REGULATIONS AND CURRICULUM
for
B.Sc. (Hons.) AGRICULTURE DEGREE PROGRAMME
(Effective from 2019-20 batch onwards)
Pondicherry University
B.Sc.(Hons.) Agriculture
REGULATIONS
(Effective from the academic year 2019-20)

1. Course for which the consideration is made: B.Sc.(Hons.) Agriculture

2. Aims, Objectives and Programme Outcomes:
   - Imparting subject-related knowledge along with developing a connection between practical solutions and theory.
   - Encourage personal growth among students and boost their self-confidence, which will give them opportunities to be an integral part of the agro-industry.
   - Making the agriculture-related subjects interesting through scientific and experimental evidence.
   - Develop 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
      
      | 10+2 or Intermediate with any of the following three subjects from a recognized Board / University |
      |-----------------------------------------------------------------------------------------------|
      | B.Sc.(Hons.) Agriculture                                                                   |
      | a) Physics, Chemistry, Mathematics, Biology                                               |
      | b) Physics, Chemistry, Biology / Botany & Zoology                                          |
      | c) Physics, Chemistry, Agriculture                                                        |

   b) H.Sc - Vocational Stream for B.Sc. (Hons.) Agriculture only (For U.T. of Puducherry candidates only)
      Two seats are exclusively reserved for candidates under Vocational Stream (Agriculture). They are not considered under general merit and any of the reservation categories mentioned under the item 1.2 of admission details.

      For the H.Sc. Vocational (Agriculture) Candidates, the list of eligible courses for admission to B.Sc.(Hons.) Agriculture degree programme are given below:

      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.

c) **Eligible Minimum Qualifying Marks (U.T. of Puducherry)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Minimum Qualifying Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open competition (OC)/ Open General</td>
<td>50% aggregate of all the three subjects</td>
</tr>
<tr>
<td>Other Backward Class (OBC) / Backward Class Muslim (BCM) / Most Backward Class (MBC) / Extreme Backward Class (EBC) / Backward Tribe (BT) / Scheduled Caste (SC)</td>
<td>40% aggregate of all the three subjects</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Category</th>
<th>Minimum Qualifying Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduled Caste (SC) / Scheduled Tribe (ST)</td>
<td>40% aggregate of all the three subjects</td>
</tr>
<tr>
<td>All Other Communities</td>
<td>50% aggregate of all the three subjects</td>
</tr>
</tbody>
</table>

**e) 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 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.) Agriculture 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.) Agriculture 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>13</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>9</td>
<td>14</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td>Second</td>
<td>III</td>
<td>11</td>
<td>14</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>10</td>
<td>13</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Third</td>
<td>V</td>
<td>11</td>
<td>15</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>VI</td>
<td>11</td>
<td>15</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Fourth</td>
<td>VII</td>
<td>2</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>67</td>
<td>84</td>
<td>99</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.

<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><strong>Internal</strong></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><strong>External</strong></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><strong>TOTAL</strong></td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

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></td>
<td><strong>TOTAL</strong></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></td>
<td><strong>TOTAL</strong></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:

**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></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>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical Field work / Lab Work / Written exam</td>
<td>10.0</td>
</tr>
<tr>
<td>Continuous evaluation and record</td>
<td>2.5</td>
</tr>
<tr>
<td>Viva Voce</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15.0</strong></td>
</tr>
<tr>
<td>Assignment</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>20.0</strong></td>
</tr>
</tbody>
</table>
11.3 Evaluation of courses with only practical credits:
i. The evaluation of courses with only practical 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.) 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></td>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) 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>
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><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.

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><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.

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><strong>TOTAL</strong></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
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 - 1\textsuperscript{st} Day)
Last date for Registration without fine: 06.08.2019 (Tuesday - 2\textsuperscript{nd} Day)
: 07.08.2019 (Wednesday - 3\textsuperscript{rd} Day)
: 08.08.2019 (Thursday - 4\textsuperscript{th} Day)
: 09.08.2019 (Friday - 5\textsuperscript{th} Day)
: 10.08.2019 (Saturday - 6\textsuperscript{th} Day)
: 11.08.2019 (Sunday - Holiday)
Last date for Registration with fine: 12.08.2019 (Monday - 7\textsuperscript{th} 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>i.</td>
<td>Mid-semester</td>
<td>50.00</td>
</tr>
<tr>
<td>ii.</td>
<td>Final practical</td>
<td>50.00</td>
</tr>
<tr>
<td>iii.</td>
<td>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
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.

**06. 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:

```
<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><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>
```

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

(30 Marks & 1 hour duration)
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></td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>40</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></td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>50</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 Fieldwork / 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></td>
<td><strong>Total</strong></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></td>
<td><strong>Total</strong></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>
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<tr>
<td>Behaviour</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
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<tr>
<td>Participation in campus</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
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<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 upto 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.
PONDICHERY 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)

I. Choose the correct answer

Answer all questions

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>
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<td>3</td>
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<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>
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<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>
### B.Sc. (Hons.) AGRICULTURE 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><strong>Agricultural Economics &amp; Extension</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Agricultural Economics</td>
<td>5</td>
<td>8+3</td>
<td>11</td>
</tr>
<tr>
<td>2.</td>
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**Student READY**

|       | Rural Agricultural Work Experience and Agro-Industrial Attachment (RAWE&AIA) | 1 | 0+20 | 20 |
|       | Experiential Learning Programme                                                | 2 | 0+20 | 20 |

**Total** 3 0+40 40
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### DEPARTMENT WISE DISTRIBUTION OF COURSES

#### DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

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### Department of Agricultural and Food Sciences

#### Agricultural Engineering

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#### Animal Husbandry

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#### Forestry

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#### Department of Plant Breeding and Genetics

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<td>SAC 101</td>
<td>Fundamentals of Soil Science</td>
<td>2+1</td>
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<td>2.</td>
<td>SAC 201</td>
<td>Problematic Soils and their Management</td>
<td>1+1</td>
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<td>3.</td>
<td>SAC 301</td>
<td>Manures, Fertilizers and Soil Fertility</td>
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<td></td>
<td></td>
<td>Management</td>
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# LIST OF ELECTIVE COURSES

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<th>Cr.Hr.</th>
<th>Semester</th>
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<tbody>
<tr>
<td>1.</td>
<td>AEC 251</td>
<td>Agribusiness Management</td>
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<tr>
<td>2.</td>
<td>AEX 251</td>
<td>Agricultural Journalism</td>
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<td>Weed Management</td>
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<td>Landscaping</td>
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<td>System Simulation and Agro-advisory</td>
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<td>Commercial Plant Breeding</td>
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<td>HOR 351</td>
<td>Protected Cultivation</td>
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<td>8.</td>
<td>HOR 352</td>
<td>Hi-tech Horticulture</td>
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<td>9.</td>
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<td>Micro Propagation Technologies</td>
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<td>Agrochemicals</td>
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# STUDENT READY

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<tr>
<td>1.</td>
<td>AEX 401</td>
<td>Rural Agricultural Work Experience and Agro-Industrial Attachment (RAWE&amp;AIA)</td>
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## Experiential Learning Programme

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# LIST OF EXPERIENTIAL LEARNING PROGRAMME COURSES

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<td>1.</td>
<td>ELP 401</td>
<td>Commercial Beekeeping</td>
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<td>ELP 402</td>
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<td>Organic Production Technology</td>
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<td>ELP 406</td>
<td>Integrated Farming System</td>
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<td>Cr.Hr.</td>
<td>Semester</td>
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<td>ELP 411</td>
<td>Plant Tissue Culture</td>
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<td>12.</td>
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<td>ELP 413</td>
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<td>14.</td>
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<td>15.</td>
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<td>Soil, Plant, Water, Manure and Fertilizers Testing</td>
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**NON-GRADIAL COURSES**

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<th>Semester</th>
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<tbody>
<tr>
<td>1.</td>
<td>MAT 101</td>
<td>Elementary Mathematics</td>
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<tr>
<td>2.</td>
<td>NCC101 / NSS101</td>
<td>National Cadet Corps / National Service Scheme</td>
<td>0+1</td>
<td>I</td>
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<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>
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**REMEDIAL COURSE**

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<tbody>
<tr>
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<td>Introductory Biology</td>
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# Team Teaching
## Semester Wise Distribution of Courses

### Semester I

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<th>Sl.No.</th>
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<th>Cr.Hr.</th>
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<tbody>
<tr>
<td>1.</td>
<td>AEX 101</td>
<td>Rural Sociology &amp; Educational Psychology</td>
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<td>2.</td>
<td>AGM 101</td>
<td>Agricultural Microbiology</td>
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<tr>
<td>3.</td>
<td>AGR 101</td>
<td>Fundamentals of Agronomy and Agricultural Heritage</td>
<td>2+1</td>
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<td>CRP 101</td>
<td>Fundamentals of Crop Physiology</td>
<td>2+1</td>
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<td>5.</td>
<td>ENG 101</td>
<td>Comprehension &amp; Communication Skills in English</td>
<td>0+1</td>
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<td>6.</td>
<td>GPB 101</td>
<td>Fundamentals of Genetics</td>
<td>2+1</td>
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<td>7.</td>
<td>HOR 111</td>
<td>Fundamentals of Horticulture</td>
<td>1+1</td>
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<td>8.</td>
<td>SAC 101</td>
<td>Fundamentals of Soil Science</td>
<td>2+1</td>
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<td>9.</td>
<td>MAT 101</td>
<td>Elementary Mathematics*</td>
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<td>National Social Service / National Cadet Corps*</td>
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<td>NCC 101</td>
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<td>11.</td>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
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*Non-Gradial Courses

### Semester II

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<tbody>
<tr>
<td>1.</td>
<td>AEC 101</td>
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<td>AEN 101</td>
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<td>Environmental Studies and Disaster Management</td>
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<td>FOR 101</td>
<td>Introduction to Forestry</td>
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<td>PAT 101</td>
<td>Fundamentals of Plant Pathology</td>
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<td>NSS 101 /</td>
<td>National Social Service / National Cadet Corps*</td>
<td>0+1</td>
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<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
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*Non-Gradial Course continued from first semester
### SEMESTER III

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<tbody>
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<td>Farm Management, Production &amp; Resource Economics</td>
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<td>AEG 201</td>
<td>Farm Machinery and Power</td>
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<td>3.</td>
<td>AEN 201</td>
<td>Principles of Integrated Pest Management</td>
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<td>Livestock and Poultry Management</td>
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<td>Introductory Nematology</td>
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*Non-Gradial Course continued from first semester

### SEMESTER IV

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<td>Soil and Water Conservation Engineering</td>
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<td>AGR 203</td>
<td>Farming System &amp; Sustainable Agriculture</td>
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<td>Geoinformatics and Nano-technology and Precision Farming</td>
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<td>Fundamentals of Plant Biotechnology</td>
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<td>Production Technology for Ornamental Crops, MAP and Landscaping</td>
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<td>Principles of Integrated Disease Management</td>
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*Non-Gradial Course continued from first semester

*Non-Gradial Course continued from first semester

# Non-Gradial Course
### SEMESTER V

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<td>Renewable Energy and Green Technology</td>
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<td>AEN 301</td>
<td>Pests of Crops and Stored Grain and their Management</td>
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<td>AEX 301</td>
<td>Communication Skills and Personality Development</td>
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<td>Practical Crop Production – I (<em>Kharif</em> crops)</td>
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<td>Crop Production Technology –II (<em>Rabi Crops</em>)</td>
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<td>Rainfed Agriculture &amp; Watershed Management</td>
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<td>Production Technology for Fruit and Plantation Crops</td>
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<td>Diseases of Field and Horticultural Crops and their Management-I</td>
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**TOTAL** 15+10=25

# Team teaching

### SEMESTER VI

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<tr>
<td>1.</td>
<td>AEC 302</td>
<td>Agricultural Finance and Cooperation</td>
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<td>AEG 302</td>
<td>Protected Cultivation and Secondary Agriculture</td>
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<td>3.</td>
<td>AEN 302</td>
<td>Management of Beneficial Insects</td>
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<td>4.</td>
<td>AEX 302</td>
<td>Entrepreneurship Development and Business Management</td>
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<td>5.</td>
<td>AGR 304</td>
<td>Practical Crop Production –II (<em>Rabi crops</em>)</td>
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<td>6.</td>
<td>AGR 305</td>
<td>Principles of Organic Farming</td>
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<td>7.</td>
<td>FSN 301</td>
<td>Principles of Food Science and Nutrition</td>
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<td>GPB 301</td>
<td>Crop Improvement</td>
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<td>HOR 312</td>
<td>Post-harvest Management and Value Addition of Fruits and Vegetables</td>
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<td>10.</td>
<td>PAT 302</td>
<td>Diseases of Field and Horticultural Crops and their Management-II</td>
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<td>Elective Course-3</td>
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**TOTAL** 15+10=25
### SEMESTER VII

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<td>AEX 401</td>
<td>Rural Agricultural Work Experience and Agro-Industrial Attachment (RAWE&amp;AIA)</td>
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<td>2.</td>
<td>PJN 401</td>
<td>Educational Tour - II (All India)*</td>
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* Non-Gradial Course

### SEMESTER VIII

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<td>Experiential Learning Programme 1</td>
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### ABSTRACT

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<td>AGR 101</td>
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<td>Physical Education &amp; Yoga Practices*</td>
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TOTAL 13+10=23

*Non-Gradial Courses
Outcomes:

- In depth understanding of importance of Rural Sociology in Agricultural Extension
- Understanding of importance of Educational Psychology in Agricultural Extension

Unit I: Extension and Rural Sociology
Extension Education and Agricultural Extension – Meaning, Definition, Scope and Importance. Sociology and Rural Sociology, Meaning, Definition, Scope, Importance of Rural Sociology in Agricultural Extension and Interrelationship between Rural Sociology & Agricultural Extension. Indian Rural Society, Important characteristics, Differences and Relationship between Rural and Urban societies.

Unit II: Social institutions and Groups
Social ecology, Social Institutions – Meaning, Definition, Major institutions in Rural society and importance in Agricultural Extension. Social Organizations – Meaning, Definition, Types and Role in Agricultural Extension. Social Groups – Meaning, Definition, Classification, Factors in formation and organization of groups, Motivation in group formation and role in Agricultural Extension. Social Stratification – Meaning, Definition, Basis for stratification, Class & Caste System.

Unit III: Culture, social values and social change

Unit IV: Extension and Educational Psychology
Psychology and Educational Psychology – Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension. Intelligence – Meaning, Definition, Types, Factors affecting intelligence and Importance of intelligence in Agricultural Extension. Personality – Meaning, Definition, Types, Factors influencing the Personality and Role of personality in Agricultural Extension. Motivation and theories of motivation.

Unit V: Human Behaviour and Teaching - Learning

Lecture Schedule:
1. Extension Education and Agricultural Extension – Meaning, Definition, Scope and Importance.
2. Sociology and Rural Sociology, Meaning Definition, Scope, Importance and significance of Rural Sociology in Agricultural Extension
3. Indian Rural Society, Important characteristics, Differences and Relationship between Rural and Urban societies.
4. Society & Community Definition, elements and differences.
5. Social ecology, components, Social Institutions – Meaning, Definition, functions and role of major institutions in rural society.
6. Social Organizations – Meaning, Definition, Types of organizations and Role of Social organizations in Agricultural Extension.
7. Family – Definition, types, characteristics and functions.
8. Social Groups – Meaning, Definition, Classification, characteristics of primary and secondary groups.
9. Factors considered in formation and organization of groups, Motivation in group formation and Role of Social groups in Agricultural Extension.
10. Social Stratification – Meaning, Definition, Functions, Basis for stratification, Forms of Social stratification
11. Social class – definition, meaning, characteristics and – Differences between Class & Caste System.
12. Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions – Meaning, Definition and their Role in Agricultural Extension. Social control and means of social control.
14. Social Values and Attitudes – Meaning, Definition, Types and Role of Social Values and Attitudes in Agricultural Extension.

18. Mid semester
19. Psychology- Meaning, Definition and Branches of Psychology Educational Psychology – Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension.
22. Attention – Factors, characteristics of attention.
25. Learning experience and Learning situation, Elements of learning situation and its characteristics.
27. Theories of learning.
28. Adult – characteristics, their implication in extension teaching.
29. Intelligence – Meaning, Definition, Measurement, Factors affecting intelligence and Importance in Agricultural Extension.
30. Personality – Meaning, Definition, Types, Factors influencing the Personality and Role of personality in Agricultural Extension.
31. Motivation – Meaning, Definition and types and importance in extension
Theories of Motivation.

References
1. Introductory Rural Sociology – Chitambar, J.B.1997, Wiley Eastern Limited, New Delhi
5. Educational Psychology – Mangal S.K.2000, Prakash Brothers, Ludhiana

Journals
1. Journals of Advances in Social Work
2. Journal of Asian Social Sciences
3. Journal of Social Sciences and Research

Web resources
1. www.ijsaf.org
2. www.ag.auburn.edu
3. www.doaj.org
4. www.iccssr.org
AGM 101 Agricultural Microbiology 2+1

Outcomes:
- In depth understanding of Microorganisms in Living world, Groups of Micro-organisms
- Understanding importance Soil microorganism in soil fertility, Microbial transformation of nutrients in soil and bio-fertilizers in agriculture.

Theory

Unit I: History of Microbiology and Microscopy
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; Prokaryotes Vs Eukaryotes; Groups of microorganisms; Bacterial size, shape, arrangement and morphology; Structure and organization of a bacterial cell; Microscopy – principles and types.

Unit II: Microbial physiology, metabolism and genetics
Bacterial growth, reproduction and factors influencing bacterial growth – Growth curve; Nutritional types and metabolic diversity of bacteria; Principles of energy generation and carbon metabolism; fermentation–respiration in bacteria. Bacterial viruses – Lytic and Lysogenic cycles; Genetic recombination-transformation, conjugation, transduction.

Unit III: Soil Microbiology
Distribution and importance of soil microorganisms in soil fertility - factors affecting the activities of soil microorganisms; Rhizosphere microorganisms and Importance; Phyllosphere microorganisms - Plant-microbe and microbe-microbe interactions in soil.

Unit IV: Microbial transformation of nutrients in soil
Microbial transformation of nutrients in soil - Carbon, Phosphorous and Sulphur cycle; Nitrogen cycle, Biological nitrogen fixation - symbiotic and non-symbiotic microorganisms, Process of nodulation and nitrogen fixation; Silicate and zinc solubilising bacteria; Mycorrhizae.

Unit V: Applied Microbiology
Types and importance of biofertilizers in agriculture; Mass production and quality control of biofertilizers; Microbes in human welfare – silage production: Microbial insecticides and biocontrol agents; Biogas and biofuel production; Biodegradation of agro wastes.

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; Morphological and biochemical characters of bacteria. Organic matter decomposition – measurement of CO2 evolution; Isolation of N2 fixing and phosphate solubilizing microorganisms; Examination of BGA from soil and Azolla; Mass production of biofertilizers – method of application of biofertilizers.
Theory schedule

1. Definition and scope of Microbiology - Spontaneous Generation theory.
3. Position of microorganisms in living world; Prokaryotes Vs Eukaryotes.
4. Bacterial morphology - arrangement of cells, structures.
5. Functional anatomy and reproduction in bacteria.
6. Microscopy: principles - different types of microscopy.
8. Environmental conditions for growth – Temperature – psychrophiles, mesophiles and thermophiles; air – aerobic and anaerobic; pH- acidic and alkali; salt.
10. Microbial metabolism – principles of energy generation - Phosphorylation.
15. Diversity of soil microorganisms-bacteria, actinomycetes, fungi and algae- factors influencing the microbial diversity and activity.
16. Rhizosphere microorganisms- R: S ratio and importance.
17. Mid Semester Examination.
18. Plant growth promoting rhizobacteria; Phyllosphere microbiology and Methylotrophs.
19. Microbial interactions in soil - neutralism, positive and negative interactions.
20. Microbial transformation of nutrients in soil – Carbon cycle.
22. Microbial transformation of nutrients in soil – Nitrogen cycle
23. Biological nitrogen fixation - symbiotic and non-symbiotic microorganisms.
25. Microbial transformation of nutrients in soil - Phosphorous & Sulphur.
26. Silicate and zinc solubilizing microorganisms; Mycorrhizae.
27. Types of biofertilizers and importance in agriculture.
28. Production and quality control of biofertilizers and methods of application of biofertilizers.
29. Silage and Biogas production.
30. Biomass to Biofuel production-ethanol production.
31. Microbial insecticides and microbial agents for pest and plant disease control.

Practical schedule

1. Microscopy- principles - handling light microscope.
2. Staining - principles and techniques-Simple staining: positive and negative staining
3. Differential staining
4. Sterilization- principles and techniques - equipment and apparatus used for sterilization
5. Media preparation for bacteria, fungi and actinomycetes
6. Enumeration of soil microorganisms- serial dilution plate technique (bacteria, fungi, and actinomycetes)
7. Purification of bacteria & fungi
11. Isolation of symbiotic N2 fixing microorganism – Rhizobium
12. Isolation of associative and non symbiotic N2 fixer: Azospirillum and Azotobacter
13. Isolation of phosphate solubilizing microorganisms.
14. Examination of BGA from soil and Azolla
15. Mass production of biofertilizers
16. Method of application of biofertilizers
17. Final Practical Examination

Further reading

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/).
AGR 101 FUNDAMENTALS OF AGRONOMY AND AGRICULTURAL HERITAGE (2+1)

Outcomes:

- Understanding the importance and scope of Agriculture as Art, Science and Business.
- Knowledge about Agro ecological zones of India and Tamil.
- Understanding factors affecting crop production

Theory:

Unit I: Agriculture and Agronomy


Unit II: Agricultural Heritage

Introduction of Indian agricultural heritage; Relevance of heritage to present day agriculture – Agriculture in ancient India – Stages of agriculture development - Era of civilization- Importance of Neolithic civilization - Kautilya's Arthasasthra - Sangam literature - Indigenous Technical Knowledge (ITK).

Unit III: Tillage and sowing


Unit IV: Crop nutrition and weed management


Unit V: Irrigation and Cropping system

Irrigation - Time and methods of irrigation - Modern techniques of irrigation - Drainage and its importance - Irrigated farming and Dry farming - Concepts and principles Cropping patterns and cropping systems - intensive cropping - Crop rotation and its principles - adaptation and distribution of crops - Sustainable agriculture - integrated farming systems - Farm enterprises; Organic agriculture - Concepts and principles; Crop management technologies in problematic areas; harvesting and threshing of crops.
Practical:
Identification of crops, seeds, fertilizers, pesticides and tillage implements, study of agro-climatic zones of India, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population and herbicide requirement. Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill.

Lecture Schedule:

1. Agriculture – Definition – Importance and scope - Agriculture as Art, Science and Business
2. Branches of agriculture - Development of scientific agriculture - National and International Agricultural Research Institutes
3. Indian agriculture – Indian economy - National income
5. Agronomy – Definition – Meaning and its scope
6. Agro-climatic zones of India and Tamil Nadu – Agro ecological zones of India and Tamil Nadu.
7. Agriculture heritage – Relevance of heritage to present day agriculture. Agriculture in ancient India.
8. Stages of agriculture development- History of agricultural development in world and India.
9. Era of civilization -Importance of Neolithic civilization
10. Kautilya’s Arthasasthra- Sangam literature
11. Indigenous Technical Knowledge (ITK)
12. Major soils of India, Tamil Nadu and Pudhucherry; Growth and development of crops
15. Tillage – Definition – Objectives – Types of tillage – Main field preparations
16. Modern concepts of tillage
17. MID-SEMESTER EXAMINATION
18. Seeds - seed rate - sowing methods; Germination – Factors affecting germination - Crop stand establishment
19. Crop density and geometry - its effect on growth and yield - After cultivation – Thinning - Gap filling – Inter cultural operations
21. Classification of manures and fertilizers - Time and methods of application of manures and fertilizers
23. Weeds – Definition – Harmful and beneficial effects of weeds
24. Classification of weeds – crop weed competition and concept of weed management
25. Principles and methods of weed management
26. Herbicides – meaning, classification, selectivity and resistance Allelopathy and IWM.
27. Irrigation - Time and methods of irrigation - Modern techniques of irrigation - Drainage and its importance
29. Cropping patterns and cropping systems - Intensive cropping - Crop rotation and its principles
30. Adaptation and distribution of crops - Sustainable agriculture- Integrated farming systems - Farm enterprises.
32. Crop management technologies in acid, saline and sodic soils – Harvesting and threshing of crops

Practical schedule:
1. Visit to college farm to observe farming system and identification of crops
2. Study of some basic terminologies and units in agriculture
3. Identification of seeds, manures and fertilizers
4. Identification of tools and implements and acquiring skill in ploughing and puddling.
5. Acquiring skill in handling primary tillage implements
6. Acquiring skill in handling secondary tillage implements
7. Raising nursery for wet land and garden land crops
8. Working out seed rates for crops.
9. Study of seed germination and viability tests.
10. Study of different methods of seed treatments, methods of sowing and seeding implements
11. Practicing thinning, gap filling operations for optimum crop stand and inter-cultural operations
12. Working out manure and fertilizer requirement of crops and manures acquiring skill on application of manures and fertilizers
13. Study of green manures and green leaf manures and their incorporation.
14. Identification of weeds, weeding practices and handling of weeding tools and implements
15. Practicing harvesting operations in major field crops
16. Participation in on-going field operations during on campus /off campus visit
17. FINAL PRACTICAL EXAMINATION
References:


CRP101 FUNDAMENTALS CROP PHYSIOLOGY (2 + 1)

Outcomes:

- Understanding importance of crop physiology in Agriculture, Functions of Plant nutrients, Deficiency symptoms of plant nutrients.
- Understanding role of physiological growth parameters in crop productivity


UNIT V: Stress Physiology – Abiotic stresses – water, temperature and salt stress – physiological changes and adaptation

Lecture Schedule

1. Introduction and importance of Crop Physiology in Agriculture, an over view of Plant cell.
4. Translocation of water – ascent of sap – mechanisms of xylem transport
7. Physiological functions and disorders of macronutrients, Hidden hunger
8. Physiological functions and disorders of micronutrients
9. Foliar nutrition - fertigation – sand culture, hydroponics and aeroponics
10. Light reaction of photosynthesis – photolysis of water and photophosphorylation - Z scheme
11. Dark Reaction of photosynthesis - C3, C4 and CAM pathways and differences.
13. Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations
16. Fat metabolism: fatty acid synthesis and breakdown
17. MID SEMESTER EXAMINATION
19. Hormones and plant growth regulators (PGR): physiological roles and agricultural uses - Biosynthetic pathway and role of auxins and gibberellins
20. Plant growth regulators (PGR): physiological roles and agricultural uses - Biosynthetic pathway and role of cytokinin, ethylene and ABA
21. Novel growth regulators viz., Brassinosteroids and salicylic acid – New Generation PGRs - Growth retardants and inhibitors - commercial uses of PGRs
22. Photoperiodism - short, long and day neutral plants – Chailakhyan’s theory of flowering
23. Forms of phytochrome - Pr and Pfr - regulation of flowering
25. Physiological aspects of growth and development of major crops
26. Growth analysis – role of physiological growth parameters in crop productivity
27. Seed dormancy, seed viability and seedling vigour – basic concepts - Seed germination - seed dormancy and breaking methods
28. Senescence and abscission – physiological and biochemical changes
29. Physiology of fruit ripening- climacteric and non climacteric fruits - factors affecting ripening and manipulations
30. Role of physiological growth parameters in crop productivity
31. Drought - physiological changes - adaptation – compatible osmolytes - alleviation

Practical schedule
1. Preparation of solutions
2. Study of leaf epidermal, xylem and phloem cells
3. Determination of stomatal index and stomatal frequency
4. Measurement of plant water potential
5. Estimation of leaf area by different methods
6. Estimation of photosynthetic pigments
7. Determination of photosynthetic efficiency in crops
8. Measurement of transpiration and photosynthesis by IRGA
9. Diagnosis of nutritional and physiological disorders in crops
10. Rapid tissue test for mineral nutrients
11. Estimation of relative water content
12. Measurement of osmosis and plasmolysis
13. Growth Analysis
14. Bioassay for gibberellin and cytokinin
15. Estimation of chlorophyll stability index
16. Estimation of proline content
17. FINAL PRACTICAL EXAMINATION

References

e- 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

Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Conversation:

Rate of speech, clarity of voice, speaking and Listening, politeness & Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

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 overcome them – 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:**
1. www.orwell.ru/library/articles/spirit/english/e_spirit
2. www.essays.com
3. www.onestopenglish.com
4. www.bogglesworld.com
5. www.eltweb.com
6. www.reportingskills.com
7. www.writing-skills.com
8. www.negotiation.com
9. www.teachersdesk.com
10. www.flexiblelearning.net.an
GPB 101  FUNDAMENTALS OF GENETICS (2+1)

Outcomes:

- In-depth understanding of cytology, Mendelian laws and modifications of Mendelian Laws.
- Understanding the concepts of quantitative inheritance, linkage, crossing over, sex determination, sex linkage and cytoplasmic inheritance.

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, McCleod 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 and Monad – Lac and Trp operons. Fine structure of gene; rII locus. Benzer experiments, Concept of Cistron,mutron and recon. Mutation – characteristics of mutation – micro and macro mutation – CIB 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, Bchromosomes, ring and isochromosomes.
7. Chromosomal aberrations (Numerical) – euploid, aneuploid, types of aneuploids and their origin;
8. Polyploid - auto and allopolyploids, their characters.
12. Duplicate dominant epistasis (15:1), Duplicate recessive epistasis (9:7), Dominant and recessive epistasis (13:3); Summary of epistatic ratios.
13. Lethal genes, Pleiotropy, penetrance and expressivity, Multiple alleles, blood group in humans, coat colour in rabbits, self-incompatibility in plants; pseudo alleles, isoalleles.
15. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers.
16. Linkage - coupling and repulsion; Experiment of Bateson and Punnet
17. Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group.

MID SEMESTER EXAMINATION
1. Crossing over – significance of crossing over; cytological proof for crossing over - Stern’s experiment; Factors controlling crossing over.
2. Strength of linkage and recombination; Two point and three point test cross. Double cross over, interference and coincidence; genetic map, physical map.
4. Genic balance theory of Bridges - Gynandromorphs
5. Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex limited inheritance - Genetic disorders
6. 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
7. DNA, the genetic material – Griffith’s experiment, experiment of Avery, McCleod and McCarthy.
8. Confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment.
10. DNA replication: steps involved in DNA replication. Transcription: RNA types - mRNA, tRNA, rRNA.
11. Translation: Steps involved in protein synthesis
12. Regulation of gene expression – Operon model of Jacob and Monad – Lac and Trp operons.
15. 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.
a. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
9. Multiple alleles and polygenic inheritance
10. Estimation of linkage with F2 and test cross data; Coupling and repulsion.
11. Problems on three point test cross; working out interference, coincidence and drawing genetic maps.
15. Problems in gene regulation/Mutation.
16. **FINAL PRACTICAL EXAMINATION**

References

HOR 111  FUNDAMENTALS OF HORTICULTURE  1+1

Outcomes:

- Understanding basics of Horticulture, propagation and use of growth regulators.
- Understanding principles of Orchard establishment and management.
- Understanding problem of unfruitfulness and their remedy in horticultural crops.

Theory

Unit – I: BASICS OF HORTICULTURE
Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification, climate and soil for horticultural crops.

Unit - II: PROPAGATION AND USE OF GROWTH REGULATORS
Plant propagation-methods and propagating structures; Seed dormancy, Seed germination and importance of plant bio regulators in horticulture

Unit – III: ORCHARD ESTABLISHMENT
Principles of orchard establishment, orchard layout and planting systems in horticulture.

Unit – IV: ORCHARD MANAGEMENT
Principles and methods of training and pruning, irrigation methods, role of fertilizers and their application in horticultural crops.

Unit – V: UNFRUITFULNESSS AND PARTHENOCARPY
Unfruitfulness – causes and remedies, pollination, pollinizers and pollinators, fertilization and parthenocarpy, medicinal and aromatic plants.
Practical

Lecture Schedule
1. Definition, importance, scope of Horticulture
2. Divisions of Horticulture and horticultural and botanical classification of crops
3. Importance and role of soil and climate in horticultural crop production
4. Definition, importance and methods of plant propagation in horticultural crops
5. Specialised plant propagation structures in horticultural crops
6. Seed development, germination and dormancy
7. Principles of orchard layout and planting systems for fruit crops
8. Principles and methods of training in horticultural crops
9. MID SEMESTER EXAMINATION
10. Principles and methods of pruning in horticultural crops
11. Problem of unfruitfulness and their remedy in horticultural crops
12. Parthenocarpy in fruits and vegetables
13. Importance and application of plant growth regulators in horticultural crops
14. Definition, importance and methods of irrigation in horticultural crops
15. Role of manures and fertilizers and their method of application in horticultural crops
16. Medicinal and aromatic plants and their importance

Practical schedule
1. Study of various features in orchard
2. Identification of various horticultural crops in the orchard
3. Study of horticultural tools and implements
4. Studies on media for horticultural plants and preparation of potting mixture
5. Studies on seed treatment methods in horticultural crops
6. Preparation and use of growth regulators in horticultural crops
7. Preparation of nursery beds and portray raising of horticultural plants
8. Propagation through cutting and layering of horticultural crops
9. Propagation through grafting and budding of horticultural crops
10. Studies on micro propagation in horticultural crops
11. Layout of kitchen garden / nutrition garden
12. Studies on planting system and planting of horticultural crops
13. Studies on training and pruning in horticulture
14. Studies on irrigation methods in horticulture with special reference to micro irrigation
15. Practicing various methods of fertilizer application in horticultural crops
16. Visit to commercial nurseries / orchard
17. PRACTICAL EXAMINATION
SAC 101  Fundamentals of Soil Science (2 + 1)

Outcomes:

- Understanding the origin of earth, rocks and minerals, soil genesis and soil taxonomy.
- Understanding soil physical properties, soil chemical, soil biological properties, and soil survey and 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


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

References

Web resources
   user=2945072&coverDate=01/31/2005&rdoc=1&fmt=high&orig

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 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 3rd 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 $(x_1, y_1)$ & $(x_2, y_2)$.

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
Popularization of agro techniques – Self employment opportunities – Animal health, Dairy and Poultry farming – Road safety – Training on First aid and emergency cell. Popularization of small
savings – communal harmony and National integration – Care of Senior citizens – Personality development – meditation, Yoga Art of living – Activities on the preservation of National monuments, cultural heritage and folklore – special camp activities – National days – commemorative days – NSS thematic programmes – literacy & computer awareness campaigns.

**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

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>
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<tr>
<th>Practical schedule</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>General - Military History -Historical – geographical – Customs and Traditions of India -Defence services</td>
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<tr>
<td>2</td>
<td>Introduction to NCC – NCC Song-Aims of NCC – Principles of NCC-NCC organization-Duties of good citizen</td>
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<td>3</td>
<td>System of NCC training –Drill- Foot drill – Arms drill -Word of command</td>
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<td>4</td>
<td>Arms drill – Guard of Honour – Ceremonial Drill</td>
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<td>5</td>
<td>Weapon Training &amp;Equipment-Parts of weapon-Communication – Different types</td>
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<td>6</td>
<td>National Integration-Leadership-Civil affairs- Civil defence –Disaster management-Social service</td>
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<td>7</td>
<td>First Aid-Health &amp;Hygiene</td>
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<td>8</td>
<td>Environment and Ecology- Conservation-Pollution and its control</td>
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<td>9</td>
<td>Self Defence Mechanisms-Boat pulling</td>
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<td>10</td>
<td>Camps &amp;Adventure training/activities-Boat pulling</td>
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<td>11</td>
<td>Changing trends in Technology-Personality development-Communication Skills-Group Discussion -Public Speaking, etc</td>
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<tr>
<td>12</td>
<td>Specialised subject-Navy-Naval Orientation -Naval communication-Navigation-</td>
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<tr>
<td>13</td>
<td>Seamanship -Rigging-Oceanic wealth- Gunnery</td>
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<td>14</td>
<td>Fire Fighting and Damage control &amp; Safety</td>
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<td>15</td>
<td>Ship and Boat modelling- Submarine-Search and Rescue- Antisubmarine- Swimming- Boat pulling</td>
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<td>16</td>
<td>Final Examination</td>
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</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 and 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, overhead pass, setting, spiking, back pass, jump pass, stunts, elementary dive, flaying 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, back hand 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 pary obraine, 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+ 2 ½ hours)

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

Aims and objectives of yoga – asanas : ie. padmasana, pujankasana, sarvagasana, 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.

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<table>
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<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Cr.Hr.</th>
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<tbody>
<tr>
<td>1.</td>
<td>AEC 101</td>
<td>Fundamentals of Agricultural Economics</td>
<td>2+0</td>
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<tr>
<td>2.</td>
<td>AEN 101</td>
<td>Fundamentals of Entomology</td>
<td>2+1</td>
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<td>3.</td>
<td>AEX 102</td>
<td>Fundamentals of Agricultural Extension Education</td>
<td>2+1</td>
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<td>4.</td>
<td>AGR 102</td>
<td>Introductory Agro-meteorology &amp; Climate Change</td>
<td>1+1</td>
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<td>5.</td>
<td>BIC 101</td>
<td>Fundamentals of Biochemistry</td>
<td>1+1</td>
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<td>6.</td>
<td>COM 101</td>
<td>Agri-Informatics</td>
<td>1+1</td>
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<td>7.</td>
<td>ENS 101</td>
<td>Environmental Studies and Disaster Management</td>
<td>2+1</td>
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<td>8.</td>
<td>FOR 101</td>
<td>Introduction to Forestry</td>
<td>1+1</td>
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<td>9.</td>
<td>PAT 101</td>
<td>Fundamentals of Plant Pathology</td>
<td>2+1</td>
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<td></td>
<td>NSS 101 /</td>
<td>National Social Service / National Cadet Corps*</td>
<td>0+1</td>
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<td>NCC 101</td>
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<td></td>
<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
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*Non-Gradual Course continued from first semester
AEC 101 Fundamentals of Agricultural Economics (2+0)

Outcomes

- In depth understanding of concepts of economics, theory of consumption, production, exchange and distribution.
- Understanding the macro economic concepts.

Theory

Unit:1 Nature and Scope of Economics

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.

Unit:2 Theory of Consumption

Demand: meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Indifference curve analysis and properties, budget line - Consumer’s equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.

Unit:3 Theory of Production


Unit:4 Exchange and Theory of Distribution

Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

Unit:5 Macroeconomic Concepts


Lecture schedule

2. Approaches to economic analysis; micro and macroeconomics, positive and normative analysis – deductive and inductive methods.
3. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behaviour – Basic concepts: Goods and services – classification and characteristics.
4. Want – meaning and characteristics, demand, utility, cost and price, wealth, capital, income and welfare.
5. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development.
6. Agricultural planning and development in the country.
8. Demand: meaning, kinds of demand, law of demand, demand schedule and demand curve, determinants of demand – Extension and contraction Vs Increase and decrease in demand.
9. Indifference curve analysis and properties – budget line – definition, assumptions, limitations and applications – Consumer’s equilibrium and derivation of demand curve.
12. Production: process, creation of utility, factors of production, definition and characteristics - Input Output Relationship.
13. Laws of returns: Law of variable proportions and law of returns to scale.
15. Supply: Stock versus supply, law of supply, supply schedule, supply curve, Supply and its determinants of supply, elasticity of supply.
16. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets.
17. Mid Semester Examination
18. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points.
19. Distribution theory: meaning, factor market and pricing of factors of production.
20. Concepts of Rent and Ricardian theory of rent - Quasi rent - Wages: Real wage and money wage
22. National income: Meaning and importance, circular flow, Concepts of national income - accounting and approaches to measurement, difficulties in measurement.
23. Population: Importance, Malthusian and Optimum population theories
24. Natural and socio-economic determinants, current policies and programmes on population control.
27. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy.
28. Agricultural and public finance: meaning, micro versus macro finance, need for agricultural finance, public revenue and public expenditure.
29. Tax: meaning, direct and indirect taxes, Cannons of taxation - agricultural taxation, VAT and GST.
30. Economic systems: Concepts of economy and its functions,
31. Important features of capitalistic, socialistic and mixed economies.

References

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

AEN 101   FUNDAMENTALS OF ENTOMOLOGY   (2+1)

Outcomes:
- Understanding the position of insects in animal kingdom, insect morphology, anatomy and physiology.
- Understanding taxonomy of insects.

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:

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, Tettigonidae, Gryllidae and Gryllotalpidae), Mallophaga and Siphunculata
11. Exopterygota —Isoptera and Hemiptera — Homoptera (Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerriidae 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, Siphunculata)
15. Observing the characters of Lepidoptera (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochliidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Spingidae, Lymantriidae and Hesperiidae)
16. Observing the characters of Neuroptera (Chrysopidae, Myrmeleontidae, Mantispidae, Ascalaphidae), Siphonoptera. Identification and naming of collected insects based on characters — order and family
17. Practical examination

References

AEX 102 FUNDAMENTALS OF AGRICULTURAL EXTENSION EDUCATION (2+1)

Outcomes:
- Understanding extension education, programme planning, rural development, extension teaching methods.
- Understanding extension administration and recent approaches in Agricultural extension.

Theory

Unit I: Extension Education, Programme Planning
Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development.

Unit II: Evolution of Extension System, Rural development
Rural Development: concept, meaning, definition. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. and NES and Panchayat raj. Various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.). Various agricultural/ rural development programmes launched by Govt. of India – ATMA, PKVY, PMKSY.

Unit III: Extension Teaching Methods
Transfer of technology: concept and models T& V, BBES, Extension Teaching Methods: meaning, classification, individual, group and mass contact methods. Extension Communication: meaning and importance. Agricultural journalism, Diffusion and Adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Unit IV: Extension administration and Rural Leaders
Extension administration: meaning and concept, principles and functions. Capacity building of extension personnel, Monitoring and Evaluation: concept and definition, monitoring and evaluation of extension programmes. Rural Leadership: concept and definition, types, selection and training of leaders in rural context.
Unit V : Recent approaches in Agricultural Extension
New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc. ICT Applications in TOT (New and Social Media), media mix strategies.

Lecture Schedule
1. Education: Meaning, definition & Types;
2. Extension Education: meaning, definition, scope and process;
3. Extension Education : objectives and principles of Extension Education.
5. Steps in programme planning and importance of programme planning.
7. Rural Development: concept, meaning, definition. - Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, IVS, Economic Conference of Mysore etc..)
8. Extension systems in India post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.)
9. Community Development : meaning, definition, concept & principles, Philosophy of C.D and NES
10. Extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, ATIC etc..)
11. Extension/ agriculture development programmes launched by ICAR/ Govt. of India - IVLP, ORP, ND, NATP, NAIP).
12. Various agricultural/ rural development programmes launched by Govt. of India – ATMA, PKVY, PMKSY.
14. Rural Leadership: concept, definition and types of leaders.
15. Selection and training of lay leaders in rural context.
16. Transfer of technology: concept, models T & V, BBES
17. Mid Semester
18. Extension teaching methods: meaning, classification.
19. Individual contact methods - farm and home visit, result demonstration and field trails – meaning, objectives, steps
20. Group contact methods - Method demonstration, Group discussion sessions, field trips - meaning, objectives, steps.
21. Mass contact methods : campaign, exhibition, farmers day Radio, TV - purpose, procedures, advantages and limitations.
22. Extension Communication: meaning and definition and Importance
23. Agricultural journalism
24. Diffusion and adoption of innovation: concept and meaning, process.
26. Adoption process, models of adoption process, steps in adoption process.
27. Innovation-decision process, functions, adopter categories-factors influencing adoption
28. Extension administration: meaning and concept, principles and functions.
29. Capacity building of extension personnel – Training and types of training
30. New trends in agriculture extension: Privatization of extension, market-led extension,
    and farmer-led extension.
32. ICT Applications in TOT (New and Social Media), media mix strategies, Kissan Call
    Centres, mobile apps.

**Practical**

To get acquainted with university extension system. Group discussion-exercise;
handling and use of audio visual equipments and digital camera and LCD projector;
preparation and use of AV aids, preparation of extension literature – leaflet, booklet,
folder, pamphlet news stories and success stories; Presentation skills exercise; micro
teaching exercise; A visit to village to understand the problems being encountered by
the villagers/farmers; to study organization and functioning of DRDA and other development
departments at district level; visit to NGO and learning from their experience in rural
development; understanding PRA techniques and their application in village development
planning; exposure to mass media: visit to community radio and television studio for
understanding the process of programme production; script writing, writing for print and
electronic media, developing script for radio and television.

**Practical Schedule**

1. Understanding about the University extension system.
2. Visit to Department of Agriculture and allied departments.
3. Understanding the functioning of BDO/DRDA
4. Visit to NGO
5. Presentation about the understanding of extension system of various development
departments.
6. Preparation of Leaflet, Folder, Booklet, pamphlet - I
7. Preparation of Leaflet, Folder, Booklet, pamphlet - II
8. Writing news stories and success stories
9. Handling of digital camera and LCD projector
10. Script writing for radio and Television/video
11. Presentation of radio and Television/video script.
12. Visit to Community radio centre/AIR
13. Visit to Educational Media Centre
14. Presentation skills exercise - micro teaching exercise
15. Understanding about PRA
16. Visit to village to understand the problems being encountered by the farmers by
   practicing selected PRA techniques.
17. Practical Exam
References

Journals
1. Indian Journal of Social Sciences, Serials Publications, New Delhi
2. Agricultural Extension Review, Department of Agriculture and Co-operation, Ministry of Agriculture, New Delhi
3. Journal of Rural Development, NIRD, Rajendra Nagar, Hyderabad
4. MANAGE, NAARM, Hyderabad
5. Yojana, Ministry of Rural Development, New Delhi

Web resources
1. www.i4d.com
2. www.panasia.org
3. www.joe.org

AGR 102 INTRODUCTORY AGRO METEOROLOGY & CLIMATE CHANGE (1+1)

Outcomes:
- Understanding the concepts of meteorology, importance in crop production, different agricultural seasons of India and Tamilnadu.
- Understanding the role of solar radiation, temperature, Rtt, atmospheric pressure and wind in crop production.
- Understanding weather forecasting and climate change.

Theory:
Unit I: Climate and weather
Meteorology - Agricultural Meteorology - Importance and scope in crop production - Co-ordinates of India and Tamil Nadu – Earth Atmosphere - Composition and vertical layers of atmosphere (stratification) – Atmospheric variables - Climate - Weather - Factors affecting climate and weather - Different agricultural seasons of India and Tamil Nadu.

Unit II: Solar radiation, Temperature and RH
Unit III: Atmospheric pressure and Wind


Unit IV: Precipitation and weather hazards

Precipitation - forms - monsoon – mechanism- importance in Indian Agriculture- rainfall variability – Weather hazards-drought, flood and their effect – extreme weather conditions such as heat wave- cold wave-Cloud seeding - Evaporation - transpiration - Evapotranspiration - PET.

Unit V: Weather forecasting and Climate change

Agro climatic normals - Weather forecasting – types-uses and its impact in agriculture. Climate change- climate variability, global warming - definition and causes of climate change - Impact of climate change on Regional and national Agriculture.

Practical:


Lecture Schedule:

1. Meteorology - Agricultural Meteorology - Definition, their importance and scope in crop production. Coordinates of India and Tamil Nadu.
6. Role of temperature in crop production. – Lapse rate- inversion daily and seasonal variation in temperature-Soil temperature - Importance in crop production.
7. Humidity - Types - Dew point temperature - Vapour pressure deficit - Diurnal variation in Relative humidity and its effect on crop production

9. **MID SEMESTER EXAMINATION.**
11. Precipitation - Forms of precipitation - Isohyets - Monsoon - Different monsoons of India - Rainfall variability
15. Weather forecasting - Types, importance, Agro Advisory Services.
16. Climate change, global warming climate variability - definition and causes of climate change. Impact of climate change on Regional and national Agriculture.

**Practical Schedule:**

1. Visit to Agrometeorlogical observatory- Site selection and layout for Agromet Observatory.
2. Calculation of local time - Time of observation of different weather elements - Reviewing agromet registers.
4. Measurements ofalbedo- sunshine hours (sunshine recorder)
5. Measurement of maximum and minimum air temperatures-tabulation-analysis.
7. Relative humidity measurements - use of wet and dry bulb thermometers –
11. Measurement of rainfall - Ordinary and self-recording rain gauges
12. Measurement of Dew - dew gauge
15. Computation of ET-AET- PET.

**17. PRACTICAL EXAMINATION.**
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

BIC 101 Fundamentals of Biochemistry (1+1)

Outcomes:
- Understanding concepts of biochemistry, carbohydrates, lipids, proteins, enzymes and nucleic acids.
- Skills in estimation of starch, amylose, amino acids, protein and ascorbic acid.

Theory

Unit I: Carbohydrates

Unit II: Lipids
Lipids - occurrence and classification. Storage lipids - Fatty acids and triacyl glycerol.
Essential fatty acids and phospholipids - types and importance; Sterols - basic structure and their importance. Physical and chemical constants of oils. Rancidity of oils.

**Unit III: Proteins**
Amino acids - Classification and properties, essential amino acids. Importance and classification of proteins based on functions and solubility. Structure of proteins. Properties and reactions of proteins..

**Unit IV: Enzymes**

**Unit V: Nucleic acids**

**Practical:**

**Theory Lecture schedule:**

1. Introduction to Biochemistry, Carbohydrates – occurrence and classification
2. Structure of mono saccharides, 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. Sorenson’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

References:

E-References:
COM 101 Agri-Informatics (1+1)

Outcomes:
- In-depth understanding of various concepts of programming using python
- Skill to do statistical analysis using ‘R’
- Understanding role of information communication technology (ICT) in Agriculture.

Theory

Unit I: Introduction to Computers
Hardware, Software, Block diagram of a computer, RAM, Hard disks, Input / Output devices. Trash, Copy, Move, Rename, & Delete File/Folder using Linux File Manager Files / Nautilus

Unit II: Introduction to LibreOffice
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.
LibreOffice Base - Creating Table in Design View
LibreOffice Base - Create using Wizard - Queries, Forms, and Reports

Unit III: Introduction to Programming using Python
input, print, if, elif, else using Python
list, for in list using Python

Unit IV: Statistical Analysis using R
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

Unit V: e-Agriculture (ICT in Agriculture)
ICT in Agriculture, Internet, World Wide Web, Browsers, Email.
Computer controlled devices (automated systems) for Agriculture,
Smartphone Apps for Agriculture, E-Commerce for Agriculture,
Global Positioning System (GPS) for Agriculture,
Geographic Information Systems (GIS) for Agriculture,
Introduction to Crop Simulation Model

Theory Lecture Schedule
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. LibreOffice Base - Creating Table in Design View  
8. LibreOffice Base - Create using Wizard - Queries, Forms, and Reports

9. Mid-Semester Exam  
10. input, print, if, elif, else using Python  
11. list, for in list using Python  
12. R Console, R Prompt >, Assignment operator = or <-  
13. Creating dataframe using data.frame(), Edit dataframe using edit() function, Import dataset from clipboard to dataframe using read. table(),  
14. Using R find Sum, Mean, Standard deviation and Correlation  
15. ICT in Agriculture, Internet, World Wide Web, Browsers, Email. Computer controlled devices (automated systems) for Agriculture, Smartphone Apps for Agriculture, E-Commerce for Agriculture, Global Positioning System (GPS) for Agriculture, Geographic Information Systems (GIS) for Agriculture, Introduction to Crop Simulation Model

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, 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, LibreOffice Base – Table creation in design view, Create using Wizard - Queries, Forms, and Reports, Python Programming – input, print, if, elif, else, list, for in list, R Console, R Prompt >, Using R - 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, Hands on a Crop Simulation Model Software.

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. LibreOffice Base – Table creation in design view  
8. LibreOffice Base – Create using Wizard - Queries, Forms, and Reports  
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, Import dataset from clipboard to dataframe using read. table(),  
14. Using R find Sum, Mean, Standard deviation and Correlation  
15. Hands on a Crop Simulation Model Software  
16. Practical Examination
ENS 101 Environmental Studies and Disaster Management (2+1)

Outcomes:

- Understanding the concepts and importance of various natural resources, ecosystem and biodiversity.
- Understanding environmental pollution, laws and regulations.

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. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) 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
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. • Introduction, types, characteristic features, structure and function of the following ecosystem. a. Forest ecosystem. b. Grassland ecosystem. c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

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.
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
FOR 101  
INTRODUCTION TO FORESTRY  
1+1

Outcomes

- Understanding the role of forestry, silvics and silviculture, agroforestry and social forestry.
- Understanding forest utilization and silvicultural techniques.

Theory

Unit-I: Forest and Forestry, Silvics and Silviculture
Indian Forest - Status of Indian forests – Global forest scenario- History of forest-Role of forests – Locality Factors- Regeneration techniques- Natural Regeneration- Artificial Regeneration- Quality planting stock production techniques- Clonal forestry techniques

Unit-II: Agroforestry and its classification
Agroforestry – Definition- Benefits and constraints in agroforestry –Classification of agroforestry systems – Agroforestry systems for seven agro climatic zones of Tamil Nadu. Role of trees in soil fertility- Difference between agroforestry and social forestry

Unit-III: Social forestry

References:


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.
Unit-IV: Forest Utilization

Forest utilization- Solid wood- timber and its products- Non Timber forest products –
Non wood forest produce- status and value addition

Unit-V: Silviculture techniques


PRACTICAL

Forest nursery technology – Types of forest nurseries – Layout – Bed preparation – Identification of seeds and seedlings of multipurpose trees – Nursery practices for teak, sandal, rose wood, eucalyptus, Casuarina, Bamboo, Acacia, TBO – Clonal propagation techniques for forest trees- Study of pulp and paper making- Study of ply wood production technology- study of match manufacturing process- practicing tree planting technique- Practicing tending and cultural operation – Visit to forest nursery – Visit to agroforestry model unit- Visit to pulp and paper manufacturing industry- Visit to plywood industry- Visit to matchwood industry- Visit to NWFP value addition unit

Theory Schedule

1. Forest definition - Indian forest- History of forest- Global Scenario- Classification of forest Role of forests – productive role –protective role.
2. Locality Factors (Climate, edaphic, physiographic and biotic factors) - Regeneration techniques- Natural Regeneration
3. Artificial Regeneration- Quality planting stock production techniques- Clonal forestry techniques
4. Agroforestry-definition- different terminologies- concepts- Classification of agroforestry systems on structural, functional, socio- economic and ecological basis
5. Primary systems - agrisilviculture, silvipasture, agrisilvipasture and mixed woodlots. Sub-systems - shifting cultivation, taungya, home garden, intercropping, alley cropping, multistorey cropping, windbreak and shelterbelt - Constraints in agroforestry – interference effects - management options for overcoming constraints - diagnosis and design methodology.
6. Distinction between agroforestry and social forestry- Benefits and constraints of agroforestry- Agroforestry systems for seven agro climatic zones of Tamil Nadu. Role of trees in soil fertility
7. Social forestry- History – Concepts – Objectives - Social forestry in Tamil Nadu, Interface forestry – JFM
8. Social forestry projects in Tamil Nadu – Phase I & II– sponsoring agency - components, targets and achievements. Social forestry projects in Tamil Nadu - TAP and NAP projects
9. MID SEMESTER EXAMINATION
10. Urban forestry, recreation forestry techniques -Ecotourism- concepts and its application
11. Forest utilization- Solid wood- timber and its products
12. Forest utilization - Non Timber forest products (fibers, flosses, grasses, bamboos and canes- status and value addition
13. Silviculture techniques for Teak, Eucalyptus and Casuarina
14. Silviculture techniques for Neem, Melia, Pungam
15. Silviculture techniques for Ailanthus, Sandal wood and Red sander
16. Silviculture techniques for Silk cotton, Acacias and Bamboos

PRACTICAL SCHEDULE
1. A study on forest nursery technology and seed treatment process for tree species
2. Identification of seeds and seedlings of important multipurpose tree species
3. Nursery practices for teak and sandal wood
4. Nursery practices for Eucalyptus and casuarinas
5. Nursery practices for Neem and Melia
6. Nursery practices for pungam and prosopis
7. Nursery practices for Red sander and Silk cotton
8. Nursery practices for Acacia sps
9. Nursery management and propagation techniques in bamboos
10. Clonal propagation techniques for forest trees
11. Practicing tree planting technique
12. Practicing tending and cultural operations in forest plantations
13. Visit to forest nursery and agroforestry model unit
14. Study on pulp and paper manufacturing and visit to pulp and paper manufacturing industry
15. Study on plywood manufacturing and visit to plywood industry
16. Study on matchwood manufacturing and visit to matchwood industry

17. FINAL PRACTICAL EXAMINATION

References
Outcomes:
- In-depth understanding of concepts, classification of plant diseases, pathogenesis.
- Understanding symptoms of fungal, bacterial and virus disease of plants.

Theory

Unit I: Introduction to Plant Pathology

Unit II: Pathogenesis
Koch’s postulates - Pathogenesis - Mode of infection – Pre-penetration, penetration and post penetration - Types of parasitism - Spread and survival of plant pathogens -Role of enzymes and toxins in disease development

Unit III: General characters and taxonomy of Protozoa, Chromista and Fungi

Unit IV: General characters and taxonomy of fungi - Ascomycota and Basidiomycota
Phylum: Ascomycota: Classification , symptoms and taxonomy characters of Taphrina, Capnodium, Cercospora, (Mycosphaerella), Cochliobolus (Helminthosporium), Alternaria (Lewia), Venturia, Macrophomina, Botryodioidia (Botryosphaeria), Aspergillus (Eurotium), Penicillium (Talaromyces), Erysiphe, Leveillula, Phyllactinia, Claviceps, Ustilaginoidea, Fusarium (Gibberella), Verticillium, Colletotrichum (Glomerella) Pestalotia (Pestalosphaeria) and Pyricularia (Magnaporthe) - Phylum: Basidiomycota: Classification, symptoms and life cycle of Puccinia, Uromyces, Hemileia, Ustilago and Exobasidium - Important taxonomic characters of Agaricus, Pleurotous, Volvariella and Calocybe - Symptoms and Important taxonomic characters of Ganoderma, Sclerotium (Athelium) and Thanetophorus (Rhizoctonia).

Unit V: Bacteria, virus, viroids, algae, phanerogamic parasite and abiotic disorders
Classification of bacteria - General characters and symptoms of phytopathogenic bacteria - Pathogenesis - Mode of entry, survival and spread - General characters and symptoms of Candidatus Phytoplasma, Fastidious Vascular Bacteria, Spiroplasma, Virus, Viroids, Algae Phanerogamic parasites and abiotic disorders.
1. **Practical**

**Note:** Students should submit 50 well preserved diseased specimens in 3 installments during the semester.

2. **Theory schedule**
   1. Plant diseases – Concepts and history of Plant Pathology
   2. Etiology - Classification of plant diseases - Koch’s Postulate
   4. Types of parasitism – parasite, saprophyte, facultative saprophyte, facultative parasite, obligate parasite, biotrophs, hemibiotrophs, perthotrophs, necrotrophs, and symbiosis
   5. Pathogenesis – Stages in pathogenesis
   6. Spread and survival of fungal pathogens
   7. Role of enzymes and toxins in pathogenesis
   8. General characters of fungi - Types of Mycelia – Resting structures
   9. Asexual and sexual reproduction in fungi
   10. Physiological specialization in fungi
   11. Classification of Kingdom - *Protozoa* - Fungi like Protozoa - General characters - Life cycle and symptoms produced by *Plasmodiophora brassicae* – Flagellate Protozoa - Taxonomic characters and diseases caused by *Phytoponas*
   12. Classification of Kingdom : *Chromista* - General characters – Phylum: *Oomycota* – General characters and classification
   13. Taxonomic characters, life cycle and symptoms produced by *Pythium*, *Albugo* and *Phytophthora*
   14. Taxonomic characters and symptoms produced by downy mildew fungi - Life cycle of *Sclerospora* and *Plasmopara*
   15. Classification of Kingdom: *Fungi* – Phylum: *Chytriomycota* and *Zygomycota* - Taxonomic characters, life cycle and symptoms produced by *Rhizopus* and *Mucor*
   16. Classification of Phylum: *Ascomycota* - General characters
   17. **Mid Semester Examination**
18. Taxonomic characters and symptoms produced by Taphrina, Capnodium, Cercospora, (Mycosphaerella), Helminthosporium (Cochliobolus), Alternaria (Lewia), Venturia, Macrophomina and Botryodiplodia (Botrysphaeria)

19. Taxonomic characters and symptoms produced by Aspergillus (Eurotium), Penicillium (Talaromyces) and powdery mildew fungi – Life cycle of Eurotium and Erysiphe, Uncinula, Leveillula and Phyllactinia

20. Taxonomic characters and symptoms produced by Claviceps, Ustilaginoidea, Fusarium (Gibberella), Verticillium, Colletotrichum (Glomerella) Pestalotia (Pestalosphaeria) and Pyricularia (Magnaporthe)

21. Classification of Phylum: Basidiomycota - General characters

22. Symptoms and general characters of rust fungi - Life cycle of Puccinia and Uromyces

23. Symptoms and general characters of smut fungi - Life cycle of Ustilago

24. Taxonomic characters and symptoms produced by Exobasidium, Ganoderma, Thanetophorus (Rhizoctonia) and Sclerotium (Athelium) - Life cycle of Thanetophorus

25. Important taxonomic characters of Agaricus, Pleurotus, Volvariella and Calocybe

26. Classification and general characters of phytopathogenic bacteria

27. Mode of entry and symptoms produced by Xanthomonas, Ralstonia, Erwinia, Pectobacterium, Agrobacterium (Rhizobium), Corynebacterium (Clavibacter) and Streptomyces

28. General characters and symptoms produced by Candidatus Phytoplasma, spiroplasma and fastidious vascular bacteria

29. Virus - Morphology, structure and multiplication of plant virus - Virusoids and Satellite RNA

30. Movement and transmission of plant viruses - Symptoms of virus diseases

31. Important characters and symptoms of Viroid, Algal and Phanerogamic parasites

32. Abiotic / non-parasitic diseases

Practical schedule
1. Acquaintance with light microscope - and demonstration of koch’s postulates
2. Study of general characters of fungi - Types of mycelium and resting structures
3. Asexual and sexual reproduction in fungi
4. Study of systematic position, host parasite relationship and symptoms produced by Plasmodiophora, Pythium and Albugo.
5. Study of systematic position, host parasite relationship and symptoms produced by Phytophthora, Sclerospora, and Plasmospora
6. Study of systematic position, host parasite relationship and symptoms produced by Rhizopus, Mucor, Taphrina and Capnodium
7. Study of systematic position, host parasite relationship and symptoms produced by Helminthosporium (Cochliobolus), Alternaria, Venturia, Macrophomina and Botryodiplodia (Botrysphaeria)
8. Study of systematic position, host parasite relationship and symptoms produced by Aspergillus (Eurotium), Penicillium (Talaromyces), Erysiphe, Leveillula and Phyllactinia.
9. Study of systematic position, host parasite relationship and symptoms produced by Claviceps, Fusarium (Gibberella), Verticillium, Colletotrichum (Glomerella) Pestalotia (Pestalosphaeria) and Pyricularia (Magnaporthe)
10. Study of systematic position, host parasite relationship and symptoms produced by Puccinia, Uromyces, Hemileia, Sphacelotheca (Sporisorium) and Tolyposporium (Moeziomyces)
11. Study of systematic position, host parasite relationship and symptoms produced by *Exobasidium*, *Ganoderma*, *Sclerotium (Athelium)* and *Thanetophorus (Rhizoctonia)*.
12. Study of important taxonomic characters of *Agaricus*, *Pleurotus*, *Calocybe* and *Volvariella*
13. Symptoms Produced by bacteria, *Candidatus Phytoplasma*, spiroplasma and fastidious vascular bacteria
14. Symptoms produced by virus and viroids
15. Symptoms produced by algae, phanerogamic parasites and non-parasitic diseases
16. Field visit

**Assignment:** Students should submit 50 well preserved diseased specimens in 3 installments during the semester.

**References**

**Web resources**
1. [www.mycobank.org](http://www.mycobank.org)
2. [www.mycology.net](http://www.mycology.net)
3. [www.bspp.org.uk](http://www.bspp.org.uk)
4. [www.ictv.org](http://www.ictv.org)
5. [www.bibo.library.cornell.edu](http://www.bibo.library.cornell.edu)
6. [www.apsnet.org](http://www.apsnet.org)
## Semester III

<table>
<thead>
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<th>Sl.No.</th>
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<td>2.</td>
<td>AEG 201</td>
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<td>AEN 201</td>
<td>Principles of Integrated Pest Management</td>
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*Non-Gradial Course continued from first semester*
AEC 201 Farm Management, Production and Resource Economics (1+1)

Outcomes:
- Understanding the concepts of production economics and farm management.
- Understanding principles of Farm Management, Farm planning and budgeting, RISK & uncertainty in agricultural production and resource economics.

Theory

Unit 1: Production Economics and Farm Management - Nature and Scope

Unit 2: Factor – Product, Factor – Factor and Product – Product Relationships

Unit 3: Farm Planning and Budgeting
Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting - linear programming, appraisal of farm resources, selection of crops and livestock’s enterprises.

Unit 4: Risk and Uncertainty in Agriculture Production
Concept of risk and uncertainty occurrences in agriculture production, nature and sources of risks and their management strategies, Crop / livestock / machinery insurance. Weather based crop insurance - Features and determinants of compensations.

Unit 5: Resource Economics
Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources. Natural Resources - Issues – Scarcity of resources – Factors mitigating scarcity – Property Rights: Common Property Resources (CPRs): meaning and characteristics of CPRs – Externalities:
meaning and types - positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions; Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practical

Theory lecture schedule
1. Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms – Objectives of farm management – Production Economics Vs Farm Management.
4. Meaning and concept of cost, types of costs, cost curves - and their inter-relationship - shut down and break even points, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income.
9. Mid Semester Examination
10. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises.
11. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts.
12. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting – Concept of risk and uncertainty in agriculture production, nature and sources of risks and its management strategies.

13. Linear programming, appraisal of farm resources, selection of crop and livestock enterprises.


15. Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources.


17. Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practical Schedule
1. Preparation of farm layout. Determination of cost of fencing of a farm.
2. Computation of depreciation of farm assets. Cost of farm assets: Valuation of assets by different methods.
3. Application of equi - marginal returns / opportunity cost principle in allocation of farm resources.
4. Determination of most profitable level of inputs use in a farm production process.
5. Determination of least cost combination of inputs.
6. Selection of most profitable enterprise combination.
10. Preparation of farm plan and budget.
11. Farm records and accounts: Usefulness, types of farm records: farm production records and farm financial records.
12. Preparation of Cash flow statement
13. Preparation and Analysis of Net worth Statement and Profit and Loss statement
15. Graphical solution to Linear Programming problem.
16. Collection and analysis of data on various resources in India.
17. Final Practical Examination.

References

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

AEG 201 FARM MACHINERY AND POWER 1+1

Outcomes:
- In-depth understanding of farm mechanization, sources of farm power, tractor and functional components.
- Understanding the usage of tillage, sowing, intercultural, plant protection and harvesting implements and equipment.

Theory:

Unit I: Farm Power and IC engines
Farm Power- Status of Farm Power in India and their use in agriculture, farm mechanization its advantages and limitations Sources of Farm Power, Engine – Types of engines; I.C. engines, working principles of IC engines, comparison of two stroke and four stroke cycle engines , Study of different components of IC engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply.

Unit II: Tractor and functional components
Hydraulic control system of a tractor, Familiarization with Power transmission system: clutch, gear box, differential and final drive of a tractor,Tractor types, Cost analysis of tractor power and attached implements.

Unit III: Tillage implements
Familiarization with Primary and Secondary Tillage implements, Implements for hill agriculture.
Unit IV: Sowing and Intercultural implements
Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, implement for intercultural operations.

Unit V: Plant Protection and Harvesting equipments
Familiarization with Plant Protection equipments, Familiarization with harvesting and threshing equipments.

Practical:
Study of different components of I.C. engine - To study air cleaning and cooling system of engine - Familiarization with clutch - Transmission - Differential and final drive of a tractor - Familiarization with lubrication and fuel supply system of engine - Familiarization with brake - Steering - Hydraulic control system of engine - Learning of tractor driving - Familiarization with operation of power tiller - Implements for hill agriculture - Familiarization with different types of primary and secondary tillage implements - Mould board plough - Disc plough and disc harrow -Familiarization with seed-cum- fertilizer drills their seed metering mechanism and calibration - Planters and transplanter - Familiarization with different types of sprayers and dusters - Familiarization with different inter-cultivation equipment - Familiarization with harvesting and threshing machinery.

Lecture schedule:
1. Farm power - sources of farm power and their use in agriculture; farm mechanization its advantages and limitations; status of farm power in India.
2. Engine – Types of engines; components of IC engine - Working principles of IC Engines.
3. Two stroke and Four stroke engines – comparison - Engine terminology.
4. Familiarization of different systems of IC engine – air cleaning, cooling, lubricating and fuel supply systems.
5. Tractors – types; power transmission system - clutch, gearbox, differential and final drive and hydraulic system.
6. Cost analysis of tractor with attached implement.
7. Tillage – Definition, objectives and types; ploughing methods. Primary tillage implements - mould board plough, disc plough, chisel plough and subsoil plough - components and functions, types, advantages and disadvantages.
8. Secondary tillage equipments - cultivators, harrows, levelers; land forming equipments – rotovators, ridgers, bund former; puddlers - manure tramplers and cage wheels,
9. MID SEMESTER EXAMINATION
10. Implements for Hill agriculture.
11. Sowing methods - seed drills and planters - seed cum fertilizer drills - components and functions - Calibration - solved examples.
12. Paddy transplants - types, working principle, field and nursery requirements.
13. Implements for intercultural operations - cultivators, sweep, junior hoe, manual weeder and power operated weeder for wet land and garden land.
16. Threshing of crop, thresher and its principles of operation - threshing losses.

**Practical schedule:**

1. Study of working of two and four stroke IC engines and their systems with solved problems.
2. Study of different systems of tractor - clutch, gearbox, differential and final drive, brake, steering, hydraulic control, air cleaning and cooling system, lubrication and fuel supply system of engine.
3. Study of tractors and power tillers - their operation and maintenance.
4. Learning driving of tractor.
5. Learning operation of power tiller.
6. Study of primary tillage implements (mould board plough, disc plough, chisel plough and subsoiler) and their components.
7. Study of secondary tillage implements (cultivator, disc harrows, rotavator, bund former, ridger, leveller).
8. Study of seed drills, planters and seed-cum-fertilizer drills and their components and metering mechanisms - calibration- simple problems on calibration.
9. Study and operation of machinery for rice cultivation - puddling implements- rotary puddlers and cage wheels, tray seeder for rice nursery, transplanters - types operation and maintenance- drum seeder, conoweeder, power weeder and finger type weeder.
10. Study of different inter-cultivation equipment for uplands - manual, animal drawn, power operated - tractor and power tiller operated - field operation.
11. Study of plant protection equipment – manually operated sprayers and dusters, knapsack mist blower cum duster, tractor operated sprayers- their operation, adjustment, calibration and safety requirements.
12. Study of tools for hill agriculture and horticultural crops - propagation tools, vegetable transplanter, harvesting tools -lawn mower, posthole diggers, tree climber, shredders for crop residue.
13. Threshing machinery for paddy and identification of its components - different threshing drums - calculation of efficiency and losses.
15. Study of harvesters for root crops - turmeric and tapioca and groundnut diggers.
16. Problems on cost of operation of tractor operated machinery.
17. **FINAL PRACTICAL EXAMINATION.**

**References:**

AEN 201 PRINCIPLES OF INTEGRATED PEST MANAGEMENT (1+1)

Outcomes:
- In-depth understanding of methods of diagnosis and defection of various insect pests, surveillance and forecasting of insect pests.
- Understanding assessment of crop yield losses, integrated pest management, safety issues in pesticide uses.

Theory

Unit –I: Pest categories and IPM
Categories of insect pests, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests and pest risk analysis. Methods of detection and diagnosis of insect pests.

Unit –II: Components of IPM
Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control.

Unit –III: Ecology of pests
Ecological management of crop environment. Introduction to conventional pesticides for the insect pests management. Survey surveillance and forecasting of insect pests.

Unit –IV: IPM Module
Development and validation of IPM module. Implementation and impact of IPM (IPM module for insect pests. Safety issues in pesticide uses.

Unit –V: IPM case studies
Political, social and legal implication of IPM. Case histories of important IPM programmes.

Practical
Methods of diagnosis and detection of various insect pests, Methods of insect pests measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of Trichogramma, NPV etc. Identification and nature of damage of important insect pests and their management. Crop (agro-ecosystem) dynamics of a selected insect pests. Plan and assess preventive strategies (IPM module) and decision making. Crop monitoring attacked by insect pests. Awareness campaign at farmers fields.

Lecture schedule
1. Definition of insect ecology and introduction to environment and its components
2. Effect of abiotic factors- temp, moist, humidity, RF, light and air on the population of insects
3. Effect of biotic factors- food competition, natural and environmental resistance on the population of insects
4. Definition of pests, Categories of pests based on ETL and EIL
5. Causes for pest outbreak
6. Survey surveillance and forecasting of Insect pests
7. Definition and concept of IPM and scope and limitation of IPM
8. Tools of IPM and cultural methods of pest control
9. Mid semester examination
10. Mechanical methods of pests control
11. Physical methods of pests control
12. Biological control of insect pests and weeds
13. Legal methods of pest control
14. Host plant resistance in IPM
15. Chemical control- classification of insecticides
16. Case histories of important IPM programme.

Practical schedule
1. Types of damage caused by insect to plants
2. Methods of insect pests measurement and Assessment of crop yield losses
3. Pest survey, surveillance and forecasting
4. Different methods of insect sampling for insect population assessment
5. Identification of Predators
6. Identification of Parasitoids
7. Mass production of predators and parasitoids
8. Mass production of entomopathogens
9. Behavioural approaches in pest management
10. Pesticide formulation and application equipments
11. Different methods of pesticide application
12. Biotechnological approaches in pest management
13. Pest risk analysis and partial budgeting
14. Pest awareness campaign at farmers field (AESA)
15. IPM module for important pests
16. Identification of recent invasive pests

17. Practical examination

References
Outcomes:
- Understanding irrigation systems of India, water resources and irrigation potential.
- Understanding soil-water-plant relationship, crop-water requirement, scheduling and methods of irrigation and quality of irrigation water and drainage.

Theory:
Unit I: Irrigation - History and importance
- History and development of irrigation in India – Irrigation systems of India and Tamil Nadu
- Importance of irrigation – Water resources and irrigation potential of India and Tamil Nadu
- Role of water in plant growth

Unit II: Soil-water-plant relationship

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 for different field crops.

Unit IV: Scheduling and methods of irrigation

Unit V: Quality of irrigation water and drainage
- Quality of irrigation water – Agronomic practices for use of poor quality water (saline, effluent and sewage water) for irrigation – tank irrigation, well irrigation – on-farm development – command area development - 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.
Lecture schedule:
1. History and development of irrigation in India - Irrigation systems of India and Tamil Nadu. Importance of irrigation
2. Water resources of India and Tamil Nadu - Role of water in plants
5. Absorption of water and evapotranspiration - Available soil moisture – definition and importance – moisture extraction pattern -
7. Crop water requirement – effective rainfall - potential evapotranspiration (PET), consumptive use (CU) – definition and estimation.
9. MIDS EMESTER EXAMINATION
10. Scheduling of irrigation – criteria based on plant and soil moisture - different approaches - climatological approach, empirical methods, crop co-efficient.
11. Methods of irrigation – surface (flooding, beds and channels, border strip, ridges and furrows, broad bed and furrows, surge irrigation) and sub-surface methods.
12. Micro irrigation system (drip and sprinkler irrigation) – suitability, components, layout, operation, advantage and disadvantage.
14. Water management for cereals, pulses, oilseeds and commercial crops (cotton, sugarcane, sugar beet, tobacco)
15. Quality of irrigation water – Agronomic practices for use of poor quality water (saline, effluent and sewage water) – Tank irrigation, well irrigation – on-farm development – Command area development.

Practical schedule:
1. Determination of soil bulk density, particle density and porosity by different methods
2. Determination of soil moisture by direct methods
3. Determination of soil moisture by indirect methods
4. Determination of Soil moisture constants by different methods
5. Measurement of irrigation water
6. Determination of infiltration rate and hydraulic conductivity
7. Demonstration of Surface irrigation methods – I (Border Strip and Check Basin)
8. Demonstration of Surface irrigation methods – II (Ridges and Furrows and Broad bed furrow)
9. Layout, operation and maintenance of sprinkler irrigation systems
10. Layout, operation and maintenance of Drip irrigation systems
11. Scheduling of irrigation
12. Estimation of crop water requirement by direct and indirect methods
13. Calculations of irrigation water based on source, water flow, soil moisture status, depth of irrigation and efficiency parameters
15. Visit to irrigation command area and study of command area development.
16. Observation on drainage structures during on / off campus field visit.

17. FINAL PRACTICAL EXAMINATION.

References:

AMP 201 LIVESTOCK AND POULTRY MANAGEMENT (2+1)

Outcomes:
• In-depth understanding of significance of livestock and poultry in Indian economy, various system of livestock production.
• Understanding dairy cattle management, sheep and goat management, swine and poultry management.

Theory:
Unit I: Introduction to Livestock and Poultry Management

Unit II: Dairy Cattle Management
Breeds – Classification - Characteristics of Indian breeds - Sindhi, Gir, Sahiwal, Tharparkar, Kankeyam, Umblacherry. Exotic breeds - Jersey, Holstein Friesian. Buffalo breeds - Murrah and Surti. Breeding - Cross breeding - Upgrading - Economic traits of cattle - Culling -

Unit III: Sheep and Goat Management

Unit IV: Swine Management

Unit V: Poultry Management

Practical:

Lecture Schedule:
1. Significance of livestock and poultry in Indian economy - Livestock and poultry census. Different livestock development programmes of Government of India
2. Various systems of livestock production – extensive, semi intensive and intensive systems. Different Farming types - mixed, integrated and specialized farms.
3. Breeds - Classification of Indian white and black cattle - Breed characteristics of Sindhi, Gir, Sahiwal and Tharparkar.
4. Indian Draught breeds - Kangayam and Umblacherry. Exotic breeds - Jersey and Holstein Friesian - Indian Buffaloes - Murrah and Surti
5. Breeding - Cross breeding - Upgrading programme - Economic traits of cattle
6. Estrous cycle – Signs of Estrous - Artificial insemination - merits and demerits - Principles and outline of Embryo Transfer Technology
7. Housing - farm site selection - Floor space requirement for calves, heifer, milch animal and Work bullocks
8. Systems of housing - Single row system - Double row system - head to head and tail to tail -merits and demerits
9. Care and management of new born calf and heifers
10. Care and management of pregnant animals, lactating and dry cows.
12. Model composition of concentrate mixture of young and adult stock - age wise feed and fodder requirement - Importance of green fodder.
13. Milk - factors affecting yield and composition – Pasteurization
14. Diseases - Classification - viral, bacterial and metabolic - General control and preventive measures - Vaccination schedule
15. Viral Disease - Foot and mouth - Bacterial disease - Anthrax, HS, BQ and Mastitis, Metabolic disease - Bloat, Ketosis and Milk fever.
17. MID SEMESTER EXAMINATION
18. Systems of rearing - Housing management - Type and design - Space requirement for adult and young stock
19. Care and management of Ram, Ewe and Lamb - Nutrition - Feeds and Fodder for small ruminants.
20. Care and management of Buck, Doe and kid - Nutrition - Flushing.
23. Care and management of Sow, Boar and piglets – Nutrition - Creep feeding.
25. Poultry – Breed classification - Nomenclature of commercial layer and broiler strains
27. Care and management of chicks - Brooder management.
28. Care and management of grower and layers - vaccination schedule.
29. Care and management of broilers - vaccination schedule.
30. Incubation and hatching of eggs.
31. Nutrition - Feed formulation - Composition of chick, grower, layer, broiler starter and finisher mashes - Feed Conversion Ratio of egg and meat.
32. Classification of Disease - Cause, symptoms and prevention of Viral disease - Ranikhet, IBD, Bird Flu - Bacterial disease - E.coli, Coryza - Protozoan disease - Coccidiosis

**Practical schedule:**
1. Study of external parts of Livestock
2. Identification of livestock and poultry
3. Common restraining methods of Livestock
4. Disbudding, Dehorning, Castration and Dentition of Livestock
5. Type & design of livestock and poultry houses
6. Selection of dairy cows and work bullocks
7. Determination of specific gravity, fat percentage and total solids of milk. Common adulterants and preservatives of milk
8. Clean milk production and Milking methods
9. Identification of feeds and fodder
10. Economics Dairy, Goat and Swine farming
11. Study of External Parts of Fowl. Preparation of Brooder House
12. Judging good layer and poor layer.
15. Demonstration of dressing of broiler chicken. Economics of Poultry Farming
16. Visit to a modern Dairy plant / poultry farms

**17. Final Practical Examination**

**References:**
5. Prabakaran, R., 1998. Commercial Chicken Production. Publisher P.Saranya, 5/2, Ramalingam Street, Seven Wells, Chennai
Web resources:
1. www.sciencecentral.com
2. www.ansci.umn.edu/poultry/resources/layermgmt.htm
3. www.armsd.com/
4. www.animalwebsites.co.uk
6. www.britishangoragoats.org.uk/management.htm
7. www.indiagoatfarm.com
8. www.indiadairy.com
9. www.indiagronet.com
10. www.foodsci.uoguelph.ca

ANM 201 INTRODUCTORY NEMATOLOGY (1+1)

Outcomes:
- Understanding morphology and taxonomy of nematodes, symptoms of nematode damage, nematode management.
- Understanding nematode pests of crops.

Theory
Unit I: Introduction - History and Importance of Nematodes:
Introduction – Brief history and development of Nematology in India and abroad – Position of nematodes in animal kingdom – Economic importance of nematodes and loss in crop plants. Beneficial nematodes (entomopathogenic nematodes – Steinernema and Heterorhabditis).

Unit II: Morphology and Taxonomy of Nematodes:
Morphology and Anatomy of nematodes (cuticle, cephalic region, alimentary, excretory, reproductive and nervous system, sense organs) – Taxonomy of plant parasitic nematodes – Classification of plant parasitic nematodes based on feeding habits, temperature and mode of life.

Unit III: Symptoms, interaction and bio-ecology of nematodes:
Symptoms of nematode damage – Interaction of nematodes with other microorganisms (fungi, bacteria and viruses) – Biology and ecology of important plant parasitic nematodes. (Meloidogyne, Heterodera, Rotylenchulus, Tylenchulus and Radopholus).

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; biological control (nematode trapping fungi, egg parasitic fungi, obligate parasites, PGPR and predators); chemical control – soil fumigants and nematode management. Integrated nematode management.
Unit V: Nematode pests of crops:
Major nematode parasites and their management in cereals (rice and wheat), millets (sorghum and maize), pulses (redgram, blackgram, greengram and cowpea), oilseeds (castor and groundnut), fibre crops (cotton), vegetables (tomato, brinjal, bhendi, chilli and potato), fruits (banana, citrus, grapevine and papaya), spices and plantation crops (turmeric, pepper, betelvine and coconut), flower crops (crossandra, jasmine and tuberose) and medicinal and aromatic plants, (medicinal coleus, diascorea, geranium and patchouli).

Practical:
Methods of survey – sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following combined Cobb’s decanting–sieving and Baermann funnel technique and Modified Baermann funnel Technique, counting and estimation of plant parasitic nematodes; Extraction of nematodes by sugar flotation technique; Extraction of cyst nematodes from soil by Fenwick can and other methods. Preparation of temporary and permanent mounts; Morphology of orders Tylenchida (Hoplolaimus), and Dorylaimida (Xiphinema) Study and identification of most important plant parasitic nematodes with special – Meloidogyne, Pratylenchus, Hirschmanniella, Heterodera, Globodera, Tylenchulus, Radopholus, Rotylenchulus, and Helicotylenchus. Study of life stages of Meloidogyne, Rotylenchulus and Radopholus. Study of different types of nematicides, application methods and calculation of dosages.

Lecture schedule
Theory
1. Introduction – Brief history and development of Nematology in India and abroad
4. Nematode Anatomy - alimentary, excretory, nervous system.
5. Nematode anatomy - sense organs, reproductive system.
6. Taxonomy of plant parasitic nematodes- Secernentea and Adenphorea
7. Classification of plant parasitic nematodes based on feeding habits, temperature and mode of life.
8. Symptoms of nematode damage.
9. Mid-semester examination
10. Interaction of nematodes with other microorganisms (fungi, bacteria and viruses)
11. Biology and ecology of important plant parasitic nematodes, (Meloidogyne, Heterodera, Rotylenchulus, Tylenchulus and Radopholus).
13. Nematode parasites of cereals, millets and pulses
14. Nematode parasites of oilseeds and fibre crops
15. Nematode parasites of vegetables and fruits.
Practical:
2. Extraction of nematodes by sugar flotation technique
3. Extraction of cyst nematodes by Fenwick can and other methods.
4. Extraction of nematodes from plant roots and staining of roots infested with endo and semi-endoparasitic nematodes.
5. Killing, fixing of nematodes and preservation of nematodes and preparation of temporary and permanent mounts.
6. Morphology of orders Tylenchida (Hoplolaimus) and Dorylaimida (Xiphinema and Longidorus)
7. Identification of nematodes Tylenchorhynchus and Helicotylenchus
8. Identification of nematodes Pratylenchus and Hirschmanniella
9. Identification of nematodes Hemicriconemoides and Criconema; Heterodera and Globodera
10. Identification of nematodes Tylenchulus and Aphelenchoides
12. Study of life stages of Rotylenchulus
14. Nematode disease of rice: white tip and rice root nematode
15. Nematode damage symptoms caused by citrus nematode, lesion nematode and burrowing nematode.
16. Study of different nematicides, application methods and calculation of nematicide dosages.
17. Practical examination.

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:
GPB 201  Fundamentals of Plant Breeding (2+1)

Outcomes:
- In-depth understanding of reproductive systems in plant breeding, breeding methods of self-pollinated, cross pollinated and clonally propagated crops.
- Understanding special breeding methods, 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
• Breeding: Biotechnological and Conventional Approaches. Narosa Publishing House (India)

HOR 211 PRODUCTION TECHNOLOGY FOR VEGETABLES AND SPICES 1+1

Outcomes:
• Understanding production technology for vegetables like tomato and brinjal, okra, cucurbits, cole crops, peas and beans.
• Learning production technology for spices like black pepper, cardamom, ginger and turmeric.

Theory
Unit – I: Introduction and production technology for tomato and brinjal
Importance of vegetables and spices- kitchen gardening - origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of tomato and Brinjal.

Unit – II: Production technology for okra, cucurbits, cole crops, peas and beans
Origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of okra, cucurbits (cucumber, melons, gourds and pumpkin), cole crops (Cauliflower, Cabbage and Knol khol), peas and French bean.
Unit – III: Production technology for root crops, tubers and bulbs
Origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of root crops (Radish, Carrot and Beet root), bulb crops (Onion and Garlic) and tuber crops (Potato and Tapioca).

Unit – IV: Production technology and processing of black pepper, cardamom, ginger and turmeric
Origin, area, climate, soil, improved varieties and cultivation practices such as propagation, planting, shade regulation, training and pruning, fertilizer requirements, irrigation, inter cultural operations, harvesting, processing and yield- pest and diseases of black pepper, cardamom, ginger and turmeric.

Unit – V: Production technology for coriander, fenugreek, cumin and fennel
Origin, area, climate, soil, improved varieties and cultivation practices such as propagation, planting, shade regulation, training and pruning, fertilizer requirements, irrigation, inter cultural operations, harvesting, processing and yield- pest and diseases of seed spices (coriander, fenugreek, cumin and fennel).

Practical

Lecture Schedule
1. Importance of vegetable and species –kitchen garden
2. Tomato-, origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders
3. Brinjal and Chilli-origin, area, production, varieties and - origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders
4. Okra and Leafy vegetables (Amaranthus, palak and perennial vegetables) - origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders
5. Cucurbits-(cucumber, melons, gourds and pumpkin) - Sex expression- origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders
6. Cauliflower, Cabbage and Knol khol- origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance,
fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders
7. Peas and French bean- origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders
8. Root crops (Radish, Carrot and Beet root)- origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders
9. **MID SEMESTER EXAMINATION**
10. Bulb crops (Onion and Garlic)- origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders
11. Tuber crops (Potato and Tapioca)- origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders
12. Black pepper- origin, area, climate, soil, improved varieties and cultivation practices such as propagation, planting, shade regulation, training and pruning, fertilizer requirements, irrigation, inter cultural operations, harvesting, processing and yield- pest and diseases.
13. Cardamom - origin, area, climate, soil, improved varieties and cultivation practices such as propagation, planting, shade regulation, training and pruning, fertilizer requirements, irrigation, inter cultural operations, harvesting, processing and yield- pest and diseases.
14. Clove and Cinnamon- origin, area, climate, soil, improved varieties and cultivation practices such as propagation, planting, shade regulation, training and pruning, fertilizer requirements, irrigation, inter cultural operations, harvesting, processing and yield- pest and diseases.
15. Ginger, Turmeric and coriander - origin, area, climate, soil, improved varieties, system of cultivation, propagation, planting, mulching, fertilizer requirements, irrigation, inter cropping, inter cultural operations, harvesting, processing and yield- pest and diseases.
16. Cumin, Fennel and Fenugreek - origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, processing and yield and physiological disorders.

**Practical Schedule**
1. Identification of vegetables and spices and their seeds
2. Nursery techniques for direct sowing / vegetative and transplanted vegetable crops
3. Study of morphological characters of tropical vegetables
4. Study of morphological characters of temperate vegetables
5. Method of fertilizer applications in different vegetable crops
6. Harvesting techniques in different vegetable crops
7. Post harvest handling of vegetable crops
8. Visit to commercial vegetable farms
9. Identification of different spices and their seeds
10. Method of propagation – Seed treatment and sowing / planting of different spices
11. Cultural operations – hoeing, earthing up, manuring and use of weedicides in spices
12. Training and pruning in tree spices
13. Maturity indices and harvesting of spices
14. Curing, processing and grading of spices
15. Economics of vegetable and spice cultivation
16. Visit to Commercial Spice garden
17. PRACTICAL EXAMINATION

References
SAC 201  Problematic Soils and their Management (1+1)

Outcomes:

- In-depth understanding of Problem soil and soil quality, Physical and Chemical constraints & polluted soil
- Understanding remediation of solid and irrigation water.

Theory

Unit-I: Problem soil and soil quality
Soil quality and health, Distribution of Waste land and problem soils in India. Categorization of waste lands based on properties. Problematic soils under different Agro ecosystems

Unit-II: Chemical constraints
Characteristics, reclamation and management of chemical constraints -, Saline and sodic soils, Acid soils, Acid Sulphate soils.

Unit III: Physical constraints and polluted soil
Soil physical constrains and management. Polluted soils and their management. Remote sensing and GIS in diagnosis and management of problem soils

Unit-IV: Remediation of soils
Multipurpose tree species, bio remediation of soils through MPTs. Land capability and suitability classification.

Unit-IV: Irrigation water
Irrigation water – quality and standards. Utilization of poor quality water in agriculture

Practical
Identification, characterization and management of problem soils and water.

Lecture Schedule:
1. Problem soils –Definition – Different types of problematic soils – Extent and distribution of problematic and wastelands soils in different agro-eco systems in India: coastal salinity, inland salinity, marshy, swampy soils, red sand dunes (Theri soils) Tsunami affected soils
9. Mid-semester examination
10. Soil pollution - Potentially toxic elements - Excessive use of fertilizers, pesticides and weedicides – Heavy metal contamination – Management..
14. Land suitability classification - Index – Criteria - Different approaches – Land suitability for different crops
15. Irrigation water – Quality and standard parameters - Classification based on ICAR, CSSRI and USDA criteria.
16. Management of poor quality water in agriculture

**Practical schedule:**
1. Estimation of pH and EC of problem soil
2. Estimation of CEC of soil.
3. Estimation of exchangeable calcium and magnesium in soil.
5. Estimation of lime requirement of acid soil
7. Collection of different types of irrigation water samples and estimation of pH, EC and TSS.
8. Estimation of calcium and magnesium in irrigation water
9. Estimation of sodium and potassium in irrigation water
10. Estimation of carbonate and bicarbonate in irrigation water
11. Estimation of chloride and sulphate in irrigation water.
12. Estimation of Boron in irrigation water
13. Classification of irrigation waters as per USSL and other systems.
15. Estimation of heavy metals in polluted soil and water.
16. Interpretation of soil data for land capability and crop suitability.

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8. inkinghub.elsevier.com/retrieve/pii/S0166248197800335
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10. www.angrau.net/BSc(Aq)CourseCurriculum.htm
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SST 201 Principles of Seed Technology (2+1)

Outcomes:

- Understanding Principles of Seed Technology, Post-harvest handling of seeds, Seed quality enhancement techniques.
- Learning about seed certification, seed low enforcement, seed storage and marketing.

Theory

Seed and seed technology- definition-importance-Characters of good quality seed -Seed development and maturation - Germination - phases of seed germination - Dormancy - types of seed dormancy - Different classes of seed - generation system of seed multiplication in supply chain - Seed replacement rate and varietal replacement - Seed Multiplication Ratio -Seed renewal period. Varietal deterioration of crops - causes and maintenance. Principles of seed production- Foundation and certified seed production of varieties and hybrids - Cereals – rice, wheat, maize, sorghum and bajra - Pulses – green gram, black gram and red gram - Oilseeds - groundnut, sesame, sunflower and castor - Cotton, Forage crops - Cenchrus sp and lucerne - Vegetables - tomato, brinjal, chillies, bhendi, onion and gourds – bitter gourd, ash gourd, snake gourd, ribbed gourd, bottle gourd and pumpkin. Principles of GM crops and organic seed production.

Practical
Study on seed structure of major Cereals - rice, wheat, maize, sorghum and bajra - Pulses – green gram, blackgram, red gram, Bengal gram and field pea - Oilseeds - groundnut, sesame, sunflower, castor, soybean and mustard - Cotton - Forage crops – Green manures-Vegetable crops. Seed production techniques - identification of physical and genetic contaminants - Supplementary pollination in hybrid rice -Detasselling techniques in hybrid maize - Emasculation and dusting technique in cotton - Supplementary pollination in sunflower - Pre-germinative technique - Enhancing female flowers in cucurbit - Assessment of physiological maturity indices - Seed extraction methods in vegetables. Visit to seed production farms-Identification of off-types and Roguing - Seed enhancement techniques - seed coating, seed priming and seed pelleting, dormancy breaking treatments. Visit to seed processing plant-Study of Seed Processing machines- Seed certification - field inspection and counting procedures - Seed sampling and testing - Seed moisture content- Physical purity-Seed germination-Seed Viability - Seed and seedling vigour test - Seed health test- Genetic purity test -Grow out test and Electrophoresis - Seed production planning - Economics - Visit to seed testing laboratory.

Theory lecture schedule
1. Seed and seed technology - definition -importance -Characters of good quality seed.
2. Seed development and maturation.
3. Germination - phases of seed germination - Dormancy - types of seed dormancy.
4. Different classes of seed - generation system of seed multiplication in supply chain - Seed replacement rate and varietal replacement - Seed Multiplication Ratio -Seed renewal period.
5. Varietal deterioration of crops - causes and maintenance.
7. Seed production techniques in varieties and hybrids of rice.
8. Seed production techniques in varieties and hybrids of maize.
9. Seed production techniques in varieties and hybrids of sorghum and bajra.
10. Seed production techniques in greengram and blackgram varieties.
11. Seed production techniques in varieties and hybrids of redgram.
12. Seed production techniques in varieties and hybrids of sunflower and groundnut varieties.
13. Seed production techniques in varieties and hybrids of castor and sesame varieties.
14. Seed production techniques in varieties and hybrids of cotton.
15. Seed production techniques in Cenchrus species and lucerne.
16. Seed production techniques in varieties and hybrids of tomato, brinjal and chillies.
17. Seed production techniques in varieties and hybrids of bhendi and onion.
18. Mid semester examination.
19. Seed production techniques in varieties and hybrids of gourds – bitter gourd, ash gourd, snake gourd, ribbed gourd, bottle gourd and pumpkin.
22. Seed processing - principle - importance - seed processing sequence for different crops - equipments.
24. Principles and mechanism of upgrading equipments - colour sorter - indented cylinder separator - spiral separator - magnetic separator - needle separator
25. Seed quality enhancement techniques - importance - seed fortification - seed priming - seed coating - seed pelleting-dormancy breaking treatments.
26. Seed certification - phases of certification, procedure for seed certification, field inspection, field counts, field and seed standards - post harvest inspection - processing - bagging and tagging.
27. Seed Act and Rules - Seed law enforcement - Duties and powers of seed inspector - offences and penalties - Seeds Control Order 1983.
29. Seed testing for quality assessment - importance - methods.
31. Seed storage - principles - factors affecting seed longevity during storage.
32. Seed treatment and packaging materials - measures for pest and disease control during storage and godown sanitation.
33. Seed marketing - structure and organization - sales promotional activities - factors affecting seed marketing and demand.
34. History of Indian Seed Industry-History-International seed movement - Role of international organizations - WTO and OECD in seed trade.

Practical schedule
1. Study on external and internal seed structure and identification of major cereals - pulses - oilseeds - cotton - forage crops-green manures and vegetable crops.
2. Practicing supplementary pollination techniques in hybrid rice and detasselling techniques in hybrid maize.
3. Practicing emasculation and dusting technique in cotton and supplementary pollination in sunflower.
4. Practicing pre-germinative technique and female flowers production enhancement techniques in cucurbits.
5. Assessment of physiological maturity indices in various crops and seed extraction methods in vegetables.
6. Visit to seed production farms - Identification of off-types and Roguing
7. Seed enhancement techniques - Seed coating - seed priming and seed pelleting-dormancy breaking treatments.
8. Seed certification - field inspection and counting procedure - identification of physical and genetic contaminants in seed production plots and roguing.
10. Estimation of seed moisture content and physical purity.
11. Seed germination testing – Evaluation -Tetrazolium test for viability
14. Seed health testing - methods.
15. Seed production planning - economics.
16. Visit to seed processing plant and seed testing laboratory.

**16. Final practical examination.**

**References**

5. Indian Minimum Seed Certification Standards. 2014. Published by Ministry of Agriculture and Farmers Welfare, Govt. of India, New Delhi.
6. Seed legislations. 2014. Published by Ministry of Agriculture and Farmers Welfare, Govt. of India, New Delhi.

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1. www.fao.org
2. www.seednet.gov.in
3. www.agricoop.nic.in
4. www.online library.willey.com
5. www.sciencedirect.com
6. Seed Science Research (www.jgateplus.com)
7. Seed Science and Technology (www.jgateplus.com)
STA 201 Statistical Methods (1+1)

Outcomes:

- Understanding the applications of statistics in Agriculture.
- Understanding sampling theory, distribution, sampling methods, analysis of variance, correlations and regression.

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 for Means, paired t test
13. F test for comparison of variances, Chi-Square Test of Independence of Attributes in $2 \times 2$ 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 $2 \times 2$ 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
### SEMESTER IV

<table>
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<td>AEG 202</td>
<td>Soil and Water Conservation Engineering</td>
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<td>Crop Production Technology – I (<em>Kharif Crops</em>)</td>
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<td>4.</td>
<td>AGR 203</td>
<td>Farming System &amp; Sustainable Agriculture</td>
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<td>GPB 202</td>
<td>Fundamentals of Plant Biotechnology</td>
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<td>10.</td>
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<td>NSS 101 /</td>
<td>National Social Service / National Cadet Corps*</td>
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<td>PED 101</td>
<td>Physical Education &amp; Yoga Practices*</td>
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<td><strong>TOTAL</strong></td>
<td><strong>13+9=22</strong></td>
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*Non-Gradial Course continued from first semester

# Non-Gradial Course
AEC 202 Agricultural Marketing, Trade and Prices (2+1)

Outcomes:

- Understanding importance of agricultural marketing, market structure, marketing mix and segmentation.
- Understanding marketing functions, pricing and promotion strategies, marketing efficiency and marketing institutions.

Theory

Unit 1: Agricultural Marketing – Nature and Scope


Unit 2: Marketing Functions, Pricing and Promotion strategies

Marketing process and functions: Marketing process - concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK); Standardization, Finance, Storage and Warehousing, Processing, Value Addition and Risk Taking - Market Structure, Conduct and Performance paradigm (SCP) – Market Structure: Meaning, Components, Dynamics of Conduct and Performance – Price determination under perfect and imperfect competition.

Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits and demerits.

Unit 3: Marketing Efficiency and Marketing Institutions

Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration over space, time and form: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing, reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Modern marketing systems versus traditional agricultural marketing systems; Role of Government in agricultural marketing - Public sector institutions - CWC, SWC, FCI and DMI – their objectives and functions; cooperative marketing in India; New EXIM policy of India – Advantages of AEZs, ITPO, Export Promotion Councils, APEDA, MPEDA, and Commodity Boards.
Unit 4: Trade in Agricultural Products

International Trade: Concept of International Trade and its need - Free trade, Autarky and it needs - Theories of Trade: Absolute and comparative advantage; Present status and prospects of Agricultural exports / imports from India and their share - Barriers to Trade: Tariff and non-tariff barriers - Trade policy instruments – Terms of Trade - Role of institutions like UNCTAD and GATT - WTO in promoting trade in agricultural products - Free Trade Agreements – AoA and its implications on Indian agriculture: Sanitary and Phyto-sanitary issues, Market Access, Domestic Support and Export Subsidies - IPR.

Unit 5: Agricultural Prices and Risk Analysis

Agricultural Prices and Policy: Meaning and functions of price; administered prices; need for agricultural price policy; Objectives of Price Policy and Price Stabilization – Role of CACP – Concept of MSP, FRP (SMP) and SAP – Price Parity - Procurement of food grains and buffer stock - Risk in marketing: Meaning and Importance - Types of risk in marketing: Speculation and Hedging and Forward and Futures trading; an overview of futures trading; – Role of Contract Farming in risk mitigation.

Practical

Computation of marketable and marketed surplus of important commodities; Study of price behavior over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, Cooperative marketing society, etc to study their organization and functioning; Application of principles of comparative advantage of international trade.

Theory Schedule

1. Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing.
2. Market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets.
3. Demand and supply of agri-commodities: meaning, nature and determinants of demand and supply of farm products.
4. Approaches to the study of marketing: Market functionaries and Market forces.
7. Exchange functions – buying and selling; physical functions – storage, transport and processing.
11. Market structure and Price determination under perfect and imperfect competition.
12. Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC.
14. Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits and demerits.
15. Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products.
16. Integration overspace, time and form: Meaning, definition and types of market integration.

17. Mid-Semester Examination
18. Marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing reasons for higher marketing costs of farm commodities; ways of reducing marketing costs.
19. Role of Government in agricultural marketing - Modern marketing systems versus traditional agricultural marketing systems.
20. Public sector institutions- CWC, SWC, FCI, and DMI – their objectives and functions.
21. Co-operative marketing in India.
22. Advantages of AEZs, ITPO, Export Promotion Councils, APEDA, MPEDA, and Commodity Boards.
23. International Trade: Concept of International Trade and its need - Free trade, Autarky and it needs.
24. Theories of Trade: Absolute and comparative advantage;
25. Present status and prospects of Agricultural exports / imports from India and their share.
27. Terms of Trade - Role of institutions like UNCTAD and GATT - WTO in promoting trade in agricultural products - Free Trade Agreements.
29. Agricultural Prices: Meaning and functions of price; administered prices; need for agricultural price policy; Objectives of Price Policy and Price Stabilization – Role of CACP – Concept of MSP, FRP (SMP) and SAP.
30. Price Parity - Procurement of food grains and buffer stock.
31. Risk in marketing: Meaning and Importance - Types of risk in marketing. Role of Contract Farming in risk mitigation.
32. Speculation and Hedging and Forward and Futures trading: an overview of futures trading.
**Practical Schedule**

1. Preparation of farm survey schedule
2. Visit to a farm to collect information on marketing practices of agricultural commodities and marketing problems.
3. Computation of marketable and marketed surplus of important commodities.
4. Visit to a local market / weekly *shandy* / farmers’ market to study various marketing functions performed by different agencies.
5. Identification of marketing channels for selected commodity.
6. Marketing costs, margins; price spread estimation for major agricultural and allied agricultural products.
7. Estimation of marketing efficiency and market integration.
8. Visit to market committee and regulated market to study their organization and functioning.
9. Visit to co-operative marketing society to study its organization and functioning.
10. Visit to Food Corporation of India (FCI)
11. Visit to market institutions – SWC / CWC to study their organization and functioning.
12. Visit to AGMARK Laboratory / Grading institutions.
13. Visit to NAFED
14. Visit to Commodity Boards / AEZ / Export oriented units.
15. Construction of Index Numbers and their uses.
16. Application of principles of comparative advantage of international trade.
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)
AEG 202 SOIL AND WATER CONSERVATION ENGINEERING (1+1)

Outcomes:

- In-depth understanding about surveying and leveling of soil, soil erosion, water and wind erosion.
- Understanding about soil conservation and water harvesting.

Theory:

UNIT I: Surveying and Leveling

UNIT II: Soil Erosion

UNIT III: Water Erosion

UNIT IV: Wind Erosion

UNIT V: Soil Conservation and Water Harvesting
Introduction to soil and water conservation - contour bund, graded bund and bench terracing. Grassed water ways and their design. Water harvesting - importance and techniques water harvesting structures - farm ponds and percolation ponds - lining of ponds, tanks and canal system.

Practical:
Lecture Schedule:

1. Surveying - uses of surveying - classification of surveying - measurement of distance - chain - types of chain
2. Chain surveying, cross staff surveying, compass surveying and plane table surveying - computation of angles - WCB - QB - RB - FB and BB.
3. Levelling - types of leveling - dumpy level - setting.
6. Factors affecting soil erosion - soil loss estimation - soil loss measurement techniques - multi slot device - empirical equation - USLE.
8. Types of water erosion - splash, sheet, rill, gully erosion, ravine landslides.
9. MID SEMESTER EXAM
13. Biological control measures of wind erosion - contour cultivation, strip cropping - types of strip cropping.
15. Introduction to soil and water conservation - contour bund, graded bund and bench terracing. Grassed water ways and their design.
16. Water harvesting - importance and techniques - Water harvesting structures - farm ponds, percolation pond - lining of ponds, tanks and canal system.

Practical Schedule:

1. Study of survey instruments
2. Study of leveling instruments.
3. Chains and cross staff surveying - linear measurement - plotting and finding areas.
5. Determination of difference in elevation by using dumpy level.
6. General status of soil conservation in India.
7. Calculation of erosion index.
8. Estimation of soil loss by Universal Soil Loss Equation
9. Measurement soil loss by multi slot device
11. Preparation of contour maps.
12. Design of contour bund.
15. Design of bench terracing system.
16. Visit to soil and water conservation areas.
17. **FINAL PRACTICAL EXAMINATION.**

**References:**
2. Ghanshyam Das., 2012. Hydrology and Soil Conservation Engineering,

**AGR 202 CROP PRODUCTION TECHNOLOGY – I (KARIF CROPS) (2+1)**

**Outcomes:**
- In-depth understanding about origin, distribution, economic importance, soil and climate requirements of cereals and millets, pulses, oilseeds. Green manure and fibre crops.
- Understanding production technology and cultural practices of cereals, millets, pulses and oilseeds etc.

**Theory :**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of

**Unit I: Cereals and Millets**
- Rice and Maize - Sorghum, Pearl millet, Finger millet and minor millets (Foxtail millet, Little millet, Kodo millet, Common millet and Barnyard millet)

**Unit II: Pulses**
- Redgram, Blackgram, Greengram, Horse gram and Cowpea.

**Unit III: Oilseeds and Green Manure crops**
- Groundnut, Sesame, Soybean, Castor and Niger
- Daincha, *Sesbania rostrata*, sunhemp, tephrosia
Unit IV: Fibre and Narcotic crops
   Cotton, jute, Mesta, Sunhemp and Tobacco

Unit V: Tuber and Forage crops
   Tapioca, Fodder maize, Fodder sorghum, Fodder pearl millet, Fodder cowpea, Fodder cluster bean and Bajra-Napier Hybrid grass

Practical:
   Rice nursery preparation, transplanting of rice, sowing of soybean, pigeonpea and mungbean, maize, groundnut and cotton, effect of seed size on germination and seedling vigour of *kharif* season crops, effect of sowing depth on germination of *kharif* crops, identification of weeds in *kharif* season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of *kharif* season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of *kharif* season crops, visit to research centres of related crops.

Lecture Schedule:
1. Importance, area, production and productivity of cereals and millets in world, India and Puducherry
3. Rice - Important Varieties and hybrids, Transgenic Rice
4. Rice - Systems of rice cultivation, System of Rice Intensification
6. Maize - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
7. Sorghum - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
8. Pearl millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
9. Finger millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
10. Minor millets - Foxtail millet, little millet, Kodo millet, Common millet and barnyard millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
11. Importance, area, production and productivity of pulses in world, India and Puducherry. Reasons for low productivity of pulses in India and Techniques to improve productivity
12. Pigeonpea - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
13. Blackgram and Greengram Cowpea - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield, Agronomy of rice fallow pulses.
14. Horse gram and Cowpea - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
15. Importance, area, production and productivity of oilseeds in world, India and Puducherry. Reasons for low productivity of oilseeds in India and Techniques to improve productivity
16. Groundnut - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
17. **MID SEMESTER EXAMINATION**
18. Sesame - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
19. Soybean - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
20. Castor - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield
21. Niger - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield
22. Importance of green manures, types of green manuring; GM Crops (Daincha, *Sesbania rostrata*, sunhemp, tephrosia) - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield
23. Cotton - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
24. Jute - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
25. Mesta and sunhemp - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
26. Tobacco - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices, curing and yield.
27. Importance of forage crops in Indian agriculture.
28. Tapioca - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices, curing and yield.
29. Fodder maize and fodder sorghum - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
30. Fodder pearl millet, fodder cowpea and fodder cluster bean - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
31. Bajra-Napier - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
32. Forage preservation techniques

**Practical Schedule:**
1. Identification of seeds of *kharif* crops
2. Acquiring skill in different seed treatment techniques for *kharif* crops.
3. Practicing various nursery types and main field preparation for rice.
4. Layout and raising of crop cafeteria
5. Acquiring skill in nursery preparation and sowing of important millets.
6. Acquiring skill in main field preparation, manuring and sowing/transplanting of *kharif* crops.
7. Calculation of seed rate and plant population per unit area of *kharif* crops.
8. Acquiring skill in after cultivation practices of cereals, millets and pulses.
9. Acquiring skill in after cultivation practices of oilseeds, fibre and forage.
11. Study of yield parameters and yield estimation in *kharif* crops.
12. Acquiring skill in harvesting of *kharif* crops
13. Working out cost and returns of *kharif* crops.
14. Study of crop varieties and important agronomic experiments at experimental farm
15. Visit to farmers field / experimental farm to acquire skill in mechanisation.
16. Visit to nearby Forage farm / Agricultural Research Station / Farmer’s field.
17. **PRACTICAL EXAMINATION.**

**References:**


**AGR 203   FARMING SYSTEM AND SUSTAINABLE AGRICULTURE (1 + 0)**

**Outcomes:**

- Understanding the concepts, principles of cropping system, farming systems and sustainable farming practices.
- Understanding Integrated Farming System and resource management in IFS.

**Theory**

**Unit I: Cropping system**

  Cropping systems - Definition - Principles - Concepts - Classification – mono cropping – intensive cropping - cropping systems of India and Tamil Nadu - Interaction between different
cropping systems – Cropping system management – Resource management – land, nutrient, water and weed - Indices for evaluation of cropping systems - Land use - yield advantages - Economic evaluation

**Unit II: Farming systems**

**Unit III: Sustainable farming practices**
Sustainable farming – Definition, Concept and practices. Sustainable Farming methods – Bio-dynamic farming, Permaculture, Organic Farming, IFS, LEISA etc.

**Unit IV: IFS**
Farming systems models- Definition - Principles - Concepts - Scope and advantages of Integrated Farming system – Study of models of Integrated Farming System-Wetland- Garden land- Dryland-various components of IFS. Study of different units: dairy, goat, poultry, fishery. Mushroom, sericulture and biogas

**Unit V: Resource management in IFS**

**Lecture Schedule**
1. Cropping systems - Definition - Principles - Concepts
2. Classification – mono cropping – intensive cropping - cropping systems of India and Tamil Nadu
3. Cropping system management – Resource management
4. Indices for evaluation of cropping systems and Land use
5. Indices for evaluation of yield advantages - Economic evaluation
6. Farming systems - Definition - Principles - Concepts
7. Enterprises selection and management - interaction between different enterprises
8. Scope, advantages and evaluation indicators of Integrated Farming system
9. **MID-SEMESTER EXAMINATION**
10. Integrated farming system models for different agro eco-systems and resource recycling
11. Study of models of Integrated Farming System -Wetland- Garden land- Dryland-various components of IFS. Study of different units: dairy, goat, poultry, fishery. Mushroom, sericulture and biogas
12. Non-monetary inputs and low-cost technologies - Labour management
13. Conservation agriculture – principles, concept and scope
14. Sustainable farming – Definition, Concept and practices
15. Bio-dynamic farming, Permaculture, Organic Farming, IFS, LEISA
16. Good Agriculture practices

References

AGR 204 GEOINFORMATICS, NANO-TECHNOLOGY AND PRECISION FARMING (1+1)

Outcomes:
- Understanding Precision Agriculture, GIS, Remote sensing and GPS
- Understanding Nanotechnology concepts and Applications of nanotechnology

Theory:
Unit I : Precision Agriculture
Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture.

Unit II: GIS
Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS;

Unit III: Remote sensing and GPS
Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture.

Unit IV: Nanotechnology concepts
Nanotechnology, definition, concepts and techniques, synthesis of nanomaterials - brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors.
**Unit V: Applications of nanotechnology**

Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity. Energy, Environment, Health and Nanotoxicology

**Practical:**


**Lecture Schedule:**

1. Precision agriculture - introduction, scope, concepts and techniques, components and its implications, issues, role and concerns in Indian agriculture.
2. Geo informatics - definitions and terminology, concepts,
4. Crop discrimination and yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies.
5. IS -components of GIS, Spatial data and their management, Graphic representation of data, Vector / Raster - models-digitization.
6. Remote sensing - concepts - applications in agriculture; Images - sensor systems, satellites, types - NOAA satellites, GOES satellites, INSAT, IRS, SEASAT, OCEANSAT-1, IKONOS
   Image processing and interpretation
8. Crop simulation models - Application of modelling in agriculture - crop yield models, growth models
9. **MID-SEMESTER EXAMINATION**
10. Soil fertility management - Soil Test crop response (STCR) studies - Integration of Remote sensing and GIS - need for integration-applications.
12. Nanoparticles, nano materials, nano structures – their properties
14. Nano technology in agriculture – nano fertilizers, nano pesticides, soil binders, nano sensors
15. Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.
16. Nanotechnological applications in energy, environment, health sciences and nanotoxicology

**Practical Schedule:**
1. Introduction to GIS software, spatial data creation and editing.
2. Introduction to image processing software. Visual and digital interpretation of remote sensing images.
4. Supervised and unsupervised classification and acreage estimation.
5. Multispectral remote sensing for soil mapping.
6. Creation of thematic layers of soil fertility based on GIS.
7. Creation of productivity and management zones using GIS.
8. Fertilizers recommendations based on VRT and STCR techniques.
10. Use of GPS for agricultural survey.
11. Synthesis of nanoparticles by chemical reduction.
13. Application of nanoparticles for seed treatment and as.
15. Visit to nanotechnology lab.
17. **PRACTICAL EXAMINATION**

**References:**
Out comes:

- In depth understanding of basic and applied aspects of Plant tissue culture
- Understanding recombinant DNA technology and Genetic Transformation, Molecular Marker technology 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 - secondary metabolite production- invitro germplasm conservation

Unit III: Basic Molecular Biology


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- Molecular analysis of transgenic plants – Transgenesis, Cisgenesis, Epigenesis and Genome editing- 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-principles, methods and applications of Marker Assisted Selection in crop improvement- Omics technology - Applications of Plant Genomics and genome databases.
Practicals

Biotech Laboratory organization, safety regulations – basics of reagents and solution preparation- Plant tissue culture media preparation- shoot tip culture (rose) - Meristem culture (tapioca)- Micro propagation 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 field

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
5. Anther and pollen culture (doubled haploids), ovule and embryo culture, In vitro fertilization
6. Micropropagation - banana and ornamental plants
7. Meristem tip culture (virus free plants)
8. National certification and Quality management of TC plants
9. Protoplast isolation and fusion
10. Somatic embryogenesis - synthetic seeds, Secondary metabolite production, invitro germplasm conservation
11. Genome organization- prokaryotes vs eukaryotes
12. Central dogma of life - Structure of nucleic acids
13. DNA replication- Mechanism
14. Transcription and Post transcriptional processing - RNA splicing
15. Translation - genetic codes and protein synthesis
16. Concept and structure of a gene- classical and modern concept, Regulation of gene expression, Operon concept
17. Mid semester Examination
18. Blotting techniques and Polymerase chain reaction
19. DNA sequencing methods
20. DNA manipulation enzymes: Polymerases, restriction endonucleases and ligases
21. Different types of vectors: plasmids, phagemids, cosmids, BAC
22. Construction of recombinant DNA molecules- Bacterial transformation
23. Direct and indirect gene transfer methods in plants: microinjection, electroporation, particle bombardment, Agrobacterium mediated method
24. Tissue specific promoters, selectable and scorable markers, reporter genes, Molecular analysis of transgenic plants, Tranogenesis, Cisgenesis, Epigenesis and Genome editing
25. Transgenic plants: herbicide, pest and disease resistant, abiotic stress resistant,
26. Transgenic plants: nutritional enhancement and traits for improved quality
27. Detection of GMOs – regulations and biosafety.
28. DNA markers - hybridization based markers (RFLP) - PCR based markers: RAPD, SSR, AFLP, and SNPs
29. DNA fingerprinting of crop varieties
30. Development of mapping populations, Linkage and QTL analysis
31. Principles, methods and applications of Marker Assisted Selection in crop improvement
32. Omics technology and Applications of Plant Genomics and genome databases, Bioinformatics

**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**

5. Dubey, R. C. 2014. A textbook of Biotechnology. 5\textsuperscript{th} revised Edn. S. Chand Publications. New Delhi

E- Reference

HOR 212 PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS, MEDICINAL AND AROMATIC PLANTS AND LANDSCAPING

Out comes:
• In depth understanding of Scope and importance of ornamental crops, medicinal and aromatic plants and landscaping, Production technology of important cut flowers and loose flowers and Production technology of medicinal crops.

• Understanding of Production technology of aromatic crops and Postharvest technology of ornamental crops, medicinal and aromatic plants

Theory
Unit -I: Scope and importance of ornamental crops, medicinal and aromatic plants and landscaping
Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers.

Unit -II: Production technology of important cut flowers and loose flowers

Unit -III: Production technology of medicinal crops
Unit -IV: Production technology of aromatic crops


Unit-V: Postharvest technology of ornamental crops, medicinal and aromatic plants

Processing and value addition in ornamental crops, medicinal and aromatic plants produce.

Practical


Lecture Schedule:

1. Importance and scope of ornamental crops and landscaping - Landscape uses of trees, shrubs and climbers.


9. MID SEMESTER EXAMINATION


Practical schedule
1. Identification of ornamental plants.
2. Identification of Medicinal and Aromatic Plants.
3. Nursery bed preparation and flower seed sowing.
4. Training and pruning of roses.
5. Planning and layout of ornamental garden.
7. Protected structures – Care and maintenance.
8. Intercultural operations in flowers crops.
9. Intercultural operations in Medicinal and Aromatic plants.
11. Floral preservatives to prolong vase-life of cut flowers.
13. Processing of Medicinal and Aromatic Plants.
15. Visit to commercial flower unit.
16. Visit to commercial medicinal and aromatic plants unit.

17. **PRACTICAL EXAMINATION**

**References**


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**PAT 201**  
**Principles of Integrated Disease Management**  
(1+1)

**Outcomes:**
- In-depth understanding of importance of IPM, Surveillance, detection and diagnosis of pest and diseases
- Understanding the Principles, tools and module of IPM

**THEORY**

**Unit I: Importance of IPM**
- Categories of diseases - Economic importance of diseases - Pest risk analysis - Epidemiology - Role of weather factors in disease development

**Unit II: Surveillance, detection and diagnosis of pest and diseases**
- Disease surveillance and assessment - Forecasting of diseases - Calculation and dynamics of economic injury level - Detection and diagnosis of diseases - Seed health tests - Chemodiagnosis - Serodiagnosis - ELISA - PCR - Nucleic acid hybridization techniques for detecting plant pathogens
Unit III: Principles and tools of IPM

Host plant resistance – Types of resistance - Mechanism of resistance and resistant varieties - Cultural practices - Ecological management of crop environment - Mechanical, physical practices in disease management - Plant quarantine - Phytosanitary certificate - Quarantine in India - Exotic diseases introduced into India

Unit IV: Principles and tools of IPM

Chemical control of diseases – Pesticides - Different group of fungicides and antibiotics for disease management - Biological control of pest and diseases - Biopesticides and Antiviral principles - Method of application - Safety issues in pesticide uses

Unit V: IM module for Insect pest and disease

Development and validation of IPM modules for rice, groundnut, cotton, sugarcane, brinjal, bhendi, coconut and banana - Political, social and legal implication of IPM - Case histories of important IPM programmes - Implementation and impact of IPM module

PRACTICAL

Methods of diagnosis and detection of various plant diseases - Methods of plant disease measurement - Assessment of crop yield losses and calculations based on economics of IDM - Major group of fungicides and antibiotics - Preparation of Bordeaux mixture and Bordeaux paste - calculation of spray fluid - Methods of application of fungicides - Special methods of application of fungicides - Botanicals in plant disease management - Identification of biocontrol agents - Mass multiplication of Trichoderma, Pseudomonas, Bacillus - Pre-immunization techniques in crop disease management - Plan and assess preventive strategies (IDM module) and decision making - IDM practices for soil borne, seed borne, air borne and vector borne diseases - Crop monitoring attacked by diseases - Awareness campaign at farmers’ fields - Visit to commercial biocontrol production unit /seed testing laboratories

Theoretical schedule – Plant diseases

1. Epidemiology – Role of weather factors in plant disease development - Boom and bust cycle in disease outbreak
2. Disease surveillance, assessment and forecasting of plant diseases
3. Diagnosis of plant diseases - Seed health tests, Chemodiagnosis - Serodiagnosis - ELISA - PCR - Nucleic acid hybridization techniques
4. Principles of crop disease management - Avoidance – Exclusion - Plant quarantine – domestic, international and embargo - Phytosanitary certificate - Quarantine in India. Post entry quarantine in India - Exotic diseases introduced into India
5. Principles of crop disease management - Eradication - Different methods of eradication of plant diseases
6. Principles of crop disease management - Protection - Physical and chemical methods - Fungicides - Ideal characters - Formulations - Safety measures to be followed while handling fungicides
7. Contact Fungicides - Sulphur fungicides, copper fungicides, mercury fungicides, heterocyclic nitrogen compounds, organo tin, quinone, benzene and miscellaneous compounds - classification and uses

8. Mid semester examination

9. Systemic fungicides including antibiotics - classification and uses

10. Methods of application of fungicides - Seed treatment, foliar spray, soil drenching and special methods of application - Compatibility and Phytotoxicity of fungicides

11. Biological control - Definition - Mechanism of action - Mass production - Methods of application

12. Botanicals in plant disease management - Antiviral principles - Preparation - Methods of application

13. Host plant resistance - Mechanisms of resistance - Cross protection

14. Resistant varieties - Biotechnological approaches - Tissue culture techniques - Meristem tip culture, somoclonal variation and transgenic plant production by genetic engineering.

15. IDM module for rice, groundnut, cotton and sugarcane

16. IDM module for brinjal, bhendi, coconut and banana

Practical Schedule

1. Diagnosis of plant diseases
2. Seed health testing methods
3. Survey and assessment of important plant diseases
4. Chemicals in plant disease management – Major group of fungicides and antibiotics
5. Preparation of Bordeaux mixture and Bordeaux paste
6. Calculation of spray fluid
7. Methods of application of fungicides
8. Special methods of application of fungicides
9. Botanicals in plant disease management
10. Mass production and methods of application of Trichoderma viride
11. Mass production and methods of application Pseudomonas fluorescens
12. Mass production and methods of application of Bacillus subtilis
13. Pre-immunization techniques in crop disease management
14. IDM practices for soil borne, seed borne, air borne and vector borne diseases
15. IDM awareness campaign at farmers fields.
16. Visit to commercial biocontrol production unit /seed testing laboratories

Reference Books

e- Books


PJN 201 Educational Tour – I (State) (0+1)

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 short tour during third semester for seven days covering KVK’s, Research stations, Sister campuses and ICAR institutes in the southern part of Tamil Nadu & Puducherry. The study tour will provide an exposure to the students to know about the soil, climatic conditions and cropping patterns in the respective agro-climatic zones. The students will also have first-hand information on latest technologies on various crops and allied activities.

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### SEMESTER V

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<td>Elective Course-2</td>
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**TOTAL 15+10=25**

# Team teaching
AEC 301    Intellectual Property Rights    1+0

Outcomes:

- Understanding the meaning of intellectual property and brief introduction to GATT, WTO, TRIPS and WIPO, IPR protection and covering in India.

Theory

Unit 1: Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPS and WIPO, Treaties for IPR protection: Madrid Protocol, Berne Convention, Budapest Treaty, etc.

Unit 2: Types of IP and legislations covering IPR in India: Patents, copy rights, trademark, industrial design, geographical indication, integrated circuits and trade secrets.


Unit 4: Origin, history including a brief introduction to UPOV for protection of plant varieties, protection of plant varieties under UPOV and PPV & FR Act of India, Plant Breeders rights, registration of plant varieties under PPV & FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge - meaning and rights of TK holders.

Unit 5: Convention on Biological Diversity, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Lecture Schedule

2. Introduction to GATT, WTO, TRIPS and WIPO - role and importance
3. Treaties for IPR protection: Madrid Protocol, Berne Convention, Budapest Treaty, etc.
4. Types of IP and legislations covering IPR in India.
5. Patents, copy rights, trademark, industrial design,
9. Mid semester Examination.
11. Origin, history including a brief introduction to UPOV.
12. Protection of plant varieties under UPOV and PPV & FR Act of India.
14. Traditional knowledge - meaning and rights of TK holders and IPR.
15. Convention on Biological Diversity, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA),
16. Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.
17. Research collaborations in agriculture and role of IPR in protecting public institute inventions.

Note: Lecture No. 1 to 10 (Unit 1, 2 & 3) to be handled by Agricultural Economics Department and from 11 to 17 (Unit 4 & 5) to be handled by Genetics and Plant Breeding Department. The course may be numbered as UGS as team teaching one.

Books, Acts and suggested readings:
5. Erbisch FH and Maredia k . 1998 Intellectual Properties in Agricultural Biotechnology. CABI
Outcomes:
- In-depth understanding of Energy contribution in agricultural sector, biomass utilization and importance of biofuels
- Understanding production and application of biogas, Solar and Wind energy

Theory:
Unit I: Energy scenario
Energy - energy unit conversion - energy crisis - Indian energy scenario - classification of energy sources - contribution of these sources in agricultural sector - significance - potential and achievements in India.

Unit II: Biomass and biofuels

Unit III: Biogas

Unit IV: Solar Energy

Unit V: Wind energy
Introduction to wind energy and their application - Wind mills - types - components - working principles - applications, advantages and disadvantages of wind mill.
Practical:
Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

Lecture schedule:
1. Energy - energy unit conversion - energy crisis - Indian energy scenario - classification of energy sources
2. Contribution of energy sources in agricultural sector - significance - potential and achievements in India
4. Biochemical conversion methods - fermentation and anaerobic digestion - bioalcohol - principle of production of bio ethanol from wood and sugar subtracts - effect of different parameters on ethanol production - application in agriculture
8. Biogas plant - types of biogas plant - KVIC - Janata - Deenbandhu model biogas plant - construction and working principles - application of biogas - Boidigased slurry

9. MID SEMESTER EXAMINATION
15. Wind energy - Energy available in wind - WECS - components of WECS - wind power transmission - controls - applications.
Practical schedule:

1. Study of basic principles of working of renewable energy gadgets
2. Study of production process of biodiesel.
4. Study of working principle of KVIC biogas plant.
5. Study of working principle of deenbandhu biogas plant.
6. Study of different types of agro residue gasifier.
7. Study of different types of briquetting machines.
8. Study of different solar energy gadgets.
10. Study of solar cookers.
11. Study of distillation.
12. Study of solar pond
15. Study of solar PV system - solar water pumping
16. Study of different types of wind mills.

17. FINAL PRACTICAL EXAMINATION

References:


AEN 301 PESTS OF CROPS AND STORED GRAINS AND THEIR MANAGEMENT (2+1)

Outcomes:

- In-depth understanding Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of rice, grams, cotton and sugarcane, green manures.
- Understanding Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of fruits, vegetables, flowers, Coconut, Tea, Coffee, spices products and Curry leaf stored products.
- Understanding agricultural importance and management of Rodent, birds and Locusts
Theory

**Unit-I:** Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of rice, wheat, maize, sorghum, cumbu, ragi, tenai, redgram, green gram, black gram, bengal gram, cowpea, groundnut, castor, gingelly, sunflower, safflower, jatropa, soybean and mustard.

**Unit-II:** Distribution, bionomics, symptoms of damage and management strategies of insects and non-insect pests of cotton and sugarcane, green manures (Sunnhemp, Sesbania, Daincha, Glyricidia), forage crops (Lucerne and Subabul)

**Unit-III:** Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Brinjal, Bhendi, Tomato, Chillies, Onion, Garlic, Moringa, Amaranthus, Crucifers, Cucurbits, Mango, Citrus, Banana, Guava, Grapevine and Sapota

**Unit-IV:** Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Pomegranate, Papaya, Aonla, Apple, Pine apple, Custard apple and Jack, Potato, Sweet potato, Tapioca, Yam, Colocasia, Coconut, Areca nut, Tea, Coffee, Cashew, Cocoa, Betelvine, Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind

**Unit -V:** Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Glory lily, Coleus, Stonebreaker, Aswagantha, Senna, Periwinkle and Lawn. Distribution, bionomics, symptoms of damage and management strategies of pests of and stored products. Rodents and birds of agricultural importance and their management. Locusts and their management.

Practical

Identification of symptoms of damage and life stages of important pests of different field crops *vi.* cereals, millets, pulses, oilseeds, cotton, sugarcane and green manure crops and horticultural crops *viz.* vegetables, fruits, spices, tubers, plantation crops, flower crops, medicinal plants, lawn and stored products.

**Lecture schedule:**

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of

1. Rice – Sucking pests
2. Rice – Borers and defoliators
3. Maize, sorghum and cumbu
4. Wheat, ragi and tenai
5. Redgram, bengalgram, blackgram, greengram and cowpea
6. Groundnut, gingelly and sunflower
7. Castor, soybean, safflower, jatropha and mustard
8. Cotton – Sucking pests
9. Cotton – Bollworms, borers and defoliators
10. Sugarcane
11. Green manures and forage crops - sunnhemp, sesbania, daincha, lucerne, subabul and glyricidia
12. Brinjal, bhendi and tomato
13. Chillies, onion, garlic, moringa and amaranthus
14. Crucifers
15. Cucurbits
16. Mango
17. **Mid semester**
18. Citrus and banana
19. Guava, grapevine and sapota,
20. Pomegranate, papaya and aonla
21. Apple, pine apple, custard apple and jack
22. Potato, sweet potato, tapioca
23. Coconut and arecanut
24. Tea and coffee
25. Cashew, cocoa and betelvine
26. Ginger, turmeric and coriander,
27. Cardamom, pepper, curry leaf and tamarind
28. Rose, jasmine, crossandra, chrysanthemum, tuberose and cut flowers Glory lily, coleus, stone breaker, aswagantha, senna, periwinkle and lawn
29. Role of physical, biological, mechanical and chemical factors in deterioration of grain by Stored product pests
30. Stored product pests and their management
31. Locusts and their management
32. Rodents and birds of agricultural importance and their management

**Practical schedule:** Identification of symptoms of damage and life stages of pests of

1. Pests of rice
2. Pests of maize, sorghum, cumbu, ragi and tenai
3. Pests of pulses
4. Pests of groundnut, gingelly sunflower and castor
5. Pests of cotton
6. Pests of sugarcane
7. Pests of brinjal, bhendi and tomato
8. Pests of chillies, onion, garlic, moringa and amaranthus
9. Pests of crucifers and cucurbits
10. Pests of mango, citrus, sapota, banana, grapevine and guava
11. Pests of pomegranate, aonla, papaya, jack, pine apple, custard apple, ber and apple
12. Pests of potato, sweet potato and tapioca
13. Pests of coconut, cashew, cocoa, betelvine, coffee and tea
14. Pests of turmeric, ginger, coriander, cardamom, pepper and curry leaf
15. Pests of rose, jasmine, crossandra, chrysanthemum and tuberose
16. Pests of stored products
17. Practical exam

References:

E- References:
1. http://www.ncipm.org.in
2. http://agritech.tnau.ac.in/
5. ipm.illinois.edu

AEX 301  COMMUNICATION AND PERSONALITY DEVELOPMENT (1+1)

Outcomes:

- In-depth understanding of communication and personality.
- Understanding significance of 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
13) Meenakshi Raman, Sangeeta Sharma. Technical Communication Principles and Practice
17) Hahn, "The Internet complete reference", TMH
Outcomes:

- Each student will be allotted a minimum land area of 100/200 m$^2$ and he / she will do all field operations in the allotted land from field preparation to harvest and processing.

- Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce.

- Any irrigated upland crop (maize / sorghum / pearl millet / finger millet / cotton / groundnut / sunflower / sesame / greengram / blackgram etc.).

Practical Schedule for Irrigated upland crop (e.g. Maize):

- Ecosystem - Climate and weather - Seasons and varieties of India.

- Selection of field - Main field preparation - seed treatment - Application of manures and fertilizers - Sowing - Weed management and practicing pre-emergence application of herbicides - Thinning and gap filling - Estimation of plant population - Top dressing - Weed management - Water management - Pest management - Observation on nutrient and weeds - Recording growth, yield attributes and yield

- Harvesting, threshing and cleaning the produce - Cost of cultivation and economics.

Practical schedule

1. Selection of field for ID crop cultivation
2. Acquiring skill in seed treatment practices
3. Study and practice of main field preparation for ID crop
4. Practicing of application of manures and fertilizers for ID crop
5. Practicing sowing of ID crop/ exposure to mechanized sowing
6. Acquiring skill in pre-emergence application of herbicides
7. Estimation of plant population and acquiring skill in gap filling and thinning
8. Observation on nutritional deficiency symptoms and corrective measures
9. MID-SEMESTER EXAMINATION
10. Study of weeds and weed management in ID crop/ exposure to mechanized weeder
11. Recording growth parameters and assessing dry matter production
12. Study of water management practices for ID crop
13. Observation of insect pests and diseases and their management
14. Estimation of yield and yield parameters in ID crop
15. Harvesting, threshing and cleaning of the produce/ exposure to mechanized harvesting and threshing.
16. Preparation of balance sheet including cost of cultivation and net returns per student
17. FINAL PRACTICAL EXAMINATION
References:


E-References:
www.cimmyt.org

AGR 302 CROP PRODUCTION TECHNOLOGY-II (RABI CROPS) (2+1)

Outcomes:

- In-depth understanding Origin, geographical distribution, soil and climatic requirements, varieties, cultural practices and yield of Cereals, Pulses, Oil Seeds.
- Understanding Origin, geographical distribution, soil and climatic requirements, varieties, cultural practices and yield of Sugar crops and Forage crops

Theory:
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of

Unit I: Cereals
- Wheat, Barley, Oats and Rye

Unit II: Pulses
- Chickpea, Lentil, Peas and French bean

Unit III: Oil seeds
- Rapeseed, Mustard, Sunflower, Safflower and Linseed

Unit IV: Sugar crops
- Sugarcane, Sugarbeet and sweet Sorghum

Unit V: Forage crops
- Fodder oats, guinea grass, cenchrus, berseem, lucerne, hedge lucerne and desmodium
Practical:
Sowing methods of wheat and sugarcane, identification of weeds in rabi season crops, study of morphological characteristics of rabi crops, study of yield contributing characters of rabi season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of rabi crops at experimental farms. Study of rabi forage experiments, visit to research stations of related crops.

Theory schedule:
1. Importance, area, production and productivity of rabi cereals.
2. Wheat - Origin - geographical distribution - economic importance - soil and climatic requirements – varieties
7. Importance, area, production and productivity of rabi pulses.
13. Importance, area, production and productivity of rabi oilseeds.

17. MID SEMESTER EXAMINATION


19. Importance, area, production and productivity of sugar crops in India.

20. Sugar cane - Origin – Cultivated species - geographical distribution - economic importance - soil and climatic requirements –varieties


22. Sugar cane – Seed production, SSI, Processing of cane to sugar and jiggery.

23. Sugarcane – Ratooning and ratoon crop management


26. Importance, area, production and productivity of rabi fodders.


32. Hedge lucerne and Desmodium - Origin - geographical distribution - economic importance - soil and climatic requirements –varieties - Cultural practices: Field

**Practical Schedule:**

1. Identification of seeds of *rabi* crops
2. Study of methods of sowing of *rabi* crops
3. Study of different methods of planting of Sugarcane
4. Acquiring skill on different seed treatment techniques in *rabi* crops
5. Layout and raising of crop cafeteria
6. Study of morphological characteristics of *rabi* crops
7. Identification of weeds in *rabi* crops
8. Acquiring on intercultural operations in *rabi* crops
9. Acquiring skill on top dressing and foliar application of nutrients
10. Recording of bio-metric observations of the standing *rabi* crops.
11. Study of yield contributing characters of *rabi* crops.
13. Working out economics of cultivation of *rabi* crops
14. Visit to forage production farm
15. Study of important agronomic experiments of *rabi* crops at experimental farms
16. Visit to research stations of *rabi* crops

**17. FINAL PRACTICAL EXAMINATION**

**References:**


AGR 303 RAINFED AGRICULTURE AND WATERSHED MANAGEMENT (1 + 1)

Outcomes:

- Understanding the significance and scope of Rain fed agriculture and management strategies for drought and water shed.

- In-depth understanding the principle, techniques and types of soil and water conservation, water harvesting.

Theory:

Unit I: Rain fed agriculture

Rainfed agriculture – introduction and definition –Dry farming and rainfed farming: Characteristics. Significance and scope of dry farming in India –History of rainfed agriculture and watersheds in India. Problems and prospects of rainfed agriculture in India – Soil and climatic conditions prevalent in rainfed areas.

Unit II: Drought

Drought – types, effect of water deficit on physio- morphological characteristics of the plants, Mechanism of crop adaptation under moisture deficit condition; Management strategies for drought.

Unit III: Soil and water conservation

Soil erosion – definition – losses due to erosion – types of water and wind erosion – factors affecting erosion – Agronomic measures, mechanical measures and In-situ moisture conservation measures of soil and water conservation
Unit IV: Water harvesting

Water harvesting – importance and its techniques – Water harvesting structures – Storage and recycling – Efficient utilization of water through soil and crop management practices – Management of crops in rainfed areas – Contingent crop planning for aberrant weather conditions – mid season correction.

Unit V: Water shed


Practical:

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed

Lecture Schedule:

1. Rainfed agriculture – introduction and definition – Dry farming and rainfed farming: Characteristics. Significance and scope of dry farming in India
2. History of rainfed agriculture and watersheds in India.
3. Problems and prospects of rainfed agriculture in India – climate – rainfall pattern – distribution – variabilities of rainfall
4. Soil and climatic conditions prevalent in rainfed areas.
5. Drought – definition – types of drought – effect of water deficits on physio-morphological characteristics of the plants- mechanism of crop adaptation under drought
6. Management strategies for drought – measures to reduce evapotranspiration – weeding, use of mulches, anti transpirants, windbreaks and shelterbelts
9. **MID-SEMESTER EXAMINATION**
10. Mechanical measures of soil and water conservation – gully control – bench terraces –
contour contour bunds – graded bunds
11. In-situ moisture conservation measures – bund forming – bunding, ridge and furrow
system – conservation furrows – inter plot water harvesting, mulching – Broad Bed and
Furrow (BBF) and 20evelling.
Storage and recycling
13. Efficient utilization of water through soil and crop management practices – Management
of crops in rainfed areas
14. Contingent crop planning for aberrant weather conditions – mid season correction.
15. Watershed: concept - objectives – principles and components of watershed
development programme – factors affecting watershed management.

Practical schedule:
1. Climate classification.
2. Rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of
monsoons.
3. Cropping pattern of different rainfed areas of India
4. Mapping of rainfed areas in India.
5. Interpretation of meteorological data for rainfall variability.
6. Scheduling of supplemental irrigation based on crop ET demand.
7. Critical analysis of rainfall and calculation of wet spells,dry spells and length of growing
period.
8. Calculation of effective rainfall.
9. Drought management technologies in dryland agriculture
10. Soil & moisture conservation measures.
11. Water harvesting structures
12. Characterization and delineation of model watershed
13. Cropping and farming systems in drylands.
15. Alternate land use system
16. Visit to watershed / rainfed research station.
17. FINAL PRACTICAL EXAMINATION

References:
ICAR, New Delhi.
and agro-meteorological perspective. B S publications.

E-References:
In www. Crida.
Org www. lcrisat. Org

HOR 311 PRODUCTION TECHNOLOGY OF FRUIT AND PLANTATION CROPS 1+1

Outcomes:
• In-depth understanding the importance and classification of fruit crops.
• Understanding production technology of fruit crops and plantation crops.

Theory
Unit–I: Importance and classification of fruits
Importance and scope of fruit and plantation crop industry in India – nutritional value of fruit crops - classification of fruit crops – area, production, productivity and export potential of fruit and plantation crops.

Unit–II: Production Technology of mango, banana, papaya, guava, sapota

Unit–III: Production Technology of citrus, grape, litchi, pineapple, pomegranate, jackfruit
Climate and soil requirements – varieties – propagation and use of rootstocks- planting density and systems of planting - High density and ultra high density planting - cropping systems - after care - training and pruning - water, nutrient and weed management – fertigation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest and value addition. Fruit crops: citrus, grape, litchi, pineapple, pomegranate, jackfruit.

Unit–IV: Production Technology of apple, pear, peach, strawberry, almond, walnut
Climate and soil requirements – varieties – propagation and use of rootstocks - planting density and systems of planting -High density and ultra high density planting -cropping systems - after care - training and pruning - water, nutrient and weed management – fertigation - special
horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest and value addition. Fruit crops: apple, pear, peach, strawberry, almond, walnut

**Unit-V: Production Technology of Plantation Crops**


**Practical**


**Lecture Schedule**

1. Importance and scope of fruit and plantation crop industry in India – nutritional value of fruit crops. Classification of fruit crops – area, production, productivity and export potential of fruit and plantation crops.


6. Climate and soil – varieties - propagation methods - planting and cropping systems- after care – systems of training and pruning and bud forecasting - water, nutrient and
weed management - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of Grapes.


9. **MID SEMESTER EXAMINATION**


Practical schedule

1. Propagation techniques, selection of planting material, varieties, important cultural practices for Mango
2. Propagation techniques, selection of planting material, varieties, important cultural practices for Banana
3. Propagation techniques, selection of planting material, varieties, important cultural practices for Papaya
4. Propagation techniques, selection of planting material, varieties, important cultural practices for Guava
5. Propagation techniques, selection of planting material, varieties, important cultural practices for Sapota
6. Propagation techniques, selection of planting material, varieties, important cultural practices for Grapes
7. Propagation techniques, selection of planting material, varieties, important cultural practices for Citrus (Mandarin and acid lime)
8. Propagation techniques, selection of planting material, varieties, important cultural practices for Pomegranate
9. Propagation techniques, selection of planting material, varieties, important cultural practices for Jackfruit
10. Preparation and application of PGR's for propagation
11. Micro propagation, protocol for mass multiplication and hardening of fruit crops.
14. Identification and description of varieties - nursery practices - training and pruning - pests and diseases – processing of Tea and coffee
15. Identification and description of varieties, clones - bud wood nursery practices - propagation techniques - top working – preparation of plant bio regulators and its uses- pests and diseases - processing of rubber and cashew
16. Visit to commercial orchard and plantation industries.
17. **PRACTICAL EXAMINATION**

References

Outcomes

- Understanding Etiology, symptoms, mode of spread, survival, epidemiology, management, diseases of cereals and millets, pulses and oilseeds
- Understanding Etiology, symptoms, mode of spread, survival, epidemiology, management, diseases of cash, fruit, vegetables, plantation and medicinal crops

THEORY

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of important diseases of the following crops

Unit I: Diseases of cereals and millets
Cereals: Rice and maize - Millets: Sorghum, pearl millet, finger millet and small millets

Unit II: Diseases of pulses and oilseeds
Pulses: Pigeon pea, urd bean, mung bean, cowpea, soyabean - Oilseeds: Ground nut, castor and sesame - Diseases of stored grains

Unit III: Diseases of cash crops and fruit crops
Cash crops: Tobacco, jute and mulberry - Fruit crops: Banana, guava, sapota, papaya, pomegranate, pineapple, jack fruit, aonla and ber

Unit IV: Diseases of vegetable crops
Vegetable crops: Tomato, brinjal, okra, crucifers, beans, sweet potato, carrot and beetroot - Post harvest diseases of fruits and vegetables.

Unit V: Diseases of plantation and medicinal crops
Plantation crops: Coconut, arecanut, oilpalm, vanilla, tea, coffee, rubber and cocoa - Medicinal crops: Gloriosa, coleus, stevia and aloe

PRACTICAL
Study of symptoms and host parasite relationship of rice, maize, sorghum, pearl millet, finger millet, small millets, pigeon pea, urd bean, mung bean, cowpea, soyabean, ground nut, castor, sesame, tobacco, jute, mulberry, banana, guava, sapota, papaya, pomegranate, pineapple, jack, ber, aonla, tomato, brinjal, okra, crucifers, beans, sweet potato, carrot, beetroot, coconut, arecanut, oilpalm, vanilla, tea, coffee, rubber, cocoa, gloriosa, coleus, stevia and aloe.

THEORY

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of

1. Diseases of rice
2. Diseases of maize
3. Diseases of sorghum
4. Diseases of pearl millet and finger millet
5. Diseases of small millets
6. Diseases of pigeonpea
7. Diseases of urdbean, mungbean and cowpea
8. Diseases of soybean
9. Diseases of groundnut
10. Diseases of sesame and castor
11. Diseases of stored grains and their management
12. Diseases of tobacco
13. Diseases of jute and mulberry
14. Diseases of banana
15. Diseases of guava, papaya and sapota
16. Diseases of pomegranate and pineapple
17. **Mid semester examination**
18. Diseases of jack fruit, ber and aonla
19. Diseases of crucifers
20. Diseases of tomato
21. Diseases of brinjal and okra
22. Diseases of sweet potato and beans
23. Diseases of carrot and beetroot
24. Diseases of coconut
25. Diseases of arecanut and oilpalm
26. Diseases of vanilla
27. Diseases of tea
28. Diseases of coffee
29. Diseases of rubber
30. Diseases of cocoa
31. Diseases of gloria, coleus, stevia and aloe
32. Post-harvest diseases of fruits and vegetables

**PRACTICAL**

**Study of symptoms and host-parasite relationship of:**
1. Diseases of rice
2. Diseases of maize and sorghum
3. Diseases of pearl millet, finger millet and small millets
4. Diseases of pigeonpea, urdbean, mungbean, soybean and cowpea
5. Diseases of groundnut, sesame and castor
6. Diseases of tobacco, jute and mulberry
7. Diseases of banana, papaya, pomegranate
8. Diseases of guava, sapota, pineapple, jack fruit, ber and aonla
9. Diseases of crucifers
10. Field visit/ exposure visit to fruits, vegetables and plantation crops
11. Diseases of tomato, brinjal and okra
12. Diseases of sweet potato, beans, carrot and beetroot
13. Diseases of coconut, arecanut, oilpalm and vanilla
14. Diseases of tea and coffee
15. Diseases of rubber and cocoa
16. Diseases of gloriosa, coleus, stevia and aloe
17. Final practical examination

Reference Books

e-References
1. www.plantdisease.com
2. www.apsnet.org
3. www.ipm.ucdavis.edu
4. www.nhb.gov.in
5. www.umain.edu
6. www.farmers.gov.in
7. www.nrcb.res.in
SAC 301 MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT (2+1)

Outcomes:
- In-depth understanding the history of soil fertility and plant nutrition, chemistry of soil nutrients and fertilizers.
- Understanding the importance of organic manures and nutrient managements

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

**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 fertiligation, 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 on 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.**

**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.ilri.cgiar.org/agtrweb/Documents/Library/docs/.../Module4.htm
6. www.uoa.edu.er/academics/graduate/.../courses.html -
7. www.fao.org/wairdocs/ilri/x5546e/x5546e08.htm
8. www.fao.org/wairdocs/ilri/x5546e/x5546e08.htm
9. www.uoa.edu.er/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/.../010117attrasoilmanual/010117attra.html
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<td>Practical Crop Production –II (<em>Rabi</em> crops)</td>
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AEC 302 Agricultural Finance and Co-operation (2+1)

Outcomes:
- In-depth understanding about nature and scope of Agricultural Finance, Financial Institutions and Farm Financial Analysis.
- Understanding Co-operation, Banking and Insurance.

Theory

Unit 1: Agricultural Finance – Nature and Scope:
Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Sources of credit - advantages and disadvantages - Rural indebtedness- History and Development of rural credit in India.

Unit 2: Financial Institutions:
Sources of agricultural finance: institutional and non-institutional sources and their roles, commercial banks - social control and nationalization of commercial banks – AD branches – Area approach – Priority sector lending. Micro financing including KCC, Micro finance – SHG Models, Lead Bank Scheme, RRBs, Scale of finance and unit cost. Cost of credit. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India. Recent development in agricultural credit: Rural credit policies of Government – Subsidized farm credit - Differential Interest Rate (DIR) Scheme – Loan relief measures

Unit 3: Farm Financial Analysis:
Credit analysis: 3 R’s, 7 P’s and 5 C’s of credit. Preparation of bankable projects / Farm credit proposals – Feasibility; Appraisal - Time value of money: Compounding and Discounting - Undiscounted and Discounted measures. Preparation and analysis of financial statements Balance Sheet, Income Statement and Cash Flow Statement. Basic guidelines for preparation of project reports - Bank norms – SWOT analysis.

Unit 4: Co-operation:
Agricultural Cooperation in India – Meaning, brief history of cooperative development in India - Pre and Post - Independence periods and Co-operation in different plan periods, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Cooperative credit structure: short term and long term. Agricultural Cooperation - credit, marketing, consumer and multi-purpose cooperatives, farmers’ service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED. Strength and weakness of co-operative credit system, Policies for revitalizing co-operative credit.

Unit 5: Banking and Insurance:
Negotiable Instruments: Meaning, Importance and Types - Central bank: RBI – functions - Credit control – Objectives and Methods: CRR, SLR and Repo rate - Credit rationing - Dear

Practical


Theory Schedule
1. Agricultural Finance - meaning, scope and significance, credit needs and its role in Indian agriculture.
2. Agricultural credit: meaning, definition, need and classification.
3. Sources of credit - advantages and disadvantages.
4. Rural indebtedness - History and Development of rural credit in India.
5. Sources of agricultural finance: institutional and non-institutional sources - their roles.
6. Commercial banks - social control and nationalization of commercial banks.
8. RRBs, Scale of finance and unit cost. Cost of credit.
10. Role of Insurance and Credit Guarantee Corporation of India.
11. Recent developments in agricultural credit.
12. Rural credit policies of Government: Subsidized farm credit- Differential Interest Rate (DIR) Scheme– Loan relief measures
13. Credit analysis: 3 R's, 7 P's and 3C’s of credit.
14. Preparation of bankable projects / Farm credit proposals – Feasibility.
15. Appraisal: Time value of money: Compounding and Discounting - Undiscounted and Discounted measures.
17. **Mid Semester Examination**
18. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.
19. Agricultural Cooperation in India – Meaning, brief history of cooperative development in India.
20. Pre and Post - Independence periods and Co-operation in different plan periods, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.
21. Co-operating credit structure: short term and long term. Agricultural Cooperation - credit, marketing, consumer and multi-purpose cooperatives, farmers’ service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing;
22. Role of ICA, NCUI, NCDC and NAFED.
23. Strength and weakness of co-operative credit system, Policies for revitalizing co-operative credit.
26. Credit rationing - Dear money and cheap money.
27. Financial Inclusion and Exclusion: credit widening and credit deepening monetary policies.
28. Credit gap: Factors influencing credit gap.
31. Weather based crop insurance, features, determinants of compensation.

**Practical Schedule**
1. Determination of most profitable level of capital use.
2. Optimum allocation of limited amount of capital among different enterprises.
3. Analysis of progress and performance of cooperatives using published data.
4. Analysis of progress and performance of commercial banks and RRBs using published data.
5. Visit to a commercial bank, cooperative bank / cooperative society to acquire first - hand knowledge of their management, schemes and procedures.
6. Visit to District Central Co-operative Bank (DCCB) to study its role, functions and procedures for availing loan – Fixation of Scale of Finance.
7. Guest lecture on Role and functions of Commercial Bank and Lead Bank / NABARD and its Role and Functions.
8. Estimation of credit requirement of farm business – A case study.
11. Preparation and analysis of income statement – A case study.
12. Preparation of Bankable projects / Farm Credit Proposals and appraisal.
13. Undiscounted methods and Discounted methods.
15. Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.
16. Seminar on selected topics.
17. Practical Examination.

References

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

AEG 302 PROTECTED CULTIVATION AND SECONDARY AGRICULTURE (1+1)

Outcomes:
- In-depth understanding about protected cultivation, application and design of green houses.
- Understanding Engineering properties of food materials, Drying, dehydration and material handling.

Theory:

Unit I: Protected cultivation and design of green houses
Protected cultivation - need, advantages and limitations - present status. Green house technology - introduction - types of greenhouses - plant response to greenhouse environment. Planning and design of greenhouses - design criteria of green house for cooling and heating purposes - green house equipments - materials for construction of traditional and low cost green houses- irrigation systems used in greenhouses.

UNIT II: Applications of greenhouses
Typical applications - passive solar greenhouse - hot air greenhouse heating systems - greenhouse drying - cost estimation and economic analysis.

UNIT III: Engineering properties of food materials
Important engineering properties: physical, thermal, aero and hydro dynamic mechanical, frictional, rheological and optical properties of cereals, pulses and oil seeds and their application in PHT equipment design and operation.
UNIT IV: Drying and dehydration

Drying and dehydration, moisture determination- direct method and indirect method of moisture determination. EMC - importance of EMC - drying theory - drying rate periods- constant rate period- falling rate period - CMC. Drying methods- contact type dryers- convective type dryer- radiation dryer. Commercial grain dryer - deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer, LSU dryer and solar dryer - types of solar dryer.

UNIT V: Material handling

Material handling - material handling equipments- selection of material handling equipments. Belt conveyor- bucket elevator - screw conveyor - pneumatic conveyor - their working principle and selection - capacity - horse power - advantages and limitations.

Practical:

Study of different type of greenhouses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house.Study of greenhouse equipments. Visit to various Post Harvest Laboratories. Determination of moisture content of various grains by oven drying & infrared moisture methods.Determination of engineering properties (shape and size, bulk density and porosity of biomaterials).Determination of Moisture content of various grains by moisture meter.Field visit to seed processing plant.

Lecture schedule:

1. Introduction to protected cultivation - need, advantages and limitations and present status - green house technology - types of greenhouses
2. Plant response to greenhouse environment - sunlight, temperature, relative humidity, carbon dioxide enrichment - soil / media
3. Planning and design of greenhouses -design criteria of green house for cooling and heating purposes.
4. Green house equipments - materials for construction of traditional and low cost green houses - irrigation systems used in greenhouses.
5. Typical applications of greenhouses - passive solar greenhouse, hot air greenhouse heating system
7. Important Engineering properties of cereals, pulses and oilseeds and their application in PHT equipment design and operation.
9. **MID SEMESTER EXAMINATION.**
10. Thermal properties- specific heat - thermal conductivity- thermal diffusivity - Frictional properties - angle of repose - angle of internal friction - optical and rheological properties- application
11. Drying and dehydration - moisture measurement, direct method and indirect methods of moisture measurements.
12. EMC - importance of EMC - drying theory- drying rate periods - constant rate period, falling rate period, CMC.
13. Drying methods - contact type dryers - convective type dryer- radiation dryer - Commercial grain dryers - thin layer dryer, deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer, LSU dryer and solar dryer - types of solar dryer

Practical schedule:
1. Study of different types of greenhouses based on shape.
2. Determination of rate of air exchange in an active summer and winter cooling systems.
3. Determination of drying rate of agricultural products inside green house.
4. Study of greenhouse equipments.
5. Determination of engineering properties shape and size, bulk density and porosity of biomaterials.
6. Determination of moisture content of various grains by direct method - oven drying and infra red moisture methods.
7. Determination of moisture content of various grains by indirect method - moisture meter.
8. Performance evaluation of grain winnower
9. Performance evaluation of air screen cleaner
10. Study of fluidized bed dryer
11. Performance evaluation of tray dryer
12. Determination of capacity of a belt conveyor and its performance evaluation
13. Determination of capacity of a bucket conveyor and its performance evaluation
14. Field visit to greenhouse
15. Visit to post harvest laboratories.
16. Visit to Seed processing unit.

17. FINAL PRACTICAL EXAMINATION

References:
5. Greenhouse Engineering - Robert A. Aldrich and John W. Bartok, Jr., 1994. NRAES

**AEN 302 MANAGEMENT OF BENEFICIAL INSECTS (1+1)**

**Outcomes:**
- In-depth understanding importance of insects beneficial, biology, method of rearing, pests and diseases of honey bee and silkworm.
- Understanding Species of lac insect, morphology, biology, host plant, pollinator, weed killers and scavengers

**Theory**

**Unit I:** Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

**Unit II:** Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

**Unit- III:** Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control.

**Unit - IV:** Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

**Practical**

Theory lecture schedule:
1. Economic classification of insects and importance of beneficial insects
2. Bee species – comparison – castes of bees – bee behaviour and bee dance
4. Different types hives -Bee products- Bee enemies- predators and parasites
5. Bee diseases – bacteria, virus, fungi and protozoan
6. Equipments used in bee keeping
8. Pests and diseases of mulberry
9. **Mid semester examination**
10. Types of silkworm - Mulberry silkworm – origin – classification based on voltinism, moultinism, geographical distribution and genetic nature
11. Characters of multivoltine races, bivoltine races, cross breeds and bivoltine hybrids – double hybrids– suitability for rearing in different seasons
13. Methods of chawki and late age silkworm rearing- disinfections- pests and diseases of silkworms
14. Lac insect- biology-strains-Natural enemies of lac insect and lac products
15. Biological control – definition, parasitoids and predators and their role in pest management and mass production.
16. Biological weed control, pollinators, scavengers and soil builders

Practical schedule:
1. Identification, morphology and structural adaptations in honey bees
2. Different species of honey bees
3. Bee keeping appliances and seasonal management
4. Rearing of queen, worker and drone cell and colony organization
5. Bee enemies and diseases/ bee products
7. Pests and diseases of mulberry
8. Different species of silkworms - Chawki and late age silkworm rearing
9. Appliances and disinfection in silkworm rearing
10. Pests and diseases of mulberry silkworm
11. Lac insect - life history, hosts and culturing of lac, natural enemies and lac products
12. Identification and mass culturing of different types of parasitoids
13. Identification and mass culturing of different types of predators
14. Mass production techniques of predators and parasitoids
15. Identification of weeds, and weed killers, pollinators, scavengers and soil builders
16. Visit to research and training institutions for bee keeping, sericulture, lac insect and natural enemies

17. Practical examination

References:

E – references
4. www.silkbase.org
5. www.papilo.ab.a.u.tokyo.ac.jp
AEX 302 ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION (1+1)

Outcomes:
- Understanding the importance of Entrepreneurial process and Entrepreneurship Opportunities.
- Understanding Managerial Functions – I & II and functional area of management.

Theory

Unit I – Entrepreneur and Entrepreneurial process
Concept and Types of Entrepreneurship - Importance of Entrepreneurship, Characteristics of Entrepreneurs and Entrepreneurial Skills - Entrepreneurial process.

Unit II – Entrepreneurship Opportunities
Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness/Agrienterprises, Entrepreneurial Development Process, Opportunities for agri-entrepreneurship and rural enterprise, SWOT Analysis.

Unit III – Managerial Functions – I
Planning, managing and setting up of an enterprise – Financing for enterprise: Venture capital, contract farming, Joint venture, PPP. Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation)

Unit IV – Managerial Functions – II
Business Leadership Skills (Communication, direction and achievement motivation), problem solving skill.

Unit V – Functional Areas of Management

Lecture Schedule
1. Concept of Entrepreneurship and Types of Entrepreneurship
2. Characteristics of Entrepreneurs and Entrepreneurial Skills
3. Entrepreneurial process – Importance of Entrepreneurship
4. Government policy and programs and institutions for entrepreneurship development.
5. Impact of economic reforms on Agribusiness/Agri-enterprises.
6. Opportunities for agri-entrepreneurship and rural enterprise, SWOT Analysis
7. Entrepreneurial Development Process, Planning, managing and setting up of an enterprise.
8. Financing for enterprise: Venture capital, contract farming, Joint venture, PPP.
9. Mid Semester
10. Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation)
11. Business Leadership Skills (Communication, direction)
12. Motivation, hypothesis behind motivation, entrepreneurial motivation training.
15. Supply Chain Management – Importance, Drivers and flows and Total Quality Management – Meaning and Principles
16. Project Planning Formulation and report preparation

Practical
Assessing entrepreneurial traits, practicing business communication, problem solving skills, managerial skills and achievement motivation, exercise in creativity, time audit through planning, monitoring and supervision, identification and selection of business idea, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

Practical Schedule
1. Assessment of entrepreneurial traits
2. Practicing business communication
3. Understanding about Problem solving skills through case analysis - I
4. Understanding about Problem solving skills through case analysis - II
5. Discussion and Understanding achievement motivation by case analysis
6. Exercise in creativity
7. Understanding Time audit through planning by case analysis.
8. Visit to entrepreneurship development institutes
9. Visit to firms / discussion with entrepreneurs
10. Exercise on SWOT Analysis of Agribusiness enterprises in India - I
11. Exercise on SWOT Analysis of Agribusiness enterprises in India - II
12. Identification of new business opportunities.
13. Preparation of business plan and proposal writing - I
14. Preparation of business plan and proposal writing - II
15. Presentation and evaluation of the business plan - I
16. Presentation and evaluation of the business plan - II
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/

AGR 304 PRACTICAL CROP PRODUCTION – II (RABI CROPS) (0+1)

Outcomes:

• Each student will be allotted a minimum land area of 100/200 m². He / she will do all field operations in the allotted land from field preparation to harvest and processing.

• Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce.

• Rice (Transplanted or direct sown)

Transplanted rice:

• Rice ecosystems - Climate and weather - Seasons and varieties of India.
• Preparation of nursery - Application of manures to nursery - seed treatment - Forming nursery beds and sowing seeds - Weed management and plant protection to nursery.
• Harvesting, threshing, drying and cleaning the produce - Working out cost of cultivation and economics.

Practical Schedule:

1. Selection of nursery area, preparation of nursery, application of manures and fertilizer to nursery
2. Study and practice of green manuring and bio-fertilizer application in rice
3. Acquiring skill in seed treatment, seed soaking and incubation, nursery sowing and management
4. Study and practice of main field preparation and puddling operations
5. Practicing of field preparatory operations – sectioning of field bunds and plastering, leveling and basal application of fertilizers
6. Practicing transplanting techniques in lowland rice/ exposure to mechanized transplanting
7. Estimation of plant population and acquiring skill in gap filling and thinning
8. Study of weeds and weed management in rice/ exposure to mechanized weeding
9. MID-SEMESTER EXAMINATION
10. Acquiring skill in nutrient management and practicing top dressing techniques
11. Study of water management practices for lowland rice
12. Observation of insect pests and diseases and their management
13. Recording growth and other related characters of rice
14. Estimation of yield and yield parameters in rice
15. Harvesting, threshing and cleaning of the produce/ exposure to mechanized harvesting & threshing.
16. Preparation of balance sheet including cost of cultivation and net returns per student
17. FINAL PRACTICAL EXAMINATION

References:

E-References:
1. www.irri.org
2. www.crri.nic.in
3. www.drrindia.org

AGR 305 PRINCIPLES OF ORGANIC FARMING (1+1)

Outcomes:
• In-depth understanding impacts of green revolution, organic farming and nutrient management.
• Understanding principles of pest management, organic Certification, marketing, exports opportunities and ITK in organic agriculture
Theory

Unit I: Types of farming and impacts of green revolution farming
Types of farming – Impacts of green revolution farming – Fate of agro chemicals in ecosystem.

Unit II: Organic farming - Concepts and principles

Unit III: Nutrient management in organic farming

Unit IV: Pest and disease 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-inoculants - quality analysis of inputs and products - grading, packaging, post-harvest management – visit to organic farms, market outlets and organic certification centers.

Lecture Schedule
1. Farming – types of farming
2. Impacts of green revolution farming
3. Fate of agro chemicals in ecosystem.
5. Organic farming: Definition - Scope - Principles and concepts - History of organic farming
8. Soil and crop management - inter cropping, crop rotation, green manures, cover crops, mulching - bio fertilizers
9. **MID-SEMESTER EXAMINATION**
10. Principles of pest management in organic farm - Bio intensive pest and diseases management - physical, cultural, mechanical and biological methods
11. Non-chemical weed management methods: preventive, physical, cultural, mechanical and biological control measures.
12. Organic certification – NPOP guidelines
13. Certification agencies in India – crop production standards
14. Quality considerations - labeling and accreditation process - marketing and export opportunities.
15. Indigenous Technical Knowledge (ITK) in organic agriculture – Integrated farming system approach

**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**

**References**

FSN 301 PRINCIPLES OF FOOD SCIENCE AND NUTRITION 2+0

Outcomes:

- In-depth understanding classification and scope of foods, Carbohydrate, Protein and Fat, Vitamin and Mineral Nutrition
- Understanding preservation and processing of Food, requirements of Food Quality and Safety

Theory

Unit I: Principles of Food Science and Nutrition

Unit II: Carbohydrate, Protein and Fat

Unit III: Vitamin and Mineral Nutrition

Unit IV: Food Preservation and Processing
Introduction – preservation by sugar - processing of jam, squash, jelly, marmalade and beverages. Preservation by using salt, chemicals, dehydration technology, canning technology, preservation by low temperature and irradiation techniques. Processing of puffed, flaked and extruded products. Quality control of raw and processed products.
Unit V: Food Quality and Safety


Lecture Schedule
1. Food Science – definition, scope and classification, food pyramid
2. Methods, merits and demerits of moist heat, dry heat and microwave cooking of foods.
3. Importance and scope of nutrition and the relation of nutrition to health.
4. Concepts of food science (density, phase change, pH, osmosis, surface tension, colloidal system etc.)
5. Carbohydrate – classification, functions, digestion and absorption, deficiency symptoms, sources and requirements.
6. Protein – classification, functions, digestion and absorption, deficiency symptoms, sources and requirements.
7. Protein quality – supplementary value of protein.
8. Fat - classification, functions, digestion and absorption, deficiency symptoms, sources and requirements.
10. Determination of energy value of foods.
11. Fat soluble vitamins – A, D, E and K – functions, deficiency symptoms, sources and requirements.
12. Water soluble vitamins - thiamine, riboflavin, niacin, pyridoxine, folic acid, cyanacobalamin, biotin, pantothenic acid, ascorbic acid – functions, deficiency symptoms, sources and requirements.
15. Importance of water and maintenance of electrolyte balance.
16. Health benefits of fibre, requirements and sources
17. MIDSEMESTER EXAMINATION
18. Energy metabolism
19. RDA and factors affecting RDA, RDA for various age groups.
20. Assessment of Nutritional status – Anthropometric, clinical, biophysical, functional, biochemical dietary assessments and vital health statistics
21. Balanced and modified diets, menu planning
22. New trends in food science and nutrition
23. Principles and methods of food processing and preservation (use of heat and low temperature)
24. Methods of food processing and preservation (use of chemicals, drying and radiation)
25. Types of dryers
26. Preservation by using sugar (jam, jelly, squash and marmalade), preservation by using salt (brining and pickling) and use of preservatives in food preservation.
27. Production of fermented food
28. Food microbiology (Bacteria, yeast, moulds spoilage of fresh and processed food)
29. Browning reaction of fruits and vegetables.
30. Food packaging – importance, types of packaging materials and nutrition labeling.
31. Common food adulterants and their detection.

References
4. The Indian Journal of Nutrition and Dietetics
5. Journal of Food Science and Technology
6. Critical Reviews of Food Science and Nutrition
7. www.cellinteractive.com
8. www.nutrition.org.uk
10. www.myfooddiary.com

GBP 301 CROP IMPROVEMENT (2+1)

Outcomes:
- In-depth understanding the origin, distribution, conservation of species in cereals, millets, pulses, oilseeds, fibers and vegetables.
- Understanding the importance of Intellectual Property, Maintenance breeding and IPR Issues

THEORY

Unit I: Breeding Cereals
Centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds; Plant genetic resources, its utilization and conservation; Floral biology; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Ideotype concept and climate resilient crop varieties for future in the following crops.
Cereals and Millets: Rice, Wheat, Maize, Sorghum, Pearl millet and Finger millet.

**Unit II: Breeding Pulses and Oilseeds**

Centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds; Plant genetic resources, its utilization and conservation; Floral biology; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Ideotype concept and climate resilient crop varieties for future in the following crops.

**Pulses:** Red gram, Bengal gram, Green gram, Black gram, Cowpea and Soybean. **Oilseeds:** Groundnut, Sunflower, Gingelly, Castor, Rape and Mustard.

**Unit III: Breeding Cash crops and Fodder crops**

Centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds; Plant genetic resources, its utilization and conservation; Floral biology; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Ideotype concept and climate resilient crop varieties for future in the following crops.

**Fibres:** Cotton, Mesta and Jute; **Sugars and starches:** Sugarcane and Potato; **Fumitories:** Tobacco and Areca nut; **Fodder:** Guinea grass, Napier grass, Cumbu – Napier hybrids, Lucerne and *Stylosanthes*.

**Unit IV: Breeding Horticultural crops**

Centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds; Plant genetic resources, its utilization and conservation; Floral biology; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Ideotype concept and climate resilient crop varieties for future in the following crops.

**Vegetable crops:** Bhendi, Tomato, Brinjal, Chilli, Cabbage, Cauliflower, Radish, Amaranthus, Drumstick, Ridge gourd, Bottle gourd, Bitter gourd and Cucumber. **Spices and Condiments:** Onion, Garlic, Turmeric and Ginger. **Fruit crops:** Mango, Papaya, Banana and Guava. **Flower crops:** Rose and Jasmine

**Unit V: Maintenance breeding and IPR Issues**


PRACTICAL

Theory Lecture schedule
Centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds; Plant genetic resources, its utilization and conservation; Floral biology; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Ideotype- concept and climate resilient crop varieties for future in the following crops:

2. Cereals: Rice.
3. Cereals: Wheat
4. Cereals : Maize
5. Cereals: Sorghum
6. Cereals: Pearl millet and Finger millet,
7. Pulses: Red gram and Bengal gram
8. Pulses: Green gram and Black gram
9. Pulses: Soybean and Cowpea
10. Oilseeds: Groundnut and Gingelly
11. Oilseeds: Rapeseed and Mustard
12. Oilseeds: Castor and Sunflower
13. Fibres: Cotton and Jute
14. Sugars and starches: Sugarcane and Potato
15. Forrage Grasses: Guinea grass, Napier grass, Cumbu-Napier hybrids
16. Forage legumes: Lucerne and *Stylosanthes*
17. Mid Semester Examination
18. Fumitories and Narcotics: Tobacco and Areca nut
19. Vegetable crops: Bhendi and Brinjal,
20. Vegetable crops: Tomato and Chilli
21. Vegetable crops: Cabbage and Cauliflower
22. Vegetable crops: Radish and Amaranthus and Drumstick
23. Vegetable crops: Ridge gourd and Bottle gourd
24. Vegetable crops: Bitter gourd and Cucumber
25. Spices and Condiments: Onion and Garlic
26. Spices and Condiments: Turmeric and Ginger
27. Fruit crops: Mango and Papaya
28. Fruit crops: Banana and Guava
29. Flower crops: Rose and Jasmine.
30. All India Coordinated Crop Improvement Projects. Procedure for release of new variety.

**Practical schedule**
1. Rice
2. Wheat and Maize
3. Sorghum, Pearl millet and Finger millet
4. Red gram, Bengal gram, Cowpea and Soybean
5. Green gram, Black gram and Groundnut
6. Sesamum, Sunflower, Mustard and Castor
7. Cotton and Jute
8. Sugarcane and Potato
9. Guinea grass, Cumbu – Napier hybrids, Lucerne and *Stylosanthes*
10. Bhendi, Brinjal, Tomato and Chilli
11. Cabbage, Cauliflower, Radish, Amaranthus and Drumstick
12. Ridge gourd, Bottle gourd, Bitter gourd and Cucumber
13. Onion, Garlic, Turmeric and Ginger
14. Mango, Papaya, Banana and Guava
15. Rose and Jasmine
16. Visit to AICRP and Hybrid seed production plots of different field crops

**17. Final Practical Examination**

**References**

HOR 312 POST-HARVEST MANAGEMENT AND VALUE ADDITION OF 1+1
FRUITS AND VEGETABLES

Outcomes:

- In-depth understanding the principles and importance of postharvest technology and physiology of ripening in fruits and vegetables
- Understanding preservation, dehydration and canning techniques in fruits and vegetables

Theory

UNIT I - Principles and importance of postharvest technology
Importance of fruits and vegetables, extent and possible causes of post harvest losses;
Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening.

UNIT II - Post harvest handling and physiology of ripening
Respiration and factors affecting respiration rate; Role of ethylene; Post harvest disease
and disorders; Heat, chilling and freezing injury; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric).

UNIT III - Value addition and preservation
Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and nonfermented beverages.

UNIT IV – Value added products and dehydration techniques
Tomato products- Concepts and Standards; Drying/Dehydration of fruits and vegetables – Concept and methods, osmotic drying.

UNIT V – Canning technology
Canning – Concepts and Standards, Packaging of products.

PRACTICAL
Applications of different types of packaging containers for shelf life extension, Effect of temperature on shelf life and quality of produce, Demonstration of chilling and freezing injury in vegetables and fruits, Extraction and preservation of pulps and juices, Preparation of jam, Preparation of Jelly, Preparation of RTS, Preparation of Nectar, Preparation of Squash, Osmotically dried products, Fruit bar and Candy and Tomato products, Canned products, Quality evaluation of products — physico-chemical and sensory, Visit to processing unit/industry

Lecture schedule
1. Scope and Importance of post-harvest technology of fruits and vegetables - Extent and possible causes of post-harvest losses - Causes of post-harvest losses.
5. Post harvest diseases and disorders - Heat, chilling and freezing injury.
7. Storage – Methods of storage – Traditional storages (In-situ, pit storage, high altitude, clamp storage, wind breaks, cellars, barns, Night ventilation, Evaporative cool storage
ZECC) - Improved storage methods (Refrigerated storage, modified atmospheric storage, controlled atmospheric storage, hypobaric storage).


9. MID SEMESTER EXAMINATION

10. Value addition – Concept – Scope and importance of fruit preservation in India – Status of fruit preservation in India. Principles and methods of preservation – Principles of preservation – Preservation methods – High temperature, low temperature, drying, filtration, chemicals, food additives, fermentation, carbonation, antibiotics, irradiation etc.

11. Intermediate moisture foods - Jam, jelly, marmalade – Problems in Jam making important considerations and problems in Jelly making- Problems in marmalade making.


13. Fruit beverages –Fermented (Juices, Ready to serve, Nectar, cordial, Squash, crush, Syrup, Fruit Juice concentrate, Fruit Juice, Powder, Carbonated beverages) and non-fermented beverages (Wine, Champagne, Port, Sherry, Tokay, Muscat, Perry, Nira, Feni, Cider) – Preparation and preservation of unfermented fruit beverages.


**Practical Schedule**

1. Applications of different types of packaging containers for shelf life extension.
2. Effect of temperature on shelf life and quality of produce.
3. Demonstration of chilling and freezing injury in vegetables and fruits.
4. Extraction and preservation of pulps and juices.
5. Preparation of jam.
6. Preparation of jelly.
7. Preparation of RTS.
8. Preparation of nectar.
9. Preparation of squash.
11. Preparation of fruit bar and candy.
12. Preparation of tomato sauce.
13. Preparation of tomato ketchup.
15. Quality evaluation of products - (physic-chemical and sensory).
16. Visit to processing unit/ industry.
17. **PRACTICAL EXAMINATION**

**References**


**PAT 302**  
**Diseases of Field and Horticultural crops and their management-II**  
(2+1)

**Outcomes:**
- In-depth understanding the Etiology, symptoms, mode of spread, survival, epidemiology & integrated management of important diseases of Cereals, Cash and Vegetable crops.
- Understanding the Etiology, symptoms, mode of spread, survival, epidemiology & integrated management of important diseases of Plantation crops & mushroom

**Theory**

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of important diseases of the following crops

**Unit I:** Diseases of cereals, pulses and oil seed crops
- Cereals: Wheat - Pulses: Chick pea and lentil - Oil seeds - Sunflower and mustard

**Unit II:** Diseases of cash crops and fruit crops
- Cash crops: Cotton and sugarcane - Fruit crops: Mango, citrus, grapevine, apple, peach, plum and pear

**Unit III:** Diseases of vegetable and spice crops
Vegetable crops: Cucurbits, peas, potato, cassava, colacasia and yam - Post harvest diseases of fruits and vegetables - Spice crops: Chillies, ginger, turmeric, onion, garlic, coriander, cardamom

Unit IV: Diseases of plantation and flower crops

Plantation crops: Black pepper and betelvine - Flower crops: Rose, jasmine, marigold, crossandra, chrysanthemum, tube rose, carnation, lillium and orchids

Unit V: Mushroom cultivation

Importance of mushroom - Cultivation of oyster mushroom, milky mushroom, paddy straw mushroom and button mushroom – Constraints in mushroom cultivation - Post harvest technology

PRACTICAL

Study of symptoms and host parasite relationship of the important diseases of wheat, chick pea, lentil, sunflower, mustard, cotton, sugarcane, mango, citrus, grapevine, apple, peach, plum, pear, cucurbits, potato, peas, cassava, colacasia, yam, chillies, turmeric, ginger, onion, garlic, coriander, cardamom, black pepper, betelvine, rose, jasmine, marigold, crossandra, chrysanthemum, tube rose, carnation, lillium, orchids and cultivation of button mushroom, oyster mushroom, milky mushroom and paddy straw mushroom.

THEORY

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of

1. Diseases of wheat
2. Diseases of chickpea and lentil
3. Diseases of sunflower and mustard
4. Diseases of cotton
5. Diseases of sugarcane
6. Diseases of mango
7. Diseases of citrus
8. Diseases of grapevine
9. Diseases of apple
10. Diseases of peach, plum and pear
11. Diseases of cucurbits
12. Diseases of potato
13. Diseases of peas
14. Diseases of cassava, colacasia and yam
15. Post-harvest diseases of fruits and vegetables
16. Diseases of chillies
17. Mid semester examination
18. Diseases of turmeric and ginger
19. Diseases of onion and garlic
20. Diseases of cardamom and coriander
21. Diseases of black pepper and betel vine
22. Diseases of rose and jasmine
23. Diseases of marigold, crossandra and chrysanthemum
24. Diseases of tube rose and carnation
25. Diseases of lillium and orchids
26. Mushroom - Medicinal and nutritional values of mushroom
27. Mushroom spawn preparation
28. Cultivation of oyster mushroom and milky mushroom
29. Cultivation of paddy straw mushroom
30. Substrates for button mushroom - Compost preparation
31. Cultivation of button mushroom
32. Constraints in mushroom cultivation and post-harvest technology

PRACTICAL
Study of symptoms and host-parasite relationship of:
1. Diseases of wheat
2. Diseases of chick pea, lentil, sunflower and mustard
3. Diseases of cotton and sugarcane
4. Diseases of mango
5. Diseases of citrus and grapevine
6. Diseases of apple, peach, plum and pear
7. Diseases of cucurbits
8. Diseases of potato and peas
9. Diseases of cassava, colacasia and yam
10. Field visit/ exposure visit to fruits, vegetables and plantation crops/mushroom unit
11. Diseases of chillies, turmeric and ginger
12. Diseases of onion and garlic
13. Diseases of coriander, cardamom, black pepper and betelvine
14. Diseases of flower crops
15. Cultivation of oyster, milky and paddy straw mushroom
16. Cultivation of button mushroom
17. Final practical examination

Reference Books

e- References
18. www.plantdisease.com
19. www.apsnet.org
20. www.ipm.ucdavis.edu
21. www.nhb.gov.in
22. www.umain.edu
23. www.farmers.gov.in
24. www.nrcb.res.in
# SEMESTER VII

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course No.</th>
<th>Course Title</th>
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<tr>
<td>1.</td>
<td>AEX 401</td>
<td>Rural Agricultural Work Experience and Agro-Industrial Attachment (RAWE&amp;AIA)</td>
<td>0+20</td>
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<td>2.</td>
<td>PJN 401</td>
<td>Educational Tour - II (All India)*</td>
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* Non-Gradial Course
AEX 401  Rural Agricultural Works Experience and Agro-Industrial Attachment (RAWE & AIA) (0+20)

Outcome:

- Ensuring and assuring employability and develop entrepreneurs among agriculture 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 RAWE & AIA 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 RAWE & AIA 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>
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<tbody>
<tr>
<td>1.</td>
<td>General orientation &amp; On campus training by different faculties</td>
<td>1</td>
<td>0+15</td>
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<tr>
<td>2.</td>
<td>Village attachment</td>
<td>10</td>
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<tr>
<td>3.</td>
<td>Attachment with Department of Agriculture /KVK/ Research Station attachment</td>
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<td>4.</td>
<td>Plant clinic / NGO attachment</td>
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<td>5.</td>
<td>Agro-Industrial Attachment</td>
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<tr>
<td>6.</td>
<td>Project Report Preparation, Presentation and Evaluation</td>
<td>1</td>
<td>0+1</td>
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<td><strong>Total weeks for RAWE &amp; AIA</strong></td>
<td><strong>20</strong></td>
<td><strong>0+20</strong></td>
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</tbody>
</table>

**Village Attachment (10 weeks)**

The following time schedule reflect the quantum/proportion of time to be spent for each of the following categories and should not be considered as distinct time frame for each of the categories.

- Orientation with farmers and survey and study of village and representative farmers – 3 weeks
- Study of rural/ agricultural development institutions/ organisations – 2 weeks
- Crop Interventions (Agronomical, Plant Protection, soil improvement, fruit and vegetable interventions, etc.) - 3 weeks
- Extension and TOT interventions – 2 weeks
**Functional Components of RAWE & AIA:**

I: Staff incharge and Responsibilities:

1. The Programme Coordinator - The programme coordinator of the RAWE & AIA 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, Industrials study etc.

2. Programme Officers: The programme officer for a 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. Identifying agro-industries/ cottage Industries include Seed/Sapling production, Pesticides-insecticides, manures production, bio agents production, Post-harvest-processing-value addition, Agri-finance, institutions providing consultancy and extension services, etc., and place the students for industrial attachment.
   e. Monitoring the field level activities of the students providing technical guidance and counseling.

**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.

**Syllabus**
- Visit to important 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.
## SEMESTER VIII

<table>
<thead>
<tr>
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## EXPERIENTIAL LEARNING PROGRAMME (ELP)

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<thead>
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<th>Sl.No.</th>
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<tr>
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<td>ELP 401</td>
<td>Commercial Beekeeping</td>
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<td>ELP 402</td>
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<td>Urban Entomology and Pest Management</td>
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<td>Production Technology for Bio-control Agents #</td>
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<td>5.</td>
<td>ELP 405</td>
<td>Organic Production Technology</td>
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<td>6.</td>
<td>ELP 406</td>
<td>Integrated Farming System</td>
<td>0+10</td>
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<td>ELP 407</td>
<td>Poultry Production Technology</td>
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<td>ELP 408</td>
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<td>Floriculture &amp; Landscape Architecture</td>
<td>0+10</td>
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<td>Molecular Breeding</td>
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<td>Plant Tissue Culture</td>
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<td>ELP 412</td>
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<td>ELP 413</td>
<td>Mushroom Cultivation Technology</td>
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<td>ELP 414</td>
<td>Bio-inoculants Production Technology</td>
<td>0+10</td>
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<td>Soil, Plant, Water, Manure and Fertilizers Testing</td>
<td>0+10</td>
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<td>ELP 416</td>
<td>Agriculture Waste Management</td>
<td>0+10</td>
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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


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

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
ELP 405  Organic Production Technology (0+10)

Outcome:

- Skill in Organic Production Technology

Objective

To enable students to gain hands-on-experience in Organic production technologies and to train the students in establishing an Organic Farming unit.

Activities

- Suitability, identification and development of Organic farming field
- Preparation of Organic farm maps with boundaries.
- Estimation of soil fertility, resources availability both on and off farm with their potential
- Maintenance of records and registers for an organic farm
- Planning of a suitable Integrated farming system model for a diversified ecosystem
- Preparation of wastes and other recycling methods
- Preparation of biological (nutrient / pest control) solutions
- Preparation of cropping system and resource budgeting
- Carrying out Certification procedures.
- Establishing organic outlet and proceeds for sale.
- Working out Production, Environmental and economic sustainability indices
- Preparation of DPR for bankable project

Deliverables

The student who completes this course will able to establish an organic farm individually and able to know the procedures for certification and commercialization.

References

Outcome:

- Hands-on-experience in commercial Integrated Farming System
- Skill in establishing a commercial IFS unit.

Objective

To enable students to gain hands-on-experience in commercial Integrated Farming System and to train the students in establishing a commercial IFS unit.

Activities

Farming systems models - Definition - Principles - Concepts - Enterprises selection and management - interaction between different enterprises - scope and advantages of Integrated Farming system - Study of models of Integrated Farming System - Wetland - Garden land - Dryland - Various components of IFS - related enterprise. Visit to different units: dairy, goat, poultry, fishery. Mushroom, sericulture and biogas - study on evaluation indicators on farming system - on farm field visit.

Deliverables

The student who completes this course will be able to establish and run integrated farm with various enterprises.

References

ELP 407 POULTRY PRODUCTION TECHNOLOGY (0+10)

Outcome:

- Skill in Commercial Poultry Production Technology

Objective:

To develop students as entrepreneurs and managers by providing hands on experience in all the aspects of poultry farming.

Activities:


References:

5. Prabakaran, R., 1998. Commercial Chicken Production. Publisher P.Saranya, 5/2, Ramalingam Street, Seven Wells, Chennai
6. Asha Rajini, 2011. R. Simply Poultry Science, Alpha Publications, NewDelhi,
Outcome:

- Skill in 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.


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

References

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:

Establishment of a molecular marker laboratory - Isolation, purification and quantification of DNA from various crops; Electrophoresis. PCR based marker assays. Genetic map construction using molecular markers; Mapping major genes. QTL mapping procedures. Marker assisted selection: types, requirements. Marker assisted backcross breeding. Case studies. PGR conservation and utilization using markers. DUS characterization and genetic purity analysis. Entrepreneurship development and project report preparation.

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

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 (emasculcation 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.
<table>
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<th>Week</th>
<th>Classes</th>
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<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>
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<tr>
<td>2.</td>
<td>Pollination behaviour - tools employed in hybrid seed production - study of morphological characters of varieties, parental lines and hybrids.</td>
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<tr>
<td>3.</td>
<td>Designing of planting ratio and border rows - Physical and genetic contaminants - Isolation distance.</td>
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<tr>
<td>5.</td>
<td>Pre sowing seed invigouration treatments - Dormancy breaking treatments - Seed priming - pelleting - polymer coating.</td>
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<tr>
<td>7.</td>
<td>Main field preparation - layout - formation of beds - transplanting - fertilizer and nutrient management.</td>
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<tr>
<td>8.</td>
<td>Weed management - Irrigation management - Special cultural practices - pest and disease management.</td>
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<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>
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<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>
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<tr>
<td>13.</td>
<td>Visit to seed processing unit and seed storage godown and learning sanitation measures</td>
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<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>
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<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>
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<tr>
<td>17.</td>
<td>Visit to seed retail shop - Seed marketing - Project preparation and submission.</td>
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</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/

ELP 414  Bio-inoculants Production Technology (0+10)

Outcomes:
• Skill in Commercial Bio-inoculants

Week Activities
1. 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.
2. Isolation, purification and characterization of nitrogenous biofertilizers – Azotobacter, Azospirillum,
3. Isolation and purification of nitrogenous biofertilizers – Rhizobium and Gluconoacetobacter.
4. Isolation, purification and characterization of phosphate solubilizing bacteria. Isolation of AM spores from soil and morphological characterization of AM spores.
5. Selection of efficient AM fungi by plant infection tests. Isolation, purification and characterization of zinc solubilizing microbes.
6. Isolation, purification and characterization of plant growth promoting bacteria - Pink Pigmented Facultative Methylotrophs (PPFM) and screening of PPFM.
7. Preparation of medium and carrier material for large scale production.
8. Mass production of Azotobacter and Rhizobium
11. Mass production of PPFM and AM fungi
12. Mass production of Azolla and BGA.
13. 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.
14. Study of plant response to biofertilizers- visit to biofertilizer inoculated fields / Biofertilizer production unit.
15. 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.,
16. Formulation and presentation of a project for production of fixed quantity of various biofertilizers.
17. Final practical examination

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
Outcomes:

- Skill in testing of Plant, Water, Manure and Fertilizers

**Week 1:**
Good laboratory practices (GLP), Do’s and Don’t’s in a soil chemical laboratory and First aid in laboratory. **Principles of analytical chemistry:** Analytical techniques, concepts of gravimetry, concepts of titrimetry (volumetric), preparation of standard solution of an acid, standardization.

**Week 2:**
**Instruments used in soil, plant, water, manure and fertilizer analysis:** Potentiometer (pH meter), Conductometer (EC bridge), Spectrophotometer, Flame photometer, Atomic Absorption, Spectrophotometer (AAS)

**Week 3:**
**Soil Analysis:** Collection and preparation of soils samples, study of soil profile, **physical properties of soil:** mechanical analysis (soil texture), International pipette method, Hydrometer method, Determination of soil texture by feel method.

**Week 4:**
**Density of soil:** Bulk density, Particle density and Pore space of soil. Soil colour, **physico chemical properties of soil:** pH, EC, Chemical properties of soil, organic matter in soil, cation exchange capacity (CEC) of soil, Determination of exchangeable Calcium, Magnesium, Sodium and Potassium in soil,

**Week 5:**
**Major nutrients in soil:** Available Nitrogen, Phosphorus and Potassium in soil. **Secondary nutrients in soil:** available sulphur in soil, **Micronutrients in soil:** Available micronutrient (Fe, Cu, Mn and Zn) cations in soil, available boron in soil.

**Week 6:**
**Problematic soils and amendments for acid soil:** Soil acidity and lime requirement, Determination of exchangeable acidity in soil, reserve acidity in soil, extractable aluminum in soil, lime requirement of acid on soil, Determination of lime content of soil.

**Week 7:**
**Problematic soils and amendments for Sodic soil:** Soil alkalinity and gypsum requirement, carbonate and bicarbonate in soil, sodium in soil, gypsum requirement of alkali soil.
**Week 8:**
**Irrigation Water Analysis:** Irrigation water sampling, Determination of pH, electrical conductivity, carbonate, bicarbonate, chloride, sulphate, calcium magnesium and sodium in irrigation water. Computation of SAR and RSC of irrigation water. Determination of boron in irrigation water.

**Week 9:**
**Plant Analysis:** Sampling handling and preparation of plant sample, Determination of Nitrogen in plant sample, Digestion of plant sample for estimation of nutrients (except nitrogen).

**Week 10:**
**Plant Analysis:** Determination of phosphorus, potassium, calcium, magnesium, sulfur and micronutrients in plant sample.

**Week 11:**

**Week 12:**
**Fertilizer Analysis:** Fertilizer sampling, Qualitative test for identification of fertilizer, Detection of adulterants in fertilizer, Estimation of ammonium nitrogen (NH$_4$ - N) in ammonium fertilizer, nitrate nitrogen (NO$_3$ -N) in nitrate fertilizer,

**Week 13:**
**Fertilizer Analysis:** amide nitrogen (NH$_2$ -N) in amide fertilizer (urea), Determination of biuret content of urea, Estimation of phosphorus in phosphatic fertilizer, Determination of potassium in potassic fertilizer.

**Week 14:**
**Fertilizer calculation and recommendation:** Fertilizer prescription calculations for important crops - Nutrient equivalent basis - Soil Test Crop Response based recommendation for targeted yields.

**Week 15:**
**Fertilizer calculation and recommendation:** Deriving the nutrient requirement using DSSIFER software for different crops (STCR), and Fertilizer prescription using DSSIFER software

**Week 16:**
Preparation of Soil Health Card, Preparation of project report.

**References**


E-References
  3. www.soiltesting.okstate.edu/
  4. www.texasplantandoillab.com/
  5. www.ulm.edu/spal/
  6. soilhealth.cals.cornell.edu/extension/.../managing_constraints.pdf
  7. cnal.cals.cornell.edu/
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:
## ELECTIVE COURSES

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<td>SAC 352</td>
<td>Agrochemicals</td>
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Outcomes:
- In-depth understanding the nature and scope of Agribusiness Management, Management functions, Human Resources, Finance and Marketing.
- Understanding the classification of agricultural projects, Types of agro-based industries, Laws and policies related to agri-business in India.

Theory

Unit I: Agribusiness and Management


Unit II: Management Functions


Unit III: Functional areas of management
Unit IV: Preparation of bankable project


Practical


Theory schedule

4. Agri-supply chain management and agri-value chain management – Forward and Backward linkages.
10. Steps in planning – Characteristics of Sound plan. Objectives – MBO
17. Leadership – Definition – Styles – Difference between leadership and management.

18. Mid-semester examination
21. Scheduling the work – controlling production in terms of quantity and quality – ISO standards – HACCP – TQM.
22. Inventory – meaning – types – inventory costs – inventory management – EOQ.
24. Marketing management: meaning, definition – market segmentation, targeting and positioning – 4Ps of marketing mix and marketing strategies.
25. Consumer buying behavior – factors influencing buying behavior – Buying decision process.
26. Sales and distribution management.
27. Pricing policy- pricing method – pricing at various stages of marketing.
29. Project appraisal and evaluation techniques – undiscounted and discounted measures.
31. Procedure to set up agro-based industries – constraints in establishing agro-based industries.
33. Preparation of project reports for various activities in agriculture and allied sectors.
34. Laws and policies related to agri-business in India.

Practical schedule
4. Visit to agro-processing unit to study retail trade, commodity trading and value addition.
5. Visit to Cooperatives to know their role in agriculture development.
7. Visit to NABARD district office.
9. Exercise on project evaluation techniques – Undiscounted measures.
10. Exercise on project evaluation techniques – Discounted measures.
11. Preparation of bankable project – I.
12. Preparation of bankable project – II.
14. Group presentation of projects – II.
15. Trend and growth rate in prices of agro-inputs.
17. Final Practical examination
References

E-References
1. www. management teacher.com
2. www.management.about.com
3. www.bized.co.uk
5. www.fma.org
6. http://www.ifmr.ac.in
AEX 251  Agricultural Journalism (2+1)

Outcomes:
- In-depth understanding the nature and scope of agricultural journalism, components of newspapers and magazines and collection of other agricultural news sources.
- Understanding how to write the agricultural stories, reporting using of photographs, artworks, graphs, charts, maps & editing and publishing.

Theory
Unit I: Introduction to Agricultural Journalism
Agricultural Journalism: The nature and scope of agricultural journalism characteristics and how agricultural journalism is similar to and different from other types of journalism, ethics of journalism.

Unit II: Components of Newspaper and Magazines
Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines.

Unit III: Collection of Information
The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources.

Unit IV: Reporting and Writing Agricultural Stories
Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions.

Unit V: Editing and Publishing
Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing, E-Journalism

Theory Schedule :
1. Journalism – Meaning, Definition, Principles
2. Origin and Types of journalism
3. Agricultural Journalism the nature and scope of agricultural journalism, characteristics
4. Similarities and differences between agricultural journalism and other types of journalism
5. Ethics of journalism
6. Characteristics of newspapers and magazines
7. Kinds and functions of newspapers and magazines
8. Types of News
9. Characteristics of newspaper and magazine readers.
10. Parts of newspapers and magazines.
11. Style and language of newspapers
12. Style and language of magazines,
13. Balancing newspaper and symmetry
14. The agricultural story: Types of agricultural stories
15. Subject matter of the agricultural story, structure of the agricultural story
16. Gathering agricultural information: Sources of agricultural information
17. MID SEMESTER
18. Interviews, types and coverage of events
19. Abstracting from research and scientific materials, wire services, other agricultural news sources
20. Writing feature stories, structure
21. Writing the story: Organizing the material
22. Treatment of the story, writing the news lead and the body
23. Readability measures
24. Photo journalism
25. Newspaper design concepts
26. Writing news stories and inverted pyramid
27. Elements of news / qualities of news
28. Reporting - qualities of a good reporter, reporting skills
29. Editing - general principles of editing, qualities of an editor
31. Editorial mechanics: Copy reading
32. E-Journalism - online journalism , scope and Importance in agricultural journalism.

Practical

Practice in interviewing. Covering agricultural events. Abstracting stories from research and scientific materials and from wire services. Writing different types of agricultural stories. Selecting pictures and artwork for the agricultural story. Practice in editing, copy reading, headline and title writing, proofreading, layouting. Testing copy with a readability formula. Visit to a publishing office.

Practical Schedule
1. Practice in interviewing
2. Visit to village and interview farmers / farm women
3. Interview with agricultural officers
4. Practice in abstracting stories from research and scientific materials
5. Visit to a publishing office
6. Writing news stories
7. Writing feature stories
8. Practice in editing, copy reading, headline and title writing
9. Understanding about designing and layouting
10. Preparing layout of farm publication
11. Preparing cover design of farm publication
12. Testing copy with a readability formula
13. Practice in photography and editing – I
14. Practice in photography and editing – II
15. Practice in videography and editing – I
16. Practice in videography and editing – II
17. Practical Exam

References:


AGR 251 WEED MANAGEMENT (2+1)

Outcomes:

- In-depth understanding the characteristics of weeds, biology, ecology, methods, physical, chemical, biological, Integrated weed management and use in herbicides.
- Understanding the mode of action of herbicides, behavior of herbicides in soil, allelopathy and its application, problematic weeds and their control.

Theory:

Unit I: Introduction to Weeds

Introduction to weeds – Definition and classification; characteristics of weeds, their harmful and beneficial effects on ecosystem, reproduction and dissemination of weeds. Weed biology and ecology, crop weed competition and allelopathy.

Unit II: Methods of weed control


Unit III: Herbicides

Unit IV: Selectivity and activity of herbicides


Unit V: Weed management

Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Integration of herbicides with non chemical methods of weed management. Weed management in major field and horticultural crops, shift of weed flora in cropping systems, aquatic and problematic weeds and their control.

Practical:


Lecture schedule:

1. Weeds-Definition and classification – based on relative position, origin, morphology and life cycle
2. Classification of weeds – based on growth characteristics, habitat, ecological affinity to water and dependence on other plants
3. Characteristics of weeds - harmful and beneficial effects of weeds
4. Weed biology and ecology- Life cycle of weeds, Weed reproduction, weed dissemination,
5. Weed seed germination; Weed dormancy; Weed Ecology
7. Principles of weed management- Prevention, eradication and control.
8. Methods of weed management - Physical/Mechanical
9. Methods of weed management - Cultural
13. Herbicide formulations and methods of application.
14. Commonly used herbicides in India
15. Introduction to adjuvants and surfactants - herbicide antidotes and their use in herbicides.
16. Activity and selectivity of herbicides; Factors affecting activity and selectivity.

**17. MID-SEMESTER EXAMINATION**

18. Herbicide absorption and translocation; Factors influencing herbicide absorption and translocation.
19. Mode of action of herbicides
21. Herbicide mixtures, rotations and interactions with other agro chemicals.
22. Persistence and behavior of herbicides in soil
23. Residual effect of herbicides and herbicide residue management
24. Definitions of Herbicide resistance and management of herbicide resistance in weeds; Herbicide Resistant Crops
25. Allelopathy and its application for weed management.
27. Integration of herbicides with non chemical methods of weed management.
28. Weed management in major field crops
29. Weed management in major horticultural crops
30. Management of weeds in non-cropped situations
31. Management of aquatic and problematic weeds.
32. 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. Study of herbicide formulations and mixtures of herbicide.
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. Shift of weed flora study in long term experiments
16. Visit to Problem and parasitic weed infestation areas/ herbicide industries

**17. FINAL PRACTICAL EXAMINATION**

**References:**


HOR 251 LANDSCAPING (2+1)

Outcomes:
- In-depth understanding the importance and scope of landscaping, terrace and vertical gardening, trees selection and climber and creepers.
- Understanding the pot plant, bio-aesthetic planning, lawn: establishment and maintenance. CAD applications.

Theory
UNIT I
Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.

UNIT II

UNIT III

UNIT IV
Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions.

UNIT V
Bonsai: principles and management, lawn: establishment and maintenance. CAD applications.

Practical
Identification of trees, shrubs, annuals, pot plants; Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lath house. Use of computer software, visit to important gardens/ parks/ institutes.

Theory
1. Importance and scope of landscaping- Goals of landscaping – Categories of landscaping (Residential, public, commercial, specialty landscaping).
8. Vertical gardening – Components.
9. Garden components or features- Garden walls – Retaining wall – Fences and Gates – Hedges and Edges – Flower bed – Borders – Carpet Bedding - Steps – Garden Drives (Gravel and Asphalt) and Paths (Gravel, Brick, Grass, Stone, Crazy pavings).
10. Arches and Pergolas – Screens – Bridges – Outdoor garden rooms (Gazebos, garden pavilions, band stand, bower and thatched huts) walk-Paths, bridges, other constructed features etc.
17. Mid semester examination
18. Trees: Selection, propagation, planting schemes, canopy management- Ornamental and shady Trees – Definition – Classification based on purpose with suitable examples – Specimen trees – Shady trees – Flowering trees – Avenue or road side trees – Screening trees – Fragrant flowering trees – Pollution controlling trees.
19. Shrubs - Definition – Utility (aesthetic values) – Classification with suitable examples – Based on purpose of growing – Flowering – Foliage – Flowering and foliage – Fragrant shrubs – Based on sunlight requirement - Growing of shrubs – Soil – Climate – Cultivation practices.
29. Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Importance – Need – Planting materials for different areas of institutions.
31&32. Computer Aided Designs (CAD) – Applications in landscaping.

**Practical**
1. Identification of avenue trees.
2. Identification of shrubs.
3. Identification of annuals.
4. Identification of pot plants.
5. Propagation of ornamental trees.
6. Propagation of shrubs.
7. Propagation of annuals, care and maintenance of plants.
8. Potting and repotting of ornamentals.
9. Identification of tools and implements used in landscape design.
10. Training and pruning of plants for special effects.
11. Lawn establishment and maintenance.
12. Study of planning, designing and layout of formal gardens and informal gardens.
13. Layout of special type of gardens (sunken garden, terrace garden, rock garden).
15. Use of computer software.
16. Visit to important gardens/parks/institutes.

**17. FINAL PRACTICAL EXAMINATION**

**References**
Outcomes:
- In-depth understanding the system and models of crop, data requirements, validation of models and modelling techniques for their estimation.
- Understanding the weather forecasting and verification, simulation model for preparation of Agro-advisory and its effective dissemination.

Theory:
Unit I: System & Models
System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams.

Unit II: Validation of models
Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis.

Unit III: Modelling techniques
Potential and achievable crop production concept and modelling techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.

Unit IV: Weather forecasting and verification
Weather forecasting, types, methods, tools and techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity.

Unit V: Simulation and Agromet Advisory Bulletins
Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

Practical:

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams.
Lecture Schedule:

3. Soil-plant-atmospheric continuum
4. Model- System boundaries – inputs
5. Models limitations- constrains
6. Crop models, concepts and techniques
7. Types of crop models – Abstract models and Simulation Models.
8. Input and output data requirements, relational diagrams.
9. Evaluation of crop responses to weather elements;
10. Elementary crop growth models
11. Calibration, validation, verification
13. Potential and achievable crop production
14. Concept and modelling techniques for estimation of yields
15. Crop production in moisture and nutrients limited conditions;
17. MID SEMESTER EXAM
18. Weather forecasting- definitions- scope
19. Types and methods of weather forecasting and tools
20. Techniques of weather forecasting and forecast verification
21. Value added weather forecast.
22. Now casting and its application.
23. National Centre for Medium Range Weather Forecasting (NCMRWF) and Agro Meteorological Field Units (AMFU) and forecasting.
24. Gramin Krishi Mausam Sewa (GKMS) and District Agromet field Units (DAMU) - role in weather forecasting.
25. Long Range Weather Forecasting (LRF)
26. ITK for weather forecast and its validity
27. Preparation of agro-advisory bulletin based on weather forecast.
28. Use of crop simulation model for preparation of Agro-advisory
29. Dissemination of weather forecasting and its mode.
30. Crop-Weather Calendars
31. IMD and its role in weather forecasting.
32. Websites and information on weather forecasting.

Practical Schedule

1. Visit to Agro meteorological Observatory.
2. Preparation of crop weather calendars.
3. Preparation of agro-advisories based on weather forecast using various approaches
4. Synoptic charts
5. Working with statistical and simulation models for crop growth
6. Potential & achievable production, Yield forecasting
7. Insect & disease forecasting models.
8. Simulation with limitations of water and nutrient management options.
10. Use of statistical approaches in data analysis and
11. Preparation of historical, past and present meteorological data for medium range weather forecast.
12. Feedback from farmers about the agro advisory.
13. Visit to GKMS centre / AIR, Karaikal
14. Visit to IMD, DWRS, Karaikal
15. Visit to RMC, Chennai
16. Field visits.
17. PRACTICAL EXAMINATION

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

GPB 351 Commercial Plant Breeding (2+1)

Outcomes:
- Understanding the types of crops and modes of plant reproduction, Advances in hybrid seed production techniques and Quality seed production.
- Understanding the alternative strategies for the development of commercial plant breeding and IPR issues.

Theory
Unit I
Types of crops and modes of plant reproduction. Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production. Genetic purity test of commercial hybrids.
Unit II
Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops. Advances in hybrid seed production techniques.

Unit III
Hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc. Quality seed production of vegetable crops under open and protected environment.

Unit IV
Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools. Speed breeding, Rapid generation advancement, Molecular markers and Genomic selection.

Unit V
IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release, replacement rate and notification systems in India.

Practical
Floral biology in self and cross pollinated species, selfing and crossing techniques. Techniques of seed production in self and cross pollinated crops using A/B/R and two line system. Learning techniques in hybrid seed production using male-sterility in field crops. Understanding the difficulties in hybrid seed production, Tools and techniques for optimizing hybrid seed production. Concept of rouging in seed production plot. Concept of line its multiplication and purification in hybrid seed production. Role of pollinators in hybrid seed production. Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops. Sampling and analytical procedures for purity testing and detection of spurious seed. Seed drying and storage structure in quality seed management. Screening techniques during seed processing viz., grading and packaging. Visit to public private seed production and processing plants.

Theory schedule
1. Types of crops and modes of plant reproduction.
2. Line development and maintenance breeding in self pollinated crops (A/B/R and two line system)
3. Principles and techniques of seed production in self pollinated crops.
4. Development of hybrids and seed production in self pollinated crops.
5. Line development and maintenance breeding in cross pollinated crops
6. Principles and techniques of seed production in cross pollinated crops.
7. Development of hybrids and seed production in cross pollinated crops.
8. Genetic purity test of commercial hybrids.
9. Types of seeds, quality testing in self and cross pollinated crops.
10. Advances in hybrid seed production techniques
11. Hybrid seed production in rice.
12. Hybrid seed production in maize.
13. Hybrid seed production in sorghum.
14. Hybrid seed production in pearl millet.
15. Hybrid seed production in castor.
16. Hybrid seed production in sunflower.
17. **Mid Semester examination**
18. Hybrid seed production in cotton.
19. Hybrid seed production in pigeon pea.
20. Hybrid seed production in brassica.
21. Quality seed production of vegetable crops under open and protected environment.
22. Hybrid seed production in tomato.
23. Hybrid seed production in brinjal and bhendi.
24. Hybrid seed production in capsicum and chilli.
25. Hybrid seed production in cucurbits, cabbage and cauliflower.
26. Alternative strategies for the development of the line and cultivars: haploid inducer and tissue culture techniques.
27. Alternative strategies for the development of the line and cultivars: genetic engineering tools.
28. Speed breeding and rapid generation advancement.
29. Molecular markers and Genomic selection.
30. IPR issues in commercial plant breeding.
31. DUS testing and registration of varieties under PPV & FR Act.
32. Variety testing, release, replacement rate and notification systems in India.

**Practical schedule**

1. Floral biology in self and cross pollinated species, selfing and crossing techniques.
2. Techniques of seed production in self and cross pollinated crops using A/B/R and two line system.
3. Learning techniques in hybrid seed production using male-sterility in field crops.
4. Understanding the difficulties in hybrid seed production.
5. Tools and techniques for optimizing hybrid seed production.
6. Concept of rouging in seed production plot. Concept of line its multiplication and purification in hybrid seed production.
7. Role of pollinators in hybrid seed production.
8. Hybrid seed production techniques in rice and sorghum.
9. Hybrid seed production techniques in maize and pearl millet.
10. Hybrid seed production techniques in pigeon pea and cotton.
11. Hybrid seed production techniques in rapeseed-mustard, sunflower and castor.
12. Hybrid seed production techniques in vegetable crops (brinjal, bhendi, and capsicum).
13. Sampling and analytical procedures for purity testing and detection of spurious seed.
14. Seed drying and storage structure in quality seed management.
15. Screening techniques during seed processing viz., grading and packaging.
16. Visit to public private seed production fields and seed processing plants.

17. Final Practical examination

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

HOR 351 PROTECTED CULTIVATION (2+1)

Outcomes:
- In-depth understanding the importance and scope of protected cultivation, greenhouse design, poly house, types of benches and containers.
- Understanding the off-season production of flowers and vegetables, Irrigation and fertigation, management Insect pest and disease management

Theory
UNIT I
Protected cultivation- importance and scope, Status of protected cultivation in India and World, types of protected structure based on site and climate.

UNIT II
Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers.

UNIT III
Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops.
UNIT IV
Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc. Cultivation of economically important medicinal and aromatic plants.

UNIT V
Off-season production of flowers and vegetables. Insect pest and disease management.

Practical
Raising of seedlings and saplings under protected conditions, use of protrays in quality planting material production, Bed preparation and planting of crop for production, Inter cultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging ad misting.

Lecture outlines
Theory
1. Protected cultivation- Importance and scope - Status of protected cultivation in India.
2. World types of protected structure based on site and climate – Glass house, poly house, rain shelters, poly tunnels, hotbeds and cold flames, shade nets.
4. Types of green houses – Types of green houses based on shape, utility, construction and cladding material.
6. Cladding material involved in greenhouse/ poly house – Glass, flexible plastic films, polyethelene, Ethylene Venyl acetate, poly venyl fluoride, poly venyl chloride, acrylic, tefzel T2 film, reinforced plastic, rigid plastic sheet, Saran plastic mesh.
8. Environment control - Ventilation and cooling in a green house – Naturally ventilated, Fan and Pad cooling, forced air cooling etc. – Relative humidity, carbondi- oxide level.
10. Types of benches and containers – No bench, raised benches, ground benches – Arrangement of benches – Longitudinal, cross-benching, peninsula arrangement, movable benches, pyramid benches – Containers – Types of containers.
11. Irrigation management - Water application methods – Hand watering and automatic watering systems- Tube watering, capillary mat, overhead sprinklers, perimeter watering, drip system, misting – Fertigation – Dry and liquid fertilizers – Methods of application of liquid fertilizers (constant feed and intermittent feed) –Carbon-di-oxide fertilization.
12. Automation – Parameters to be controlled – Types of green house control – Step control, integrated control, feedback, proportional, integral, derivative, feed forward, energy balance, sensors (Temperature, Light, CO2, Humidity, Irrigation etc.).
17. Mid Semester examination


29. Cultivation of economically important medicinal – Stevia, Ginseng and aromatic plants.


32. Disease management in green houses – Bacterial blight, bacterial canker, bacterial leaf spots- Viral diseases - Tomato spotted wilt virus – Fungal Diseases – Downy Mildew, Powdery mildew, Sclerotinia rot, Damping off – Nematodes and their management.

**Practical**

1. Study of different types of green houses based on shape.
2. Study of different types of green houses based on construction.
3. Study of different types of green houses based on cladding material.
4. Study of materials for construction of greenhouses.
5. Study of construction of pipe framed green house.
7. Calculation of ventilation rates in active summer cooling system.
8. Calculation of rate of air exchange in active winter cooling system.
9. Field visit to green house.
10. Raising of seedlings and saplings under protected conditions.
11. Use of protrays in quality planting material production.
13. Intercultural operations.
14. Soil EC and pH measurement.
15. Regulation of irrigation.
16. Fertilizers through drip, fogging ad misting.

**17. FINAL PRACTICAL EXAMINATION**

**References**


Outcomes:
- In-depth understanding the importance of management and micro propagation, Modern field preparation and planting methods.
- Understanding micro irrigation systems and components of precision farming and application in horticultural crops.

UNIT I
Introduction & importance; Management and mechanization in horticultural nursery; Micro propagation of horticultural crops

UNIT II
Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques

UNIT III
Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding

UNIT IV
Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA)

UNIT V
Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

Practical
Types of Polyhouses and shade net houses, intercultural operations, tools and equipments identification and application, micro propagation, nursery-portrays, microirrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

Theory
1. Hi-tech horticulture – Introduction - Scope and importance – Perspectives of Hi-tech horticulture in India.
2. Nursery management – Quality control of planting material- Plastics in nursery management – Advantages of plant propagation under green houses (Hi-tech nursery).
3. Mechanization – Importance of mechanisation in Hi-tech horticulture – Mechanisation of nursery, sowing and transplanting, plastic mulching, irrigation, fertigation, pest and disease control, weed control, harvesting etc.
7. Modern planting methods – Container planting - Soil less culture – Hydroponics, aerophonics.
8. Protected cultivation- Advantages- Types of protected structures - Glass house, poly house, rain shelters, poly tunnels, hotbeds and cold flames, shade nets etc.
9 & 10. Greenhouse – Advantages- Controlled conditions – Light, Humidity, Temperature, CO2 - Ventilation and cooling in a green house – Naturally ventilated, fan and pad cooling, forced air cooling etc. – Relative humidity, carbon-di-oxide level.
11 &12 Micro irrigation systems and its components – Methods of micro irrigartion (Surface drip, sub-surface drip irrigation, Bubblers, micro sprinkler etc.) - Maintenance of micro irrigation system.
14 EC, pH based fertilizer scheduling – Site specific nutrient management – Advantages and disadvantages.
15 & 16 Canopy management – Importance of canopy management- principles of canopy management – Tools of canopy management (Rootstocks, plant density, training and pruning, nutrient management, growth retardants etc.).

17. Mid Semester Examination
18. High Density orcharding – Concept – HDP systems – Components of HDP (use of genetically dwarf scion cultivars, dwarf rootstocks, pruning and training, use of growth retardants, induction of viral infection, use of incompatible rootstocks etc.) – Impact of HDP- Advantages-Constraints in HDP.
20 & 21 Remote sensing – Role of remote sensing in precision farming - Application of remote sensing in the field of horticulture.
22 Geographical Information System (GIS) – Role of GIS in precision farming.
23 & 24. Differential Global Positioning System (DGPS) – GPS introduction - Types of GPS - DGPS uses in Agriculture - Yield monitoring, field mapping, precision crop input application (fertilizers, pesticides, weedicides etc.).
27, 28 & 29. Precision farming – Applications of precision farming in horticultural crops (fruits, vegetables and ornamental crops) – Strategic approaches of precision technology for improvement of fruit production.

30. Mechanized harvesting of produce – Advantages and disadvantages of mechanical harvesting – Mechanical harvesters developed for different horticultural crops – Robots in harvesting.


**Practical**
1. Study of types of polyhouses.
2. Study of shade net houses.
3. Intercultural operations in Hi-tech horticulture.
4. Identification and application of tools and equipments.
5. Micro propagation.
7. Study of Micro-irrigation system and its components.
8. Problems of micro irrigation system.
10. Estimation of pH in soil and water.
11. Fertilizer scheduling.
12. Canopy management in Mango.
13. Canopy management in Guava.
15. Visit to Hi-Tech orchard.

**17. FINAL PRACTICAL EXAMINATION**

**References**
GBP 352 MICRO-PROPAGATION TECHNOLOGIES (2+1)

Outcomes:
- In-depth understanding the meaning and concept of in vitro culture and micropropagation, compounds of tissue culture and Haploid culture.
- Understanding the Public and private organizations involvement, National certification and Quality management, Project proposal for establishing a commercial Tissue culture lab.

Theory Course outlines

Unit I:
Meaning and concept of *in vitro* culture and micro-propagation. Different concepts employed in micropropagation. Historical mile stones, advancement and future prospects of micropropagation; totipotency, dedifferentiation. Applications, advantages and limitations of tissue culture techniques. Tissue culture methodology: Sterile techniques, synthetic and natural media components, growth regulators, environmental requirement, genetic control of regeneration. Techniques of sterilization/asepsis for glass and metal ware, liquids both thermo stable and thermolabile and disposal of remnants of culture. Laboratory organization, requirements, layout of small, medium and large scale Tissue culture laboratories.

Unit II:
Components of the tissue culture media – Inorganic nutrients, vitamins, amino acids and other organic supplements, carbon source, hormones/plant growth regulators, pH of the media, gelling agents. Different types of media. Preparation of media – Stocks and working media, preparation and storage. Plant regeneration pathways-Organogenesis and Somatic embryogenesis. Organogenesis-Purpose, methods and requirements for organogenesis, indirect and direct organogenesis. Somatic embryo genesis – Procedures and requirements for organogenesis, indirect and direct embryogenesis; Differences between somatic and gametic embryogenesis,

Unit III:

Unit IV:
Micropropagation-Definition, stages of micropropagation-Factors affecting micropropagation – applications and limitations. Micropropagation techniques in Banana, Neem, Bamboo,

**Unit V:**

**Practical outline**
Laboratory organization, Laboratory organization small, medium and large scale laboratories. Sterilization techniques for explants, glassware, plasticwares, labwares and working platform. Preparation of stocks and working solution. Preparation and sterilization of growth regulators. Preparation of working medium and Experimentation on determining optimum concentration of growth regulators. Callus induction and regeneration of whole plants from different parts of plants. Direct regeneration into whole plants using bud, node and other tissues. Induction of somatic embryos. Experiments of synthetic seeds production and testing storability and germination efficiency.

**Theory Lecture Schedule**
1. Meaning and concept of *in vitro* culture, micropropagation, totipotency, dedifferentiation. Different concepts employed in tissue culture. Scope of Plant Tissue culture.
2. Historical mile stones, advancement and future prospects of micropropagation; totipotency, dedifferentiation.
3. Different tissue culture techniques- applications, advantages and limitations.
4. Layout of Tissue culture, requirements and types- small, medium and large scale laboratories. Environmental requirements of Tissue culture unit.
5. Techniques of sterilization/asepsis for glass and metal ware, liquids both thermo stable and thermo labile, disposal of remnants of culture.
7. Components of the tissue culture media- carbon source, hormones/ plant growth regulators, pH of the media, gelling agents.
8. Preparation of media – Stocks and working media, preparation and storage.
10. Organogenesis-Purpose, methods and requirements for organogenesis, indirect and direct organogenesis.
12. Culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture. Applications and limitations.
13. Auxiliary bud proliferation, shoot tip and meristem culture - application and limitations.
14. Anther culture, pollen culture and ovary culture - applications and limitations.
15. Production of virus free plants through Meristem tip culture.
16. Synthetic seeds and Artificial seed – Concept, necessity, procedure and requirements of synthetic seeds.
17. **MID SEMESTER**
19. Micropropagation techniques in Banana and Neem
20. Micropropagation techniques Bamboo and Cassuarina
21. Micropropagation techniques in Sugarcane and *Eucalyptus*
22. Micropropagation techniques in *Aloe vera* and *Phyllanthus*
23. Micropropagation techniques in Gerbera and Coleus
24. Micropropagation techniques in Rose and Chrysanthemum
25. Micropropagation techniques in Orchids
26. Primary hardening of tissue cultured plants – requirements and layout of polyhouse.
27. Secondary hardening of Tissue cultured plants- requirements and layout of shade net provision.
28. National certification and Quality management of TC plants
29. Genetic fidelity test and virus indexing in TC plants.
30. Production of secondary metabolites through cell culture techniques.
31. Public and private organizations involved in Plant Tissue culture in India.
32. Preparation of Project proposal for establishing a commercial Tissue culture lab.

**Practical schedule**
1. Organization of tissue culture laboratory- small, medium and large scale laboratory layout.
2. Sterilization techniques used in tissue culture laboratory – Glass, plastic and metal ware.
3. Study and use of laminar flow unit for tissue culture.
4. Study and use of autoclaves for tissue culture.
5. Preparation of stock and working solutions of tissue culture media.
6. Sterilization techniques used in tissue culture laboratory media.
7. Filter Sterilization thermo labile compounds-Hormones and Vitamines and Aminoacids.
13. Determination of optimum concentration of auxins to generate shoots from *in vitro* generated calli.
15. Visit to commercial Tissue culture lab.
16. Visit to Accredited Tissue Culture lab/NRC Banana, Trichy

17. FINAL PRACTICAL EXAMINATION

References

AGM 352 APPLIED MICROBIOLOGY (2+1)

Outcomes:
- In-depth understanding the factors affecting microorganisms in food-Intrinsic factors, food preservation, physical & chemical methods, Food poisoning, intoxication, milk-contamination and preservation.
- Understanding the Industrial Microbiology, Health and Environmental Microbiology and Bioenergy and Recombinant products.

Theory
Unit I: Food Microbiology
Microbial spoilage of foods-cause and ease of spoilage; Factors affecting microorganisms in food-Intrinsic factors, Factors affecting microorganisms in food-Extrensic factors; Principles of food preservation-physical methods, chemical methods; Food poisoning, intoxication.

Unit II: Dairy and fermentation Microbiology
Microbes in milk-contamination and preservation; Spoilage of milk; Fermented milk products; Fermented foods; Fermentation of tea, coffee and cocoa; Production of single cell protein; Production of alcoholic beverages-beer, wine, and distilled alcoholic beverages.

Unit III: Industrial Microbiology
Microbial production of primary and secondary metabolites-organic acids, amino acids, enzymes, vitamins, antibiotics; Microbial polysaccharides; Microbial phytohormones; Microbial pigments.
Unit IV: Health and Environmental Microbiology
Probiotics, prebiotics and synbiotics. Microbial biotransformations; Biodegradation of agrowastes- composting types; Bioremediation-importance, degradation of oils, xenobiotic compounds; Biomining.

Unit V: Bioenergy and Recombinant products.
Microbes in genetic engineering-vectors, plasmids, transposons; Recombinant DNA products using microbes; Biomass to biofuel-ethanol production, biogas generation; Hydrogen production, electricity generation.

Practical
Enumeration of microorganisms in food, Microbiological examination of spoiled meat/fish, milk and milk products; Fermented products-Wine making, Saurekraut preparation; Isolation of probiotic microorganism-LAB from curd/idli batter; Isolation of yeast from fruit juice; Isolation of Acetobacter acetii from fruit juice; Production of vinegar; Application of yeast in leavening of dough; Application of enzymes in fruit juice clarification, meat tenderization; Isolation of antibiotic producing microorganism by crowded plate technique, Identification of antibiotic activity by cross streak assay/agar well diffusion technique; Isolation of microorganisms from compost and Bioconversion of agricultural waste by composting.

Theory schedule
1. Microbial spoilage of foods-cause and ease of spoilage
2. Factors affecting microorganisms in food-Intrinsic factors,
3. Factors affecting microorganisms in food-Extrensic factors
4. Principles of food preservation-physical methods
5. Principles of food preservation-chemical methods
6. Food poisoning, intoxication
7. Microbes in milk-contamination and preservation
8. Spoilage of milk
9. Fermented milk products
10. Fermented foods-Saurekraut, kefir, tempeh, miso etc.,
11. Fermentation of tea, coffee and cocoa
12. Production of single cell protein
13. Production of alcoholic beverages-beer, wine
14. Production of distilled alcoholic beverages
15. Microbial production of organic acids-citric acid, acetic acid
16. Microbial production of amino acids-glutamic acid, lysine, tryptophan
17. Mid semester examination
18. Microbial production of enzymes-amylase, protease
19. Microbial production of vitamins-B12, Riboflavin
20. Microbial production of antibiotics- types, penicillin production
21. Microbial polysaccharides
22. Microbial phytohormones and pigments
23. Probiotics-importance, application.
24. Prebiotics and synbiotics
25. Microbial biotransformations-types and significance
26. Biodegradation of agrowastes-composting types
27. Microbiology of composting-succession of microbes during composting.
28. Bioremediation-importance, degradation of oils, xenobiotic compounds; Biomining
29. Microbes in genetic engineering-vectors, plasmids, transposons
30. Recombinant DNA products using microbes
31. Biomass to biofuel-ethanol production, biogas generation
32. Hydrogen production, electricity generation

Practical

1. Enumeration of microorganisms in food
2. Microbiological examination of spoiled meat/fish
3. Microbiological examination of milk and milk products
4. Fermented products-Wine making
5. Fermented products-Sauerkraut preparation
6. Isolation of probiotic microorganism-LAB from curd/idli batter
7. Isolation of yeast from fruit juice
8. Isolation of Acetobacter acetii from fruit juice
9. Production of vinegar
10. Application of yeast in leavening of dough
11. Application of enzymes in fruit juice clarification
12. Application of enzymes in meat tenderization
13. Isolation of antibiotic producing microorganism by crowded plate technique
14. Identification of antibiotic activity by cross streak assay/agar well diffusion technique
15. Isolation of microorganisms from compost
17. Final practical examination

References:
SAC 352 Agrochemicals (2+1)

Outcomes:
- In-depth understanding the role and type in agrochemicals, organic fungicides and insecticides of classification and Fate of herbicides.
- Understanding the importance of Fertilizers and their importance, Mixed and complex fertilizers, Fertilizer control, Fertilizer logistics and marketing.

Theory

Unit I – Agrochemicals and Fungicides
An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.


Unit III - Insecticides
Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals,

Unit II – Herbicides, Bio pesticides and Insecticide Act
Herbicides-Major classes, properties and important herbicides. Fate of herbicides.

IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant.

Unit IV - Fertilizers
Unit V – Mixed, complex fertilizers and FCO


Practical


Theory schedule

1. An introduction to agrochemicals, their type and role in agriculture.
2. Effect of agro chemicals on environment, soil, human and animal health, merits and demerits of their uses in agriculture.
4. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride
5. Inorganic fungicides - Mode of action - Bordeaux mixture and copper oxychloride
7. Systemic fungicides - Benomyl, carboxin, oxyzcarboxin, Metalaxyl, Carbendazim, characteristics and use.
8. Introduction and classification of insecticides: inorganic and organic insecticides.
10. Organophosphates- properties and mode of action.
11. Carbamates- properties and mode of action.
12. Synthetic pyrethroids- properties and mode of action.
15. Mid semester examination
16. Herbicides- Definition, advantage and limitation of their usage, classification.
17. Major classes, properties and important herbicides, Fate of herbicides
18. IGRs - mode of action, toxicity, formulation and use
21. Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant.
22. Botanicals, plant and animal systemic insecticides their characteristics and uses
23. Fertilizers and their importance, classification, Nitrogenous fertilizers: Feedstock and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride
24. Feedstock and Manufacturing of urea and Slow release N-fertilizers.
26. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate
27. Mixed and complex fertilizers: Sources, advantages and disadvantages over straight fertilizers. Compatibility of fertilizer physical and chemical problems associated with bulk blending of fertilizers.
30. Preparation of major, secondary, micronutrient mixtures and multi nutrient fertilizers.
31. Fertilizer control order – fertilizer storage standards
32. Fertilizer logistics and marketing.

Practical schedule

1. Sampling of fertilizers and pesticides.
2. Study and identification of various agrochemicals and its formulation available in market.
3. Calculation of doses of fertilizers.
4. Calculation of doses of herbicides and fungicides.
5. Calculation of doses of insecticides.
6. Application technology to study about various pesticides appliances.
7. Quick tests for identification of common fertilizers.
8. Identification of anion and cation in fertilizers.
11. Estimation of citrate soluble P₂O₅ in phosphatic fertilizer
12. Estimation of potassium in Muriate of Potash/ Sulphate of Potash by flame photometer.
13. Determination of copper content in copper oxychloride.
14. Determination of sulphur content in sulphur fungicide.
15. Determination of active ingredient content in Thiram
16. Determination of active ingredient content in ziram.
17. Practical examination
References


Web resources

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