examination.
10. Symptoms of nematode damage.
11. Interaction of nematodes with other microorganisms.
12. Principles and methods of nematode management and IPM.
13. Nematode diseases of fruit crops (Banana, Citrus, Grapevine, Papaya)
15. Nematode diseases of spices (turmeric, pepper, cardamom) flower (crossandra, jasmine, tuberose) and plantation crops (tea, coffee, betelvine)
17. Improved techniques for nematode resistance breeding.

**Practical schedule**

1. Sampling techniques for nematode assay.
2. Processing of soil samples for extraction of active nematodes by cobb’s method
3. Extraction of nematodes by centrifugal floatation and extraction of cyst nematodes.
4. Extraction of nematodes from plant samples.
5. Staining techniques, direct examination and Blender technique.
6. Killing, fixing, preservation and counting of nematodes.
7. Processing and mounting of nematodes.
8. Observation of morphological characters of Tylenchida (Hoplolaimus) and Dorylaimida (Xiphinema)
10. Identification of nematodes Pratylenchus, Longidorus, Xiphinema.
11. Identification of nematodes Hemicriconemoides / Hemicycloiphora and Tylenchulus and Aphelenchoides.
12. Study of life stages of Meloidogyne and Globodera
13. Study of life stages of Rotylenchulus and Radopholus
15. Nematode disease symptoms in vegetables, spices, flower crops and medicinal plants.
17. Practical examination.

Text books

References:

Further reading:
1. Manjunath, B. and Srinivasa, N. Plant Nematology at a glance. New Vishal Publications,

Journals:
1. Indian Journal of Nematology, IARI, New Delhi.

E-sites:

FLA 203 ORNAMENTAL HORTICULTURE 1+1

Outcomes:
- In-depth understanding the scope of ornamental horticulture, industria importance, cultivation aspects.
- Understanding the design & establishment of garden, Garden adornments, Flower arrangement, types of garden and maintanance.

Theory
Unit—I: Scope and Importance of Ornamental Horticulture
History, definitions, scope of ornamental horticulture, aesthetic values, Floriculture industry, Importance, area and production, industrial importance of ornamental plants and flowers.
Unit-II: Cultivation aspects of ornamental plants
Importance, classification, design values and general cultivation aspects for ornamental plants viz. Annuals, biennials, herbaceous perennials, grasses and bulbous ornamentals, shrubs, climbers, trees, indoor plants, palms and cycads, ferns and sellaginellas, cacti and succulents.

Unit-III: Garden components
Importance, of design and establishment garden features/components viz., hedge, edge, borders, flower beds, bridges, paths, drives, fences, garden walls, gates, carpet bed, arbour, Patio, decking, retaining walls, shade garden, sunken garden, roof garden, terrace garden, pebble garden, rockery, pools, waterfalls, fountains, bog garden, avenue planting and children garden.

Unit–IV: Garden adornments
Importance of Garden adornments viz., floral clock, bird bath, statues, sculptures, lanterns, water basins, garden benches etc. Lawn types, establishment and maintenance.

Unit–V: Flower arrangement, special types of garden, bonsai
Importance of flower arrangement, Ikebana, techniques, types, suitable flowers and cut foliage, uses of vertical garden, bottle garden, terrariums, art of making bonsai, culture of bonsai and maintenance.

Practical
Identification and description of annuals, biennials, herbaceous perennials, climbers, shrubs, trees, indoor plants, ferns and sellaginellas, Palms and cycads and Cacti and succulents. Planning and designing and establishment of garden features viz., lawn, hedge and edge, rockery, water garden, carpet bedding, shade garden, roof garden, Study and creation of terrariums, vertical garden, study and practice of different types of flower arrangements, preparation of floral bouquets, preparation of floral rangoli, veni etc., Study of Bonsai techniques, Bonsai practicing and training. Visit to nurseries and floriculture units.

References

Lecture Schedule
1. History, development, scope and importance of landscape gardening
2. Aesthetic values, Floriculture industry and its importance, industrial importance of ornamental plants and flowers.
3. Importance, classification, design values and general cultivation aspects for ornamental plants viz., Annuals, biennials, herbaceous perennials.
4. Importance, classification, design values and general cultivation aspects for ornamental plants viz., grasses and bulbous ornamentals.
5. Importance, classification, design values and general cultivation aspects for ornamental plants viz., trees, shrubs, climbers.
6. Importance, classification, design values and general cultivation aspects for ornamental plants viz., indoor plants.
7. Importance, classification, design values and general cultivation aspects for ornamental plants viz., palms and cycads, ferns and sellaginellas.
8. Importance, classification, design values and general cultivation aspects for ornamental plants viz., Cacti and succulents.
9. MID SEMESTER EXAMINATION
10. Importance, design and establishment of garden features/components viz., hedge, edge, borders, flower beds, bridges, paths, drives, fences, garden walls, gates, carpet bed, arbour, Patio, decking, retaining walls, shade garden, sunken garden, roof garden.
11. Importance, design and establishment of garden features/components viz., terrace garden, pebble garden, rockery, pools, waterfalls, fountains, bog garden, avenue planting and children garden. Importance of Garden adornments viz., floral clock, bird bath, statues, sculptures, lanterns, water basins, garden benches etc.
12. Lawn types, establishment and maintenance.
13. Importance of flower arrangement, Ikebana, techniques, types, suitable flowers and cut foliage.
15. Art of making bonsai
16. Culture of bonsai and maintenance.

Practical schedule
1. Identification and description of annuals, biennials, herbaceous perennials
2. Identification and description of trees, shrubs, climbers
3. Identification and description of indoor plants
4. Identification and description of ferns and sellaginellas
5. Identification and description of palms and cycads
6. Identification and description of cacti and succulents
7. Planning and designing and establishment of garden features viz., lawn, hedge and edge, rockery, water garden, carpet bedding, shade garden, roof garden.
8. Study and creation of terrariums, vertical garden
9. Study and creation of vertical garden
10. Study and practice of different types of flower arrangements
11. Preparation of floral bouquets
12. Preparation of floral rangoli
13. Preparation of veni
14. Study of Bonsai techniques  
15. Bonsai practicing and training  
16. Visit to nurseries and floriculture units  
17. PRACTICAL EXAMINATION

GPB 211 ELEMENTARY PLANT BIO-TECHNOLOGY (1+1)

Outcomes:
- In-depth understanding the concepts, history, scope, methods and techniques of plant tissue culture, micropropagation, application and fusion, basic molecular techniques.
- Understanding the importance of Recombinant DNA Technology and Genetic Transformation and Molecular Breeding.

Theory

Unit I: Basics of Plant Tissue Culture

Plant tissue culture: Concepts, history and scope - Media and Culture Conditions - Sterilization techniques - Regeneration methods - morphogenesis, organogenesis and embryogenesis - culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture; anther and pollen culture; ovule and embryo culture – embryo rescue technique

Unit II: Applied Plant Tissue Culture

Micropropagation - banana and ornamental plants; National certification and Quality management of TC plants- Applications of organ culture - Meristem tip culture (virus free plants) and anther culture (doubled haploids)- Protoplast isolation and fusion- somaclonal variation- somatic embryogenesis - synthetic seeds- In vitro fertilization - invtro germplasm conservation

Unit III: Basic Molecular Techniques

Blotting techniques- Polymerase chain reaction - DNA sequencing methods – DNA fingerprinting.

Unit IV Recombinant DNA Technology and Genetic Transformation

DNA manipulation enzymes: Polymerases, restriction endonucleases and ligases - Different types of vectors: plasmids, phagemids, cosmids, BAC - Construction of recombinant DNA molecules- Bacterial transformation - Direct and indirect gene transfer methods in plants: microinjection, electroporation, particle bombardment, Agrobacterium mediated method - Tissue specific promoters, selectable and scorable markers, reporter genes– Transgenic plants and achievements: herbicide, pest and disease resistant, abiotic stress resistant, nutritional enhancement and traits for improved quality- Detection of GMOs – regulations and biosafety.
Unit V Molecular Marker Technology and Molecular Breeding

DNA markers - hybridization based markers (RFLP) - PCR based markers: RAPD, SSR, AFLP, and SNPs - DNA fingerprinting of crop varieties – Development of mapping populations - linkage and QTL analysis - Marker Assisted Selection (MAS)

Practicals

Biotech Laboratory organization, safety regulations – basics of reagents and solution preparation - Plant tissue culture media preparation- shoot tip culture (rose) - Meristem culture (tapioca) - Micropropagation of banana - Callus culture – Culturing of E. coli and determination of growth curve - Isolation of bacterial plasmid DNA - Restriction Digestion and Ligation - Competent cell preparation and Bacterial transformation – confirmation of transformation through colony screening - DNA extraction from plants - Quantification of DNA and quality check through Agarose gel electrophoresis - Molecular marker analysis - DNA fingerprinting using RAPD/SSR markers - DARwin- analysis of diversity in crop plants - Visit to tissue culture units / biotech labs in seed industry/Bt cotton field/tissue culture banana fields

Lecture Schedule

1. Plant tissue culture: Concepts, history and scope
2. Media and Culture Conditions and Sterilization techniques
3. Regeneration methods - morphogenesis, organogenesis and embryogenesis
4. Culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture, Anther and pollen culture; ovule and embryo culture
5. Micropropagation - banana and ornamental plants
6. Protoplast isolation and fusion, Somaclonal variation- Somatic embryogenesis, synthetic seeds
7. Somatic embryogenesis, Somaclonal variation-synthetic seeds
8. In vitro fertilization- Secondary metabolite production, invitro germplasm conservation National certification and Quality management of TC plants
9. Mid semester Examination
10. Blotting techniques, Polymerase chain reaction and DNA sequencing methods
11. DNA manipulation enzymes: Polymerases, restriction endonucleases and ligases Different types of vectors: plasmids, phagemids, cosmids, BAC
12. Construction of recombinant DNA molecules- Bacterial transformation
13. Direct and indirect gene transfer methods in plants: microinjection, electroporation, particle bombardment, Agrobacterium mediated method, Tissue specific promoters, selectable and scorable markers, reporter genes, Molecular analysis of transgenic plants
14. Transgenic plants: herbicide, pest and disease resistant, abiotic stress resistant, nutritional enhancement and traits for improved quality, Detection of GMOs – regulations and biosafety.
15. DNA markers - hybridization based markers (RFLP) - PCR based markers: RAPD, SSR, AFLP, and SNPs
Practical schedule

1. Biotech Laboratory: Organization and Safety Regulations
2. Basics of Reagents and Solution Preparation
3. Plant Tissue Culture Media Preparation
4. Sterilization techniques and Explant preparation
5. Shoot Tip Culture of Rose
6. Meristem Tip Culture of Tapioca
7. Micropropagation of Banana
8. Callus Culture
9. Isolation of Bacterial Plasmid DNA
10. Restriction Digestion and Ligation
11. Genomic DNA Extraction from Plants
12. Quantification of DNA and Quality Check through Agarose Gel Electrophoresis
13. DNA Fingerprinting using PCR
14. Study of Molecular markers
15. DARwin - Analysis of Diversity in Crop Plants
16. Visit to Tissue Culture Units /Biotech Lab in Seed Industry/Bt Cotton Field – Lateral Flow Strip Assay
17. Final Practical Examination

Reference


E- Reference

3. http://www.agbiosafety.unl.edu/
Outcomes:
- In-depth understanding the breeding of fruits, breeding methods and achievements in fruits.
- Understanding the historical perspectives, approaches and challenges in improvement of plantation crops

Theory

Unit-I: Introduction, breeding of Mango, Banana, Lime, Oranges and Lemon
- Historical perspectives, approaches and challenges in improvement of fruit crops; Centers of origin and diversity of major fruit crops. Breeding of fruit crops – Breeding methods and achievements in Mango, Banana, Lime, Oranges and Lemon

Unit-II: Breeding of Grapes, Guava, Sapota, Papaya, Aonla, Pomegranate, Pineapple. Breeding of fruit crops - Breeding methods and achievements in Grapes, Guava, Sapota, Papaya, Aonla, Pomegranate, Pineapple

Unit-III: Breeding of Ber, Jamun, Litchi, Apple, Plum, Peach, Pear, Strawberry, Apricot, Walnut, Pistichonut. Breeding of fruit crops - Breeding methods and achievements in Ber, Jamun, Litchi, Apple, Plum, Peach, Pear, Strawberry, Apricot, Walnut, Pistachio nut

Unit-IV: Breeding of Tea, Coffee, Cashew and Cocoa
- Historical perspectives, approaches and challenges in improvement of plantation crops; Centers of origin and diversity of major plantation crops. Breeding of plantation crops- Breeding methods and achievements in Tea, Coffee, Cashew and Cocoa

Unit-V : Breeding of Coconut, Arecanut, Oilpalm and Rubber. Breeding of plantation crops - Breeding methods and achievements in Coconut, Arecanut, Oilpalm and Rubber

Practical
- Exercises on floral biology, pollen viability; emasculation and pollination procedures; hybrid seed germination; raising and evaluation of segregating populations; use of mutagens to induce mutations and polyploidy in major crops like Mango, Banana, Citrus, Grapes, Guava, Sapota, Papaya, Annona, Aonla, Ber, Litchi, Pomegranate, Jamun, Pistachionut, Apple, Pear, Plum, Peach, Apricot and Strawberry, Arecanut, Coconut is palm, Rubber, Coffee, Tea, Cashew and Cocoa.

References

**Lecture Schedule**
1. History of Fruit and plantation crops breeding and achievements.
2. Pure line selection, mass selection, pedigree selection, back cross breeding procedures
3. Breeding methods -- clonal selection for varieties and hybrids
4. Application of mutation, mutagens in Horticultural crop and achievements
5. Breeding objectives, breeding methods and achievements in coconut, Arecanut
6. Breeding objectives, breeding methods achievements in coffee
7. Breeding objectives, breeding methods and achievements in tea
8. Breeding objectives, breeding methods and achievements in Cashew, Cocoa
9. Breeding objectives, breeding methods of rubber and achievements
10. History, Breeding objectives, Methods of breeding and achievements in Mango
11. History, Breeding objectives, Methods of breeding and achievements in Banana
12. History, Breeding objectives, Methods of breeding and achievements in Oranges
13. History, Breeding objectives, Methods of breeding and achievements in lime
14. History, Breeding objectives, Methods of breeding and achievements in lemon
15. History, Breeding objectives, Methods of breeding and achievements in Guava
16. History, Breeding objectives, Methods of breeding and achievements in Sapota
17. **MID SEMESTER EXAMINATION**
18. History, Breeding objectives, Methods of breeding and achievements in Papaya
19. History, Breeding objectives, Methods of breeding and achievements in Grapes
20. History, Breeding objectives, Methods of breeding and achievements in Pineapple
21. History, Breeding objectives, Methods of breeding and achievements in Pomegranate
22. History, Breeding objectives, Methods of breeding and achievements in Aonla
23. History, Breeding objectives, Methods of breeding and achievements in Ber
24. History, Breeding objectives, Methods of breeding and achievements in Jamun
25. History, Breeding objectives, Methods of breeding and achievements in Litchi
26. History, Breeding objectives, Methods of breeding and achievements in Apple
27. History, Breeding objectives, Methods of breeding and achievements in Peach
28. History, Breeding objectives, Methods of breeding and achievements in Pear and Plum
29. History, Breeding objectives, Methods of breeding and achievements in Strawberry and Apricot
30. History, Breeding objectives, Methods of breeding and achievements in Walnut and Pistachio nut
31. In vitro breeding tools and achievements in fruit crops
32. In vitro breeding tools and achievements in plantation crops

**Practical Schedule**
1. Selfing, emasculation and crossing techniques
2. Breeding objectives, Floral biology, selfing and crossing technique in Mango & Banana.
3. Breeding objective, Floral biology, selfing and crossing technique in Grapes & Citrus
6. Breeding objectives, Floral biology, selfing and crossing technique in Custard apple, Aonla, Ber
7. Breeding objectives, Floral biology, selfing and crossing technique in Litchi, Pomegranate, Jamun
8. Breeding objectives, Floral biology, selfing and crossing technique in Apple and Plum
9. Breeding objectives, Floral biology, selfing and crossing technique in Pear and Peach
10. Breeding objectives, Floral biology, selfing and crossing technique in Apricot and Strawberry
11. Breeding objectives, Floral biology, selfing and crossing technique in coconut, arecanut
12. Breeding objectives, Floral biology, selfing and crossing technique in coffee, tea and rubber
14. Working out variability, heritability and Genetic advance
15. Working out different types of heterosis
16. Preparation and use of physical and chemical mutagens
17. Practical Examination

HOR 201 DRY LAND HORTICULTURE 1+1
(Team teaching: Agronomy and Horticulture)

Outcomes:
- In-depth understanding of dry climates, classification, problems, uses, drought of dry land horticulture, soil erosion, watershed management.
- Understanding of dry land fruit crops, cropping systems, management, special horticultural practices, plant growth regulators and post harvest handling.

Theory
Unit-I: Dry land horticulture

Unit-II: Soil erosion

Unit-III: Watershed management
  Watershed management – objectives and approaches, steps in watershed planning. Land use capability and classification. Soil and water conservation measures in watershed areas. Water
harvesting and lifesaving irrigation. Problems and prospects under watersheds. Dry land horticultural crops based alternate land use systems.

**Unit-IV: Dry land fruit crops (aonla, ber, pomegranate, date palm, fig, phalsa and custard apple)**
Composition and uses - origin and distribution - climate and soil requirements – varieties - spacing and planting patterns - cropping systems - management of nutrients, water, weeds – special horticultural practices – use of plant growth regulators – harvest and yield-production constraints - post harvest handling.

**Unit-V: Dry land fruit crops (jamun, bael, wood apple, west indian cherry, carissa and manila tamarind)**
Composition and uses - origin and distribution - climate and soil requirements – varieties - spacing and planting patterns - cropping systems - management of nutrients, water, weeds – special horticultural practices – use of plant growth regulators – harvest and yield-production constraints - post harvest handling.

**Practical**
Preparation of seed bed, fertilizer application and sowing, rainfall analysis and interpretation, study of dry farming implements, Study of agronomic measures of soil and moisture conservation, study of mulches and anti-transpirants, visit to watershed areas, study on effects of drought on crops, collection of biometric data on crop and its interpretation, study of soil erosion problems in the field, collection of data on temperature and evaporation.
Description and identification of cultivars/varieties - nursery preparation, seed sowing and raising seedlings / rootstocks, practicing propagation techniques, manures, fertilizers and biofertilizers application – application of growth regulators - training and pruning of aonla, ber, pomegranate, date palm, custard apple, jamun, bael, wood apple and manila tamarind - practicing harvesting methods - ripening of fruits - grading and packaging - visit to commercial orchards - project preparation for commercial cultivation of arid zone fruit crops.

**References**

Lecture Schedule
4. Soil erosion - types, factors affecting erosion, agronomic and soil conservation measures.
5. Fertilizer use in dry land horticultural crops, inorganic, organic and biofertilizers.
6. Efficient cropping systems, normal and contingency crop planning under aberrant weather conditions. Evapo transpiration – measures to reduce evaporation and transpiration.
7. Watershed management – objectives and approaches, steps in watershed planning. Land use capability and classification. Soil and water conservation measures in watershed areas.
8. Water harvesting and lifesaving irrigation. Dry land horticultural crops based alternate land use systems.

9. MID SEMESTER EXAMINATION
15. Jamun and wood apple – composition and uses - origin and distribution - climate and soil requirements – varieties -spacing and planting patterns - cropping systems - management


Practical Schedule

1. Preparation of seed bed, fertilizer application and sowing.
3. Collection and interpretation of data on temperature and evaporation.
4. Study of dry farming implements.
5. Study of agronomic measures of soil and moisture conservation.
6. Study of mulches and antitranspirants.
7. Study of erosion problems in field.
8. Preparation of contingent crop planning for aberrant weather conditions.
10. Study of varieties and propagation techniques for aonla, pomegranate, fig and phalsa.
11. Study of varieties and propagation techniques for custard apple Jamun, bael and West Indian cherry.
12. Study of varieties and propagation techniques for Carissa and manila tamarind.
13. Assessment of maturity standards for dry land fruit crops.
15. Project preparation for commercial cultivation of dry land fruit crops.
16. Visit to watershed areas and dry land fruit crop fields.

17. PRACTICAL EXAMINATION

SAC 211 SOIL, PLANT AND WATER ANALYSIS (0+1)

Outcomes:
- In-depth understanding the preparation of soil, water and plant samples for analysis, identification of soil problem, requirement of soil.
- Understanding the irrigation and classification

Determination of pH and EC, calcium, Magnesium, Sodium, Potassium, Carbonate, Bicarbonate, Chloride, sulphate and Boron in irrigation water. Classification of irrigation waters.

Practical schedule
1. Sampling, processing and storage of plant materials and irrigation water for chemical analysis.
2. Estimation of moisture and ash content in plant sample and preparation of di and triple acid extract.
3. Estimation of Calcium, Magnesium, sulphur and Micronutrient in plant samples
4. Estimation of pH and EC in soil sample
5. Estimation of CEC of the soil
6. Estimation of exchangeable calcium and magnesium in soil
7. Estimation of exchangeable sodium and potassium in soil. Categorization based on soil properties
8. Estimation of gypsum requirement for sodic soil
11. Estimation of calcium and magnesium in irrigation water
12. Estimation of sodium and potassium in irrigation water
13. Estimation of carbonate and bicarbonate in irrigation water
15. Estimation of Boron in irrigation water
16. Classification of irrigation waters as per USSL and other systems.

Reference:
Suggested Reading:
8. C. S. Piper. 2014, Soil and plant analysis, Scientific publishers India.
Outcomes:
- In-depth understanding the scope, importance, role of plantation crops.
- Understanding the production technology of trees, cocoa and cashew, coffee and tea

Theory

Unit-I: Scope and importance of plantation crops

Plantation crops, History, scope and importance, area and production, export and import potentials, role in area and state economy.

Unit-II: Production technology of coconut, arecanut, oil palm, palmyrah and date palm

Introduction, importance, area and production, origin and distribution, uses, soil, climate, propagation – propagation, preparation of pits, spacing and planting, planting systems, care of young palm, irrigation, soil moisture conservation, manuring and fertilization, methods of application of fertilizers, weeding, cropping system, physiological disorder, harvesting, yield, processing, deficiency disorders and byproducts for the following crops
Crops: Coconut, Areca nut, Oil Palm, Palmyrah and Date palm

Unit-III: Production technology of cocoa and cashew

Introduction, area and production, origin & distribution, uses –varieties, classification of cocoa, climate, soil, propagation, preparation of land, shade regulation, spacing, planting, intercropping, irrigation, manuring, weeding, types of branching, pruning, top-working harvesting, processing, physiological disorder, and byproducts for the following crops
Crops: Cocoa and Cashew,

Unit-IV: Production technology of coffee and tea

Introduction, area, origin and distribution, production, export, soil, climate, types, varieties, propagation, preparation of main field and planting, shade regulation, irrigation, manuring, training and pruning inter cultural practices, mulching, weeding, cropping pattern and harvesting and processing for the following crops.
Crops: Coffee and Tea.

Unit-V: Production technology of rubber

Introduction, origin and distribution, area and production, uses, climate and soil, varieties and types of clones, propagation, spacing, planting, polyclonal seed garden manuring, cover crops, irrigation, weeding, tapping, tapping, use of growth regulators for latex flow, rain guarding, latex collection, yield of latex, processing and storage.
Practical

Description and identification of coconut varieties, selection of coconut and arecanut mother palm and seed nut, planting of seed nuts in nursery, layout and planting of coconut, arecanut, oil palm, cashew nut, cocoa gardens, manuring, irrigation; mulching, raising masonry nursery for palm, nursery management in cocoa. Description and identification of species and varieties in coffee, harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry collection, seed extraction, treatment and sowing of coffee, epicotyl, softwood, grafting and top working in cashew, working out the economics for coconut, arecanut, oil palm, cashew nut, cocoa, etc. Mother plant selection, preparation of cuttings and rooting of tea under specialized structure, training, pruning, tipping and harvesting of tea.

References


Lecture schedule

1. Plantation crops, History, scope and importance, area and production, export and import potentials, role of plantation crops in economy of our country.
2. Coconut- Introduction, importance, area and production, origin and distribution, uses, varieties-tall x dwarf hybrids (TXD), dwarf x tall hybrids (DXT), tall x tall hybrids (T X T).
3. Coconut- Soil, climate, propagation – seed propagation, selection of seed nuts, selection of mother palm, collection of seed nuts, nursery site selection and preparation, sowing of seed nuts, management of nursery, selection of seedling for planting, preparation of pits, spacing and planting,
4. Coconut - planting systems, care of young palm, irrigation, soil moisture conservation, manuring and fertilization, methods of application of fertilizer application and weeding cropping system, physiological disorder, harvesting, yield, storage, deficiency disorders – crown choke and Products / by products.

5. Areca nut - Introduction, importance, area and production, origin and distribution, uses, varieties, soil, climate, nursery raising techniques- selection of mother palms, seed nut selection, primary and secondary nurseries and selection of nursery plant material.

6. Areca nut - Establishment of plantation – spacing, season of planting, plantation management- inter cultural operations- manuring, irrigation, weeding, cropping system, harvesting, processing- dried ripe nuts, chali and kalipak, scented supari, and products/ byproducts,

7. Oil Palm - Introduction, importance, area and production, origin and distribution, uses - varieties, classification based on fruit structure, seed propagation, nursery practices, raising nursery, climate – sunshine and temperature requirement – oil palm growing areas.

8. Oil Palm - Soil- types of soils for oil palm growing regions, spacing, planting, irrigation, manuring, weeding and mulching, pruning, flowering and pollination, ablation, physiological disorder.

9. Oil Palm - Harvesting, yield and processing – extraction of oil from mesocarp and kernel, products/ byproducts.

10. Palmyrah - Introduction, importance, area and production, origin and distribution, uses, varieties – black and red skin fruit, male and female palms differentiation, soil and climate, propagation – raising nursery.

11. Palmyrah -Pre-treatment of seeds, nursery practices – raising seedlings in situ, in mound nursery bed and in masonary bed, transplanting, cultural practices – tending, irrigation, fertilization, tapping, harvesting, yield, processing and products / byproducts.

12. Date Palm - Introduction, importance, area and production, origin and distribution, uses - varieties, soil and climatic requirements, methods of propagation, preparation of land, spacing and planting.


15. Cocoa - Preparation of land, provision of shade, spacing, planting, shade regulation and inter cropping.

16. Cocoa - Irrigation, manuring, weeding, types of branching, pruning, top-working harvesting, and physiological disorder- cherelle wilt.

17. MID SEMESTER EXAMINATION


20. Cashew Nut - Planting, HDP, irrigation, weeding, manuring and nutrient deficiency
22. Cashew Nut - Processing methods – CNSL extraction, grading and packing.
23. Coffee - Introduction, origin and distribution, area and production, soil, climate, species and climatological differences in arabica and robusta, varieties and propagation.
24. Coffee - Preparation of main field, planting, shade management, irrigation and manuring
25. Coffee - Training and pruning, inter cultural practices, digging, scuffling or soil stirring, trenching, mulching, weeding, liming, flowering- season of flowering, fruit set and control of premature fruit drop, bean disorders.
27. Tea - Introduction, origin and distribution, area and production, types of tea- assam, china and cambod hybrid, soil, location, climate and varieties.
29. Tea - Training and pruning, manuring, liming, application of zinc sulphate, irrigation
30. Tea - Leaf plucking, yield of leaves, processing, grading and packing.
31. Rubber - Introduction, origin and distribution, area and production, uses, climate and soil, varieties and types of clones, propagation- seeds, vegetative methods, bud wood nursery for stump planting, planting – season, spacing, manuring, cover crops, irrigation, weeding.
32. Rubber - Types of planting material, improved clones and polyclonal seed garden, tapping, tapping systems, puncture tapping, slaughter tapping, use of growth regulators for latex flow, rain guarding, latex collection, yield of latex, processing and storage.

Practical schedule
1. Description and identification of coconut, arecanut & oil palm varieties / hybrids
2. Description and identification of cocoa, cashew nut varieties / hybrids.
3. Selection of mother palm, seed nuts and planting of seed nuts in the nursery of coconut and arecanut – selection criteria for planting of seedlings.
4. Layout and planting of coconut, arecanut and oil palm.
5. Identification of branching pattern in cashew nut & cocoa.
6. Description and identification of branching pattern in coffee.
7. Description and identification of species and varieties of Coffee
8. Processing of coffee beans
9. Cashew- Epicotyl grafting, soft wood grafting and top-working
10. Working out of economics and project preparation for coconut and arecanut plantations.
11. Working out of economics and project preparation for oil palm and cashew nut plantations.
13. Tea - training and pruning-tipping and harvesting
15. Processing of Rubber.
16. Visit to commercial plantations and processing centers
17. PRACTICAL EXAMINATION

SPC 202 SPICES AND CONDIMENTS 2+1

Outcomes:
- In-depth understanding the importance and classification of spices and condiments, types, and active principle.
- Understanding the production technology of major spice crops, tree spices, herbal and improvement of spices and condiments

Theory

Unit I: Importance and classification of spices and condiments
Introduction, history of spices, definition of spices and condiments, important spice crops of India, importance, role of spices in human nutrition, industry, exports and imports of spices in improving the national economy. Classification of Spices - Different classifications based on economic importance, cultivation methods, family, longevity of spice plants, type of the spice, origin and flavour, plant part used, active principle.

Unit II: Production technology of major spice crops
Origin and distribution, area and production, uses, botany, varieties, soil and climate, propagation, intercrop and mixed crop, shade and shade regulation, training and pruning, role of growth regulators, nutritional management, irrigation, weed control, maturity indices, harvesting, post harvest technology and value added products.
Crops: Black pepper, Betel vine, Cardamom, Turmeric and Ginger.

Unit III: Production technology of tree spices
Importance, origin and distribution, area and production, importance, uses, botany, varieties, soils and climate, propagation, nursery management, planting, staking, weeding, manuring, irrigation, pruning, mixed cropping system, harvesting, curing and processing, grading, packing, storage and value added products.
Crops: Clove, Nutmeg, Cinnamon, All spice, Curry leaf and Tamarind

Unit IV: Production technology of condiments, herbal and other spices
Importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, season, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting and threshing and value added products.
Crops: Coriander, Fenugreek, Fennel, Cumin, Dill, Celery, Bishop weed, Rosemary, Thyme, Vanilla, Saffron and Asafoetida

Unit V: Role of boards/institute/organizations for improvement of spices and condiments

Role of spices board, Pepper Export Promotion Council, Institutes working on spices and condiments, role of organizations for improvement of spices and condiments.

Practical:
Identification of varieties, propagation, seed treatment, sowing, layout, planting, hoeing and earthing up, manuring and use of weedicides, training and pruning, fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins. Visit to commercial plantations.

References

Lecture Schedule
1. Introduction, history of spices, definition of spices and condiments, important spice crops of India (List of the crops with Common name, Botanical name and family), importance, role of spices in human nutrition, industry, exports and imports of spices in improving the national economy.
2. Classification of Spices - Different classifications based on economic importance, cultivation methods, family, longevity of spice plants, type of the spice, origin and flavour, plant part used, active principle.
3. Institutes working on spices and condiments, role of organizations for improvement of spices and condiments like IISR, ICAR, DCASD and Spices Board.
4. Black Pepper – origin and distribution, area and production, uses, botany, types of shoots, varieties, soil and climate, propagation with seed, vegetative method – cuttings, layering, rapid multiplication method, bush pepper, intercrop and mixed crop.

5. Black Pepper – Establishment of pepper garden, planting of standard plants, planting of the vines, shade and shade regulation, training and pruning of pepper vines. Role of growth regulators, nutritional management, irrigation, weed control, maturity indices, harvesting, post harvest technology, despiking, blanching, black pepper, white pepper, drying and curing various forms of black pepper. Packing, storage and value added products.

6. Betel vine – origin and distribution, area and production, uses, botany, soil and climate, varieties, propagation, season, preparation field and planting, training of live standard, trailing of vines, lowering of vines, intercrop and mixed crop, nutritional management, irrigation, weed control, maturity indices, harvesting, post harvest technology and value added products.

7. Cardamom – origin and distribution, area and production, uses, botany, varieties, small and large cardamom, types of cardamom like, Malabar, Mysore and Vazukka, soil and climate, selection of site, propagation, seed and vegetative method like suckers.

8. Cardamom – planting, mulching, weeding, trashing, shade regulation, earthing up, nutrient and irrigation management, role of growth regulators, inter cropping and mixed cropping, harvesting indices, yield and post harvest technology – bleached cardamom.

9. Ginger – origin and distribution, area and production, importance, uses, botany, varieties, soil and climate, propagation, selection of land and preparation, planting season, seed rate, spacing, methods – bed system and ridge and furrow system, seasons, earthing up, mulching, systems of cultivation like rotations and mixed cropping.


11. Turmeric – origin and distribution, area and production, importance, uses, botany, species, varieties, soil and climate, propagation, selection of mother rhizome, selection of land and preparation. Methods of cultivation like bed system, ridge and furrow system planting – seasons, seed rate, spacing, mulching, earthing up.

12. Turmeric- irrigation, nutrient management, weeding, shade provision, cropping systems like inter cropping, rotations, role of growth regulators, harvesting and processing (curing, polishing, colouring), packing and storage, grades of turmeric, value added products like turmeric powder, oil and oleoresin, preservation of seed rhizome.

13. Clove – origin and distribution, area and production, importance, uses, botany, varieties, soil and climate, propagation by seed – selection of mother cloves, nursery management, planting, staking, weeding, manuring, irrigation, pruning, mixed cropping system, harvesting, curing and processing, grading, packing and storage, value added products like clove bud oil, clove stem oil, clove leaf oil, clove root oil, oil of mother clove.

14. Nutmeg – origin and distribution, area and production, importance, uses, botany, varieties, soils and climate, propagation, seed and vegetative method, nursery techniques, planting, cropping system like mixed cropping, manuring, weeding, intercultural, sex
problem, top working, harvesting, post harvest technology, grading, packing and value added products.

15. Cinnamon – importance, origin and distribution, area and production, uses, species of cinnamomum, difference between cinnamon bark and cassia bark, varieties, soil and climate, propagation – seed, cuttings, layers, nursery management, planting, weeding, manuring, irrigation, coppicing, harvesting, post harvest technology – cutting and peeling, preparation of quills, drying, grading – quills, quillings, featherings, chips, packing, storage and value added products

16. All Spice – introduction, area and production, uses, botany, varieties, soil and climate, propagation like seed and vegetative method – budding, approach grafting, planting, weeding, manuring, harvesting, post harvest technology like drying and curing and value added products like berry oil, leaf oil, oleoresin.

17. MID SEMESTER EXAMINATION

18. Curry Leaf – introduction, area and production, uses, botany, varieties, soil and climate, propagation like seed, planting, weeding, pruning, manuring, harvesting and post harvest technology.

19. Tamarind - introduction, area and production, uses, botany, varieties, soil and climate, propagation like seed and vegetative method – softwood grafting and air layering, planting, weeding, training and pruning, manuring, harvesting, post harvest technology and value added products.

20. Coriander - importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting, threshing and value added products.

21. Fenugreek – importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting, and threshing, value added products.

22. Fennel – importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, earthing up, harvesting, threshing and value added products.

23. Cumin – importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, sowing, nutritional management, thinning, irrigation, hoeing, and weeding, harvesting, threshing and value added products.

24. Dill – importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, sowing, nutritional management, thinning, weeding, irrigation, harvesting, and value added products.

25. Celery – importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, sowing, nutritional management, blanching, thinning, weeding, earthing up, irrigation, harvesting and value added products.
26. Bishops weed (Ajwain) – importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, sowing, nutritional management, weeding, earthing up, irrigation, harvesting and value added products.

27. Rosemary - Importance and uses, origin, distribution, botany, varieties, soil, climate, land preparation, propagation, transplanting, spacing, manures and fertilizers, irrigation, interculture, harvesting, yield.


29. Vanilla – importance, area and production, uses, botany (labellum, rostellum), varieties, constraints of production, propagation by cuttings, soil and climate, land preparation, planting, staking, training, manuring, flowering and pollination-hand pollination, harvesting, curing and processing and types of vanilla like Mexican, Bourbon and Indonesian vanilla, value added products like vanilla pods, vanilla essence, vanilla sugar, vanilla oleoresins, grading, packing and storage.

30. Saffron – importance, area and production, uses, botany, varieties, propagation, soil and climate, land preparation, planting, weeding, manuring, picking, drying, grading, packing and storage.

31. Asafoetida - introduction, area and production, uses, botany, varieties, soil and climate, propagation, preparation of land and planting, manuring, irrigation and weeding, tapping, processing, packing, storage and value added products.

32. Role of organizations/commodity boards for improvement of spices and condiments.

**Practical Schedule**

1. Identification of Spices and Condiments
2. Seed treatment, sowing, layout and planting methods in spices and condiments
3. Raising of spice crops
4. Raising of condiments.
5. Propagation methods and role of growth regulators in pepper and cardamom,
6. Propagation methods and role of growth regulators in turmeric, zinger and condiments
7. Identification of pepper, cardamom, turmeric and ginger varieties
8. Identification of coriander, fennel, fenugreek and cumin varieties
9. Important operations followed in spices like manuring, use of weedicides and earthing up operations.
10. Training and pruning in spices and condiments.
11. Maturity standards and harvesting of spices and condiments.
12. Curing, processing and grading of spices and condiments.
13. Methods of extraction of essential oils and oleoresins in spices and condiments.
14. Visits to commercial spice gardens
15. Visit to plantations and processing units.
16. Visit to essential oil extraction units.
17. **PRACTICAL EXAMINATION**
PJN 201 EDUCATION TOUR – I (STATE TOUR)

Outcome:

- Understanding about the soil, climatic conditions and cropping patterns in the agro-climatic zones of Tamil Nadu and Puducherry.
- Understanding the first-hand information on latest technologies on various crops and allied activities

The students will undertake the state tour for seven days covering KVK’s, Research stations, other SAU campuses and ICAR institutes in Puducherry and Tamil Nadu. The study tour will provide an exposure to the students to know about the soil, climatic conditions and cropping patterns in various agro-climatic zones. The students will also have first-hand information on latest technologies on various crops and allied activities.
### SEMESTER V

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEN 311</td>
<td>Insect Pests of Vegetable, Ornamental and Spice Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>2.</td>
<td>AEX 301</td>
<td>Communication Skills and Personality Development</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>FLA 301</td>
<td>Principles of Landscape Architecture</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>PAT 311</td>
<td>Diseases of Vegetable, Ornamental and Spice Crops &amp; Their Management</td>
<td>2+1</td>
</tr>
<tr>
<td>5.</td>
<td>PHT 302</td>
<td>Postharvest Management of Horticultural Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>6.</td>
<td>SPC 301</td>
<td>Medicinal and Aromatic crops</td>
<td>2+1</td>
</tr>
<tr>
<td>7.</td>
<td>SAC 301</td>
<td>Manures, Fertilizers and Soil Fertility Management</td>
<td>2+1</td>
</tr>
<tr>
<td>8.</td>
<td>VSC 301</td>
<td>Crop Production in Vegetable Crops</td>
<td>0+2</td>
</tr>
<tr>
<td>9.</td>
<td>VSC 302</td>
<td>Breeding of Vegetable, Tuber and Spice Crops</td>
<td>2+1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>14+10=24</td>
</tr>
</tbody>
</table>
AEN 311 INSECT PESTS OF VEGETABLES, ORNAMENTALS AND SPICE CROPS (2+1)

Outcomes:

- In-depth understanding the economic importance of insects in vegetables, ornamental and spice crops, pests of vegetables and pests of ornamentals crops.
- Understanding the importance of pests of species, Pests of stored products and insecticide residues.

Theory

Unit I: Economic importance of insects in vegetables, ornamental and spice crops

Economic importance of insects in vegetables, ornamental and spice crops, Ecology and pest management in these crops, Pest surveillance in important vegetables, ornamental and spice crops.

Unit II: Pests of Vegetables

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Brinjal, Bhendi, Tomato, Crucifers, Cucurbits, Moringa, Amaranthus, cowpea, lab lab.

Unit III: Pests of Ornamental crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Rose, Jasmine, Crossandra, Chrysanthemum, Marigold, Tuberose, daisy, lily, Nerium and Gloriosa, Coleus, Phyllanthus, and Aswagantha.

Unit IV: Pests of Spices

Distribution, bionomics, symptoms of damage and management strategies of insect of Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, fenugreek, mustard, fennel, clove, nutmeg, all spice, cinnamon, tamarind, vanilla, paprika, Cocoa, Cardamom, black Pepper.

Unit V: Pests of stored products and insecticide residues

Insect pests of processed vegetables and ornamental crops, bioecology, injury and IPM, insecticidal residues problems in vegetables and ornamental crops, tolerance limits.

Practical

Study of symptoms, damage, collection, identification, preservation, assessment of damage/ population of important insect- pests affecting vegetable, ornamental and spices crops in field and during storage.

Assignment

Collection and submission of 50 pests of horticultural crops
Rearing a minimum of 15 insect pests
Preparation of two riker mounts of pests of horticultural crops
References

Lecture schedule
1. Economic importance of insects in vegetables, ornamental and spice crops
2. Ecology and pest management in vegetables, ornamental and spice crops
3. Pest surveillance in vegetables
4. Pests of Brinjal
5. Pests of Bhendi and Tomato
6. Pests of Amaranthus, Moringa
7. Pests of Crucifers
8. Pests of Cucurbits
9. Pests of Cow pea and lab lab
10. Pest surveillance in spices
11. Pests of Chillies and Onion
12. Pests of Ginger and Garlic
13. Pests of Turmeric and Coriander
14. Pests offenugreek and mustard
15. Pests of Cinnamon and tamarind
16. Pests of Paprika, and Cocoa
17. **Mid semester examination**
18. Pests of fennel and clove,
19. Pests of nutmeg and allspices
20. Pests of Black pepper
21. Pests of Rose and Jasmine
22. Pests of Crossandra, Chrysanthemum
23. Pests of Marigold, Nerium
24. Pests of Gloriosa, Coleusand Phyllanthus
25. Pests of Aswaganthaand Tuberose
26. Pests of daisy and lily
27. Pests of cardamom and vanilla
28. Insect pests of processed vegetables
29. Insect pests of processed spices
30. IPM case studies in vegetables
31. IPM case studies in spices
32. Insecticide residue problem in vegetables and spices

**Practical schedule**

1. Assessment of damage/insect population in vegetables, ornamentals and spices crops in field and storage
2. Pests of Brinjal
3. Pests of Bhendi and Tomato
4. Pests of Crucifers and Cucurbits
5. Pests of Moringa, Amaranthus, cowpea, and lab lab.
6. Pests of Rose, Jasmine, Crossandra and Chrysanthemum
7. Pests of Marigold, Tuberose, Nerium and Gloriosa
8. Pests of Coleus, Phyllanthus, and Aswagamthana.
9. Pests of Chillies, Onion and Garlic
10. Pests of Turmeric, Ginger, and Coriander
11. Pests of Mustard, Fenugreek and Fennel
12. Pests of Clove, Nutmeg and All spice
13. Pests of Cinnamon, Tamarind, Vanilla
14. Pests of Pepper, and Cocoa
15. Pests of cardamom and paprika
16. Pests of processed vegetables and spices
17. **Practical examination**

**AEX 301 COMMUNICATION AND PERSONALITY DEVELOPMENT (1+1)**

**Outcomes:**

- In-depth understanding the functions, process, models, types, barriers, characteristics for effective communication.
- Understanding personality, Attitude, Self Motivation, Self Esteem, Time and Stress management.

**Unit I: Communication: Introduction, Functions, Process and Models**

Communication: Meaning & definition of communication, classification of communication, functions of communication, process of communication, models of communication, elements of communication.
Unit II : Communication: Types, Barriers, Factors for Effective communication
Types of communication : verbal communication- written, letter writing, types of letters, resume writing, report writing- Oral communication. Non-verbal communication- body language meaning, definition, use of body language gesture, posture, eye contact, facial expression. Barriers to communication, characteristics of successful communication.

Unit III: Introduction to Personality
The concept of personality - Dimensions of personality –Personality determinants, Self Awareness, Traits for building positive personality, Developing positive personality, Generating good ideas, Handling of ideas, Habits - forming good habits.

Unit IV: Personality Development- Attitude, Self Motivation
Attitude - Concept - Significance - components of attitude, attitude formation, factors affecting attitudes – types, steps for building positive attitude, steps for maintaining positive attitude, Concept of motivation – Significance, Internal and external motives, Importance of self-motivation, Skills for increasing self motivation.

Unit V: Personality Development- Self Esteem, Time and Stress management

Theory Schedule
1. Communication : Meaning & definition of communication, classification of communication,
2. Functions of communication, process of communication, elements of communication
4. Types of communication: verbal communication- written, letter writing, types of letters, resume writing, report writing and oral communication.
5. Types of communication : Non-verbal communication- body language meaning, definition, use of body language gesture, posture, eye contact, facial expression,
6. Barriers to communication, characteristics of successful communication.
7. The concept of personality, Dimensions of personality, Personality determinants.
8. Self Awareness, Traits for building positive personality, developing positive personality.
9. Mid- Semester
10. Generating good ideas, Handling of ideas, Habits - forming good habits.
11. Attitude - Concept - Significance - components of attitude, Attitude formation, Factors affecting attitudes
12. Types, steps for building positive attitude, steps for maintaining positive attitudes.
13. Concept of motivation - Significance – Internal and external motives - Importance of Self-motivation - skills for increasing self motivation.
15. Conflict and Stress Management, Stress Management - Types of Stress, causes, Stress reduction/management.
Practical
Understanding Listening and note taking, writing skills, writing skills, field diary and lab record; indexing, footnote and bibliographic procedures. Understanding Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; Practice of Non-Verbal Communication Skills, Personality Traits, role play, group discussion skills, oral presentation skills, team building skills, public speaking skills.

Practical Schedule
1. Understanding Communication and Practicing communication skills
2. Understanding public speaking
3. Practicing public speaking skills
4. Practicing of Non-Verbal Communication Skills
5. Understanding and practicing listening and note taking
6. Understanding and practicing reading and comprehension of general and technical articles.
7. Exercise in writing skills - precise writing, summarizing, abstracting
8. Practice on field diary and lab record; indexing, footnote and bibliographic procedures.
9. Understanding and practicing Group Discussion
10. Practicing Group Discussion
11. One-on-One Sessions for Individual Personality Traits – I
12. One-on-One Sessions for Individual Personality Traits – II
13. Practicing role play exercises -I
14. Practicing role play exercises- II
15. Understanding and practicing oral presentation skills
16. Practicing oral presentation skills
17. Practical Exam

References
FLA 301 PRINCIPLES OF LANDSCAPE ARCHITECTURE 1+1

Outcomes:

- In-depth understanding the history, importance of gardening, normal, informal, free style, wild gardens, basic themes of gardens, principles and practice.
- Understanding the steps in preparation of garden design, elements of landscape gardens and gardening for different situations.

Theory

Unit-I: History and style of gardening

Historical Importance of Indian gardens, Gardens of ancient world, Definitions, Famous gardens of India and abroad, formal, informal, free style and wild gardens, basic themes of gardens viz. circular, rectangular and diagonal themes

Unit-II: importance and features of various gardens

Importance, features and establishment of English garden, Japanese gardens, Mughal gardens, French and Persian garden, Italian gardens, Hindu gardens, and Buddhist gardens, Xeriscaping, definition, principles and practice.

Unit-III: Garden designing and principles of landscape design

Steps in preparation of garden design. Use of Auto CAD and Arch CAD in designing gardens. Factors affecting landscape design viz. initial approach, view, human choice, simplicity, topography etc., Principles of Landscape gardens viz. Axis, rhythm, balance, time and light, space, texture, form, mass effect, focal point, mobility, emphasis, unity and harmony etc.
Unit-IV: Elements of landscape design and planning of urban garden

Elements of landscape gardens viz. tangible and intangible elements. Bio-aesthetic planning, definition, objectives, planning and designing of home gardens, colonies, country planning, urban landscape.

Unit-V: Gardening for different situations

Development of institutional gardens, planning and planting of avenues, beautifying schools, railway lines, railway stations, factories, bus stands, air ports corporate buildings, dams, hydro electric stations, river banks, play grounds, Gardens for places of religious importance viz. temples, churches, mosques, tombs etc,

Practical


References

2. H.S.Grewal and Parminder Singh. 2014. Landscape designing and ornamental plants

Lecture Schedule

1. Historical Importance of Indian gardens, Gardens of ancient world, Definitions, Famous gardens of India and abroad.
2. History and special features of Formal, informal, free style and wild gardens, basic themes of gardens viz. circular, rectangular and diagonal themes.
4. Use of Auto CAD and Arch CAD in designing gardens.
5. Factors affecting landscape design viz. Initial approach, view, human choice, simplicity, topography.
6. Principles of Landscape gardens viz. Axis, rhythm, balance, time and light, space, texture, form, mass effect, focal point, mobility, emphasis, unity and harmony.
7. Elements of landscape gardens viz. tangible and intangible elements.
8. Bio-aesthetic planning, definition, objectives,
9. **MID SEMESTER EXAMINATION**
10. Planning and designing of home gardens, colonies, country planning, urban landscape,
11. Development of institutional gardens, planning and planting of avenues, beautifying schools, railway lines, railway stations, factories, bus stands, air ports corporate buildings, dams, hydro electric stations, river banks, play grounds.
12. Gardens for places of religious importance viz. temples, churches, mosques and tombs.
13. Importance, features and establishment of English garden and Japanese gardens
14. Importance, features and establishment of Mughal, gardens, French and Persian garden and Italian gardens.
15. Importance, features and establishment of Hindu gardens and Buddhist gardens,
16. Xeriscaping, definition, principles and practice.

**Practical Schedule**

1. Study of garden equipments, Graphic language and use of drawing equipments.
2. Study of graphic symbols and notations used in landscape designing.
3. Plant materials for landscaping and their identification i.e., annuals, herbaceous perennials, trees, shrubs, climbers, bulbous plants, cacti and succulents, aquatic plants, ground covers i.e., grasses, bamboos etc.,
4. Study of various features of an ornamental garden with suitable plants and identification of plants for each feature.
5. Study and designing of different styles of gardens, Study and designing of gardens based on different themes.
7. Study of designing gardens for home, traffic islands, schools and colleges, public buildings and factories.
8. Study of designing gardens Railway stations, air ports, temples, churches, play grounds and corporate buildings/ malls.
10. Study of designing and establishment of Japanese, English and Mughal gardens.
11. Study of special type of gardens (Terrace garden and Rock garden)
12. Study of special type of gardens (Sunken garden and Bog or Marsh garden)
13. Identification and description of indoor plants, Interior plant-scaping
14. Study of climatic factors (light, temperature, humidity, fresh air and watering) on successful culture of indoor plants.
PAT 311  Diseases of Vegetables, Ornamentals and Spice Crops and their management (2+1)

Outcomes:
- Understanding Symptoms, etiology, mode of spread, survival, epidemiology, management of important diseases of vegetables crops, tuber crops and Ornamentals Crops.
- Understanding Symptoms, etiology, mode of spread, survival, epidemiology, management of important diseases of Spices crops and their management.

THEORY

Unit I: Vegetables crops
Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of important diseases of tomato, brinjal, chilli, bhendi, cucurbits, crucifers, peas and beans.

Unit II: Tuber crops
Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of important diseases of potato, sweet potato, carrot, beet root, cassava and yam.

Unit III: Ornamentals Crops
Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of important diseases of rose, jasmine, crossandra, chrysanthemum, marigold, dahlia, carnation, zinnia, tuberose and geranium.

Unit IV: Spices crops
Symptoms, etiology, mode of spread, survival, epidemiology and integrated management of important diseases of onion, garlic, ginger, turmeric, pepper, cumin, fenugreek, cardamom, nutmeg, coriander, vanilla, clove, curry leaf and cinnamon.

Unit V: Post harvest diseases of vegetables and ornamental crops and their management

PRACTICAL
THEORY SCHEDULE

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management strategies for the diseases of the following crops.

1. Tomato
2. Brinjal
3. Chilli
4. Bhendi
5. Cucurbits
6. Crucifers
7. Peas and beans
8. Potato
9. Sweet potato
10. Carrot
11. Beetroot
12. Cassava and Yam
13. Rose
14. Jasmine and Crossandra
15. Chrysanthemum
16. Marigold and Dahlia
17. Mid semester exam
18. Carnation
19. Tuberose and Zinnia
20. Geranium
21. Onion
22. Garlic
23. Ginger
24. Turmeric
25. Pepper
26. Cumin, Fenugreek and cardamom
27. Nutmeg and coriander
28. Vanilla
29. Clove, curry leaf and cinnamon
30. Factors influencing post harvest diseases
31. Post harvest diseases of vegetables and ornamental crops
32. Integrated disease management strategies for post harvest diseases of vegetables and flowers.

PRACTICAL SCHEDULE

Observation of symptoms in the field and laboratory, examination of causal organism by cross sections, scrapings and cultures of important pathogens and study of host parasite relationship of important diseases of the following crops

1. Tomato and Brinjal
2. Chilli and Bhendi
3. Cucurbits
4. Crucifers
5. Peas and beans
6. Potato and sweet potato
7. Carrot and beetroot
8. Cassava and yam
9. Rose, jasmine, crossandra, chrysanthemum and marigold
10. Dahlia, carnation, zinnia, tuberose and geranium
11. Onion and Garlic
12. Ginger, turmeric, cumin and fenugreek
13. Pepper, cardamom and vanilla
14. Nutmeg, coriander, clove, curry leave and cinnamon
15. Post harvest diseases of vegetables and ornamental crops
16. Field visit to hot spot areas for observation and collection of diseased specimens

**Assignment:** Students should submit 50 well preserved diseased specimens in 2 installments during the semester.

**References**

**e- References**
1. [www.plantdisease.com](http://www.plantdisease.com)
4. [www.farmers.gov.in](http://www.farmers.gov.in)
Outcomes:

- Understanding the importance of post harvest management and maturity indices of fruits, vegetables, cut flowers, plantation crops, medicinal and aromatic plants.
- Understanding the importance of factors influencing, harvest treatments, packaging, storage and transport.

Theory

Unit-I: Importance of post harvest handling and maturity indices

Importance of post-harvest technology in horticultural crops. Maturity indices, harvesting, handling, grading of fruits, vegetables, cut flowers, plantation crops, medicinal and aromatic plants.

Unit-II: Factors influencing shelf life and fruit ripening

Pre-harvest factors affecting quality, factors responsible for deterioration of horticultural produce. Physiological and bio-chemical changes, hardening and delaying ripening process.

Unit-III: Pre harvest and post harvest treatments

Pre-harvest treatments, pre-cooling and post-harvest treatments of horticultural crops.

Unit-IV: Packaging

Packaging methods and types of packages, recent advances in packaging. Types of containers and cushioning materials, vacuum packaging, cold storage, poly shrink packaging, grape guard packing treatments.

Unit-V: Storage and transport

Different systems of storage, cold chain management and modes of transport of perishables.

Practical

Practice in judging the maturity of various horticultural produce, determination of physiological loss in weight and quality. Grading of horticultural produce, post-harvest treatment of horticultural crops, physical and chemical methods. Packaging studies in fruits, vegetables, plantation crops, spices and cut flowers by using different packaging materials, methods of storage, post-harvest disorders in horticultural produce. Identification of storage pests and diseases in spices. Visit to markets, packing houses and cold storage units.

References


Lecture Schedule

1. Importance and current scenario of post harvest management of perishables in India
2. Different methods of judging maturity in horticultural crops
3. Maturity indices for major fruit
4. Maturity indices for major vegetable crops
5. Maturity indices for flower crops, plantation and spices, medicinal and aromatic crops
6. Harvesting methods / techniques in horticultural crops
7. Major causes of post harvest losses of perishables
8. Pre-harvest factors affecting post harvest life and quality of horticultural crops
9. Ripening, climaacteric and non climaacteric ripening of fruits
10. Ethylene biosynthesis and its role in fruit ripening
11. Physiological and biochemical changes associated with ripening
12. Ripening management in fruits
13. Pre harvest treatments for enhancing post harvest life of fruits and vegetables
14. Pre cooling methods for perishables
15. Pre storage treatments for major fruits
16. Pre storage treatments for major vegetables

17. MID SEMESTER EXAMINATIONS
18. Post harvest handling of commercial flowers
19. Primary processing of medicinal and aromatic plants
20. Export specification for horticultural produce
21. Traditional and modern packaging methods for perishables
22. MAP, vacuum packaging, film wrapping and shrink wrapping
23. Edible packaging and nano packaging
24. On farm and low cost storage of fruits and vegetables
25. Cold storage of perishables - the need and the status of cold chain in India
26. Techniques of refrigerated storage
27. Modified and controlled atmospheric storage of fruits and vegetables
28. Hurdle technology and minimal processing of fruits and vegetables
29. Physiological disorders associated with storage
30. Post harvest pest management
31. Post Harvest diseases and their management
32. Transport of perishables

Practical Schedule

1. Determining maturity stages of commercially important fruits
2. Determining maturity stages of commercially important vegetables
3. Studies on harvesting techniques in horticultural crops
4. Studies on different packaging methods for fruits
5. Studies on different packaging methods for vegetables
6. Estimation of PLW during storage of fruits and vegetables
7. Studies on storability of tuber and bulb vegetables
8. Studies on packaging and storage of flowers
9. Studies on vase life extension of cut flowers
10. Studies on biochemical changes during storage of fruits
11. Studies on biochemical changes during storage of vegetables
12. Edible waxing and chemical treatment of fruits and vegetables
13. Ripening management in fruits
14. Studies on 'on-farm' storage structures for fruits and vegetables
15. Minimal processing of fruits and vegetables
16. Visit to cold storage / grading and packing unit

17. PRACTICAL EXAMINATION

SPC 301           MEDICINAL AND AROMATIC CROPS           2+1

Outcomes:
- In-depth understanding the history, importance, scope, opportunities, constaints, area, production, imports and exports of medicinal crops and aromatic crops.
- Understanding the soil, climate, varieties, propagation, nursery, planting, care, nutrient management, irrigation, harvest, storage and chemical composition of medicinal crops.

Theory
Unit-I: Introduction to medicinal crops History-importance – Scope- opportunities and constraints –area and production - imports and exports - classification of medicinal plants - GAP, GMP guidelines, institutions for promotion of medicinal plants- extraction techniques- Marketing

Unit-II: Medicinal crops Uses - soil and climate - varieties - propagation - nursery practices - planting and after care - nutrient management- irrigation - harvest - post harvest management-
storage techniques- Chemical composition. **Crops:** Withania, Senna, Periwinkle, Glory lily, Ashwagandha, Medicinal coleus, Aloe, Long pepper, Isabgol, Medicinal solanum

**Unit-III: Medicinal crops** Uses - soil and climate - varieties - propagation - nursery practices - planting and after care - nutrient management - irrigation - harvest - post harvest management - storage techniques - Chemical composition. **Crops:** Medicinal dioscorea, Rauvolfia, Sweet flag, Belladona, Cinchona and Gloriosa Pyrethrum, Centella, Insulin (Costus), Indian long pepper and Noni


**Unit-V: Aromatic crops**

Uses - soil and climate - varieties - propagation - nursery practices - planting and after care - nutrient management - irrigation - harvest - post harvest management - storage techniques - Chemical composition. **Crops:** Geranium, Patchouli, Lavender, bursera, Musk

**Practical**

Field visit to different medicinal and aromatic crop regions to gain ethnobotanical knowledge and the inter-relation between plant and people- Survey and identification of plants used for medicine, food and other social purposes- Collection and preparation of herbarium specimens of the above plants- Identification of medicinal and aromatic plants – propagation techniques – Harvesting and oil extraction of aromatic plants – Field visit, collection and preparation of herbarium – Visiting commercial units of medicinal plants.

**References**

Lecture schedule

1. Withania - Importance and uses, origin and distribution, botany, chemical constituents, varieties, soil, climate, propagation, season, spacing, planting, thinning pruning, trailing and lowering, manures and fertilizers, irrigation, weed control, harvesting and processing.

2. Periwinkle - Importance and uses, origin and distribution, botany, types, chemical constituents and varieties, soil, climate, propagation, spacing, planting, manures and fertilizers, irrigation, weed control, interculture, mulching, harvesting and processing.

3. Rauvolfia - Importance and uses, origin and distribution, botany, varieties, chemical constituents, soil, climate, propagation, spacing, planting, manuring, irrigation, weeding, harvesting and root yield.

4. Dioscorea - Importance and uses, origin and distribution, botany, species, chemical constituent’s varieties, soil, climate requirements of various species, propagation, field preparation, spacing, planting, staking, manures and fertilizers, irrigation, interculture and inter cropping, harvesting, yield and marketing.

5. Isabgol - Importance and uses, origin, distribution area, production, description of plant, chemical constituents, varieties, soil, climate, propagation, seed rate, season, planting, manures and fertilizers, artificial pollination, irrigation, trimming, harvesting and yield.

6. Cinchona and Gloriosa - Importance and uses, origin and distribution, description of plant, chemical constituents, varieties, soil and climate, land preparation, propagation, spacing, fertilizer application, irrigation, inter cultivation, harvesting and yield.

7. Pyrethrum - Importance and uses, origin and distribution, botany, types and chemical constituents, varieties, soil, climate, season, land preparation, propagation, planting, and fertilizers, irrigation, harvesting, drying, extraction and storage.

8. Belladona - Importance and uses, origin and distribution, botany, types and chemical constituents, varieties, soil, climate, season, land preparation, propagation, planting, and fertilizers, irrigation, harvesting, drying, extraction and storage.

9. Senna - Importance and uses, origin and distribution, botany, chemical constituents, varieties, soil, climate, land preparation, propagation, sowing, manures and fertilizers, crop rotation and intercropping, irrigation, weeding and interculture, harvesting, drying, storage and yield.

10. Coleus - Importance and uses, origin and distribution, botany, chemical constituents, varieties, soil and climate, propagation, spacing, planting, manures and fertilizers, irrigation, weeding, harvesting and yield of tubers.


12. Aloe - Importance and uses, origin and distribution, description of plant, species, chemical constituents, varieties, soil, climate, land preparation, propagation, crop duration, spacing and planting, manuring, irrigation, inter cultivation, harvesting and yield.

13. Centella - Importance and uses, origin and distribution, description of plant, species, chemical constituents, varieties, soil, climate, propagation, manures and fertilizers, irrigation, interculture, harvesting and yield.

15. Noni - Importance and uses, distribution, botany, chemical constituents, varieties, soil, climate, season, propagation, land preparation, nursery raising and transplanting, spacing, planting, manures and fertilizers, irrigation, weeding, harvesting and yield.

17. MID SEMESTER EXAMINATION

18. Indian long pepper - Importance and uses, distribution, botany, chemical constituents, varieties, soil, climate, season, propagation, spacing, planting, manures and fertilizers, irrigation, weeding, harvesting and yield.

19. Aromatic plants - History, importance and uses-industrial and cosmetic values, area and production, future prospects, opportunities and constraints in the cultivation of aromatic plants.


21. Aromatic plants - Distillation process, enfleurage or cold fat extraction, Maceration or Hot fat extraction, Solvent extraction, Expression, Supercritical Fluid Extraction (SCFE), storage of essential oils, Technical terms used in the trade.

22. Lemongrass - Importance and uses, origin, distribution, area and production, botany, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, interculture, harvesting and extraction of oil yield.

23. Citronella - Importance and uses, origin, distribution, area and production, botany, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, interculture, harvesting and extraction of oil yield.

24. Vetiver - Importance and uses, origin, distribution, botany, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, weeding, harvesting and yield.

25. Palmarosa - Importance and uses, origin, distribution, botany, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, interculture, harvesting and extraction of oil yield.

26. Lavender - Importance and uses, origin, distribution, botany, species, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, pruning, harvesting and postharvest handling.

27. Geranium - Importance and uses, origin, distribution, botany, varieties, soil, climate, propagation, spacing, planting and after care, manures and fertilizers, harvesting and yield.

28. Patchouli - Importance and uses, botany, varieties, soil, climate, propagation, planting, interculture, manures and fertilizers, irrigation, inter cropping, harvesting and extraction of oil yield.

29. Ambrette (Musk) - Importance and uses, origin, distribution, botany, soil, climate, land preparation, propagation, sowing, manures and fertilizers, irrigation, harvesting and yield.

30. Bursera (Indian Lavender Tree) - Importance and uses, botany, varieties, soil, climate, propagation, planting, pruning and training, manures and fertilizers, irrigation, inter cropping, harvesting and yield.
31. Ocimum and Davana - Importance and uses, origin, distribution, botany, varieties, soil, climate, season, propagation, interculture, manures and fertilizers, irrigation, harvesting and extraction of oil yield.
32. Mint and Sweet flag - Importance and uses, origin, distribution, botany, varieties, soil, climate, land preparation, propagation, planting, manures and fertilizers, weeding, irrigation, interculture, harvesting and yield.

Practical Schedule
1. Collection of locally available medicinal plants, plant description and preparation of herbarium
2. Collection of locally available medicinal plants, plant description and preparation of herbarium
3. Collection of locally available aromatic plants, plant description and preparation of herbarium
4. Collection of locally available aromatic plants, plant description and preparation of herbarium
5. Propagation and nursery techniques for betelvine, periwinkle, rauvolfia, dioscorea and isabgol
6. Propagation and nursery techniques for gloriosa, senna, noni, gymnema, centella and aloe
7. Propagation techniques for important citronella grass, sweet flag, lavender, geranium,
8. Propagation techniques for patchouli, bursera, mint, musk, ocimum, vettiver and davana
9. Important cultural aspects and harvesting techniques for important medicinal plants
10. Drying, curing and primary processing for important medicinal plants
11. Harvesting techniques for important aromatic crops
12. Extraction of aromatic oil through steam distillation process at field level, parts of steam distillation unit, principle of distillation process. Hydro distillation of aromatic oil in the laboratory.
13. Visit to Ayurvedic pharmacy
14. Visit to commercial perfumery industry
15. Visit to CIMAP or any other research institute working on medicinal and aromatic Plants
16. Visit to commercial farms.
17. PRACTICAL EXAMINATION
SAC 301 MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT (2+1)

Outcomes:
- In-depth understanding the history of soil fertility and plant nutrition, methods and fertilizer, chemistry of soil nutrients.
- Understanding the importance of organic manures, Green manures, composting of agricultural, industrial wastes, methods of application under rainfed and irrigated condition.

THEORY
Unit –I: Essential Nutrients

Unit- II: Chemistry of soil nutrients
Sources, forms mobility transformation, fixation, losses and availability of nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, Manganese, zinc, copper, boron, molybdenum in soil. Critical levels of different nutrients in soil. Mechanism of nutrient transport to plants. Factors affecting nutrient availability to plants.

Unit- III: Chemical Fertilizers

Unit-IV: Organic manures

Unit-V: Nutrient Management
Concepts of Nutrient management. Integrated Nutriment Management (INM), Integrated Plant Nutrient System (IPNS), Site Specific Nutrient Management (SSNM), Real Time Nutrient Management (RTNM) and Soil Test Crop Response Correlation (STCR) studies. Nutrient use efficiency of major and micro nutrients and enhancement techniques. Methods of fertilizer application. Fertigation. Methods of application under rainfed and irrigated condition.

Practicals
Soil nutrient analysis: available nutrient status - nitrogen, phosphorus, potassium, sulphur and DTPA extractable micronutrients. Plant analysis: Analysis of nitrogen, phosphorus and potassium

References

Web resources
1. www.fspublishers.org/ijab/past-issues/ijabvol_5_no_3/47.pdf
2. www.springerlink.com/index/l011256h8t325054.pdf
5. agtr.lirri.cgiar.org/agtrweb/Documents/Library/docs/.../Module4.htm
6. www.uoa.edu.e/academics/graduate/.../courses.html -
7. www.fao.org/waids/cirri/x5546e/x5546e08.htm
8. www.fao.org/waids/cirri/x5546e/x5546e08.htm
9. www.uoa.edu.e/academics/graduate/.../courses.html -
10. www.ncpahindia.com/articles/article17.pdf - Similar
11. www.energy.ca.gov/process/agriculture/ag_pubs/fertigation.pdf -
12. www.soilandhealth.org/.../010117attra/soilmanual/010117attra.html

Lecture schedule
2. Roles, deficiencies and toxicity symptoms of Nitrogen, Phosphorus and Potassium and their corrective measures.
3. Roles, deficiencies and toxicity symptoms of Calcium, Magnesium, Sulphur and micronutrients.

5. Fertilizer recommendation approaches- IARI method, Critical level approaches, Agronomic approaches, DRIS and STCR.

6. Sources, forms, mobility, transformation, fixation, losses and availability of nitrogen in soil

7. Sources, forms, mobility, transformation, fixation, losses and availability of phosphorus in soil

8. Sources, forms, mobility, transformation, fixation, losses and availability of potassium in soil

9. Sources, forms, mobility, transformation, fixation, losses and availability of calcium, magnesium and sulphur in soil

10. Sources, forms, mobility, transformation, fixation, losses and availability of micronutrients in soil

11. Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants.


14. P fertilizers- composition and properties of Rock phosphate, bone meal, basic slag, single super phosphate, diammonium phosphate and triple super phosphate

15. Manufacturing of SSP and DAP. Reactions of P fertilizers in soil.


17. Mid Semester Examination


20. Fertilizer Control Order


25. Nutrient management concepts – Deductive, INM, IPNS. Tools- DSSIFER and VDK

26. Nutrient management concepts –Inductive ,SSNM, RTNM and STCR.


29. Fertilizer application: soil and foliar application. Specific methods- seed coating, pelletilization, seedlings dipping and nutriseed pack.

30. Fertigation – Definition and types of fertigation, fertigation scheduling.


32. Long term effect of fertilization on soil health. PME and LTFE
Practical schedule
2. Estimation of Available N status in soil
3. Estimation of Available P status in soil
4. Estimation of Available K and S status in soil
5. DTPA extractable micronutrients in soil
6. Plant analysis – Estimation of N content in plant sample
7. Estimation of P and K content in plant sample
8. Estimation of N in Urea
9. Estimation of ammoniacal and nitrate N in ammonium nitrate
10. Estimation of water soluble P in SSP
11. Estimation of K in KCl and K$_2$SO$_4$
13. Estimation of P in FYM / Compost/Green manures
14. Estimation of K in FYM / Compost/Green manures
15. Soil test based fertilizer prescriptions
16. Visit to soil test laboratory / Fertilizer testing laboratory / Fertilizer mixing unit / manufacturing unit.
17. Final Practical Examination.

VSC 301 CROP PRODUCTION IN VEGETABLE CROPS 0+2

Outcomes:
- Hands on experience on crop production aspects, practical training and experience in vegetable production in transplanted crop.
- Hands on experience on crop production aspects, practical training and experience in vegetable production in direct sown crop

Objectives
To give hands on experience to the students on crop production aspects, practical training and experience in vegetable production in one transplanted crop (tomato or brinjal or chillies) and one direct sown crop (bhendi or amaranthus or radish or aggregatum onion) – seed treatment – raising nursery – sowing seeds – field preparation – transplanting, manuring, irrigation, fertigation, weed control, after culture – growth regulators – plant protection – maturity indices and harvesting – maintenance of cultivation sheet – working out cost benefit ratio.

References

**Practical Schedule**

1&2. Practice in raising nursery for transplanted vegetables.
3&4. Seed treatment, sowing, after care and collection of stubbles.
5&6. Practice in application of FYM and its incorporation.
7&8. Field preparation and forming raised and flat beds, ridges and furrows.
9&10. Application of basal dressing of fertilizers.
17. **MID SEMESTER EXAMINATION**
18&19. Practice in gap filling operation.
20&21. Practice in top dressing and earthing up operation.
22&23. Practice in PGR preparation and application.
24&25. Practice in pesticide, fungicide application and other inter cultural operations.
26&27. Assessing maturity index and harvesting.
28&29. Practice in seed extraction, processing, cleaning and packaging.
30&31. Cost economics of production.
32. **PRACTICAL EXAMINATION**
Outcomes:
- In-depth understanding the origin, bio-diversity, conservation, mode of reproduction of breeding in self and cross pollinated and breeding in asexually propagated vegetable crops.
- Understanding the principles of breeding of spice, black pepper and tree spices, Genetic basis of adoptability and stability.

Theory

Unit-I: Introduction, breeding in self and often cross pollinated vegetable crops
Centres of origin, plant bio-diversity and its conservation. Mode of reproduction, pollination mechanism and Self-incompatibility and male sterility, its classification and application in vegetable crop improvement. Principles - floral biology - objectives - methods of breeding - pure line selection, mass selection, heterosis breeding, hybridization, pedigree method, mass pedigree method, bulk method, modified bulk method, single seed descent method, back cross method - mutation and polyploidy breeding and achievements - application of biotechnology in crop improvement of Self / often cross pollinated vegetable crops (Tomato, brinjal, chilli and Capsicum, bhendi, Lab lab, vegetable cowpea, peas, french bean, cluster beans, amaranthus)

Unit-II: Breeding in cross pollinated vegetable crops

Unit-III: Breeding in asexually propagated vegetable crops
Principles of breeding – objectives - methods of breeding – clonal selection, polyploidy breeding, mutation breeding and achievements – application of biotechnology in crop improvement. Crops: Cassava, Potato, sweet potato, Dioscorea, major Yam, Ivy gourd, Chowchow, Coccinea

Unit-IV: Breeding of spice crops (gingr, turmeric and seed spices)
Principles of breeding - floral biology - objectives - methods of breeding and achievements. Crops: Ginger, turmeric, coriander, fennel, fenugreek (Seed spices and leafy spices)

Unit-V: Breeding of black pepper and tree spices
Principles of breeding - floral biology - objectives - methods of breeding and achievements. Crops: Black pepper, cardamom, nutmeg, cinnamon, tamarind (Tree spices)

Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops. Plant genetic resources, their conservation and utilization in

Practical

Floral biology and pollination mechanism in self and cross pollinated vegetables, tuber crops and spices. Working out phenotypic and genotypic heritability, genetic advance. GCA, SCA, combining ability, heterosis, heterobeltosis, standard heterosis, GxE interactions (stability analysis) Preparation and uses of chemical and physical mutagens. Polyploidy breeding and chromosomal studies. Techniques of F1 hybrid seed production. Maintenance of breeding records.

References

Lecture Schedule
1. Breeding objectives and importance of breeding of self and cross pollinated vegetable crops
2. Breeding objectives and importance of breeding vegetatively propagated crops
7. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in tomato
8. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in brinjal
11. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Cucurbits (Cucumbers)
12. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Bittergourd and Snakegourd
13. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Ribbedgourd and Bottlegourd
15. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Coccinea and Chow chow
17. MID SEMESTER EXAMINATION
22. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Carrot
23. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Radish
28. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in seed spices and leafy spices
29. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in tree spices
30. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in minor spices
31. Breeding for Quality Improvement in vegetable, tuber and spice crops
32. Achievements made in biotic and abiotic stress resistance in vegetable, tuber and spice crops.

**Practical Schedule**

1. Selfing, emasculation and hybridization techniques.
2. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Tomato
3. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Brinjal
4. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Bhendi
5. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Chilli
6. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Cucurbits
7. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Cucurbits
8. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Cucurbits
9. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in Potato
10. Breeding objectives, Floral biology in Turmeric & Ginger
11. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in seed spices
12. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in tree spices
13. Calculation of Heterosis, Heterobeltiosis and Standard Heterosis
14. Calculation of variability, inbreeding depression
15. Calculation of General combining ability, Specific combining ability, variances and effects
16. Stability analysis
17. **PRACTICAL EXAMINATION**
### SEMESTER VI

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEC 311</td>
<td>Horti-Business Management</td>
<td>2+0</td>
</tr>
<tr>
<td>2.</td>
<td>AEX 302</td>
<td>Entrepreneurship Development and Business Management</td>
<td>1+1</td>
</tr>
<tr>
<td>3.</td>
<td>AGR 311</td>
<td>Introduction to Major Field Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>4.</td>
<td>AGR 312</td>
<td>Organic Farming</td>
<td>2+1</td>
</tr>
<tr>
<td>5.</td>
<td>ENS 301</td>
<td>Environmental Studies and Disaster Management</td>
<td>2+1</td>
</tr>
<tr>
<td>6.</td>
<td>FLA 301</td>
<td>Breeding and Seed Production of Flower and Ornamental Plants</td>
<td>2+1</td>
</tr>
<tr>
<td>7.</td>
<td>PHT 303</td>
<td>Processing of Horticultural Crops</td>
<td>1+2</td>
</tr>
<tr>
<td>8.</td>
<td>HOR 302</td>
<td>Precision Farming and Protected Cultivation</td>
<td>2+1</td>
</tr>
<tr>
<td>9.</td>
<td>SST 311</td>
<td>Seed Production of Vegetable, Tuber and Spice Crops</td>
<td>2+1</td>
</tr>
</tbody>
</table>

**TOTAL** 15+9=24
AEC 311 HORTI-BUSINESS MANAGEMENT (2+0)

Outcomes:
- In-depth understanding the definition, nature, objectives, scope and characteristics of farm management, types, systems of farming, relationships, Farm planning and Budgeting.
- Understanding the importance of Agri/Horti-business and functional areas of Management.

Theory
Unit 1: Farm Management

Unit II: Factor-Product, Factor-Factor and Product-Product Relationships


Unit III: Farm planning and Budgeting

Unit IV: Agri/Horti-business
Agribusiness – Definition – Structure of Agribusiness (input, farm and product sectors) – Agribusiness Management – Importance of Agribusiness in Indian Economy. Management –


Unit IV: Functional areas of Management

Theory lecture schedule
2. Farm management decisions – Decision making process – Scope of farm management.
5. Classical production function and three stages of production – Elasticity of production.
6. Types of production function – Linear, Cobb-Douglas and Quadratic - use of production function in decision making
7. Cost concepts, cost curves and cost functions – total, average and marginal cost concepts and curves - shut down and breakeven point – CACP cost concepts – Cost of cultivation and production - importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income.
13. Farm planning: importance – characteristics of good farm plan – farm planning procedure.
15. Concept of risk and uncertainty in agriculture production, nature and sources of risks and its management strategies.
16. Mid Semester Examination.
18. Agribusiness Management - Special features of Agribusiness - Importance of Agribusiness in Indian Economy.
29. Marketing management: meaning, definition – planning the marketing programmes - market segmentation, targeting and positioning – 4Ps of marketing mix and marketing strategies.
31. Project appraisal and project evaluation measures – undiscounted and discounted measures.
32. Laws and policies related to agri-business in India.

References

E-references
1. www.managementteacher.com
2. www.management.about.com
3. www.bized.co.uk
5. www.fma.org
6. http://www.ifmr.ac.in
AEX 302 ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS MANAGEMENT (1+1)

Outcomes:
- In-depth understanding the concept of entrepreneurship, Managing an enterprise, motivation and Programmes / Schemes for Entrepreneurship development.
- Understanding the importance of venture capital, Contract farming and joint ventures, public, private partnerships, quality management, business management.

Theory

Unit I : Entrepreneurship
Concept of entrepreneurship; entrepreneurial and managerial characteristics; Assessing overall business environment in the Indian economy. Globalisation and the emerging business / entrepreneurial environment. Overview of Indian social, political and economic systems and their implications on agricultural entrepreneurs.

Unit II : Managing enterprise
Managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; SWOT analysis and Market Survey, Generation, incubation and commercialization of ideas and innovations.

Unit III: Programmes / Schemes for Entrepreneurship development

Unit IV: Functional Areas of Management

Unit V : Business Communication
Communication skills for entrepreneurs – Meaning, definition, process and importance, types of communication skills. Leadership – Definition, styles, difference between leaders and Managers.

Theory schedule
1. Concept of entrepreneurs and entrepreneurship ,entrepreneurial and managerial traits.
2. Entrepreneurship Development: Assessing overall business environment in the global and Indian economy.
3. Implication of Indian social, political and economic systems and their implications for decision making by agricultural entrepreneurs.
4. Entrepreneurship development process – generation, incubation and commercialisation of ideas and innovations.
5. Managing enterprise – planning, monitoring, evaluation and followup.
6. Motivation – meaning, definition, importance, motivating factors of entrepreneurship development.
7. SWOT analysis, concept, meaning, advantages. Market survey – meaning, importance, types of survey.
8. Entrepreneurship development initiatives of the government. – SSIB, SIDO, NSIC, KVIC, NISIET, NIESBUD, IIE, SSIDC, SDI, DIC, SIDBI, Commercial banks, SFC
9. Mid Semester
11. Export and Import Policies relevant to agriculture sector, Government policies related to horticulture and food processing sectors.
13. Contract farming, joint venture, PPP model.
14. Overview of agri inputs industry, Characteristics of Indian horticultural processing and export industries & social responsibility of business.
15. Communication skills for entrepreneurs – Meaning, definition, process and importance, types of communication skills.
16. Leadership – Definition, styles, difference between leaders and Managers.

Practical

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; news writing, preparing project proposals, individual, group presentation, features of oral presentation, presentation, evaluation of presentation and evaluation of sheet, dyadic communication-face to face conversation, telephone conversation, rate of speech and clarity of voice, speaking and listening politeness, telephone etiquettes, organising general and group meeting, salient features of participation in seminars and conferences, conducting and participating in mock interviews.

Practical Schedule
1. Exercise on reading and comprehension of general and technical articles, précis writing, summarizing, abstracting.
2. Exercise on listening and note taking, writing skills - field diary and lab record; indexing, footnote and bibliographic procedures.-I
3. Exercise on listening and note taking, writing skills - field diary and lab record; indexing, footnote and bibliographic procedures.-I
4. Visit to agri clinic/ industries
5. Visiting institution supporting entrepreneurship development
6. Analysing case study of successful enterprise by SWOT
7. Understanding oral presentation skills
8. Preparing project proposal
9. Preparing advertisements for popularization of product and news writing
10. Individual Presentation of project and evaluation –I
11. Individual Presentation of project and evaluation - II
12. Group presentation and evaluation of project - I
13. Group presentation and evaluation of project - II
14. Practice on face to face conversation and telephone conversation
15. Conducting and participating in mock interviews - I
16. Conducting and participating in mock interviews - I
17. Practical Exam

Reference books

e-References
1. www.ediindia.org/
2. iie.nic.in/
3. msme.gov.in/
4. niesbudtraining.org
5. www.nimsme.org/
6. www.nsic.co.in/
7. https://www.nabard.org/
Outcomes:
- In-depth understanding the classification and distribution of field cropping.
- Understanding the field preparation, Season, Sowing, Water, Weed & Nutrient management, Harvesting and yield of cereals, pulses, oil seeds, Fodder Crops and Green Manuring

Theory:

Unit I: Introduction
Classification and distribution of field crops (Cereals, Pulses, Oilseeds and Fodder crops); definitions and concepts of multiple cropping, mixed cropping, intercropping, relay and alley cropping and crop rotation

Unit II: Cereals

Unit III: Pulses

Unit IV: Oil seeds

Unit V: Fodder Crops and Green Manuring

Practical:
References:

Lecture schedule:
1. Classification and distribution of major field crops (Cereals, Pulses, Oilseeds and Fodder crops)
2. Definitions and concepts of multiple cropping, mixed cropping, intercropping, relay and alley cropping and crop rotation and its principles

9. MID SEMESTER EXAMINATION


15. Preservation of fodder – Hay and Silage making

16. Green Manuring: Importance and classification

Practical Schedule:
1. Identification of seeds of major field crops
2. Calculation of seed rate for major field crops
3. Acquiring skill on different seed treatment techniques
4. Acquiring skill on nursery preparation and management for Rice
5. Acquiring skill on nursery preparation and management for Sorghum and Finger millet
6. Lay out and raising of crop cafeteria
7. Estimation of plant population per unit area for major field crops
8. Acquiring skill on nutrient management practices for major field crops
9. Identification of weeds and acquiring skill on application of herbicides in major field crops
10. Study on growth parameters of major field crops
11. Study on yield parameters of major field crops
12. Study on maturity indices and harvesting of major field crops
13. Estimation of theoretical yield of major field crops
14. Working out the economics of cultivation of major field crops
15. Acquiring skill on preservation of fodder
16. Preparation of cropping Scheme

17. FINAL PRACTICAL EXAMINATION
Outcomes:

- In-depth understanding the types of farming, sustainable farming practices, concepts and principles of organic farming.
- Understanding the importance of nutrient and pest management in organic farming and Certification, exports and ITK.

Theory

Unit I: Types of farming and impacts of green revolution farming
Types of farming – Impacts of green revolution farming – Natural Nutrient cycles - Fate of agro chemicals in ecosystem.

Unit II: Sustainable farming practices
Sustainable farming – Definition, Concept and practices. Sustainable Farming methods – Bio-dynamic farming, Permaculture, Organic Farming, IFS, LEISA etc.

Unit III: Organic farming – Concepts and principles

Unit IV: Nutrient and Pest management in organic farming
Principles of pest management in organic farm - Bio intensive pest and diseases management - physical, cultural, mechanical and biological methods – non-chemical weed management methods: preventive, physical, cultural, mechanical and biological control measures.

Unit V: Certification, exports and ITK

Practical
Experiencing organic farming practices – soil, seed, nutrient, weed, water, pest and diseases, post-harvest management - hands on experience on bio composting, vermicomposting, ITK based biological preparations, bio-fertilizers bio-inoculants - quality analysis of inputs and
products - grading, packaging, post-harvest management – visit to organic farms, market outlets and organic certification centers.

References

Lecture Schedule:
1. Farming – types of farming
2. Impacts of green revolution farming
3. Natural Nutrient cycles
4. Fate of agro chemicals in ecosystem.
6. Biodiversity: importance and measure to preserve biodiversity
7. Sustainable farming – Definition, concept and practices
8. Sustainable Farming methods – Bio-dynamic farming
9. Sustainable Farming – Permaculture
10. Sustainable Farming - IFS, LEISA etc.
11. Organic farming: Definition - Scope - Principles and concepts
15. On farm and off farm sources – organic waste recycling methods
16. Soil and crop management - inter cropping, crop rotation
17. Mid semester examination
18. Green manures, cover crops, mulching, bio fertilizers
19. Principles of pest management in organic farm – physical and cultural methods
20. Pest management - Mechanical and biological methods
21. Non-chemical weed management methods: preventive, physical and cultural methods
22. Non-chemical weed management - mechanical and biological control measures.
23. Principles and Disease management in organic farm
25. Organic crop management techniques – Warm season vegetables
26. Organic crop management techniques – Cool season vegetables
27. Organic crop management techniques – Fruit trees
28. Organic Allied enterprises - honey bees and livestock production
30. Organic certification – NPOP guidelines
31. Certification agencies in India – crop production standards
32. Quality considerations - labeling and accreditation process - marketing and export opportunities.

Practical Schedule:
1. Global and Indian scenario of organic farming
2. Principles of Organic farming
3. Organic management of crops
4. Hands on experience on bio composting
5. Hands on experience on vermicomposting,
6. Hands on experience on ITK based biological preparations,
7. Hands on experience on Bio-dynamic preparations
8. Seed treatment practices in organic management
10. Nutrient management and Nutrient budgeting in organic farming
11. Weed management in organic farming
12. Insect management in organic farming
13. Disease management in organic farming
14. Bio-diversified Integrated farming practices for different ecosystems
15. Organic certification procedures
16. Visit to organic farms, market outlets and organic certification centers

17. PRACTICAL EXAMINATION

ENS 301 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT (2+1)

Outcomes:
- In-depth understanding the definition, scope and importance of natural resources, Ecosystem and Biodiversity, Human population, social issues and the Environment.
- Understanding environmental pollution, Laws and regulations, Disaster and its management.

Theory
Unit 1: Natural Resources
Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources - Renewable and non-renewable resources Natural resources and associated problems.
- Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water
logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.

Unit 2: Ecosystem and Biodiversity

Unit 3: Human population, social issues and the Environment

Unit 4 : Environmental pollution, Laws and regulations

Unit 5: Disaster and its management
Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.
Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community-based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations

Practical:
Field work: Visit to a local area to document environmental assets river/forest/grassland/hill/mountain, visit to a local polluted site -Urban/Rural/Industrial/Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.

References:
3. P.D. Sharma, 2009, Ecology and Environment, Rastogi Publications, Meerat, India

E-References:
1. Dhar Chakrabarti. P.G., 2011. Disaster management - India’s risk management policy frameworks and key challenges. Published by Centre for Social Markets (India), Bangalore. 36 pp.

Lecture Schedule
1. Multidisciplinary nature of environmental studies - Definition, scope and importance - Natural Resources: Renewable and non-renewable resources - Natural resources and associated problems
2. Forest resources: Use and over-exploitation, deforestation, case studies - Timber extraction, mining, dams and their effects on forest and tribal people
3. Water resources: Use and over-utilization of surface and ground water - Floods, drought, conflicts over water, dams - benefits and problems
4. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing
5. Effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies.
6. Land resources: Land as a resource, land degradation, man induced landslides - Soil erosion and desertification - Role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles
7. Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids
8. Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem and Desert ecosystem
9. Introduction, types, characteristic features, structure and function of Aquatic ecosystems: ponds, streams, lakes - Rivers, oceans, estuaries
10. Biodiversity and its conservation - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values
11. Biodiversity at global, National and local levels - India as a mega-diversity nation - Hotspots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
14. Water conservation, rain water harvesting, watershed management - Environmental ethics: Issues and possible solutions, climate change, global warming
15. Acid rain, ozone layer depletion, Nuclear accidents and holocaust - Wasteland reclamation - Consumerism and waste products
17. Mid Semester Examination
19. Environmental Pollution - Definition, cause, effects and control measures of Air pollution and Noise pollution.
20. Definition, cause, effects and control measures of Water pollution and Soil pollution
21. Definition, cause, effects and control measures of Marine pollution, Thermal pollution and Nuclear hazards
22. Solid Waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution - Pollution case studies.
24. Issues involved in enforcement of environmental legislation - Public awareness
25. **Disaster Management** - Natural Disasters - Meaning and nature of natural disasters, their types and effects - Floods, drought, cyclone, earthquakes, Landslides, avalanches
26. Volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion
27. Man Made Disasters - Nuclear disasters, chemical disasters, biological disasters, Building fire, coal fire, forest fire, oil fire, Air pollution, water pollution, deforestation, industrial waste water pollution
28. Road accidents, rail accidents, Air accidents, sea accidents
29. Disaster Management - Effect to migrate natural disaster at national and global levels
30. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements
31. Role of NGOs, community - based organizations and media in disaster management
32. Central, state, district and local administration in disaster management. Armed forces in disaster response - Disaster response; Police and other organizations.

**Practical schedule**
1. Visit to a local area to document environmental assets river / forest / grassland / hill / mountain
2. Energy: Biogas production from organic wastes
3. Visit to wind mill / hydro power / solar power generation units
4. Biodiversity assessment in farming system
5. Floral and faunal diversity assessment in polluted and un polluted system
6. Visit to local polluted site-Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds
7. Environmental sampling and preservation
8. Water quality analysis: pH, EC and TDS
9. Estimation of Acidity, Alkalinity
10. Estimation of water hardness
11. Estimation of DO and BOD in water samples
12. Estimation of COD in water samples
13. Enumeration of *E. coli* in water sample
14. Assessment of Suspended Particulate Matter (SPM)
15. Study of simple ecosystem – pond/river/hills
16. Visit to areas affected by natural disaster

**17. Practical Examination**
Outcomes:
- In-depth understanding the history and methods of breeding of flowers and ornamentals, seed production and techniques.
- Understanding the Breeding and seed production of Dianthus and Gladiolus.

Theory
Unit-I: Introduction and methods of breeding of flower and ornamentals
History of improvements of ornamental plants, Centre of origin of flower crops and ornamental crops, objectives and techniques in ornamental plant breeding. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental and flower crops, Breeding for disease resistance. Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility, production of open pollinated seed. Harvesting, seed production, seed processing and storage of seeds, seed certification.

Unit-II: Breeding and seed production of of Jasmine, Rose, Chrysanthemum, Tube rose, Gerbera, and Gaillardia Objectives and techniques in breeding. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental and flower crops. Breeding for disease resistance. Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility, production of open pollinated seed. Harvesting, seed production, seed processing and storage of seeds, seed certification in Jasmine, Rose, Chrysanthemum, Tube rose, Gerbera, and Gaillardia

Unit-III: Breeding and seed production of Petunia, Dahlia, Hibiscus – Bougainvillea – Zinia – Cosmos Objectives and techniques in breeding. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental and flower crops, Breeding for disease resistance. Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility, production of open pollinated seed. Harvesting, seed production, seed processing and storage of seeds, seed certification in Petunia, Dahlia, Hibiscus – Bougainvillea – Zinia - Cosmos

Unit-IV: Breeding and seed production of Dianthus - Marigold and Geranium - Antirrhinum and China aster - Orchids Objectives and techniques in breeding. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental and flower crops, Breeding for disease resistance. Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility, production of open pollinated seed. Harvesting, seed production, seed processing and storage of seeds, seed certification in Dianthus - Marigold and Geranium - Antirrhinum and China aster - Orchids

Unit-V: Breeding and seed production in Gladiolus – Heliconia – Anthurium - Carnation - Dahlia Objectives and techniques in breeding. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental and flower crops, Breeding for...
disease resistance. Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility, production of open pollinated seed. Harvesting, seed production, seed processing and storage of seeds, seed certification in Gladiolus – Heliconia – Anthurium - Carnation - Dahlia

Practical
Study of floral biology and pollination in important species and cultivars. Techniques of inducing polyplody and mutation. Production of pure and hybrid seeds. Harvesting, conditioning and testing of seeds. Practice in seed production methods.

References
4. McDonald, M. Flower seeds - Biology and Technology - Department of Horticulture and Crop Science, Ohio State University, USA, F Kwong, PanAmerican Seed Company, West Chicago, USA, F Bongers, Wageningen University
Lecture Schedule

1. History and development of hybrids, different breeding methods for self & cross pollinated crops. Important concepts of breeding of ornamental crops.
2. Breeding for disease resistance in flower and ornamental crops
3. Role of heterosis in F1 hybrids development and use of mail sterility
4. Breeding objectives, breeding methods and achievements in rose
5. Breeding objectives, breeding methods and achievements jasmine
6. Breeding objectives, breeding methods and achievements in Chrysanthemum and tuberose
7. Breeding objectives, breeding methods and achievements in Gerbera and Gladiolus
8. Breeding objectives, breeding methods and achievements in Dahlia and Heliconia
9. Breeding objectives, breeding methods and achievements in Dahlia and Gaillaidia and Petunia
10. Breeding objectives, breeding methods and achievements in Dahlia and Hibiscus
11. Breeding objectives, breeding methods and achievements in Bougainvillea
12. Breeding objectives, breeding methods and achievements in Zinnia
13. Breeding objectives, breeding methods and achievements in Cosmos
14. Breeding objectives, breeding methods and achievements in Dianthus
15. Breeding objectives, breeding methods and achievements in Marigold and Geranium
16. Breeding objectives, breeding methods and achievements in Antirrhinum and China aster
17. MID SEMESTER EXAMINATION
18. Breeding objectives, breeding methods and achievements in Orchids
19. Breeding objectives, breeding methods and achievements in Carnation
20. Introduction to Commercial Flower Seed Production – Flower Seeds and Flower Seed Industry
21. Scope and Importance of Commercial Floriculture and Seed Production techniques of ornamental plants
22. Factors considered for efficient seed programme in Ornamental seed production methods of seed production in marigold and Zinnia
23. Methods of Seed production techniques in marigold, zinnia and Chrysanthemum (including processing, storage and seed certification)
24. Methods of Seed production techniques in Dahlia, Petunia and Phalsam (including processing, storage and seed certification)
25. Methods of Seed production techniques in Cockscomb, Cosmos and Hollyhock (including processing, storage and seed certification)
26. Methods of Seed production techniques in Gaillardia and Gomphrena (including processing, storage and seed certification)
27. Methods of seed / vegetative plant production technique in rose and jasmine (including processing, storage and seed certification)
28. Methods of Seed / vegetative plant production technique in hibiscus and Bougainvillea (including processing, storage and seed certification)
29. Methods of Seed / vegetative plant production techniques in Orchids (including processing, storage and seed certification)
30. Methods of Seed / vegetative plant production technique in Gerbera and Anthurium (including processing, storage and seed certification)
31. Methods of Seed / vegetative plant production technique in Gladiolus and Carnation (including processing, storage and seed certification)
32. Classification of Seeds based on longevity – Seed storage and Storage conditions for some flower crops – Conserving the Germplasm of Herbaceous Ornamental Plants.

**Practical Schedule**

1. Selfing, emasculation and crossing techniques in ornamentals
2. Introduction, selection, hybridization - technique for improvement of ornamental plants
3. Mutation and Polyploidy breeding - technique for improvement of ornamental plants
4. Biotechnological breeding - technique for improvement of ornamental plants
5. Floral biology, selfing, emasculation and crossing technique in Rose, Jasmine, Marigold and Anthurium
6. Floral biology, selfing, emasculation and crossing technique in Gladiolus and Orchids
7. Floral biology, selfing, emasculation and crossing technique in Gaillardia and Gerbera
8. Floral biology, selfing, emasculation and crossing technique in Zinnia, Ageratum, Alyssum, Aster and Calendula
9. Seed collection in ornamental plants (annuals, perennials and tree crops)
10. Methods of seed extraction in ornamental plants
11. Identification of seed and seed structure of ornamental plants
12. Seed germination and viability testing in ornamental plants
13. Seed Dormancy & Methods of breaking of seed dormancy in ornamental plants
14. Seed germination, test evaluation and seed enhancement techniques (Seed Priming, Pre-germination, Pelleting and Coating) in ornamental plants
15. Study of seed storage, seed package and packaging materials in ornamental plants
16. Visit to ornamental seed production plots and Commercial flower seed production industries
17. **PRACTICAL EXAMINATION**
Outcomes:
- In-depth understanding scope, principles, methods of vegetables, traditional and novel methods of food preservation.
- Understanding the Preservation by freezing and Processing of plantation crops and food laws.

Theory

Unit-I: Scope of fruit and vegetables preservation
Importance and scope of fruits and vegetable preservation industry – principles and guidelines for location of units and setting up of processing units – canning and dehydration industries. food pipe line, losses in post harvest operations, unit operations in food processing.

Unit-II: Principles and methods of food preservation

Unit-III: Value addition of fruits
Traditional and novel methods of food preservation and its importance - preservation by using sugar – crystallised fruits and toffees. Preservation with salt and vinegar – chutney and sauces – tomato and mushroom sauce.

Unit-IV: Preservation by freezing
Freezing preservation – frozen orange slices and peas. Freeze drying of horticultural crops. Individual Quick Freezing,

Unit-V: Processing of plantation crops and food laws
Processing of plantation crops and products. Quality control in processed products - government policy on import and export of processed fruits. Food laws and quality control. Fruit and vegetable processing industry - costs, contribution and break even analysis

Practical
Equipment used in food processing units. Physico-chemical analysis of fruits and vegetables. Canning of fruits and vegetables – preparation of cordial, syrup, chutneys, and pickles (hot and sweet). Dehydration of fruits and vegetables – sapota and tomato product dehydration, refrigeration and freezing. Cut out analyses of fruit and vegetable based processed foods. Processing of plantation crops. Visit to processing units.
References
5. Mircae Enachesu Deuby Fruit and Vegetable processing 2004 FAO Agricultural Service Bulletin Rome

Lecture Schedule
1. Importance and scope of fruit and vegetable in world agriculture and preservation industry in India.
2. Food pipe line loss of fruit and vegetables from farm to fork - losses in post harvest operations.
3. Unit operations in fruit and vegetable processing industry.
4. Principles and guidelines for setting up of fruit and vegetable processing units.
5. Storage system of Fruit and Vegetable products
8. Traditional and Novel Methods of food preservation and its importance Preservation by using sugar – crystallised fruits and toffees.
9. MID SEMESTER EXAMINATION
11. Freeze preservation – Individual Quick Freezing , Frozen peas
13. Role of ingredients used in chocolate manufacturing - honey, molasses, cream, milk products, egg, aerating agents, additives, starches, fruits and nuts.
14. Government policy on import and export of processed fruits and vegetables – APEDA.
15. Quality control and safety of processed products - Food safety and Standards Authority of India (FSSAI), Food Safety and Standards Act (2006) and Hazard Analysis Critical Control Point (HACCP).
16. Fruit and Vegetable processing industry costs, contribution and Break even analysis

Practical Schedule
1. Market survey of fruit and vegetable based processed products.
2. Introduction to equipment used in food processing units.
3. Physico-chemical analysis of fruits
5. Bottling of fruits
6. Bottling of vegetables
Outcomes:
- In-depth understanding the importance, scope, principles and techniques of precision farming for horticultural crops and protected cultivation.
- Understanding the importance of Protected cultivation technology for vegetable, fruit and flower crops.

Theory
Unit-I: Concepts and introduction to precision horticulture
Scope and importance of precision horticulture - principles and concepts –lazer leveling, mechanized direct seed sowing - seedling and sapling transplanting – Soil mapping and plant attributes, remote sensing, sensors, role of Geographic Information Systems (GIS), Global Positioning Systems (GPS), thematic maps, spatial variability, mobile mapping system and its
application in precision farming - Site Specific Nutrient Management (SSNM), weed management, insect pests and disease management, yield mapping in horticultural crops.

Unit-II: Precision farming techniques for horticultural crops
Precision farming techniques - prostrate seedlings - field preparation - raised bed forming - row planting - drip irrigation - mulching - fertigation system - training systems – growth regulators – plant protection – harvesting – grading and packing system. **Crops:** Mango, banana, guava, tomato, chilli, bitter gourd, turmeric and marigold

Unit-III: Scope, importance and methods of protected cultivation
Scope and importance - different growing structures of protected culture viz., green house, poly house, net house, poly tunnels - Influence of environmental factors on green house production – planning, design and materials of construction for traditional and low cost green house – Heating, cooling systems, passive and hot air and drying and CO₂ enrichment – Growing media- different types, soil culture, pasteurization of media, drainage, flooding and leaching - Irrigation systems in green house - Cost estimation and economic analysis - Constraints of green house cultivation and future strategies - Nutrient film technique / hydroponics / aeroponic culture

Unit-IV: Protected cultivation technology for vegetable and fruit crops
Hi-tech protected cultivation techniques - soil sterilization - growing media preparation - bed formation - special horticultural practices - drip and fertigation - mulching - plant growth regulators - harvest and yield - storage - postharvest management (Crops: Tomato, capsicum, cucumber, melons, strawberry)

Unit-V: Protected cultivation technology for flower crops
Hi-tech protected cultivation techniques - soil sterilization - growing media preparation - bed formation - special horticultural practices - drip and fertigation - mulching - plant growth regulators - harvest and yield - storage - post harvest management **Crops:** Dutch rose, chrysanthemum, carnation, gerbera, anthurium, orchids

Practical
Precision farming - positioning systems understanding of GPS, positioning accuracy specifications and utilization of GIS software - protected cultivation - study of different kinds of protected structures - designs, components and construction – types and structures of auto control systems in green house – calculation of air rate exchange in active summer, winter cooling system – different media, pasteurization / sterilization - estimation of drying rate of agricultural products inside green house – testing of soil and water to study the suitability for growing crops – study the fertigation requirements for green house crops and estimation of EC in the fertigation solution – special horticultural practices for vegetables / flowers under protected cultivation - visit to protected cultivation units - project preparation for precision farming and protected cultivation of vegetable and flower crops.
References

Lecture Schedule
1. Scope and importance, principles and concepts of precision horticulture
2. Lazer leveling, mechanized direct seed sowing, seedling and sapling transplanting of horticultural crops
3. Soil mapping and plant attributes, remote sensing and use of sensors in precision farming
4. Geographic information system (GIS) and its application in precision farming.
5. Global positioning system (GPS) and its application in precision farming.
6. Thematic maps, spatial variability, mobile mapping systems and its application in precision farming.
7. Site specific nutrient management (SSNM) system weed management, insect pests and disease management, yield mapping in horticultural crops
8. Design, layout and installation of drip and fertigation in precision farming
10. Precision farming techniques for banana.
11. Precision farming techniques for guava
12. Precision farming techniques for tomato and chilli.
13. Precision farming techniques for bitter gourd
14. Precision farming techniques for turmeric and marigold
15. Scope and importance, principles and concepts of protected cultivation.
16. Different growing structures of protected culture viz., green house, poly house, net house and poly tunnels
17. MID SEMESTER EXAMINATION
18. Study of environmental factors influencing protected culture
19. Planning, design and materials of construction for traditional and low cost green house
20. Heating, cooling systems, passive and hot air and drying and CO₂ enrichment
21. Growing media - different types, soil culture, pasteurization of media, drainage, flooding and leaching
22. Irrigation systems in green house
23. Cost estimation and economic analysis - Constraints of green house cultivation and future strategies
24. Nutrient film techniques, hydroponics and aeroponic culture
26. Protected cultivation techniques for tomato and capsicum
27. Protected cultivation techniques for cucumber and melons.
28. Protected cultivation techniques for strawberry
29. Protected cultivation techniques for Dutch roses and chrysanthemum
30. Protected cultivation techniques for gerbera and carnation.
31. Protected cultivation techniques for anthurium and orchids
32. Integrated pest and disease management for vegetable and flower crops in protected cultivation.

**Practical Schedule**
1. Positioning systems understanding of GPS
2. Positioning accuracy specifications and utilization of GIS software
4. Types and structures of auto control system in green house.
5. Calculation of air rate exchange in active summer, winter cooling system
6. Study of heating and cooling systems in green house.
7. Study of different media, pasteurization / sterilization methods for green house
8. Estimation of drying rate of agricultural products inside green house
9. Testing of soil and water to study the suitability for growing crops
10. Study the fertigation requirements for green house crops and estimation of EC in the fertigation solution
11. Study of special cultural practices for production of vegetable crops under protected cultivation.
12. Study of special cultural practices for flower crops under protected cultivation.
13. Project preparation of protected cultivation of important horticultural crops.
14. Visit to protected cultivation units.
15. Visit to commercial precision farming fields
16. Visit to GIS lab

**17. PRACTICAL EXAMINATION**

**SST 311 SEED PRODUCTION OF VEGETABLES, TUBER AND SPICE CROPS (2+1)**

**Outcomes:**
- In-depth understanding the definition, importance, character, seed quality, factors affecting, principles and maintenance of seed production.
- Understanding the principles of Post Harvest Handling and Management, Seed quality control, Seed Storage and Marketing.

**Unit I: Introduction to Seed Production**
- Seed - definition - importance - quality characteristics - Seed and grain - Seed quality - Definition, Characteristics of good quality seed – Different classes of seed – Generation system of seed multiplication - Seed Multiplication ratio - Seed Replacement Rate - Deterioration of crop varieties – Factors affecting deterioration and their control - Maintenance of genetic purity during seed production.
Unit II: Principles of Seed Production


Unit III: Post Harvest Handling and Management

Seed Drying – Principles- moisture equilibrium between seed and air –Types of Drying – Seed Driers-Seed processing – Air screen machine and its working principle, different upgrading equipments and their use –Seed extraction- Seed treatment –Importance- types- Equipments used (Slurry and Mist –O-matic treater) - Seed packing- Seed quality enhancement - Establishing Seed Testing Laboratory-Grow Out Test.

Unit IV: Seed quality control


Unit V: Seed Storage and Marketing

Types of containers-Seed storage- Principles of seed storage - Stages of seed storage - factors affecting seed longevity during storage - conditions required for good storage – Seed godown sanitation—— History of Indian Seed Industry - Seed marketing – Seed demand forecasting and planning- marketing structure - marketing organizations- sales generation activities, promotional media, pricing policy-Factors affecting seed marketing.

Practical

Identification of seed and seed structure - Seed quality analysis in Horticultural crops - Principles and procedures - Seed sampling –Physical purity analysis- Germination testing-Moisture determination - Viability test - Vigour tests - Seed dormancy and breaking methods – Seed health test - Studies on Physiological maturity, Harvesting, Threshing & Seed Extraction-techniques- Seed Quality enhancement - Visit to seed production plots and examining field standards - Varietal identification- Emasculations & pollination, Planting ratios, isolation distance, roguing, yield assessment, etc. in seed production plots- Grow out tests and electrophoresis for varietal identification - Seed production planning- Visit to Seed Processing Unit - Visit to seed testing laboratory and Seed Certification Agency.
Theory schedule
1. Seed - definition - importance - Seed and grain - Seed quality - Definition, Characteristics of good quality seed.
2. Classes of seed – Generation system of seed multiplication- Seed Multiplication ratio - Seed Replacement Rate
3. Deterioration of crop varieties – Factors affecting deterioration and their control-Maintenance of genetic purity during seed production
4. Factors affecting vegetable seed production-role of temperature, humidity and light in vegetable seed production.
5. Seed production in Tomato and brinjal
6. Seed production in Chillies and Okra
7. Seed production in Cluster Bean-Cowpea-French bean
8. Seed production in Dolichos lab lab-Garden pea
9. Seed production in Cucurbit-Cucumber-Gourds (bitter gourd, snake gourd, ridge gourd, ash gourd and bottle gourd)-Pumpkin- musk melon-water melon
10. Seed production in Carrot-Radish
11. Seed production in Turnip-Beet root
12. Seed production in Cabbage- Cauliflower-Knol Khol
13. Seed production in Potato and Onion
14. Seed production in Palak-Fenugreek- Amaranthus- Moringa- Baby corn
15. Methods of hybrid seed production in vegetables
16. Seed Drying – principles, moisture equilibrium – Types of drying- Seed driers-types-management of seed drying
17. MID SEMESTER EXAMINATION
18. Seed processing – air screen machine and its working principle, different upgrading equipments (specific gravity separator, indented cylinder separator, inclined draper, magnetic separator, spiral separator) and their use
19. Seed treatment –Importance of seed treatment, types of seed treatment, equipment used for seed treatment (Slurry and Mist –O-matic treater) -Seed packaging-packaging materials.
20. Seed quality enhancement (coating, pelleting, encrusting, treatments to remove dormancy, seed hardening, priming – sand, PEG, solid matrix and osmotic, fortification),
21. Establishing a seed testing laboratory.
22. Seed certification, phases of certification, procedure for seed certification
23. Field inspection and field counts
25. Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories
26. Seed law enforcement -Duties and powers of seed inspectors, offences and penalties
28. Varietal Identification through Grow Out Test and Electrophoresis
29. Seed storage - Principles of seed storage - Stages of seed storage, factors affecting seed longevity during storage and conditions required for good storage.
30. Seed storage godown sanitation - Mid storage correction.
31. History of seed industry in India-Seed marketing-Seed Demand forecasting
32. Seed marketing – structure, organization, pricing policy - Factors affecting seed marketing.

**Practical schedule**
1. Identification of seed and seed structure in Horticultural crops
2. Seed sampling and physical purity analysis
3. Seed Germination testing
4. Seedling evaluation and Moisture testing methods
5. Viability testing & Vigour testing (Electrical conductivity, Accelerated Ageing, Mean Germination Time, Vigor Index)
6. Seed dormancy and breaking methods
7. Seed health testing
8. Seed Quality enhancement (IDS, pelleting, priming, hardening, fortification, coating)
9. Studies on Physiological maturity, Harvesting, Threshing & Seed Extraction
10. Visit to seed production plots - examining field standards - Field count - Roguing
11. Emasculation, Dusting & pollination techniques in Horticultural crops
12. Visit to seed production plots - Varietal identification
13. Yield assessment and seed production planning for different classes of seeds
14. Grow out tests and electrophoresis for varietal identification
15. Visit to seed processing Unit
16. Visit to seed testing laboratory and Seed Certification Agency

**17. FINAL PRACTICAL EXAMINATION**

**References**
## SEMESTER VII

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AEX 411</td>
<td>Rural Horticultural Work Experience (RHWE)- Placement in Villages</td>
<td>0+10</td>
</tr>
<tr>
<td>2.</td>
<td>HOR 401</td>
<td>Rural Horticultural Work Experience (RHWE)- Placement in Industries</td>
<td>0+10</td>
</tr>
<tr>
<td>3.</td>
<td>PJN 401</td>
<td>Educational Tour - II (All India)*</td>
<td>0+1</td>
</tr>
</tbody>
</table>

**TOTAL** 0+21

* Non-Gradial Course
AEX 411 Rural Horticultural Works Experience (RHWE) – Placement in Villages (0+10)

Out comes:

- Ensuring and assuring employability and develop entrepreneurs among horticulture graduates.

Student READY (Rural Entrepreneurship Awareness Development Yojana) programme is a new initiative of Indian Council of Agricultural Research to reorient graduates of Agriculture and allied subjects for ensuring and assuring employability and develop entrepreneurs. As per the V Dean’s committee recommendations the responsibility of organising RHWE is rests with all the departments of the college and it should be a multi-disciplinary approach involving all the faculties of different disciplines. Hence, for organising RHWE the following module may be considered.

<table>
<thead>
<tr>
<th>No.</th>
<th>Activities</th>
<th>No. of weeks</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General orientation &amp; On campus training by different faculties</td>
<td>1</td>
<td>0+9</td>
</tr>
<tr>
<td>2.</td>
<td>Village attachment</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Attachment with Department of Agriculture / KVK / Research Station attachment / Plant clinic / NGO attachment</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Project Report Preparation, Presentation and Evaluation</td>
<td>1</td>
<td>0+1</td>
</tr>
</tbody>
</table>

**Total weeks for RHWE**

10 0+10

**Village Attachment (6 weeks)**

a. Orientation with farmers and survey of village – 1 week  
b. Study of rural development institutions/ organisations – 1 weeks  
c. Crop Interventions (Agronomical, Plant Protection, soil improvement, fruit and vegetable interventions, etc.) - 3 weeks  
d. Extension and TOT interventions – 1 weeks

**Functional Components of RHWE:**

I: Staff incharge and Responsibilities:

1. The Programme Coordinator - The coordinator of the RHWE programme is from the Agricultural Extension discipline.

Duties and Responsibilities

a. General orientation & On campus training by different faculties.
b. Organising attachment with Department of Agriculture / KVK.
c. Preparation of interview schedules for village study, farmer study, NGO study, department study etc.

2. Programme Officers: Programme Officer of the respective group of 8-10 students will be nominated by the Dean from different discipline.

Duties and Responsibilities
a. Identification of stay location and arranging for their stay in the respective stay location.
b. Identifying nearby study villages and assigning a sub-group of 2-3 students per village.
c. Identification of plant clinic / NGO for attachment of student of their respective group in the nearby areas of the stay locations.
d. Monitoring the field level activities of the students providing technical guidance and counseling.

HOR 401 Rural Horticultural Work Experience (RHWE) – Placement in Industries (0+10)

Outcomes:
- Ensuring and assuring employability and develop entrepreneurs among horticulture graduates.

The students will be attached to anyone of the following for a period of five weeks.
- Seed production farms/Processing units
- Commercial Nurseries of Horticulture/Forest Department
- Floriculture Farm
- Fruit/Vegetable processing units
- Bio pesticides/fertilizer industries
- Biotechnological industries (Tissue Culture labs)
- Tissue culture (Bitechnology) Laboratory
- Agric-Clinic and Agri-Business Cell/Agro-Service Center
- Cool chain/storage units
- Agricultural finance institutions / Banks / Credit Societies etc.
- Non-Government organizations related to horticulture and rural development
During the attachment of students to the identified horti-based industries (one or two depending upon the availability of the facilities), the students are given an opportunity to acquaint themselves with the organizational set up, functioning, infrastructure available, records maintenance and financial, technical and marketing aspects. The students must record all the items of work either carried out by them/shown to them during the period of attachment to the HBI.

At the end of the attachment period the students shall submit a project report which includes all the aspects pertaining to the infrastructures facilities, organizational set up, financial and technical aspects. In addition, the students shall also describe in their report the operational and market constraints/problems faced by the industry/company / organization.

PJN 401  EDUCATIONAL TOUR –II (ALL INDIA)

Outcome:

• Understanding the activities of National and International institutes related to Agriculture, horticulture, forestry and allied fields in various regions of the country.

• Exposure to varied agro-climatic zones, crops grown, cultivation practices, socio-economic and cultural features of the farming community in different parts of the country.

The students will visit various National and International Institutions related to Agriculture, Horticulture, Forestry and other allied fields in various regions of the country. The students will gain first hand knowledge about different agro-climatic zones, crops grown, cultivation practices, socio-cultural and economic status of the farming communities in different parts of the country. The duration of the tour will be 15 days (institutional visits and intermediate journey) exclusive of onward and return journey.
### SEMESTER VIII

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELP XXX</td>
<td>Experiential Learning Programme -1</td>
<td>0+10</td>
</tr>
<tr>
<td>ELP XXX</td>
<td>Experiential Learning Programme -2</td>
<td>0+10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>0+20=20</strong></td>
</tr>
</tbody>
</table>

### EXPERIENTIAL LEARNING PROGRAMME (ELP)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Credit Hrs.</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ELP 401</td>
<td>Commercial Beekeeping</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>2.</td>
<td>ELP 402</td>
<td>Commercial Sericulture</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>3.</td>
<td>ELP 403</td>
<td>Urban Entomology and Pest Management</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>4.</td>
<td>ELP 404</td>
<td>Production Technology for Bio-control Agents</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>5.</td>
<td>ELP 408</td>
<td>Commercial Horticulture</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>6.</td>
<td>ELP 409</td>
<td>Floriculture &amp; Landscaping</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>7.</td>
<td>ELP 410</td>
<td>Molecular Breeding</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>8.</td>
<td>ELP 411</td>
<td>Plant Tissue Culture</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>9.</td>
<td>ELP 412</td>
<td>Commercial Seed Production</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>10.</td>
<td>ELP 413</td>
<td>Mushroom Cultivation Technology</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>11.</td>
<td>ELP 414</td>
<td>Bio-inoculants Production Technology</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>12.</td>
<td>ELP 416</td>
<td>Agriculture Waste Management</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>13.</td>
<td>ELP 417</td>
<td>Protected Cultivation of high value Horticulture Crops</td>
<td>0+10</td>
<td>VIII</td>
</tr>
<tr>
<td>14.</td>
<td>ELP 418</td>
<td>Processing of Fruits and Vegetables for Value addition</td>
<td>0+10</td>
<td>VIII</td>
</tr>
</tbody>
</table>
ELP 401 COMMERCIAL BEE KEEPING  (0+10)

Outcome:

- Skill in commercial bee keeping

PRACTICAL SCHEDULE

1. Identification and study of honey bees.
2. Identification and study of hive bees and stingless bees.
5. Bee hives and bee keeping appliances.
6. Hiving feral colonies and swarm.
7. Methods of hive inspection.
8. Identification of nectar and pollen yielding plants.
9. Colony management techniques in lean season.
10. Identification of honey bee pests and diseases and their management.
11. Poisoning of bees by pesticides.
12. Visit to bee nursery to learn queen rearing.
13. Extraction and processing of honey.
15. Economics of bee keeping.
16. Visit to commercial apiary to learn about migratory bee keeping techniques.
17. PRACTICAL EXAMINATION.

Reference


Outcome:

- Skill in Commercial Sericulture

PRACTICAL SCHEDULE

1. Morphology and botanical aspects of mulberry plant
2. Propagation of mulberry plants
3. Nursery and main field preparation
4. Nutrient and weed management
5. Pruning and harvesting of leaves
6. Pests and Diseases of mulberry and their management
7. Morphology and biology of mulberry silkworm
8. Rearing house, appliances and disinfection
9. Young and late age silkworm rearing
10. Pests and disease of mulberry silkworm and their management
11. Grainage technology
12. Post cocoon technology
13. Mechanization in sericulture
14. Eri and Tasar silkworm
15. Economics of sericulture (leaf harvest method)
16. Visit to sericulture unit
17. Final practical exam

References


ELP 403  URBAN ENTOMOLOGY AND PEST MANAGEMENT  (0+10)

Outcome:

- Skill in Urban Entomology and Commercial Pest Control Management

PRACTICAL SCHEDULE

1. Mosquitoes: species identification in larval an adult stages/ habitat requirement.
2. Morphological study of Houseflies/bedbugs/fleas/lice
4. Ant identification and extermination technologies.
5. Termite species: caste types, habitat and damage types.
6. Termite management in houses and wooden structures.
7. Termite proofing in constructions/buildings.
8. Medical and veterinary pests: identification and damage studies.
9. Vector and pest control treatment in homes and farms.
10. Larvicides and their application.
11. Pest management techniques in lawns, turfs and house plants.
12. Fumigation/baiting techniques for rodent management.
15. Preparation and application of insecticide formulations in urban pest management.
16. Traps and lures in domestic pest management.
17. PRACTICAL EXAMINATION.

References

ELP 404  Production technology for Bio-Control Agents  (0+10)

(Team teaching by Entomologists, Pathologists and Economists)

Outcome:

- Skill in commercial production of Bio-control agents

PRACTICAL SCHEDULE - AGRICULTURAL ENTOMOLOGY

1. Rearing of host insect – *Corcyra cephalonica*
2. Rearing of host insect- *Helicoverpa armigera* and *Spodoptera litura*
3. Rearing of predators- *Chrysoperla carnea* and *Cryptolaemous montrouzieiri*
4. Mass culturing of mealybugs
5. Production of nuclear polyhedrosis virus of *Spodoptera litura* and *Helicoverpa armigera*
6. Mass production of entomopathogenic fungi
7. Project preparation for large scale production of biocontrol agents viz., parasitoids, predators and nuclear polyhedrosis virus of *Helicoverpa armigera* and *Spodoptera litura*

Reference


PRACTICAL – PLANT PATHOLOGY

Unit 1

Importance of biological control in plant disease management – Handling of equipments - sterilization techniques - Preparation of media - Collection of soil sample and Isolation of antagonists - *Trichoderma, Pseudomonas fluorescens*, and *Bacillus subtilis* - Maintenance of pure cultures - Morphological and molecular characterization of antagonists
Unit 2

- Keys for the identification of lab contaminants
- Assessing the efficacy in vitro
- Mode of action of antagonists
- Fermentation systems and different kinds of formulations
- Mass multiplication
- Methods of delivery of biocontrol agents
- Bio efficacy against plant diseases
- Container content
- Compatibility
- Packing methods and shelf life of bio control agents
- Guidelines and requirements to establish a commercial bio control lab

Unit 3

- Legal issues involved in the establishment of commercial bio control lab and registration (Small scale and large scale)
- Cost analysis and project preparation
- Principles of enterprise management
- Exposure visit to commercial bio control units

PRACTICAL SCHEDULE

1st week

1. Bio-control agents and their significance in plant disease management
2. Safety procedures for handling of equipments
3. Good laboratory practices of a bio control lab
4. Sterilization techniques

2nd week

1. Preparation of PDA and Rose Bengal Agar Medium
2. Preparation of Trichoderma Selective Medium
3. Preparation of Kings’ B Medium and Nutrient Agar Medium
4. Collection of soil samples and isolation of Trichoderma

3rd week

1. Collection of soil samples and isolation of Pseudomonas fluorescens and Bacillus subtilis
2. Maintenance of pure cultures of biocontrol agents
3. Identification of Trichoderma, Pseudomonas fluorescens and Bacillus subtilis
4. Keys for the identification of lab contaminants

4th week

1. Assessing the efficacy of Trichoderma under in vitro condition.
2. Assessing the efficacy of Pseudomonas and Bacillus under in vitro condition.
3. Mode of action of Trichoderma against soil-borne, seed –borne, foliar and post-harvest pathogens
4. Mode of action of *Pseudomonas* and *Bacillus* against soil-borne, seed-borne, foliar and post-harvest pathogens

**5th week**
1. Fermentation systems
2. Different kinds of formulations - Solid, liquid formulation etc.
3. Mass multiplication of *Trichoderma, Pseudomonas* and *Bacillus*
4. Compatibility, packaging methods and shelf life studies of bio control agents

**6th week**
1. Quality analysis of *Trichoderma, Pseudomonas* and *Bacillus*
2. Methods of delivery of bio control agents - *Trichoderma, Pseudomonas* and *Bacillus*
3. Bioefficacy of *Trichoderma* against plant diseases
4. Bioefficacy of *Pseudomonas* and *Bacillus* against plant diseases

**7th week**
1. Guidelines and requirements to establish a commercial bio control lab
2. Studies on energy requirements to establish a commercial bio control lab
3. Legal issues involved in the establishment of commercial bio control lab and registration (Small scale and large scale).
4. Exposure visit to commercial bio control units

**8th week**

**REFERENCES**

Outcomes:

- Skill in Commercial Production of plantlets, production of potted plants, management and maintenance, sale and marketing
- Skill in Nursery raising/procurement and transplanting, management and maintenance of the crop, postharvest handling, quality control and marketing

Nursery production of fruit crops: Raising of rootstocks, grafting and budding of rootstocks, management of grafted plants, plant certification, packaging and marketing, quality control. Nursery production of ornamentals: Production of plantlets, production of potted plants, management and maintenance, sale and marketing. Protected cultivation of vegetables and flowers: Nursery raising/procurement and transplanting, management and maintenance of the crop, postharvest handling, quality control and marketing.

Practical Schedule

1. Site selection and basic criteria for set up a new nursery for production of fruit seedlings and planting materials.
2. Raising of quality rootstocks of different fruit crops for grafting.
3. Practicing of different types of grafting and budding in fruit crops
4. Studies of various management practices in grafted plants
5. Certification, packaging and marketing quality control for planting materials produced in fruit nursery.
6. Ornamental nursery establishment – Site selection – basic criteria – study about suitable environmental factors.
7. Practicing of different types of propagation methods / multiplication of plantlets and potted plants.
8. Management and maintenance of ornamental nursery.
9. Sale and marketing of produced planting materials and potted plants to create income generation.
10. Study of protected cultivation of vegetables and different types of protected structures for different vegetables.
14. Post-harvest handling of flowers and vegetables
15. Quality control and marketing of planting materials produced in the nursery
16. Visit to commercial / local nurseries.
17. PRACTICAL EXAMINATION
Outcomes:

- Skill in Commercial Floriculture
- Skill in Making of lawns, use of software in landscape.
- Skill in Making of bouquets, button hole, wreath, veni and gazaras, car and marriage palaces.


References

Practical Schedule

1. Preparation of project report, soil and water analysis, preparation of land and layout.
2. Plant materials for landscaping and their identification i.e., annuals, herbaceous perennials, trees, shrubs, climbers, bulbous plants, cacti and succulents, aquatic plants, ground covers i.e., grasses, bamboos etc.,
3. Study of various features of an ornamental garden with suitable plants and identification of plants for each feature.
4. Production and Management of commercial flowers
5. Harvesting and post harvest handling of produce
6. Marketing of produce
7. Cost Analysis
8. Institutional Management
9. Visit to Flower growing areas and Export House
10. Attachment with private landscape agencies
11. Planning and designing, site analysis, selection and use of plant material for landscaping
12. Formal and informal garden, features, styles, principles and elements of landscaping
13. Preparation of landscape plans of home gardens, farm complexes, public parks, institutions, high ways, dams and avenues.
14. Making of lawns, use of software in landscape
15. Making of bouquets, button hole, wreath, veni and festoons, car and marriage hall decoration
16. Dry flower Technology (identification of suitable species, drying, packaging and Forwarding techniques)
17. PRACTICAL EXAM
ELP 410 MOLECULAR BREEDING (0+10)

Outcome:

- knowledge and hands-on-experience in use of molecular marker techniques in plant breeding and establish a marker lab.

Objective:

To enable students to gain knowledge and hands-on-experience in use of molecular marker techniques in plant breeding and establish a marker lab.

Course content:


PRACTICALS (Weekly schedule)

1. Establishment of a molecular marker laboratory: Organization of the marker lab – Equipments and Instruments – Chemicals – Handling of equipments/ safety precautions etc.,
2. Isolation, purification and quantification of DNA from various crops; Rice, Pulses, Cotton, Groundnut, Sesame etc.,
3. Electrophoresis – preparation of various types – vertical/ horizontal – SDS PAGE etc.,
4. Set up of PCR using various types of markers- RAPD, SSR, ISSR etc.,
5. Genetic map construction using molecular markers: Development of mapping populations (F₂, RIL, NIL, DHL, ILS etc.,) – Polymorphic survey – Detection of segregation distortion – Softwares used for mapping.
8. Association mapping: Concept of Linkage Disequilibrium mapping, association panel, population structure. Multiparental mapping populations: Nested Association Mapping (NAM) and Multiparent Advance Generation Intercross Population (MAGIC) population.

Mid Semester

9. Marker Assisted Selection (MAS) – Concept, requirements – various types of MAS. Pre-requisites to MAS: QTL confirmation and marker validation.
10. Marker Assisted Backcross Breeding (MABC) – Concept of foreground, recombinant and background selection. Case studies in rice for biotic and abiotic stresses.


12. DUS characterization of crop varieties using molecular markers.


14. Entrepreneurship development: Visit to Government crop breeding stations- Visit to private seed companies.

15. Financial assistance to set up the lab – Guest lectures from experts of financial institutions – funding opportunities.


**Practical examination**

**References:**


Outcomes:

- Skill in establishment of Plant Tissue Culture Laboratory, Medium and stock solution preparation.
- Skill in Meristem and Micropropagation in Banana and Neem, Micropropagation of Eucalyptus and Aloe vera

Practical (Weekly Schedule)

1. **Basics and establishment of Plant Tissue Culture Laboratory**
   Organization for a plant tissue culture laboratory - Sterilization methods - Equipments and instruments in PTC - Surface sterilization of explants - Handling tissues in aseptic conditions under laminar flow chamber

2. **Medium and stock solution preparation-I**
   Familiarization of different chemicals - inorganic nutrients – carbon sources, vitamins and growth regulators – solidifying agents - Stock solutions preparation for MS medium and B5 medium

3. **Medium and stock solution preparation-II**
   Stock solutions preparation for WPM medium - Medium preparation- MS medium, B5 medium, WPM medium - Sprouting of tubers in potato

4. **Meristem and Micropropagation in Banana and Neem**
   Media preparation for Meristem culture in Banana and Neem. Media preparation for micropropagation in Banana and Neem - Micropropagation in Banana and Neem

5. **Micropropagation of Eucalyptus and Aloe vera**
   Media preparation for micropropagation in eucalyptus and *Aloe vera*. Micropropagation in eucalyptus and *Aloe vera*

6. **Micropropagation of Sugarcane and Phyllanthus**
   Media preparation for micropropagation in Sugarcane and *Phyllanthus*. Micropropagation in Sugarcane and *Phyllanthus*.

7. **Sub culturing -I**
   Medium preparation for subculturing- Banana, Neem and *Eucalyptus*. Subculturing in Banana, Neem and *Eucalyptus*. 
8. **Sub culturing** -II  
   Media preparation for subculturing of *Aloe vera*, Sugarcane and *Phyllanthus*-Subculturing in *Aloe vera*, Sugarcane and *Phyllanthus*

**Mid semester Examination**-

9. **Callus induction in *Phyllanthus* and *Coleus* and rooting**  
   Subculturing in sugarcane and bamboo - Medium preparation for callus induction in *Phyllanthus* and *Coleus* - Inoculation of explants for callus induction in *Phyllanthus* and *Coleus* - Medium preparation for rooting in *Phyllanthus* and *Coleus*.

10. **Media preparation and inoculation for rooting of microshoots**  
   Medium preparation for rooting in banana, neem, eucalyptus, *Aloe vera* and *Phyllanthus*. Inoculation of micro shoots for rooting in banana, neem, eucalyptus, *Aloe vera* and *Phyllanthus*.

11. **Inoculation for rooting of microshoots and hardening**  
   Inoculation of microshoots for rooting in eucalyptus, aloe vera, phyllanthus, bamboo, cassava and sugarcane - Observations on microtuber induction in potato - Hardening chambers-mist-chamber, glasshouse, polyhouse and tunnel house - Hardening procedures, visit to any hardening facility

12. **Synthetic seed preparation and Establishment of cell suspensions**  

13. **Secondary metabolite production and analysis**  
   Suspension culture in *Phyllanthus* and *Coleus* - Hairy root cultures with *Agrobacterium rhizogenes* - Preparation of stocks, medium for hairy root infection - Growth parameters for suspension-Fresh and dry weight, PCV and viability assay - Extraction of secondary metabolites and analysis through HPLC-GC-MS. Bioassay of secondary metabolites- anti-bacterial and anti-fungal activity.

14. **Field transfer of TC plants**  
   Field transfer of tissue culture plants – Hardening procedures and maintenance of regenerated plants. National certification system for tissue culture plants-application procedures. Genetic fidelity test and Virus indexing in TC plants.
15. Visits and Entrepreneurship development

Visit to a commercial tissue culture laboratory - Meeting the entrepreneur - Guest lecture from experts from financial institutions-funding opportunities. Visit to a field planted with TC plants. Visit to Accredited TC Testing Lab/National Certification Centre- NRCB, Trichy


Project proposal preparation.

17. Practical Examination

References

ELP 412 Commercial Seed Production (0+10)

Outcomes:

- Skill in Commercial Seed Production

Scope and importance of seed industry and seed production - Cereals, pulses, oilseeds, cotton and commercially important vegetable crops - principles and practices of seed production - Generation system of seed multiplication - Pollination behaviour - Tools employed in hybrid seed production - Study of morphological characters of varieties, parental lines and hybrids - Designing of Planting ratio and Border rows - Physical and genetic contaminants - isolation distance. Planning of seed production - season and land selection - Assessment of seed source and seed selection - pre sowing seed invigouration treatments - Dormancy breaking treatments - Seed priming - pelleting - polymer coating. Practicing nursery and main field preparation - Practicing the sowing of seeds in the nursery – pro-tray nursery - SRI - nursery management. Main field preparation - layout - formation of beds - transplanting - fertilizer and nutrient management - weed management - irrigation management - special cultural practices - pest and disease management - identification and removal of off-types and volunteer plants - Practicing hybridization techniques (emasculature and pollination and detasseling) - Identification of physiological disorders and management - Exposure visit to seed certification department - Seed certification procedures - Registration and sowing report - Field inspection – Field counting – Seed yield assessment-Visit to seed production plots. Pre-harvest sanitation spray - identification of physiological and harvestable maturity indices - Harvesting methods - Post harvest verification - Kapas sorting, cob sorting and pod verification - Threshing / extraction of seeds - Processing sequence - Seed drying - Seed cleaning - Grading - Pre-storage seed treatment - Seed packing - Seed storage -Visit to seed processing unit and seed storage godown and learning sanitation measures. Economics of variety and hybrid seed production (cost benefit ratio) - Visit to private seed industry. Seed sampling procedure and submission of samples - Seed testing procedure - Estimation of seed moisture - Physical purity analysis - Germination test - Visit to grow out test field and DNA finger printing laboratory for genetic purity assessment - Visit to seed retail shop - Seed marketing - Project preparation.
Schedule of Activities

<table>
<thead>
<tr>
<th>Week</th>
<th>Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Scope and importance of seed industry and seed production - principles and practices of seed production - Generation system of seed multiplication.</td>
</tr>
<tr>
<td>2.</td>
<td>Pollination behaviour - tools employed in hybrid seed production - study of morphological characters of varieties, parental lines and hybrids.</td>
</tr>
<tr>
<td>3.</td>
<td>Designing of planting ratio and border rows - Physical and genetic contaminants - Isolation distance.</td>
</tr>
<tr>
<td>4.</td>
<td>Planning of seed production - season and land selection - assessment of seed source and seed selection</td>
</tr>
<tr>
<td>5.</td>
<td>Pre sowing seed invigouration treatments - Dormancy breaking treatments - Seed priming - pelleting - polymer coating.</td>
</tr>
<tr>
<td>7.</td>
<td>Main field preparation - layout - formation of beds - transplanting - fertilizer and nutrient management.</td>
</tr>
<tr>
<td>8.</td>
<td>Weed management - Irrigation management - Special cultural practices - pest and disease management.</td>
</tr>
<tr>
<td>9.</td>
<td>Identification and removal of off-types and volunteer plants - Practicing hybridization techniques(Emasculation and pollination and detasseling) - Identification of physiological disorders and management.</td>
</tr>
<tr>
<td>10.</td>
<td>Exposure visit to seed certification department - Seed certification procedures - Registration and sowing report - Field inspection - Field counting - Seed yield assessment- Visit to seed production plots</td>
</tr>
<tr>
<td>12.</td>
<td>Post-harvest verification - Kapas sorting, cob sorting and pod verification - threshing / extraction of seeds - processing sequence - Seed drying - Seed cleaning - grading - pre-storage seed treatment - Seed packing - Seed storage.</td>
</tr>
<tr>
<td>13.</td>
<td>Visit to seed processing unit and seed storage godown and learning sanitation measures</td>
</tr>
<tr>
<td>14.</td>
<td>Economics of variety and hybrid seed production (cost benefit ratio) - Seed Production Planning- Visit to private seed industry.</td>
</tr>
<tr>
<td>15.</td>
<td>Seed sampling procedure and submission of samples -Seed testing procedure - Estimation of seed moisture</td>
</tr>
<tr>
<td>16.</td>
<td>Seed testing procedure - Physical purity analysis - Germination test -Visit to grow out test field and DNA finger printing laboratory for genetic purity assessment.</td>
</tr>
<tr>
<td>17.</td>
<td>Visit to seed retail shop - Seed marketing - Project preparation and submission.</td>
</tr>
</tbody>
</table>
Outcomes:
- Skill in Mushroom Cultivation

Unit 1
Different types of mushroom, Morphology - Edible and poisonous type - Edible mushrooms - *Pleurotus, Agaricus, Volvariella* and *Calocybe* - Nutritional values and pharmacological values - Preparation of culture media - Pure culture techniques – Sterilization techniques-media - Glassware - Maintenance of culture

Unit 2
Mother spawn production - Types of spawn - Multiplication of bed spawn - Substrates for mushroom cultivation and their preparation - Mushroom cultivation techniques for *Agaricus, Pleurotus, Calocybe and Volvariella* - Maintenance of spawn running and cropping room – Harvesting, packing and storage of *Pleurotus, Agaricus* and *Calocybe*.

Unit 3
Problems in cultivation of *Agaricus, Pleurotus, Calocybe and Volvariella* - Pests, diseases, weed moulds and abiotic disorders - Management strategies - Biodegradation of coir pith - Cost estimation

Unit 4
Post-harvest technology of *Agaricus, Pleurotus, Calocybe and Volvariella* - methods of preservation – Drying - solar, cabinet, fluidized bed and freeze drying - Packing methods - Controlled atmospheric storage - Modified atmospheric storage and canning - Cost analysis.

Unit 5
Mushroom recipes of *Agaricus, Pleurotus, Calocybe and Volvariella* - Cooking methods - Value added products - Instant foods - Cost analysis - Project preparation - Principles of mushroom farm enterprise management – Cost estimation

Practical schedule

1st week
1. Studying the general characters of mushrooms
2. Identification of edible and poisonous mushrooms
3. Morphological characters of *Pleurotus, Agaricus, Volvariella* and *Calocybe*
4. Equipments required for culture media preparation and tissue culture and their operation
2nd week
1. Sterilization techniques for the aseptic production of spawn and mushroom
2. Preparation of culture media
3. Pure culture technique – Tissue isolation in PDA, OMA and MEA medium
4. Pure culture technique – Spore print – Spore culture

3rd week
1. Laboratory requirements and essentials required for spawn preparation
2. Oyster mushroom - Mother spawn – Preparation of sorghum grain medium
3. Oyster mushroom - Mother spawn – Inoculation of sorghum grain medium
4. Oyster mushroom - First generation bed spawn - Preparation of sorghum grain medium

4th week
1. Oyster mushroom - First generation bed spawn - Inoculation of sorghum grain medium
2. Oyster mushroom - Second generation bed spawn - Preparation of sorghum grain medium
3. Oyster mushroom - Second generation bed spawn - Inoculation of sorghum grain medium
4. Quality of spawn - Spawn contaminants and their management

5th week
1. Oyster mushroom cultivation - Essentials required, cropping room requirement
2. Oyster mushroom - Preparation of substrates for bed preparation
3. Oyster mushroom - Bed preparation
4. Oyster mushroom - Maintenance of beds, harvest and storing oyster mushroom

6th week
1. Oyster mushroom - Pest and disease management
2. Oyster mushroom - Competitor and abiotic disorders management
3. Visit to oyster mushroom farm (spawn lab and mushroom farm)
4. Visit to uzhavar sandai (Farmers’ Market), markets and observing the marketing pattern

7th week
1. Milky mushroom - Mother spawn preparation
2. Milky mushroom - First generation bed spawn preparation
3. Milky mushroom - Second generation bed spawn preparation
4. Quality of spawn - Spawn contaminants and their management

8th week
1. Milky mushroom cultivation – Essentials required, cropping room requirement
2. Milky mushroom – Bed preparation
3. Milky mushroom - Casing
4. Milky mushroom - Maintenance of beds, harvest and storing

9th week
1. Milky mushroom - Pest and disease management
2. Milky mushroom - Competitor and abiotic disorders management
3. Visit to milky mushroom farm (spawn lab and mushroom farm)
4. Visit to uzhavar sandai, markets and observing the marketing pattern
10th week
1. Button mushroom - Preparation of pure culture, bed spawn, mother spawn and compost
2. Visit to button mushroom farm and compost unit - Cropping, harvest and storage
3. Button mushroom – Pest, disease and abiotic disorders and their management
4. Visit to uzhavar sandai, markets and observing the marketing pattern of button mushroom

11th week
1. Paddy straw mushroom - Preparation of pure culture and spawn
2. Paddy straw mushroom - Bed preparation
3. Paddy straw mushroom - Cropping room, Maintenance of beds, harvest and packing
4. Paddy straw mushroom - Pest, disease and abiotic disorders and their management

12th week
1. Biodegradation of agrowastes using mushroom spawn
2. Spent mushroom - Composting and their use
3. Mushroom as a component in Integrated Farming System (IFS)
4. Interaction with successful spawn producers and mushroom growers

13th week
1. Short term post-harvest processing of oyster, milky and button mushroom
2. Long term post-harvest processing of oyster, milky and button mushroom
3. Packing methods of oyster, milky and button mushroom
4. Canning of button mushroom

14th week
1. Recipe and value added products from oyster mushroom
2. Recipe and value added products from milky mushroom
3. Recipe and value added products from button mushroom
4. Recipe and value added products from paddy straw mushroom

15th week
1. Project preparation on oyster mushroom spawn production and economics
2. Project preparation on oyster mushroom production and cost estimation
3. Project preparation on milky mushroom spawn production and cost estimation
4. Project preparation on milky mushroom production and cost estimation

16th week
1. Project preparation on button mushroom spawn production and cost estimation
2. Project preparation on button mushroom production and cost estimation
3. Practical examination

References

E-REFERENCES
1. www.nrcmushroom.org
2. www.mushroomcouncil.org
6. www.mushworld.com/home/
ELP414  Bio-inoculants Production Technology (0+10)

Outcomes:

- Skill in Commercial Bio-inoculants

<table>
<thead>
<tr>
<th>Week</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Biofertilizers - types, production and demand in India; Importance and contribution of biofertilizers in Agriculture and allied sectors. Facilities and equipments required for laboratory scale, pilot scale and large scale biofertilizer production (liquid and carrier) – principles and specifications.</td>
</tr>
<tr>
<td>2.</td>
<td>Isolation, purification and characterization of nitrogenous biofertilizers – <em>Azotobacter, Azospirillum</em>,</td>
</tr>
<tr>
<td>3.</td>
<td>Isolation and purification of nitrogenous biofertilizers – <em>Rhizobium</em> and <em>Gluconoacetobacter</em>.</td>
</tr>
<tr>
<td>4.</td>
<td>Isolation, purification and characterization of phosphate solubilizing bacteria. Isolation of AM spores from soil and morphological characterization of AM spores.</td>
</tr>
<tr>
<td>5.</td>
<td>Selection of efficient AM fungi by plant infection tests. Isolation, purification and characterization of zinc solubilizing microbes.</td>
</tr>
<tr>
<td>6.</td>
<td>Isolation, purification and characterization of plant growth promoting bacteria - Pink Pigmented Facultative Methylotrophs (PPFM) and screening of PPFM.</td>
</tr>
<tr>
<td>7.</td>
<td>Preparation of medium and carrier material for large scale production.</td>
</tr>
<tr>
<td>8.</td>
<td>Mass production of <em>Azotobacter</em> and <em>Rhizobium</em></td>
</tr>
<tr>
<td>9.</td>
<td>Mass production of <em>Azospirillum</em> and <em>Gluconoacetobacter</em>.</td>
</tr>
<tr>
<td>11.</td>
<td>Mass production of PPFM and AM fungi</td>
</tr>
<tr>
<td>12.</td>
<td>Mass production of Azolla and BGA.</td>
</tr>
<tr>
<td>13.</td>
<td>BIS standards / Fertilizer Control Order – Specifications and quality control measures for various biofertilizers. Storage and preservation of various microbial cultures. Shelf life and storage of biofertilizers. Constraints in mass production of various biofertilizers.</td>
</tr>
<tr>
<td>14.</td>
<td>Study of plant response to biofertilizers- visit to biofertilizer inoculated fields / Biofertilizer production unit.</td>
</tr>
<tr>
<td>15.</td>
<td>Economics of biofertilizer production. Calculation of commercial production cost – fixed cost- cost of building, equipments and glasswares and variable cost - raw materials, maintenance, labour cost etc.,</td>
</tr>
<tr>
<td>16.</td>
<td>Formulation and presentation of a project for production of fixed quantity of various biofertilizers.</td>
</tr>
<tr>
<td>17.</td>
<td>Final practical examination</td>
</tr>
</tbody>
</table>
References


Reference


E References

1. Seednet.gov.in
2. www.iar.org.in/Directorate1.htm
3. www.apsa.org
4. www.seedassociationofindia.com
5. www.apaseed.com
6. www.apaseed.org
ELP 416 Agriculture Waste Management (0+10)

Outcomes:

- Skill in Management of Agriculture Waste

**Week 1:**

**Week 2:**

**Week 3 &4:**
Visit to a Landfill site – Study about volume, size and Chemical reduction techniques - leachate treatment facilities – assessment of pollution problems - Garbage to Green – Converting landfills to parks.

**Week 5:**

**Week 6:**
Other methods of composting – preparation of different types of compost -- Sheet composting – In vessel composting – biodynamic composting - pipe composting.

**Week 7:**

**Week 8&9:**
Preparation of Vermi compost - mass multiplication of earthworms- indoor vermicomposting (small scale) - outdoor vermicomposting (commercial scale) - insitu vermicomposting.

**Week 10:**
Rapid thermo chemical processing of agricultural wastes- Pyrolysis - Biochar production by the process of pyrolysis from organic waste.

**Week 11:**
Biogas plants – different types – designs – visit to nearby biogas production unit and study the operation and production of biogas – advantages – disadvantages - prepare lay out plan
Week 12:

Quality parameters of organic manures and specifications - procedure for collection of manure samples- solid and liquid manures.

Week 13:
Liquid organic manures- vermiwash, compost tea, biogas slurry- preparation – enrichment and uses – Other uses of agricultural wastes.

Week 14:
Evaluation of compost maturity - maturity indices of compost
Determinations - C:N ratio, temperature, colour, odour moisture content, pH, EC and nutrient contents (N, P, K, Ca, Mg, Fe, Mn, Zn, Cu).

Week 15:
Rapid test for assessing microbial load, detection of pathogens and hazardous heavy metals (Ni, Pb, Cd, As, Hg). Compost stability test-microbial respiration of CO₂ – (germination test).

Week 16:
Preparation of project proposal and work plan for establishing commercial organic manures, production unit- report preparation.

Suggested Readings


**E-References:**

**ELP 417**

**PROTECTED CULTIVATION OF HIGH VALUE HORTICULTURE CROPS**

**Out Comes:**
- Skill in Protected Cultivation of high value horticulture crops


**Suggested Reading**

**Weekly Practical schedule**
2. Study of solarization – fumigation of polyhouses – methods of fumigation
3. Preparation of beds for growing cut flower crops and vegetables in polyhouses
4. Fixing of supports – trellies, arrangement of net supports – study of different types of nets Materials used for preparation of nets
5. Preparation of seed beds – poly trays – for raising nursery seedlings of capsicum, cucumber and tomato
7. Study of climate management techniques – practices to manipulate the climate in polyhouses
8. Addition of manures of fertilizers – planting techniques of cut flower crops and vegetables
9. Practice of special horticultural techniques like pinching disbudding – deshooting – deleafing in cut flowers and vegetables
10. Training and pruning techniques in cut flower crops and vegetables
12. Visit to commercial polyhouses around colleges
13. Study of pollination techniques – Different methods of pollination – practice pollination in capsicum and tomato
14. Study of harvesting techniques for different purposes in cut flowers and vegetables.
16. Study of different types of packaging materials, storage methods – visit to cold storages and commercial markets

17. PRACTICAL EXAMINATION

ELP 418 PROCESSING OF FRUITS AND VEGETABLES FOR VALUE ADDITION 0+10

Outcomes:

- Skill in procurement of raw material, production and quality analysis of fruits and vegetables products at commercial scale, packaging, labeling, pricing and marketing of product.

Planning and execution of a market survey, preparation of processing schedule, preparation of project module based on market information, calculation of capital costs, source of finance, assessment of working capital requirements and other financial aspects, identification of sources for procurement of raw material, production and quality analysis of fruits and vegetables products at commercial scale, packaging, labeling, pricing and marketing of product.

1. Production planning – Quality assurance – raw materials, processing, packing and storage, testing ingredients and products etc.
2. Selection of site for establishment of commercial processing unit
3. Auxillary raw materials used in fruits & vegetables processing. Improving the nutritional quality of processed fruit and vegetables: the behavior of nutrients minerals, antioxidants – vitamins, lycopene and other carotene, during processing.
4. Dehydration of horticultural produce: methods of drying – sun drying, osmotic dehydration, freeze drying etc., types of dryers; tunnel dryer, belt dryer, vacuum dryer, drum dryer, spray in heated air etc. for preparation of flakes, chips, powders concentration etc.
5. Processing for drying/dehydrated horticultural produce
6. Preparation of alcoholic beverages from fruits
7. Study on maintenance of quality control, evaluation and assurance of processed products in various processing units
8. Processing for juice, squash, nectar, cordial syrup/sherbath and other beverages from different horticultural produce
9. Processing for canning of horticultural produce
10. Preparation of jam, jellies, marmalade, preserve, candy, glazed and crystallized fruits and vegetables
11. Preparation of toffee, bar etc.
12. Preparation of lactic acid fermented beverages
13. Processing technique for chutneys and sauces
15. Preparation of bottled fruits, fruit leathers and fruit cheese puree, papain, pectin etc.
16. Food processing factory wastes and their utilization
17. PRACTICAL EXAMINATION