ANNAMALAI UNIVERSITY
(ACCREDITED WITH ‘A’ GRADE BY NAAC)

FACULTY OF AGRICULTURE
(ACCREDITED BY ICAR)

Academic regulations and Syllabus

BACHELOR OF SCIENCE (HONOURS)
IN HORTICULTURE
(Semesters 1- 8)

Under Choice based credit system (CBCS)
with Outcome based Education

2018-19 Onwards
ANNAMALAI UNIVERSITY
FACULTY OF AGRICULTURE
Academic regulations and syllabus of B.Sc. (Hons.) Horticulture
(With effect from 2018-19)

1. Title and Scope
1.1. These academic regulations shall be called “Annamalai University Faculty of
Agriculture B.Sc. (Hons.) Horticulture Academic Regulations 2018” for obtaining
B.Sc. (Hons.) Horticulture Degree in the Faculty of Agriculture.
1.2. The regulations provided herein shall apply to B.Sc. (Hons.) Horticulture
Degree programmes offered by the Faculty of Agriculture, Annamalai University to
the students admitted from the academic year 2018-19 onwards.

2. Definitions
2.1. University: University means Annamalai University, Annamalainagar,
Tamil Nadu.
2.3. Academic session: An academic session is a period during which a cycle of
study is completed. It shall commence on or after 1st July of each year. There shall
be two semesters in an academic session.
2.4. Semester: A semester shall consist of 105 working days inclusive of the mid-
semester and practical examinations.
2.5. Curriculum: It is a series of courses offered to provide learning opportunities to
meet the requirements for a degree.
2.6. Course: A course is a unit of instructions, series of classes and work experience
extending over a semester. It has a specific number, title and credits. Each course is
denoted by a specific number, which has a specific meaning.
The first three alphabets stand for the Department offering the course. First digit is
related to the year; second digit is related to the semester and the third digit is
related to course number in a particular semester i.e. “HOR-119 Plant Propagation
and Nursery Management”. “HOR” stands for the Department of Horticulture; the
first digit (1) stands for the year; second digit (1) stands for the semester and the
third digit (9) stands for the serial number of course in a particular semester.
2.7. Credit: It is a measure of quantity of work done in a course. One credit
represents one contact hour for theory or two contact hours of laboratory or field
work per week. For example, a 1+1 course (2 credits) means 1 hour theory and 2
hours practical per week.
2.8. Credit load: It is the number of credits a student shall undergo in a semester
2.9. Grade Point: “Grade Point” means the total marks in percentage divided by 10
and shall be expressed on 10-point scale up to second decimal place.
2.10. Credit point: A credit point is a product of grade point obtained by a student
and number of credits in a course.
2.11. Grade Point Average (GPA): It is measure of performance of a student in all
the courses taken during a semester. The GPA is computed by dividing the total
credit points earned by a student in a semester by the total number of credits
registered during that semester.
2.12. Overall Grade Point Average (OGPA): It is measure of the cumulative
performance of a student on completion of the second and subsequent semesters of
the degree programme. It is computed by dividing the total credit points earned by
a student up to the end of a particular semester by the total number of credits. It
shall be expressed on 10 point scale up to second decimal place.
2.13. The OGPA shall be rounded off to second digit of decimal point on the basis of third digit. If third digit of decimal point is 5 or more than 5, then second digit will be increased by one. If, however, it is less than 5, it will be ignored. This will be done at the end of each semester while calculating the OGPA.

2.14. **Calculation of OGPA:** To arrive at the “Overall Grade Point Average (OGPA)” at the end of a semester, the grade point of each course is multiplied by the credit hours of the course to obtain the credit points. Then, the sum of the credit points secured by the student in all the courses taken till the end of that semester is divided by the total number of credit hours of the courses, provided that the credit hours and credit points of courses which are repeated are not counted more than once for this purpose.

**For Example**

| i.       | Total credit hours till the end of last semester | 17 |
| ii.      | Total credit points till the end of last semester | 140.50 |
| iii.     | Total credit hours in the current semester | 23 |
| iv.      | Total credit points obtained in the current semester | 156 |
| v.       | Total credit hours including the current semester | (17+23)=40 |
| vi.      | Total credit points including the current semester | 140.50 + 156 = 296.50 |
| vii.     | Overall Grade Point Average | (296.50/40) = 7.412 |
| viii.    | Corrected to two decimals | 7.41 / 10.00 |

2.15. “Transcript Card” is a consolidated report of grades secured by the student in all the semesters, issued by the University.

3. **Admission**

3.1. Admission of the student to B.Sc.(Hons.) Horticulture in the Faculty of Agriculture shall be on the basis of merit and in accordance with the policy and guidelines of the State Government and the University. The minimum admission requirement shall be decided by the University and issued from time to time. Decision of the University is final in deciding procedure of admission and finalization of number of seats. Reservation shall be made applicable as per norms of the State Government.

3.2. **Tuition fees and scholarships**

The various fees payable by the students will be decided by the University from time to time.

a) In case of new admission, the fees for the semester are payable in advance, failing which they will not be admitted.

b) In other cases, the fees are payable within seven working days from the commencement of the semester.

c) In the case of default, a fine as per the University rules will be collected.

d) The students who fail to pay the tuition fees within a month of commencement of the semester will not be allowed to attend the classes and their names will be struck off from the rolls. However, if the defaulting students pay the fees along with the fines in addition to a prescribed re-admission fee, they will be permitted to attend the classes. The period for which his/her name is struck off from the rolls will be treated as absence for the purpose of calculating the minimum attendance requirements.
e) Students who are away on study tour, camp activities or other extracurricular activities organized by the University or the Faculty at the commencement of the semester may, however, pay their semester tuition fees and other fees within the third working day after they return from such programmes, without fine.

f) A student who has been granted scholarships by the Welfare Departments or by the Government of India or by the State Government will, however, be exempted from the levy of fines, provided the fees are paid on the next day after the scholarship amount is actually disbursed to him/her. The concession referred above will apply to those who have actually been granted scholarships and not to those who have only applied and are expecting sanction.

g) The candidate should obtain a Hall Ticket from the Controller of Examinations through the Dean after clearing all arrears including the hostel dues before the commencement of each semester final examination.

4. Advisory system
   4.1. The Dean shall nominate a co-ordinator from amongst the teaching faculty.
   4.2. Student ward counselors will be nominated soon after the students’ admission. The counselor shall be nominated from amongst the teaching faculty.

5. Curriculum and programme of study
   5.1. The students admitted in the University shall be required to follow the curriculum as prescribed, revised from time to time by the respective Faculty of the University and approved by the Academic Council from time to time.

6. Award of Degree, duration and credit requirements
   6.1. A student is required to complete the duration and credit requirements for the award of degree as decided by Academic Council from time to time.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Degree</th>
<th>Duration requirements (Semester)</th>
<th>Credit requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>B.Sc. (Hons.) Horticulture</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>

7. Medium of instruction
   7.1. The medium of instruction in Faculty of Agriculture shall be English.

8. Attendance Requirements
   8.1. One hundred per cent attendance is expected from each student. A student who fails to secure 80 per cent of attendance prescribed for a course (subject) of study, separately in theory and practical shall not be permitted to appear for both theory and practical examinations in that course (subject) and shall be given ‘E’ (incomplete) and will be required to repeat the course (subject) when offered again.
   8.2. For the first year first semester students, for calculating 80 per cent attendance the number of working days will be calculated only from the date of joining of the student.
   8.3. If any student is absent for field trips, the student may be marked absent for all the compensating classes on the day of the field trip in addition to the field trip courses.
   8.4. The attendance for mid semester examination will be counted as a theory class.
   8.5. Students abstaining from the classes by prior permission from the Dean, Faculty of Agriculture on Official University business, shall be given due consideration in computing attendance requirements.
   8.6. However, condonation of attendance deficiency may be considered by the Vice-Chancellor only in case of genuine reasons including indoor hospitalization with
evidence in the form of Hospitalization certificate and Discharge summary recommended by the Dean, Faculty of Agriculture. The Vice-Chancellor may decide whether or not a condonation fee is required, based on the reason for condonation.

8.7. 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.

9. Examinations

Each course shall carry a maximum of 100 marks for the purpose of grading. The distribution of marks shall be as follows.

<table>
<thead>
<tr>
<th>9.1. Course with both theory and practical</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. No.</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9.2. Course with only Theory/Practical**</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. No.</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>I.</td>
</tr>
<tr>
<td>II.</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

* The modality of evaluation of various courses with only practical is given in Regulation 9.4

9.3. Evaluation of course work

The results of the course shall be indicated by grade points ranging from 0 to 10. The minimum grade point to be secured for the successful completion of a course will be 6.00. Securing a grade point less than 6.00 in a course will be treated as 'RA' and the grade point will be 0 for calculating the GPA/OGPA. In case of course with theory and practical, minimum of 50% marks separately in theory and practical with an aggregate of 60 per cent is essential. An OGPA of 6.50 shall be the minimum requirement for the award of Degree.

The following symbols shall be used in the Grade sheets.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Incomplete (due to attendance deficiency)</td>
</tr>
<tr>
<td>AB</td>
<td>Absent</td>
</tr>
<tr>
<td>RR</td>
<td>Re-registration</td>
</tr>
<tr>
<td>RA</td>
<td>Re-appearance</td>
</tr>
<tr>
<td>IE</td>
<td>Improvement Examination</td>
</tr>
<tr>
<td>EE</td>
<td>Incomplete for reasons other than attendance</td>
</tr>
</tbody>
</table>
9.4. Evaluation pattern for courses with only practical

The evaluation pattern of courses with only practicals is grouped and mark distribution is furnished below.

A. PED 116 Physical Education (0+1)

The students will be evaluated for 100 marks. The course teacher will evaluate the performance and behavior of students in the classes and marks will be awarded at the end of the first semester as detailed below.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Max. marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance and routine activities</td>
<td>60</td>
</tr>
<tr>
<td>Behaviour</td>
<td>15</td>
</tr>
<tr>
<td>Participation in tournaments</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

B. PED 117 Principles and practices of yoga (0+1)

Each student has to undergo 60 hours of face to face course work in a year.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Title of the paper</th>
<th>Mode</th>
<th>Hours of instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Principles and Practices of Yoga</td>
<td>Regular</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Yoga Practical</td>
<td>Regular</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

Each student enrolled in PED 117 should attend two semesters (I & II). The final practical examination will be conducted in the last practical class of the second semester. Marks will be awarded as follows.

At the end of the second semester the course teacher shall send the marks awarded to the Controller of Examinations through the Dean, Faculty of Agriculture.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Particulars</th>
<th>Max. marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Written Examination</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>PART – A Two Marks Questions 10 out of 12 (10 x 2 =20)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PART – B Five Marks Questions 2 out of 3 (2 x 5 = 10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PART – C Ten Marks Questions 1 out of 2 (1 x 10 = 10)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Yoga Practical Examination</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>Viva – Voce Examination</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Record</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

C. NSS / NCC 118 (0+1)

The duration of NCC / NSS training is for four semesters (I, II, III and IV).

NCC/NSS courses shall be registered during first semester and evaluated at the end of fourth semester.

NSS

Each student enrolled in NSS should also attend at least one special camp not exceeding 10 days duration. 80% attendance is mandatory for attending special camp. Marks will be awarded as follows.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particulars</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NSS Regular Programme (15 +15 +15 +15)</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>NSS Special camp not exceeding 10 days duration (Attendance-30 &amp; Activity 10)</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

At the end of fourth semester the course teacher shall send the marks awarded to the Controller of Examinations through the Dean, Faculty of Agriculture.

**NCC**

Each student enrolled in NCC should attend 10 parades per semester, thus 40 parades in four semesters. Marks will be awarded at the rate of two and half marks per parade (2.5 x 40 = 100).

**D. ENG 115 / TAM 114 / ENG 114 / ENG 228 (0+1)**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particulars</th>
<th>Mid-semester examination</th>
<th>Final examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Written test</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>Continuous evaluation</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Assignment</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Record</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td><em>Viva voce</em></td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>40</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

**F. Rural Horticultural Work Experience (RHWE)**

(RHWE AEX 410, RHWE AGR 411, RHWE HOR 412 and RHWE CPT 413)

Course on Rural Horticultural Work Experience will be offered in the VII Semester for eleven weeks. The village attachment will be organized by the Department of Agricultural Extension. Orientation programme will be organized in the first week of the semester. The final examination will be conducted separately at the end of the semester by the University. The marks will be awarded as detailed below.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Max marks</th>
<th>Evaluation by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation Note book</td>
<td>20</td>
<td>By Teacher in-charge</td>
</tr>
<tr>
<td>Skills learned</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td><strong>Final examination</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commendable activities</td>
<td>10</td>
<td>By the Examiners</td>
</tr>
<tr>
<td>Detailed project report presentation and Record</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td><em>Viva voce</em></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

**G. Educational tours: HOR 221 (0+1) and AEX 414 (0+1)**

Educational tour for courses HOR 221 Study tour and AEX 414 All India Study Tour are compulsory. The tours will be undertaken during IV and VII semester, respectively. The duration of HOR 221 shall not exceed 7 days and that of AEX 414 shall not exceed 14 days. The tours will be arranged by the respective Department in consultation with the Dean, Faculty of Agriculture. The final examination will be
conducted separately at the end of the semester by the University. Marks for the tours are to be awarded as follows.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Max marks</th>
<th>Evaluation by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance</td>
<td>20</td>
<td>Accompanying staff</td>
</tr>
<tr>
<td>Behaviour</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td><strong>Final examination</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tour Diary</td>
<td>20</td>
<td>By the organising staff/Examiner</td>
</tr>
<tr>
<td>Tour record</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Viva voce</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

H. HIA 415 Horticultural Industrial attachment (0+6)

Course on Industrial attachment will be offered in the VII Semester for five weeks by Department of Horticulture. Orientation programme will be organized in the 14th week of the semester. Students shall be attached with Agri. Clinic / Input Industry / Horticulture based industries like Coffee Board, Tea Board, fruit and vegetable processing industries, Floriculture units, landscape companies, Horticultural nursery units, etc. The final examination will be conducted separately at the end of the semester by the University. The evaluation shall be done as detailed below.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Max marks</th>
<th>Evaluation by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation Note book</td>
<td>20</td>
<td>By Teacher in-charge</td>
</tr>
<tr>
<td>Project report</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td><strong>Final examination</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record</td>
<td>20</td>
<td>By the Examiners</td>
</tr>
<tr>
<td>Power point presentation</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Viva voce</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

I. Experiential learning EXP XXX 42X(0+10) and EXP XXX 42X (0+10)

These courses will be offered in the VIII semester. A student can choose an experiential learning programme of his/her choice. The maximum number of students allowed to register in a department will be decided by the Dean depending on enrolment. If more number of students opt for a same department the particular subject mark is considered for selecting a student.

Periodical evaluation of the above course will be done by the course teacher during different stages of work. Final evaluation of the above course will be done by the teacher in-charge and another staff member appointed as examiner by the Head of Department. The final examination will be conducted by the University before the commencement of regular final semester examinations.
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>Entrepreneurship Skills</td>
<td>10</td>
</tr>
<tr>
<td>7.</td>
<td>Technical Skill Development/ Business networking skills</td>
<td>20</td>
</tr>
<tr>
<td>8.</td>
<td>Report Writing Skills</td>
<td>10</td>
</tr>
<tr>
<td>9.</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>

10. **Mid-Semester Examination (MSE)**

10.1. Writing the mid-semester examination is a pre-requisite for writing the final theory and practical examinations. If a student does not appear for MSE he/she is not eligible to appear for the final examinations. Such a candidate has to reappear for the MSE as and when the respective examinations are conducted only after getting permission from the Dean, Faculty of Agriculture on payment of fee prescribed by the University. MSE will be conducted by the Dean, Faculty of Agriculture. The answer scripts will be shown to the student after valuation, and returned to the course teacher. The Head of the Department/Division will be responsible to ensure the distribution of answer papers to the students.

10.2. The MSE marks will not be shown separately in the grade sheet but will be combined with the respective final theory and practical marks. MSE marks awarded in a course will be added to the supplementary examinations also.

10.3. The MSE marks will be furnished to the Dean, Faculty of Agriculture through the Head of the Department within 10 days after the conduct of MSE. If the student is not satisfied with the award of the marks, he/she shall appeal to the Dean, within three working days after the announcement of marks. The appeal will be considered and the results reviewed by a cell consisting of the Dean and the Head of the Department /Division of Studies concerned. The decision of the Review Cell shall be final. If the Head of the Department himself is the course teacher, one senior member of the Department concerned shall be nominated by the Dean.

10.4 The MSE theory will be of one hour duration.

For courses with both theory and practical, 20 marks will be apportioned as shown below.

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Fill up the blanks @ ½ mark for 10 questions out of 12</td>
<td>5</td>
</tr>
<tr>
<td>ii. Definition @ 1 mark for 5 questions out of 7</td>
<td>5</td>
</tr>
<tr>
<td>iii. Short notes @ 2½ marks for 2 questions out of 3</td>
<td>5</td>
</tr>
<tr>
<td>iv. Essay type @ 5 marks for 1 question out of 2</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
</tr>
</tbody>
</table>
For courses with only Theory, 40 marks will be apportioned as shown below.

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Fill up the blanks @ 1 mark for 10 questions out of 12</td>
<td>10</td>
</tr>
<tr>
<td>ii. Definition @ 2 marks for 5 questions out of 7</td>
<td>10</td>
</tr>
<tr>
<td>iii. Short notes @ 3 marks for 5 questions out of 7</td>
<td>15</td>
</tr>
<tr>
<td>iv. Essay type @ 5 marks for 1 question out of 2</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

10.5. If the student is not able to write the MSE due to deputation by the University, he/she may be permitted to take up a make-up missing examination. Such examination should be completed ordinarily within 15 working days after the respective MSE.

10.6. A student who fails to attend a mid-semester examination due to unavoidable circumstances shall be permitted with prior approval of the Dean to take up missing examination of the particular course, on payment of fee prescribed by the University. Such examinations should be completed ordinarily within 15 working days after the respective MSE.

11. Final Examinations
11.1. The final theory and practical examinations will be of three hours duration each.
11.2. Theory examinations will be conducted after practical examinations.
11.3. The question papers for the final theory examinations will be set by the external examiners.

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Fill up the blanks @ ½ mark for 10 questions out of 12</td>
<td>5</td>
</tr>
<tr>
<td>ii. Definition @ 1 mark for 5 questions out of 7</td>
<td>5</td>
</tr>
<tr>
<td>iii. Short notes @ 2½ marks for 2 questions out of 3</td>
<td>5</td>
</tr>
<tr>
<td>iv. Essay type @ 5 marks for 5 questions</td>
<td>25</td>
</tr>
<tr>
<td>(either or pattern from each Unit)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

Question pattern for theory papers with maximum 60 marks

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Fill up the blanks @ 1 mark for 10 questions out of 12</td>
<td>10</td>
</tr>
<tr>
<td>ii. Define / Explain @ 2 marks for 5 questions out of 7</td>
<td>10</td>
</tr>
<tr>
<td>iii. Short notes @ 3 marks for 5 questions out of 7</td>
<td>15</td>
</tr>
<tr>
<td>iv. Essay type @ 5 marks for 5 questions</td>
<td>25</td>
</tr>
<tr>
<td>(either or pattern from each Unit)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

11.4. Central valuation of answer books will be done by examiners on the advice of the Chairman, Board of Examiners.

11.5. Practical Examination
Practical examinations will be conducted separately towards the end of each semester. Proper maintenance and regular submission of practical records are required. Those who do not bring with them the certified practical records/specimen collection/assignments will not be allowed to appear for the practical examination. The marks awarded for specimen collection and assignments shall be noted in the record, at the time of first appearance and will be taken into
account for subsequent appearances. Such marks awarded by the examiner will be furnished to the Head of the Department.

11.6. Two examiners appointed by the University, nominated by the Head of the Department and recommended by the Dean will conduct the practical examination.

12. Re-appearance and Improvement Examination

12.1. Re-appearance and Improvement Examinations are permitted only for the final theory and practical examinations (retaining marks obtained in mid-semester examination) at the time of regular semester examination only, after the payment of fee prescribed by the university. A student is permitted to write reappearance examination for the failed subjects only three times during n+4 years duration excluding the regular final examination. In the event of a student failing to secure a pass in the three re-examinations permitted, he/she has to reregister the course along with juniors.

12.2. A student who failed in a course (subject) or awarded EE can take up re-examination without undergoing regular classes. A student who has not fulfilled attendance requirement should repeat the course to earn attendance before he/she is permitted to proceed to the next semester.

12.3. A student having an OGPA of less than 6.50 only is eligible to improve the grade point only once in courses completed earlier in which he/she had obtained grade point of less than 8.00. In case a student fails to secure higher grade point in the subsequent attempts, the higher grade point secured by the student either in regular or improvement examination will be accounted. Improvement and re-examination will not be allowed in courses with only practical. Those who fail in these subjects shall have to repeat the course in the subsequent year/ years.

12.4. The camp requirement in NSS and NCC may be allowed along with juniors if the student has secured more than 80 % attendance in the regular courses.

12.5. Those who miss the study tours for any valid reason must undertake the tour along with juniors to complete the degree programme.

12.6. A continuing candidate cannot appear for more than six subjects in the reappearance examination at a time. The candidate who has completed the tenure of four years in the B.Sc.(Hons.) Horticulture Degree Programme (private candidate) cannot appear for more than 16 subjects in the reappearance examination at a time.

12.7. The candidates for the reappearance examinations will submit their applications through the Dean, Faculty of Agriculture who will scrutinize the applications to ensure compliance of regulation 12.1 and 12.3. The attested copy of all grade sheets pertaining to the reappearance examinations should be enclosed along with the applications.

13. Malpractices in Examinations

13.1. The Dean, Faculty of Agriculture shall be responsible for dealing all cases of unfair means by students in writing records, assignments and examinations.

13.2. The invigilator or the course teacher concerned shall report each case of unfair means with full details of the evidence and written explanation of the student concerned to the Dean immediately.

13.3. The Dean shall take appropriate steps on receipt of the report and the report will be sent to the Controller of Examinations for appropriate action as prescribed by the University.
14. Regulations of student conduct and discipline

14.1. Ragging Rules: Students found involved in ragging or in any other misconduct, or if a complaint is received from the affected student(s) to that effect, will be immediately expelled from the current semester and the Dean shall further constitute a committee to probe and conduct enquiry into the matter and based on the report of the committee, the Dean shall forward the same to the Registrar to pass the final orders on merit of case within three working days.

14.2. Unlawful Activities: In case of students found involved in any unlawful activities either within or outside the Hostel/College Campus, besides expulsion both from the Hostel and College, at the discretion of the Dean with the knowledge of the Registrar, the matter will be reported to the Police of the jurisdiction to be dealt with, in accordance with the appropriate law in force.

14.3. Ragging – An offence

Extract of Tamil Nadu Government Gazette – Extra ordinary dt. 29.01.1997 (Tamil Nadu Prohibition of Ragging Act, 1997).

In this Act, unless the context otherwise requires, “Ragging” means display of noisy, disorderly conduct, doing any act which causes or is likely to cause physical or psychological harm or raises apprehension or fear or shame or embarrassment to a student in any educational institution and includes: teasing, abusing or playing practical jokes on or causing hurt to such student or asking the student to do any act or perform something which such student will not, in the ordinary course willingly act or perform. Ragging within or outside any educational institution is prohibited.

Who ever directly or indirectly commits, participates in, abets or propagates “Ragging” within or outside any educational institution, shall be punished with imprisonment for a term which may extend to two years and shall also be liable to fine which may extend to ten thousand rupees.

Any student convicted of an offence under section 4 shall also be dismissed from the educational institution and such student shall not be admitted in any other educational institution.

Without prejudice to the foregoing provision, whenever any student complains of ragging to the head of an educational institution, or to any other person responsible for the management of the educational institution, such head of the educational institution or person responsible for the management of the educational institution shall inquire into the same immediately and if found true shall suspend the student who has committed the offence from the educational institution.

On the recommendation of the Dean, Faculty of Agriculture, The Registrar will have full powers to punish any student who violates the rules by imposing a fine, suspension or expulsion. His decision is final and he need not assign any reason or explanation for the punishment awarded.

These rules will be altered or amended, and further rules may be added if necessary. All the rules for the time being in force should be observed by the students.

15. Award of Degree

The degree namely B.Sc. (Hons.) Horticulture shall be awarded during convocation under the seal of the University to the students who have successfully completed all the graduation requirements as detailed below.

The candidates should have undergone successfully the prescribed course of study in the University. They shall further be required to have completed and passed 180 course credits and shall have earned an overall grade point average (OGPA) of 6.50 out of 10 for all courses completed in B.Sc. (Hons.) Horticulture degree programme.
In addition to the above, students shall in the judgment of the Faculty, possess good conduct and character. The University shall issue Provisional Certificate (PC) to the candidates after having passed all provisional examinations.

15.1. Class ranking
In calculation of class equivalent for OGPA the following classification shall be adopted

<table>
<thead>
<tr>
<th>OGPA</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00 and above</td>
<td>Distinction</td>
</tr>
<tr>
<td>8.00 to 8.99</td>
<td>I Class</td>
</tr>
<tr>
<td>7.00 to 7.99</td>
<td>II Class</td>
</tr>
<tr>
<td>6.50 to 6.99</td>
<td>Pass</td>
</tr>
</tbody>
</table>

16. Transitory Regulations
Separate time table of course work under old semester system will be arranged by the HOD for students with attendance deficiency in a course/courses provided such course/courses are not currently offered due to the introduction of the revised syllabi with effect from the academic year 2017 – 2018. The candidates under old semester system will, however, complete all the examinations within a period of eight academic years from the year of admission.

17. Removal of difficulties
If any difficulty arises in giving effect to the provisions of these regulations, based on the recommendations of the Dean, the Vice-Chancellor may issue necessary orders, which appear to him to be necessary or expedient for removing the difficulty.
PROGRAMME OUTCOMES

PO1- The student will understand scientific basis of plant propagation, crop improvement, crop physiology and production technologies in horticulture crops.

PO2- Can demonstrate advanced propagation methods of horticultural crops and become eligible to manage nursery unit.

PO3- The student will be able to practice advanced production technologies of fruits, vegetable crops, flower crops, medicinal and plantation crops.

PO4- The student will become eligible to get employment in managing vegetable seed production units, organic farms, estate operations, precision horticulture units, orchards, banking sector and post harvest industries.

PO5- Will become skill full in planning, designing and execution of garden projects and will become capable of managing landscape projects.

PO6- Attracting demographic bonus of India to work for Horticulture and promote research and development in Horticulture.

PO7- Graduates will learn appropriate traditional/Indigenous and modern techniques and understand the current problems which are necessary for future goals in Horticulture. Further, they will have absolute idea about energy flow, waste management, environment related enforcements and eco system management.

PO8- Graduate will gain accurate and relevant analytical skills of problems and will have capacity to interpret information, analyze data and draw appropriate statistical conclusions, respond and adapt to changing situations and to understand the ethical standards.
# B.Sc.(Hons.) Horticulture --Semester-wise Course Distribution

## I Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>HOR 110</td>
<td>Fundamentals of Horticulture</td>
<td>2+1</td>
</tr>
<tr>
<td>02.</td>
<td>AGR 111*</td>
<td>Fundamentals of Agricultural Meteorology</td>
<td>1+1</td>
</tr>
<tr>
<td>03.</td>
<td>SAC 112*</td>
<td>Principles of Analytical Chemistry</td>
<td>1+1</td>
</tr>
<tr>
<td>04.</td>
<td>GBP 113*</td>
<td>Fundamentals of Plant Physiology</td>
<td>2+1</td>
</tr>
<tr>
<td>05.</td>
<td>TAM 114* or ENG 114</td>
<td>சமஸ் முறைகளினை கண்டு முன்பரிய அராத்து</td>
<td>0+1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>அராத்து பலு பார்வு (Or) Development Education</td>
<td></td>
</tr>
<tr>
<td>06.</td>
<td>ENG 115*</td>
<td>English for Effective Communication</td>
<td>0+1</td>
</tr>
<tr>
<td>07.</td>
<td>PED 116*</td>
<td>Physical Education</td>
<td>0+1</td>
</tr>
<tr>
<td>08.</td>
<td>PED 117*</td>
<td>Principles and practices of yoga</td>
<td>0+1</td>
</tr>
<tr>
<td>09.</td>
<td>NSS/NCC 118*</td>
<td>National Service Scheme/National Cadet Corps</td>
<td>0+1</td>
</tr>
<tr>
<td>10.</td>
<td>HOR 119</td>
<td>Plant Propagation and Nursery Management</td>
<td>1+1</td>
</tr>
</tbody>
</table>

Total 7+10 =17

## II Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>HOR 120</td>
<td>Production Technology of Tropical and Arid Zone Fruits</td>
<td>2+1</td>
</tr>
<tr>
<td>02.</td>
<td>HOR 121</td>
<td>Growth and Development of Horticultural Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>03.</td>
<td>ENT 122*</td>
<td>Fundamentals of Entomology</td>
<td>2+1</td>
</tr>
<tr>
<td>04.</td>
<td>AGM 123*</td>
<td>Fundamentals of Microbiology</td>
<td>2+1</td>
</tr>
<tr>
<td>05.</td>
<td>SAC 124*</td>
<td>Fundamentals of Biochemistry</td>
<td>2+1</td>
</tr>
<tr>
<td>06.</td>
<td>GPB 125</td>
<td>Botany of Horticultural Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>07.</td>
<td>AEC 126*</td>
<td>Principles of Economics</td>
<td>1+1</td>
</tr>
<tr>
<td>08.</td>
<td>AHS 127</td>
<td>Livestock and Poultry Management</td>
<td>2+1</td>
</tr>
<tr>
<td>09.</td>
<td>COM 128*</td>
<td>Fundamentals of Information Technology</td>
<td>1+1</td>
</tr>
</tbody>
</table>

Total 14+9=23

## III Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>HOR 210</td>
<td>Production Technology of Tropical Vegetables</td>
<td>2+1</td>
</tr>
<tr>
<td>02.</td>
<td>HOR 211</td>
<td>Production Technology of Plantation Crops, Spices and Condiments</td>
<td>2+1</td>
</tr>
<tr>
<td>03.</td>
<td>PAT 212</td>
<td>Principles of Plant Pathology</td>
<td>2+1</td>
</tr>
<tr>
<td>04.</td>
<td>SAC 213*</td>
<td>Fundamentals of Soil Science</td>
<td>2+1</td>
</tr>
<tr>
<td>05.</td>
<td>GBP 214*</td>
<td>Principles of Genetics and Cytogenetics</td>
<td>2+1</td>
</tr>
<tr>
<td>06.</td>
<td>AGR 215</td>
<td>Irrigation and Weed Management</td>
<td>1+1</td>
</tr>
<tr>
<td>07.</td>
<td>AEC 216*</td>
<td>Production Economics and Farm Management</td>
<td>1+1</td>
</tr>
<tr>
<td>08.</td>
<td>ENT 217</td>
<td>Economic Entomology and Nematology</td>
<td>1+1</td>
</tr>
<tr>
<td>09.</td>
<td>AEX 218</td>
<td>Rural Sociology, Educational Psychology and Dimensions of Extension Education</td>
<td>2+1</td>
</tr>
</tbody>
</table>

Total 15+9=24
### IV Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>HOR 220</td>
<td>Commercial Floriculture</td>
<td>2+1</td>
</tr>
<tr>
<td>02.</td>
<td>HOR 221</td>
<td>Study Tour</td>
<td>0+1</td>
</tr>
<tr>
<td>03.</td>
<td>ENT 222</td>
<td>Principles of Pest Management</td>
<td>1+1</td>
</tr>
<tr>
<td>04.</td>
<td>AGM 223*</td>
<td>Soil and Applied Microbiology</td>
<td>2+1</td>
</tr>
<tr>
<td>05.</td>
<td>PAT 224</td>
<td>Mushroom Culture</td>
<td>0+1</td>
</tr>
<tr>
<td>06.</td>
<td>GPB 225*</td>
<td>Principles and Methods of Plant Breeding</td>
<td>2+1</td>
</tr>
<tr>
<td>07.</td>
<td>AEC 226*</td>
<td>Agricultural Marketing, Trade and Prices</td>
<td>1+1</td>
</tr>
<tr>
<td>08.</td>
<td>STA 227*</td>
<td>Agricultural Statistics</td>
<td>1+1</td>
</tr>
<tr>
<td>09.</td>
<td>ENG 228*</td>
<td>Soft Skills of Employability</td>
<td>0+1</td>
</tr>
<tr>
<td>10.</td>
<td>AEG 229*</td>
<td>Farm Power, Machinery and Renewable Energy</td>
<td>2+1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>11+10=21</td>
</tr>
</tbody>
</table>

### V Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>AGR 310*</td>
<td>Climate Change and Disaster Management</td>
<td>1+0</td>
</tr>
<tr>
<td>02.</td>
<td>HOR 311</td>
<td>Breeding of Horticultural Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>03.</td>
<td>HOR 312</td>
<td>Biotechnology of Horticultural Crops</td>
<td>1+1</td>
</tr>
<tr>
<td>04.</td>
<td>HOR 313</td>
<td>Urban and Environmental Horticulture</td>
<td>1+1</td>
</tr>
<tr>
<td>05.</td>
<td>AGM 314*</td>
<td>Environmental Science</td>
<td>2+1</td>
</tr>
<tr>
<td>06.</td>
<td>SAC 315*</td>
<td>Soil Fertility, Fertilizers and Manures</td>
<td>2+1</td>
</tr>
<tr>
<td>07.</td>
<td>AGR 316</td>
<td>Production Technology of Field Crops</td>
<td>2+1</td>
</tr>
<tr>
<td>08.</td>
<td>ENT 317</td>
<td>Insects, Mites and Nematode Pests of Horticultural Crops and Their Management</td>
<td>2+1</td>
</tr>
<tr>
<td>09.</td>
<td>AEC 318*</td>
<td>Agri Business Management and Entrepreneurship</td>
<td>1+1</td>
</tr>
<tr>
<td>10.</td>
<td>AEG 319*</td>
<td>Fundamentals of Soil and Water Conservation Engineering</td>
<td>2+1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>16+9=25</td>
</tr>
</tbody>
</table>

### VI Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>HOR 320</td>
<td>Organic Horticulture and Sylvic Horticulture</td>
<td>2+1</td>
</tr>
<tr>
<td>02.</td>
<td>HOR 321</td>
<td>Production Technology of Temperate and Subtropical Fruits</td>
<td>2+1</td>
</tr>
<tr>
<td>03.</td>
<td>HOR 322</td>
<td>Production Technology of Temperate and Subtropical Vegetables</td>
<td>2+1</td>
</tr>
<tr>
<td>04.</td>
<td>HOR 323</td>
<td>Ornamental and Landscape Gardening</td>
<td>2+1</td>
</tr>
<tr>
<td>05.</td>
<td>PAT 324</td>
<td>Diseases of Horticultural Crops and their management</td>
<td>3+1</td>
</tr>
<tr>
<td>06.</td>
<td>HOR 325</td>
<td>Protected Cultivation and Precision Horticulture</td>
<td>2+1</td>
</tr>
<tr>
<td>07.</td>
<td>HOR 326</td>
<td>Processing and Post Harvest Management of Horticultural crops</td>
<td>2+1</td>
</tr>
<tr>
<td>08.</td>
<td>AEC 327*</td>
<td>Agricultural Finance, Banking and Cooperation</td>
<td>1+1</td>
</tr>
<tr>
<td>09.</td>
<td>AEX 328*</td>
<td>Extension Methodologies and Transfer of Agricultural Technology</td>
<td>1+1</td>
</tr>
<tr>
<td>10.</td>
<td>HOR 329</td>
<td>Production Technology of Medicinal and Aromatic Crops</td>
<td>2+1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>19+10=29</td>
</tr>
</tbody>
</table>
### VII Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>RHWE AEX 410</td>
<td>Village attachment and Technology Transfer (Team teaching, Agrl.Extension and Horticulture)</td>
<td>0+5</td>
</tr>
<tr>
<td>02.</td>
<td>RHWE AGR 411</td>
<td>Agronomical Interventions</td>
<td>0+2</td>
</tr>
<tr>
<td>03.</td>
<td>RHWE HOR 412</td>
<td>Horticultural Interventions</td>
<td>0+3</td>
</tr>
<tr>
<td>04.</td>
<td>RHWE CPT 413</td>
<td>Crop Protection Interventions (Entomology and Plant Pathology)</td>
<td>0+4</td>
</tr>
<tr>
<td>05.</td>
<td>AEX 414</td>
<td>All India Study Tour</td>
<td>0+1</td>
</tr>
<tr>
<td>06.</td>
<td>HIA 415</td>
<td>Horticultural Industrial Attachment</td>
<td>0+6</td>
</tr>
</tbody>
</table>

Total 0+21= 21

### VIII Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course No.</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>EXP XXX 42X</td>
<td>Experiential Learning – I</td>
<td>0+10</td>
</tr>
<tr>
<td>2.</td>
<td>EXP XXX 42X</td>
<td>Experiential Learning – II</td>
<td>0+10</td>
</tr>
</tbody>
</table>

Total 0+20= 20

* Common courses for B.Sc.(Hons.) Agriculture and B.Sc. (Hons.) Horticulture

**RHWE – Rural Horticultural Work Experience; HIA-Horticultural Industrial Attachment EXP – Experiential Learning**

### Abstract

**Semester wise credits**

<table>
<thead>
<tr>
<th>Semester</th>
<th>No of Courses</th>
<th>Credit hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Theory</td>
</tr>
<tr>
<td>I</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>II</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>IV</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>V</td>
<td>10</td>
<td>16</td>
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### Department wise Course Distribution

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<tr>
<td>01.</td>
<td>I</td>
<td>HOR 110</td>
<td>Fundamentals of Horticulture</td>
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<td>Plant Propagation and Nursery Management</td>
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<td>Growth and Development of Horticultural Crops</td>
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17
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<td>06.</td>
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<td>Production Technology of Plantation Crops, Spices and Condiments</td>
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<td>Commercial Floriculture</td>
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<td>19.</td>
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**Agronomy**

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**Genetics and Plant Breeding**

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<td>Principles of Genetics and Cytogenetics</td>
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### Agricultural Entomology

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<td>Economic Entomology and Nematology</td>
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<td>ENT 222</td>
<td>Principles of Pest Management</td>
<td>1+1</td>
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<td>ENT 317</td>
<td>Insects, Mites and Nematode Pests of Horticultural Crops and their Management</td>
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<td>Crop Protection Interventions</td>
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<td>Principles of Plant Pathology</td>
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<td>PAT 224</td>
<td>Mushroom Culture</td>
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<td>VI</td>
<td>PAT 324</td>
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<td>Crop Protection Interventions</td>
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<td>AEC 216*</td>
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<td>Agri Business Management and Entrepreneurship</td>
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### Agricultural Extension

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<td>III</td>
<td>AEX 218</td>
<td>Rural Sociology, Educational Psychology and Dimensions of Extension Education</td>
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<td>AEX 328*</td>
<td>Extension Methodologies and Transfer of Agricultural Technology</td>
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<td>RHWE AEX 410</td>
<td>Village Attachment and Technology Transfer</td>
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### Courses offered by other Departments

#### Computer Science

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#### Engineering

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<td>Farm Power, Machinery and Renewable Energy</td>
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#### Languages

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<tr>
<td>01.</td>
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<td>TAM 114 (Or) ENG 114</td>
<td>தமிழ் இலகியகளி பயிற்சி எம் (0 + 1) (Or) Development Education</td>
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<td>Soil Science and Agricultural Chemistry</td>
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LEARNING OBJECTIVES:
- This course aims to impart the importance of horticulture to students.
- To impart basic knowledge in the various branches of horticulture.
- To acquaint advanced technologies in horticulture.

THEORY
Unit-I: Scope and Importance of Horticulture

Unit-II: Establishment of Orchard and Production Techniques, Factors Influencing Crop Production

Unit-III: Nursery Management and Cropping System

Unit-IV: Growth and Development

Unit-V: Protected Cultivation and Post-Harvest Technology

PRACTICAL

THEORY LECTURE SCHEDULE
1. Scope, importance and nutritive value of horticultural crops.
2. Divisions of horticulture.
3. Area and production of horticultural crops.
4. Export and import of horticulture crops and their products – global scenario.
5. Classification of horticulture crops.
6. Different climate zones of India and Tamil Nadu in relation to horticulture crops.
8. Different planting systems.
9. Nutrition garden, kitchen garden and other types of garden.
10. Soil and climate factors in relation to horticulture crop production.
11. Factors limiting horticulture crop production.
12. Fertility management in orchards.
15. Study of cropping systems.

17. Mid Semester Examination
19. Principles of organic farming
20. Bearing habits of horticulture crops.
21. Study of flowering, pollination and fruit set in horticulture crops.
22. Unfruitfulness – causes and prevention in horticulture crops.
23. Fruit drop – causes and prevention in horticulture crops.
27. Role of growth regulators in horticultural crops.
28. Principles and practices of protected cultivation.
29. Study of different types of media and protected structures for propagation.
30. Study of green house components
31. Environmental control for crop production.
32. Post-harvest technology – importance and causes for post-harvest losses.
33. Maturity indices – climacteric and non climacteric fruits.
34. Harvesting methods.

**PRACTICAL SCHEDULE**
1. Study of different features of orchard.
2. Planning, layout and planting of fruit trees.
3. Identification of tools and implements.
4. Preparation of nursery beds and sowing vegetable seeds and transplanting of vegetable crops.
5. Practicing training of fruit trees.
6. Practicing pruning of fruit trees.
7. Identification of growth regulators and preparation and application.
8. Preparation of fertilizer mixtures and field application.
9. Practicing weeding including chemical weed control.
10. Layout of different irrigation systems and irrigation methods.
11. Study of bearing habits of horticultural crops.
12. Study of different structures for protected cultivation.
13. Study of different media for protected cultivation.
14. Practice in judging the maturity indices of fruits and vegetables.
15. Study of harvesting methods.
16. Visit to green houses.
17. Orientation for final practical examination.

**COURSE OUTCOMES:**

**CO 1:** The student will be able to understand different branches of horticulture

**CO 2:** Can demonstrate advanced technologies like training, pruning, etc in horticulture
## PO-CO MAPPING MATRIX

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## REFERENCES


## AGR 111 – FUNDAMENTALS OF AGRICULTURAL METEOROLOGY (1+1)

### LEARNING OBJECTIVES:

- The students will know the basic concepts of agricultural meteorology and recording various weather elements in observatory.
- The students will understand about solar radiation, temperature and relative humidity on crop production
- The students will be familiar with cyclones, EL Nino and La Nino
- The students will aware clouds, precipitation, drought, flood and evapotranspiration.
- The students will study about different Agro climatic zones of India and Tamil Nadu, importance of weather forecasting and remote sensing.

### THEORY

**Unit-I: Introduction to Meteorology**

Meteorology - Importance and scope in crop production - List of extreme points with the Co-ordinates of India and Tamil Nadu - Atmosphere - Composition and vertical layers of atmosphere (stratification) - Climate - Weather - Factors affecting climate and weather - Climatic types - Different agricultural seasons of India and Tamil Nadu.

**Unit-II: Solar radiation and temperature**


**Unit-III: Atmospheric pressure**

Atmospheric pressure - cyclones, anticyclones, tornado, hurricane and storms - swinging of pressure belt - EL Nino and La Nino - definition and causes. Wind and its effect on crops.
Unit -IV: Clouds and Precipitation

Unit -V: Agro climatic zones and weather forecasting
Agroclimatic Zones of India and Tamil Nadu – Agroclimatic normals – Basics of weather forecasting -importance, synoptic chart - crop weather calendar - Remote sensing - Impact of climate and weather on crop production - pest and diseases.

PRACTICAL
Agromet Observatory - Site selection and layout. Acquiring skill in the use of different instruments and recording data on rainfall / precipitation temperature, pressure, humidity, wind direction and velocity, solar radiation, sunshine hours, evaporation, evapotranspiration, Lysimeters - Automatic weather station - Preparation of synoptic charts and crop weather calendars -Mapping of Agro climatic Zones.

THEORY - LECTURE SCHEDULE
1. Meteorology - Definition, their importance and scope in crop production.
2. Extreme points / Coordinates of India and Tamil Nadu. Atmosphere - Composition of atmosphere - Vertical layers of atmosphere based on temperature difference / lapse rate.
3. Climate and weather - Factors affecting climate and weather. Macroclimate - Mesoclimate - Microclimate - Definition and their importance
8. Atmospheric pressure, diurnal and seasonal variation - causes for variation - Isobar - Low, depression, anticyclone, Tornado, hurricane.

Mid Semester Examination

11. Evaporation - Transpiration, evapotranspiration - Potential evapotranspiration / references crop ET0 - Definition and their importance in agricultural production.
12. Weather forecasting / Warming - Types, importance, Agro Advisory Services, Agromet services for India
13. Agro climatic zones of Tamil Nadu - Agro climatic normals for field crops.
14. Synoptic chart
15. Crop weather calendar.
17. Effect of weather and climate on crop production, soil fertility and incidence of pest and diseases.

PRACTICAL SCHEDULE
1. Site selection and layout for Agromet Observatory - Calculation of local time - Time of observation of different weather elements.
2. An introduction to Annamalai University Meteorological Observatory - AWS
3. Measurement of air, soil temperature and grass minimum temperature and study of thermo hygrograph
4. Measurement of solar radiation and sunshine hours
5. Humidity measurements – use of wet and dry bulb, Assmann psychrometer
6. Measurement of wind direction and wind speed
7. Measurement of rainfall - Ordinary and self-recording rain gauges
9. Measurement of atmospheric pressure - barograph
10. Measurement of Evaporation - Open pan evaporimeter- application of evaporation data-
11. Study of Automatic weather station
12. Data analysis for rainfall chart and thermo hygrograph chart data
13. Analysis of weather data - Mean, monthly, annual and diurnal variation of weather variables.
14. Preparation of crop weather calendars and forecast based agro advisories
15. Preparation of Synoptic charts
17. Orientation for final examination

COURSE OUTCOMES
CO.1: To gain knowledge about role of weather elements in crop growth and how to record various weather elements
CO2: To construct information about effect of solar radiation, temperature and relative humidity on crop production
CO3: To comprehend knowledge with cyclones, EL Nino and La Nino
CO4: To create awareness on cloud types, precipitation, drought, flood and evapotranspiration.
CO5: To formulate cropping pattern for different Agro climatic zones of India and Tamil Nadu, importance of weather forecasting and remote sensing.

PO-CO MAPPING MATRIX

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REFERENCES
LEARNING OBJECTIVES:

- This course aims to familiarize students with the basic principles of Analytical Chemistry and instrumentation techniques.
- The principles and applications of sampling and separation techniques, titrimetric analysis, UV-visible and spectrophotometry, gravimetric analysis and electrochemical methods are emphasized.

THEORY

Unit I: Analytical Principles
General principles of analytical chemistry - common analytical methods - qualitative and quantitative analysis - accuracy and precision of analytical results - Preparation of laboratory reagents.

Unit II: Standards and Indicators

Unit III: Gravimetric Analysis
Gravimetric analysis - principles of precipitation reactions - solubility product - common ion effect - conditions of precipitation - choice of filters - washing solutions.

Unit IV: Instrumentation
Instrumental analysis - principles and practices of potentiometry, conductometry, colorimetry, spectrophotometry, absorption and emission spectroscopy and chromatography - choice of analytical methods.

Unit V: Radiation Chemistry

PRACTICAL

THEORY LECTURE SCHEDULE
1. General principles in analytical chemistry - common analytical methods - quantitative and qualitative analysis - Accuracy and precision of analytical results.
2. Preparation of laboratory reagents - digestion and distillation techniques.
9. Mid Semester Examination.
11. Instrumental methods of analysis- Principles and practices of potentiometry, conductometry, colorimetry and spectrophotometry.
12. Principles and practices of absorption and emission spectroscopy-ICPA
13. Principles and practices of chromatography – Paper chromatography, Gas Chromatography, TLC, HPLC and HPTLC.
17. Use of radioactive and stable isotopes in analytical applications.

PRACTICAL SCHEDULE
1. Study of common laboratory glassware and apparatus – General Guidelines in the laboratory- Part - I
2. Volumetric analysis – Preparation of primary, secondary standards and indicators
3. Acidimetry – Standardization of bases
4. Alkalimetry – Standardization of acids
5. Permanganimetry – Standardization of KMnO4
6. Dichrometry - Standardization of Ferrous Sulphate
7. Iodimetry - Estimation of Copper
8. Complexometry - Estimation of Calcium and Magnesium
10. Potentiometry and Conductometry - Determination of pH and EC
11. Spectrophotometry - Determination of phosphorus
12. Turbidimetry - Estimation of Sulphur
13. Flame Photometry - Estimation of Potassium
14. Absorption spectrophotometry - Estimation of Fe / Zn / Mn / Cu
15. Identification of sub atomic particles, calculation of Half life and Activity Constant
16. Identification of types of radioactive decay
17. Orientation for final examination

COURSE OUTCOMES:
CO.1: Students gain knowledge on basic principles of analytical chemistry
CO.2: Students learn the techniques of stand preparations and various methods of qualitative and quantitative analysis
CO.3: Students develop a conceptual understanding on the principles of different instrumental techniques followed for soil and plant analysis.

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REFERENCES
LEARNING OBJECTIVES:
- To impart basic knowledge on various functions and processes related to crop production, mineral nutrition, plant growth regulators and environmental stresses.
- To understand the mechanism of absorption and translocation of water and nutrients from the soil.
- To study the different pathways in photosynthesis and respiration.
- To study the topics on plant growth regulators and stress physiology.

THEORY

Unit I: Plant Water Relations

Unit II: Plant Mineral Nutrition
Criteria of essentiality - classification of nutrients - macro, micro, mobile, beneficial elements and immobile - mechanism of nutrient uptake - Physiological functions, deficiencies and disorders of macro and micro nutrients - Hidden hunger - Foliar nutrition - root feeding and fertigation - sand culture, hydroponics and aeroponics.

Unit III: Photosynthesis and Respiration
Light reaction - Photosystems- red drop and Emerson enhancement effect - Photolysis of water and photophosphorylation - Photosynthetic pathways - C3 and C4, CAM - difference between three pathways - Factors affecting photosynthesis - Photosynthesis - pathway and its significance - Phloem transport - Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations - Glycolysis - TCA cycle - Oxidative phosphorylation - difference between photo and oxidative phosphorylation - energy budgeting - respiratory quotient.

Unit IV: Growth and Development
Growth - phases of growth - Factors affecting growth - Hormones - classifications - Biosynthetic pathway and role of auxins - Biosynthetic pathway and role of gibberellins and cytokinins - Biosynthetic pathway and role of ethylene and ABA - Novel and new generation PGR’s - Brassinosteroids and salicylic acid - Growth retardants - Commercial uses of PGR’s- Photoperiodism - short, long and day neutral plants - Chailakhyan’s theory of flowering - Forms of phytochrome - Pr and Pfr - regulation of flowering - Vernalisation - Theories of vernalisation - Seed germination - physiological and
biochemical changes - seed dormancy and breaking methods - Senescence and abscission
- physiological and biochemical changes -Physiology of fruit ripening- climacteric and
non-climacteric fruits - factors affecting ripening- Manipulations

Unit V: Stress Physiology

Classification of stresses - Physiological changes and adaptations to drought,
flooding, high and low temperature, salinity and UV radiation – compatible osmolytes –
membrane properties -- compartmentalization – stress alleviation - Global warming –
green house gases – physiological effects on crops - Carbon Sequestration

PRACTICALS

Preparation of different types solutions -Measurement of plant water potential
by different methods - Estimation of photosynthetic pigments- Chlorophylls and
Carotenoids - Determination of stomatal index and stomatal frequency - Measurement of
leaf area by different methods - Physiological and Nutritional disorders in crops plants -
Estimation of chlorophyll Stability Index - Estimation of Relative Water Content -
Determination of photosynthetic efficiency in crop plants – soluble protein - Estimation of
Nitrate Reductase activity -Growth Analysis - Bioassay of Cytokinins and GA - Estimation
of proline -Demonstration of Practical applications of PGRs. Field visit for foliar diagnosis

THEORY LECTURE SCHEDULE

1. Importance of Crop Physiology in Agriculture – Structure of plasma membrane,
chloroplast, mitochondria, peroxisome and vacuole
Osmosis – imbibition – Plasmolysis - Field Capacity and Permanent Wilting Point
3. Mechanisms of water absorption – Pathways of water movement – Apoplast and
symplast
4. Translocation of water – ascent of sap – mechanisms of xylem transport
5. Transpiration – significance - structure of stomata - mechanisms of stomatal opening
and closing – guttation - antitranspirants
6. Mineral nutrition – criteria of essentiality - classification of nutrients – macro, micro,
mobile and immobile – mechanism of nutrient uptake
7. Physiological functions and disorders of macro nutrients – Hidden hunger
8. Physiological functions and disorders of micro nutrients
9. Foliar nutrition- root feeding and fertigation – sand culture, hydroponics and
aeroponics
10. Light reaction – photolysis of water and photophosphorylation
11. Photosynthetic pathways – C3 and C4 cycles
12. CAM pathway – difference between three pathways - Factors affecting
photosynthesis.
13. Photorespiration – pathway and its significance
14. Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and
sink strength and their manipulations
15. Glycolysis – TCA cycle
16. Oxidative phosphorylation – difference between photo and oxidative
phosphorylation – energy budgeting - respiratory quotient
18. Mid Semester Examination
19. Biosynthetic pathway and role of auxins
20. Biosynthetic pathway and role of gibberellins and cytokinin
21. Biosynthetic pathway and role of ethylene and ABA
22. Novel growth regulators – Brassinosteroids and salicylic acid – New Generation
PGR’s
23. Growth retardants and inhibitors -commercial uses of PGR’s
24. Photoperiodism - short, long and day neutral plants – Chailakhyan’s theory of flowering
25. Forms of phytochrome - Pr and Pfr - regulation of flowering
26. Vernalisation - theories of vernalisation – Lysenko and Chailakhyan’s theories
27. Seed germination - physiological and biochemical changes - 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. Drought - physiological changes - adaptation – compatible osmolytes - alleviation
31. High and low temperature stress – physiological changes - membrane properties - adaptation
32. Salt stress - physiological changes - adaptation – compartmentalization - alleviation
33. Flooding and UV radiation stresses - physiological changes - adaptation
34. Global warming – green house gases --physiological effects on crop productivity- Carbon Sequestration

PRACTICAL SCHEDULE
1. Preparation of different types solutions
2. Measurement of plant water potential by different methods
3. Estimation of photosynthetic pigments- chlorophylls and Carotenoids
4. Determination of stomatal index and stomatal frequency
5. Measurement of leaf area by different methods
6. Physiological and Nutritional disorders in crops plants
7. Estimation of chlorophyll Stability Index
8. Estimation of Relative Water Content
9. Determination of photosynthetic efficiency in crop plants – soluble protein
10. Estimation of Nitrate Reductase activity
11. Growth Analysis - LAI, LAD, SLA, SLW, LAR, NAR, RGR, CGR and HI
12. Bioassay of Cytokinin
13. Bioassay of GA
14. Estimation of proline
15. Demonstration of Practical applications of PGRs.
16. Field visit for foliar diagnosis
17. Orientation for final examination

COURSE OUTCOMES:

CO1: Students will acquire basic knowledge on various functions and processes related to crop productivity
CO2: Will be able to identify the mineral nutrient deficiencies and their symptoms
CO3: Know about the various plant growth regulators and environmental stresses.
CO4: In addition, hands on exposure to preparation of solutions, analysis of pigment composition, estimation of growth analytical parameters,

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REFERENCES

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3. http://4e.plantphys.net
4. www.plantphysiol.org

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LEARNING OBJECTIVES:

- Basic principles of learning
- Taxonomy of educational
- Career development and entrepreneurship
- Communication skills

THEORY LECTURE SCHEDULE

2. Occupation and profession, training and education, lateral thinking and convergent thinking, teaching and learning – discussion.
3. Bloom’s classification of educational objectives – Cognitive, Affective, Psychomotor domain(s)
4. Career development – opportunity for graduates of agriculture and allied sciences – discussion
5. Success story of a farmer / entrepreneur – factors involved – role – play
6. Brainstorming – Demonstration
7. Simulation – Educational Simulation-Interactive Teaching - Business Simulation – Company’s annual report for analysis

ENG 114 DEVELOPMENT EDUCATION (0+1)
(Alternate courses for non-Tamil students)
8. Interpersonal communication – Transactional communication – ice breaker
9. **Mid semester examination**
10. The conduct of a symposium
11. Conferencing – the concept and presentation of a paper
12. Scientific Article Writing and Editing
13. Popular Article Writing, Editing and Blogging
14. Project proposal
15. Project Report – writing
17. **Orientation for final examination**

**COURSE OUTCOME**

The student will be able to:

- **CO.1:** Understand the basic principles of learning
- **CO.2:** Have carrier development either in agriculture or allied sciences
- **CO.3:** Write edit and blog scientific articles
- **CO.4:** Have ideas to prepare project
- **CO.5:** Have a knowledge of Entrepreneurship and intrapreneurship

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**REFERENCES**


**ENG 115 ENGLISH FOR EFFECTIVE COMMUNICATION (0+1)**

**LEARNING OBJECTIVES:**

- To introduce the students to the language skills.
- To enable the students to understand the difference between hearing and listening.
- To train the students in English speech with correct pronunciation, stress and tone modulation.
- To cultivate the students with reading habit.
To impart effective and flawless writing skills to the students.

- To cultivate the students with good receptive, reading and productive skills.

**Unit I - Listening**

Introduction - Listening vs Hearing - Basic listening modes - Types of listening - Intensive and Extensive Listening - Process of Listening - Methods of enhancing listening - Barriers of listening.

**Unit II - Speaking**


**Unit III - Reading**

Introduction to Reading - Types of reading - Skimming and Scanning - Idea reading (Reading for information) - Exploratory reading - Study reading (Text reading) - Critical reading - Analytical reading - Note-taking - Précis Writing.

**Unit IV - Writing**

Word formation (prefix, suffix and word coining) - Word expansion (root word and etymology) - Compound words - Single word substitutes - Abbreviations and acronyms - Sentence agreement - Sentence completion - Sentence correction - Writing definitions - Coherence and cohesion in writing - Mind mapping in writing - Paragraph writing techniques - Thesis sentence writing - Inferential sentence writing - Logical arrangement of sentences - Letter Writing - Text conversion - Interpreting charts, graphs, diagrams into text - Poster making - Essay writing (types of essays).

**Unit V**

Integrated skills - Group Discussion - Presentation (Seminar) - Forum discussion - Brain Storming - Debate - Writing Fan-mail - e-mail.

**PRACTICAL SCHEDULE**

1. Introduction - Listening vs Hearing - listening modes - Types of listening - Intensive and Extensive Listening
2. Process of Listening - methods of enhancing listening
3. Barriers of listening - Note-taking
4. English Phonology - Influence of Language 1 on Language 2
5. English Stress and Intonation
6. Principles of speech preparation
7. Presentation skills
8. Techniques of speaking
9. Mid semester examination
10. Introduction to reading - Types - Scanning and Skimming - Idea reading (Reading for information) - Exploratory reading - Study reading (Text reading) - Critical reading - Analytical reading - Note-taking - Précis Writing
11. Word formation (prefix, suffix and word coining) - Word expansion (root word and etymology) - Compound words - Single word substitute - Abbreviations and acronyms
12. Sentence agreement - Sentence completion - Sentence correction - Writing definitions
13. Writing Practice - Mind mapping - sentence writing - Logical arrangement of sentences
14. Paragraph writing - techniques - Thesis sentence writing - Inferential sentence writing - coherence and cohesion in writing
15. Letter Writing - Types of letters
16. Text conversion - Interpreting charts, graphs, diagrams into text - Poster making - Essay writing (types of essays)
17. Orientation for final examination
COURSE OUTCOME:
At the end of the course the students will be able to
CO.1: Understand the nuances of the language skills.
CO.2: Read different texts with improved skill
CO.3: Speak and write in English effectively and flawlessly
CO.4: Take part in group discussion activities with confidence
CO.5: Face the challenging interviews with confidence.
CO.6: Become competent with effective communication skills.

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LEARNING OBJECTIVES:

- Participation in sports will yield optimum physical fitness and positive health for all.
- Physical activities play an important role in the development of children and school children have a tremendous energy and desire to explore. These activities increase strength, speed and overall development and have considerable import not only in their physical growth but also on social and emotional development.
- Physical education and sports, being an integral part of education, experience the impact of scientific advancements.
- Physical education in the development of neuro muscular skills.
- Physical education has concern for and with emotional responses, personal relationships, group behavior, mental learning and other intellectual, social, emotional, and an athletic outcome. Vigorous physical education is indispensable mean today for national strength.
- Physical fitness is the ability of the human body to function with vigor and alertness without undue fatigue and with ample energy to energy in leisure activities and to meet physical stresses. Muscular strength and endurance, Cardio respiratory integrity and general alertness are the overt signs of physical fitness.
- Physical Education has a special significance, unique role and has made unlimited contribution in the modern age as it caters to the biological, sociological and psychological necessities of the man.
- Sports training is the physical, technical, intellectual, psychological and moral preparation of an athlete by means of physical exercise. It is an entire systematic process of preparation of all levels of athletic performance.

SKILL DEVELOPMENT IN ANYONE OF THE FOLLOWING GAMES

Warming up, suitable exercise, lead up games, advance skill for all the games.

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

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

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

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

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

Kho-Kho: Quadra ped, bi-ped, how to given kho, taking a direction, recede, parallel toe method, bullet tow method, distal method, foot out, dive, ring game, chains and persue and defence skills.

Chess: Moves, move of king, move of pawns, move of rooks, move of bishops, move of queen, move of knights, en passant, castling, check and notation.

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

Cricket: Grip, bowling, spin, leg spin, off spin, medium, batting, dive, sweep, mode of delivery, fielding, rolling etc.
Tennis: Grip, forehand drive, back hand drive, stroke, backhand ground stroke, service, volley, smash, wall practice, foot work, defence and offence tactics.

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

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

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

ATHLETICS
(a) Sprint: Medium start, long start, bunch start, set, pick up, finish, upsweep, downsweep, placement, receiving and exchanging.
(b) Jumps: Western roll, belly roll, eastern cut off, fass ferry flop, approach, take off, straddle, hitch-kick, handging, clearance, landing, strides etc.
(c) Throws: Grip, momentum, pre shift, sub phase, the wind up, foot work, entry to the turn, shift, angle of release, follow throw, delivery, front cross step, rear cross step, hop step, fuck method paryobraine, discoput, rotation, carry and glide.
(d) Hurdles: Finding lead leg, use of lead leg and trial leg, flight, clearing, finish.

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

COURSE OUTCOMES
CO 1: Physical education encourage through games and sports sportsmanship, Co-operation loyalty, sociality, self-control, leadership, patriotism, friendship, kindness, sympathy, tolerance, forgiveness and other similar qualities.

CO 2: Physical Education helps to improve one’s ability for work and self expression in the competitive condition of our modern life.

CO 3: Physical fitness is the combination of strength, flexibility, agility, power, speed, muscular endurance and cardio vascular endurance. It is the ability to enjoy our life and to achieve our goals without undue fatigue or stress. It is the production against the degenerative diseases and feeling of youthfulness, even when we are growing old.

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PED 117 PRINCIPLES AND PRACTICES OF YOGA (0 + 1)

LEARNING OBJECTIVES:
- Knowledge of classical and theoretical foundations of the Yoga.
- Knowledge and ability to use Yoga practice.
- Ability to use relationship based approaches to catalyze the positive changes.
- Critical thinking skills and science based literacy to advance the evolution of Yoga practice as an integrative health practice.

PRINCIPLES (20 hrs)
UNIT I
Introduction to yoga: The origins of yoga – Definitions – concepts – Aims and objectives of yoga – Five principles of yoga – yoga Diet – Classification of Diet
UNIT II
Streams of yoga: Karma yoga – Bhakti yoga – Jnana yoga – Raja yoga (Astanga yoga)
UNIT III

UNIT IV
Scientific effects: Physiological, Psychological, Biochemical effects on various systems of human body: Asana – Pranayama – Mudra - Bandha and Shat Kriya

UNIT V
Meditation and relaxation techniques: Meditation: Introduction – Meaning – Definition - Techniques –Obstacles – Benefits ; Relaxation techniques: IRT – QRT – DRT – Psychic sleep

PRACTICAL SCHEDULE (40 hrs)
1. Prayer - Starting and closing
2. Breathing practices for awareness : Hands in and out breathing,-Hand stretch breathing- Ankle breathing
3. Preparatory practices: Loosening practices- Forward and backward bending – Lateral bending-Alternate toe touching-spinal twisting; Jogging-Forward- Backward and Sideward
4. Suryanamaskar – Start with prayer/mantra – 12 poses
5. Asana: Standing -Periyaasana, Padhastasana, Trikonasana; Siting - Vajrasana,Paschimotasana, Ushtrasana, Vakrasana; Prone – Makrasana; Bhujangasana, Shalabasana, Dhanurasana; Supine – Uttanapadasana, Sarvangasana, Matyasana, Halasana, Chakrasana, Savasana
7. Mudra – Chin mudra, Chinmaya mudra, Adhi mudra, Brahma mudra, Namaskara mudra, Maha mudra, Vishnu mudra/Nasiga mudra, Yoga mudra
8. Bandha -Jalandra Bandha, Uddiyana Bandha, Moola Bandha
10. Dhayana practice – Meditation
11. Relaxation -Instant relaxation technique (IRT); Quick relaxation technique (QRT); Deep relaxation technique (DRT)
12. Practical record preparation

COURSE OUTCOMES
CO 1: Knowledge of Yoga Philosophy.
CO 2: Ability to establish the personal health and social health skills to apply.
CO 3: Appropriate application with practice of Asanas, Pranayama, Meditation and relaxation.

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3. Swami SatyanandaSaraswati, Asana, Pranayama, Mudra and Bandha, Bihar School of Yoga , Munger, 2002
NSS/NCC 118 NATIONAL SERVICE SCHEME/NATIONAL CADET CORPS

NSS

PRACTICAL SCHEDULE
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 – 17: Campus development, tree planting maintenance and greening the campus cleaning.

NCC

PRACTICAL SCHEDULE
1. NCC song - Aims and Motto of NCC - Motivation of cadets
2. History of NCC and organization of NCC
3. Food drill - General and word of Command
5. National Integration - Indian History and Culture
6. Health and Hygiene - Structure and Function of a human body, hygiene and Sanitation
7. Social Service - weaker sections of our society and their needs
8. Self Defence - Theory and practice, prevention of untoward incidence
9. Map reading - introduction to map, and lay out of map
10. Disaster Management Civil defence organization and its duties
11. Communication - Different types - media
HOR 119  PLANT PROPAGATION AND NURSERY MANAGEMENT (1+1)

LEARNING OBJECTIVES:
- To make the students learn different methods of plant propagation.
- To impart knowledge on nursery management of various horticultural crops.
- To make them familiarize with the tools and implements essential for all horticultural operations.

THEORY

Unit-I: Methods of propagation
Scope and importance – propagation – overview – methods of sexual and asexual propagation – advantages and disadvantages of sexual and vegetative propagation.

Unit-II: Principles and methods of seed propagation

Unit-III: Propagation structures

Unit-IV: Asexual propagation techniques

Unit-V: Micro propagation
Micro propagation - culture media- culture conditions - meristem culture - callus culture – micro grafting- hardening of plants in nurseries - clonal orchards- nursery registration act.

Current Stream Of Thought

PRACTICAL

THEORY LECTURE SCHEDULE
1. Scope and importance of plant propagation, study of sexual and asexual methods of propagation.
2. Advantages and disadvantages of sexual and vegetative propagation.
3. Seed dormancy – Internal and external factors.
4. Nursery techniques, protray culture, apomixes, monoembryony and polyembryony.
5. Propagation structures - mistchambers, cold frames, hot beds, humidifiers.
6. Construction of green houses and glass houses and its controlling system.
7. Tools and implements.
8. Use of growth regulators in seed and vegetative propagation.
9. **Mid Semester Examination**
10. Types of cuttings and techniques of preparation.
11. Types of layering and techniques of preparation.
15. Propagation by specialized plant parts – bulbs and tubers.
16. Propagation by specialized plant parts – runners, suckers and other organs.
17. Micro propagation techniques

**PRACTICAL SCHEDULE**
1. Preparation of nursery beds, seed treatment and sowing.
2. Identification of various tools and implements.
3. Preparation of pot mixture and study of various containers.
4. Practice in potting, repotting and liquid manures.
5. Study of special structures for propagation viz., mist chamber, cold frames, hot beds, poly house, shade net house.
7. Mist propagation techniques.
8. Practice in propagation by cuttings.
10. Practice in budding methods.
11. Practice in grafting methods.
12. Use of growth regulators in propagation.
13. Practices in separation and description of plant parts used for propagation.
14. Rejuvenation, top working and bridge grafting.
15. Practice in micro propagation and hardening methods.
16. Visit to tissue culture laboratory and controlled green houses and project preparation for commercial nurseries and visit to private nurseries.
17. Orientation for final practical examination.

**COURSE OUTCOMES:**
CO 1: The student will be able to understand basis of plant propagation and nursery management techniques
CO 2: Can demonstrate advanced propagation methods of horticultural crops.

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**REFERENCES**

Web resource
1. www.fruits.com

HOR 120 PRODUCTION TECHNOLOGIES OF TROPICAL AND ARID ZONE FRUITS (2+1)

LEARNING OBJECTIVES:
- The course has been designed to make students acquaint knowledge on production technology of tropical and arid zone fruit crops.
- To inculcate students with the propagation and planting system.
- To make the students learn training and pruning systems and crop regulation in different tropical and arid zone fruits

THEORY
Unit-I: Importance of tropical and arid zone fruit crops
Scope and importance of tropical and arid zone fruits – overview – area, production and export potential – classification of fruits – agro climatic zones of India and Tamil Nadu with emphasis on tropical fruits – research institutes.

Unit-II: Production Technology – I
Importance – nutritive value – climate and soil requirements – varieties – propagation techniques – planting systems and planting densities – after care – training and pruning – nutrient, water and weed management – specialized horticultural techniques including PGR’s – physiological disorders – production problems – pre and post-harvest technologies of the following crops:
Mango, Banana, Guava and Papaya.

Unit-III: Production Technology – II
Sapota, Acid lime, Lemon and Sweet orange.

Unit-IV: Production Technology – III
Grapes, Pomegranate, Jackfruit and Annona.

Unit-V: Production Technology – IV
Aonla, Ber and Minor fruits (wood apple, karonda, phalsa, west Indian cherry, bael).

Current Streams of thought

PRACTICAL
Description and identification of varieties – propagation techniques – application of manures and fertilizers – special practices in fruit crops – application of PGR’s – diagnosis of maladies – working out production economics – visit to commercial orchards.
THEORY LECTURE SCHEDULE
1. Tropical and arid zone fruits – scope and importance.
2. Overview – area, production and export potential of tropical and arid zone fruits.
3. Classification of fruits.
4. Agro climatic zones of India and Tamil Nadu with emphasis on tropical fruits – research institutes.
5. Production technology for Mango
6. Production technology for Mango
7. Production technology for Mango
8. Production technology for Mango
9. Production technology for Banana
10. Production technology for Banana
11. Production technology for Banana
12. Production technology for Banana
13. Production technology for Guava
14. Production technology for Guava
15. Production technology for Papaya
16. Production technology for Papaya
17. Mid Semester Examination
18. Package of practices for Sapota
19. Package of practices for Sapota
20. Package of practices for Acid lime
21. Package of practices for Acid lime
22. Package of practices for Lemon
23. Cultivation aspects of Sweet orange
24. Cultivation aspects of Grapes
25. Cultivation aspects of Grapes
26. Cultivation aspects of Grapes
27. Production techniques of Pomegranate
28. Production techniques of Pomegranate
29. Production techniques of Jackfruit
30. Production techniques of Annona
31. Production techniques of Aonla
32. Production techniques of Ber
33. Production technology for Wood apple, Karonda
34. Production technology for Phalsa, West Indian cherry and Bael.

PRACTICAL SCHEDULE
1. Study of mango varieties.
2. Propagation methods of mango.
3. Study of banana varieties.
4. Scoring technique, sucker treatment and special practices in banana.
5. Study of guava varieties and propagation methods of guava.
6. Special practices in guava.
7. Study of papaya varieties and propagation.
8. Study of sapota varieties and propagation methods.
9. Diagnosis of maladies and methods of application of manures and fertilizers in fruit crops.
10. Study of acid lime, lemon, sweet orange varieties, citrus root stocks and propagation.
11. Study of grape varieties and propagation methods.
12. Study of varieties of Ber, Pomegranate and their propagation.
15. Working out economics of production of tropical and arid zone fruits.
16. Visit to commercial orchards.
17. Orientation for final practical examination

**COURSE OUTCOMES:**

**CO 1:** The student will be able to practice the production technology aspects of tropical and arid zone fruits.

**CO 2:** Can demonstrate important production techniques and diagnose problems in cultivation of tropical and arid zone fruits.

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**REFERENCES**


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3. http://nhb.gov.in/fruit
LEARNING OBJECTIVES:

- It is aimed to impart knowledge on physiology of growth and development.
- To study role of essential nutrients in plant growth and development.
- To learn the role played by plant growth regulator in the growth and development process of horticultural crops.

THEORY

Unit-I: Growth and Growth Analysis

- Growth and development
- Definitions
- Factors affecting growth and development
- Seed germination
- Bud dormancy
- Bud breaking
- Canopy development
- Different stages of growth
- Growth curves
- Growth analysis in horticultural crops.

Unit-II: Role of Essential Nutrients on Plant Growth

- Plant nutrients
- Essential plant nutrients
- Beneficial nutrients
- Their functions
- Mobility in plants
- Deficiency and toxicity symptoms
- Uptake of nutrients from the soil
- Nutrient uptake by leaves
- Leaf sampling for tissue analysis
- Nutrient deficiency symptoms in horticultural crops
- Correction measures
- Physiological disorders of fruits, vegetables, and flower crops
- Identification and management.

Unit-III: Plant Growth Regulators

- Plant growth regulators
- Definitions
- Auxins
- Cytokinin
- Abscisic acid
- Gibberellic acid
- Ethylene
- Brassinosteroids
- Inhibitors and retardants
- Biosynthesis
- Basic functions
- Role in crop growth and development
- Propagation
- Flowering
- Fruit setting
- Fruit thinning
- Fruit development
- Fruit drop
- Fruit ripening.

Unit-IV: Physiology of Flowering

- Flowering
- Factors affecting flowering
- Physiology of flowering
- Photoperiodism
- Long day, short day, and day-neutral plants
- Vernalisation
- Its application in horticulture
- Training and pruning
- Physiological basis of training and pruning
- Source and sink relationship
- Translocation of assimilates.

Unit-V: Physiology of Fruit and Seed Development

- Fruiting
- Factors affecting fruit set and development
- Physiology of ripening of fruits
- Climacteric and non-climacteric fruits
- Seed development
- Factors affecting seed development and maturation
- Physiology of seed development and maturation
- Seed dormancy
- Types, causes, and breaking methods in horticultural crops.

PRACTICAL

- Estimation of chlorophyll content
- Measurement of leaf area by different methods
- Light intensity measurement in different tier cropping
- Growth analysis parameters including harvest index
- Seed viability by tetrazolium test
- Seed dormancy
- Seed germination and breaking seed dormancy with chemicals and growth regulators
- Identification of the deficiency symptoms of macro and micro elements in fruits, vegetables, and flower crops
- Diagnosis of nutrient deficiencies through rapid tissue testing
- Identification of nutritional deficiencies and physiological disorders and their remedial measures in fruits, vegetables, and flower crops
- Preparation of hormonal solution
- Induction of rooting in cuttings
- Ripening of fruits and control of fruit and flower drop
- Estimation of ascorbic acid in fruits
- Estimation of TSS and total sugar contents.

THEORY LECTURE SCHEDULE

1. Factors affecting growth and development
2. Bud dormancy
3. Growth analysis
4. Essential plant nutrients
5. Deficiency symptoms of essential plant nutrients
6. Physiological disorders of horticultural crops
7. Role of plant growth regulators
8. Application of plant growth regulators
9. **Mid Semester Examination**
10. Factors affecting flowering
11. Physiology of flowering
12. Photoperiodism
13. Vernalization
14. Physiology of pruning and training
15. Physiology of fruit, tuber and bulb development
16. Physiology of ripening of fruits
17. Seed dormancy - types, causes and breaking methods.

**PRACTICAL SCHEDULE**
1. Observation of different types of seed germination
2. Methods of breaking seed dormancy
3. Methods of breaking bud dormancy
4. Seed viability test using Tetrazolium
5. Measurement of leaf area by different methods
6. Estimation of chlorophyll content
8. Identification of nutrient deficiencies and physiological disorders in vegetable crops
9. Identification of nutrient deficiencies and physiological disorders in flower crops
10. Identification of plant growth regulators
11. Use of PGRs in the propagation of horticultural crops
12. Use of PGRs in the induction of flowering, fruit setting and prevention of fruit drop.
13. Visit to orchard to study different pruning and training practices in horticultural plants.
14. Use of PGR in ripening of fruits.
15. Estimation of ascorbic acid in fruit crops.
16. Estimation of TSS and total sugars in fruit crops.
17. Orientation for final practical examination.

**COURSE OUTCOMES:**

**CO1**: Students will be able to understand the physiology of growth and development and the role of growth regulators.

**CO2**: Will be able to recommend growth regulation techniques and PGRs for production problems in horticultural crops

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**ENT 122: FUNDAMENTALS OF ENTOMOLOGY (2+1)**

**LEARNING OBJECTIVES:**
- To identify and distinguish insects from other closely related taxa
- To study about the relative position of insects in animal kingdom
- To explore the external morphology, anatomy, physiology and behaviour of insects
- To understand the classification of insects and to identify different groups of insects
- To study different methods of collection and preservation of insects

**THEORY**

**Unit-I: History and Importance**


**Unit-II: Morphology and Behaviour**

Body segmentation, Structure and functions of insect cuticle – cuticular appendages and moultmg. Basic Structures of head, thorax, abdomen and their appendages. Modifications of insect antennae, mouth parts, legs, wings, wing venation, wing coupling apparatus and abdomen and its appendages; Metamorphosis and their types; Insect behaviour – tropisms, biocommunication, rhythm, diapause, migration, defense and offence.

**Unit-III: Anatomy and Physiology**

Anatomy and functions of digestive, excretory, respiratory, circulatory, nervous and reproductive systems in insects. Types of reproduction and mating. Functions of exocrine and endocrine glands. Sensory organs and their functions.

**Unit-IV: Taxonomy of Entognatha and Ectognatha (Insecta) (Apterygota and Pterygota)**


**Unit V: Taxonomy of Endopterygota**

Distinguishing characters of agriculturally important orders of Endopterygota - Neuroptera (Chrysopidae, Myrmeleontidae, Mantispidae, Ascalaphidae), Megaloptera, Rhaphidioptera, Coleoptera (Cicindellidae, Carabidae, Dytiscidae, Curculionidae, Apionidae, Staphylinidae, Coccinellidae, Lampyridae, Lampyriidae, Hydrophilidae, Scarabaeidae, Dynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae,
Meloidae, Cetonidae, Buprestidae, Elateridae and Bostrychidae), Strepsiptera,
Diptera(Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae,
Pipunculidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae, Drosophilidae),
Mecoptera, Siphonaptera, Trichoptera, Lepidoptera (Nymphalidae, Lycaenidae, Pieridae,
Papilionidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochliidae,
Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae,
Metarbelidae and Hesperiidae) and Hymenoptera (Tenthredinidae, Apidae,
Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, ,
Ichneumonidae, Braconidae, Platygastridae, Bethylidae, Evanidae,
ChalcididaeEncyrtidae, Eulophidae and Trichogrammatidae).

PRACTICAL

Assignment:
Each student has to submit 25 insects covering at least ten orders

THEORY LECTURE SCHEDULE
1. Definition and branches of Entomology, Its history and scope in Agriculture and Horticulture. Origin of insects, Position of insects in the animal kingdom
2. Characters of Phylum Arthropoda and its classes
3. Factors responsible for insect dominance
4. Segmentation and Structure of Insect body wall and cuticular appendages
5. Moulting process in insects
6. Basic structures of head and its appendages, modifications of insect antennae
7. Modifications of insect mouth parts
8. Basic structures of thorax and its appendages, modifications of legs, wings, wing venation and wing coupling apparatus
9. Basic structures of abdomen and its appendages
10. Metamorphosis and types of eggs, larvae and pupa
11. Tropism, biocommunication in insects - Sound and light production, diapause, rhythm, migration, defense and offence in insects
12. Elementary knowledge on digestive system, structure of alimentary canal and its modifications in certain groups
13. Elementary knowledge on digestive enzymes, digestion and absorption of nutrients
14. Elementary knowledge on excretory system in insects – malpighian tubules – accessory excretory organs and physiology of excretion
15. Elementary knowledge on respiratory system in insects – structure of trachea – tracheoles
16. Types of respiratory system – spiracles – respiration in aquatic and endoparasitic insects

17. **Mid Semester Examination**


20. Elementary knowledge on nerve impulse conduction – axonic and synaptic transmissions


22. Types of reproduction – oviparous, viviparous, paedogenesis, polyembryony, ovoviviparous and parthenogenesis

23. Elementary knowledge on structure and functions of Exocrine and Endocrine glands

24. Structure of sense organs – types of sensilla – photoreceptors, chemoreceptors and mechanoreceptors

25. Taxonomy and systematics – Definition, importance and binomial nomenclature. Classification of insects – Apterygota, Pterygota, Endopterygota with examples


28. Distinguishing characters of Neoptera orders – Polyneoptera – Plecoptera, Dermaptera, Embioptera, Zoraptera, Orthoptera,

29. Distinguishing characters of orders Phasmatodea, Grylloblattodea and Mantophasmatodea, (Mantodea, Blattodea (Cockroach), Blattodea (Termites)

30. Distinguishing characters of Paraneoptera orders – Psocodea (free living), Psocodea (parasitic), Thysanoptera and Hemiptera

31. Distinguishing characters of order Endopterygotes – Neuroptera, Megaloptera, Rhaphidioptera, Coleoptera and families of agricultural importance

32. Distinguishing characters of order Strepsiptera, Mecoptera, Siphonaptera, Trichoptera and Diptera and their families of agricultural importance

33. Distinguishing characters of order Lepidoptera and families of agricultural importance

34. Distinguishing characters of order Hymenoptera and families of agricultural importance.

**PRACTICAL SCHEDULE**

1. Observations on segmentation and external features of grasshopper/cockroach/blister beetle

2. Practicing the methods of collection, killing, pinning, labelling, display and preservation of insects including immature stages. Preparation of riker mount.

3. Observations on various types of insect head orientation and antennae

4. Demonstration of mouth parts of cockroach and plant bug and study of mouth parts of female mosquito, honeybee, thrips, antlion grub, house fly and butterfly

5. Observations on the modifications in legs and wings (wing venation, regions, angles and wing coupling)

6. Observations on various types of abdominal appendages

7. Studies on the types of metamorphosis. Observations on immature stages of insects – Eggs, larvae and pupae

8. Demonstration of digestive system and male and female reproductive systems (grasshopper/cockroach)

10. Observation on distinguishing characters of Phasmatodea, Grylloblattodea, Mantophasmatodea, Mantodea, Blattodea (Cockroach), Blattodea (Termites) Psocodea - free living, Psocodea (parasitic) and Thysanoptera.


12. Observation on distinguishing characters of Neuroptera, Megaloptera and Rhaphidioptera.


15. Observation on distinguishing characters of Lepidoptera (Families: Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Crambidae, Pyralitidae, Noctuidae, Arctiidae, Bombycidae, Cechinnidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae, Meteoridae and Hesperiidae).


17. Orientation for final examination

COURSE OUTCOMES:
CO 1: Describe characters of Arthropoda and Insecta, and their relationship and reasons for insect dominance
CO 2: Explain morphology of insects, its appendages, their modifications, growth and development (metamorphosis) and behaviour
CO 3: Describe anatomy and physiology of various systems of insects
CO 4: Identify different orders of insects based on their diagnostic characters up to family level
CO 5: Demonstrate different collection and preservation techniques of insects

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2. www.zin.ru/animalia
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4. www.insectexplained.com/03external.htm
5. www.earthlife.net/insects/anatomy.html

AGM 123 - FUNDAMENTALS OF MICROBIOLOGY (2+1)
LEARNING OBJECTIVES:
- To enable better understanding of students about the microscopic world around them
- To acquaint students with the basic laboratory techniques and tools of microbiology
- To introduce the fundamentals characteristics of various microorganisms
- To develop experimental skills, such as handling, various microorganisms, culturing & maintenance of Microorganisms

THEORY
Unit I. History of Microbiology

Unit II. Microbiological Techniques
General principles of light microscopy - magnification, resolving power and numerical aperture. Different types of light and electron microscopes. Staining techniques - principle and types of stains; simple, negative, differential and structural staining. Sterilization and disinfection techniques; principles and methods of sterilization physical methods – heat, filters and radiation; chemical methods. Isolation, enrichment and purification techniques of bacteria, yeast, moulds and actinobacteria. Preservation of microbial cultures.

Unit III. Position of Microbes in the living World and their Structure

Unit IV. Growth, Nutrition and Metabolism
Bacterial growth- population growth- growth cycles of population - measurement of growth; environment on growth – temperature, oxygen, pH and salts; energetics in
bacteria; oxidation –reduction , electron carrier – overview of aerobic and anaerobic respiration and fermentation in bacteria.

**Unit V. Viruses, Bacterial Genetics and Immunology**


**PRACTICAL**


**THEORY LECTURE SCHEDULE**

1. Definition and scope of microbiology – Development of microbiology as science
2. Biogenesis and a biogenesis theory. Contributions by Antonie Van Leeuwenhoek, Louis Pasteur
4. Microscopy; principles – resolving power and magnification. Light microscopy
5. Different types of microscopes - UV, Dark Field, Phase Contrast, Fluorescence and Electron Microscopes; Atomic and Confocal Scanning Laser Microscopy
6. Staining techniques - principle and types of stains staining techniques- simple, negative, differential and structural staining methods
7. Sterilization – principle – physical agents and chemical methods
8. Isolation and enrichment culture techniques; preservation techniques
9. Evolutionary relationship - Position of microbes in living world – concepts and developments in classification of microorganisms
10. Groups of microorganisms prokaryotes and eukaryotes
11. Archaea – ecology; differences among archaea, eubacteria and eukaryotes
12. Systematic bacteriology Bergey’s manual of systematic bacteriology – outline only
13. Cell biology; size, shape, structure and arrangement of cells
14. External structures in bacteria and their functionality
15. Functional anatomy and reproduction in bacteria
16. Morphology of fungi – economic importance
17. Morphology of algae – economic importance
18. Mid Semester Examination
21. Nutritional types of bacteria; energetic in bacteria. Metabolic diversity/pathways specific to bacteria
22. Microbial metabolism- Energy generation by substrate level phosphorylation, oxidative and Photo phosphorylation
23. Aerobic respiration and anaerobic respiration

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24. Fermentative mode of respiration
25. Viruses and their properties; types of viruses
26. Bacteriophages – lytic and lysogenic and temperate phages
27. Mutation in bacteria – principles and types
28. Mutagens – physical, chemical and biological
29. Genetic recombination – competency transformation
30. Genetic recombination by Conjugation – concept of Hfr
31. Genetic recombination by Transduction – generalized and specialized
32. Basic concepts of Immunology
33. Immunology – principles – specific and non specific defense
34. Antigen – antibody reactions – vaccines applications

PRACTICAL SCHEDULE
1. Laboratory safety and handling of chemical and glasswares
2. Study of compound microscope
3. Micrometry
4. Methods of sterilization
5. Preparation of culture media and agar slants
6. Isolation and identification of bacteria, fungi and actinobacteria
7. Purification of bacteria
8. Purification of fungi
9. Gram staining
10. Bacterial spore staining
11. Capsule staining
12. Negative staining
13. Morphology of fungi – somatic structures
14. Morphology of fungi – Asexual and Sexual reproductive structures
15. Morphology of actinobacteria
16. Growth of microorganisms on solid and liquid media
17. Orientation for final examination

COURSE OUTCOMES:

CO – 1: Students gained knowledge on the basic and applied aspects of understanding and exploitation of microorganisms for the welfare of human kind.

CO – 2: Students gained knowledge on the historical developments and contributions of some scientist in the field of microbiology.

CO – 3: Students exposed practical hands on experience in the basic skills employed in microbiological laboratories, which will equal them to carry out independent research in microbiological/ biotechnology in feature.

CO – 4: Students thoroughly exposed to modern approaches in classification, nutrition, cytology, cultivation, purification and preservation of microorganisms.

CO – 5: Students gained knowledge on biotechnological principle like genetic recombination, Immunological science and vaccines.

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REFERENCES

e-resources
1. http://www.microbes.info

SAC 124 - FUNDAMENTALS OF BIOCHEMISTRY (2+1)

LEARNING OBJECTIVES:
- To gain basic knowledge of the biomolecules viz., Carbohydrates, Proteins and Lipids - properties, structure and metabolism.
- To learn basics of enzymes, vitamins and hormones.
- To study qualitative tests for carbohydrates and quantitative determination of carbohydrates, proteins, chemical constants of lipids and assay of Vitamins.

THEORY

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

Unit II - Proteins and Enzymes

Unit III- Lipids:

Unit IV- Metabolism

**Unit V – Secondary Metabolites**


**PRACTICAL**


**THEORY LECTURE SCHEDULE**

1. Introduction to Biochemistry, Carbohydrates - occurrence and classification.
2. Structure of monosaccharide, oligosaccharides and polysaccharides.
5. Amino acids - Classification and structure.
7. Classification of proteins based on function and solubility.
8. Structure of protein - Primary, secondary, tertiary and quaternary structure.
9. Protein folding, physical and chemical properties of proteins.
10. Enzymes - Properties, classification and nomenclature.
12. Enzyme inhibition - competitive, non-competitive, uncompetitive and allosteric enzymes.
13. Coenzymes, cofactors and isoenzyme.
15. Storage lipids – Structural lipids - types and importance.
16. Sterols - basic structure and their importance.
17. Midsemester Examination
19. Carbohydrate metabolism - breakdown of starch by amylases
20. Glycolysis - Reactions and bioenergetics.
21. TCA cycle - Reactions and bioenergetics.
23. Respiration - electron transport chain and oxidative phosphorylation.
24. Lipid metabolism - lipases and phospholipases.
26. Biosynthesis of fatty acids and triacylglycerol.
27. Transamination, deamination and decarboxylation of amino acids.
28. Ammonia assimilating enzymes - GS, GOGAT and GDH.
29. Metabolic inter-relationship.
31. Occurrence, classification and functions of terpenes and alkaloids.
32. Vitamins – Definition – general characteristics and classification.
34. Cytokinins and other natural growth hormones and inhibitors in plants.

**PRACTICAL SCHEDULE**

I. Qualitative tests for carbohydrates
   1. Identification of glucose and fructose
2. Identification of sucrose and maltose
3. Identification of lactose
4. Identification of dextrin
5. Identification of starch
6. Scheme for identification of unknown carbohydrates

II. Quantitative analysis of carbohydrates
7. Estimation of glucose (By copper reduction method)
8. Estimation of sucrose (By Inversion method)
9. Estimation of starch

III. Analysis of proteins
10. Estimation of amino acid (by Sorenson method)
11. Colour reactions of protein

IV. Analysis of lipids
12. Determination of acid value of an oil
13. Determination of iodine value of an oil
14. Determination of saponification value of an oil
15. Determination of peroxide value of an oil

V. Vitamins
16. Determination of ascorbic acid (vitamin C)
17. Record certification

COURSE OUTCOMES:
CO1: Students gain knowledge about the biochemistry of amino acids, proteins, sugars, carbohydrates, and lipids.
CO2: Students develop a conceptual understanding of different biochemical processes and metabolic pathways specific to plants.
CO3: Students learn about the various quantitative aspects of biochemistry including enzyme kinetics, protein ligand binding, analytical techniques, and bioenergetics.

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GPB 125 BOTANY OF HORTICULTURAL CROPS (1+1)

LEARNING OBJECTIVES:

- To expose the students to the basic features of botanical description, economic parts and economic importance of different horticultural crops.
- Collection and preparation of herbarium specimens representing minimum of ten families of the crop species.
- Collection and characterization of seeds of horticultural crops.

THEORY

Unit–I: Taxonomy and floral biology


Unit–II: Botany of fruit crops

Botany, floral biology, pollination, fruit set and economic part in the families Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin), Musaceae, Moraceae, Vitaceae, Caricaceae, Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove), Sapotaceae, Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose).

Unit–III Botany of vegetable crops

Botany, floral biology, pollination, fruit set and economic part in the families Solanaceae (tomato, brinjal, chilli, potato), Malvaceae, Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber), Moringaceae, Fabaceae (peas, French beans), Alliaceae (onion, garlic), Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae, Amaranthaceae, Convolvulaceae (sweetpotato), Araceae (elephant foot yam, colocasia), Dioscoreaceae (yam, medicinal Dioscorea).

Unit–IV Botany of spice crops

Botany, floral biology, pollination, fruit set and economic part in the families Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (Vanilla, Dendrobium orchid), Apiaceae (Umbelliferae) (coriander), Myristicaceae, Lauraceae, Leguminosae, Caesalpiniaeae, Camelliaeae, Rubiaeae, Areciaeae(Palmae) (coconut, arecanut, palmyrah, oil palm), Sterculiaeae(Cocoa).

Unit–V Botany of flower crops

Botany, floral biology, pollination, fruit set and economic part in the families Oleaceae (malligai, mullai, jathimalli), Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum), Amaryllidaceae, Acanthaceae, Caryophyllaceae, Iridaceae, Apocynaceae, Poaceae (Graminae), (lemongrass, citrononella, palmarosa, vetiver), Geraniaceae, Lamiaceae (Labiatae) (coleus, patchouli, mint, maruvu), Scrophulariaeae.

PRACTICAL

Observation and recording the morphology of root, stem, leaf, flower and fruit. Study of taxonomy and morphology of crops in the above families – herbarium (minimum 50 – covering not less than 25 families) collection of the crops mentioned in theory.

THEORY LECTURE SCHEDULE

1. Systematic botany-principles involved in nomenclature.
2. Terminology, morphological description and classification based on root, stem, leaf, inflorescence, flower and fruit.


4. Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin) and Musaceae.

5. Moraceae, Vitaceae, Caricacea, Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove) and Sapotaceae.

6. Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose).

7. Solanaceae (tomato, brinjal, chilli, potato) and Malvaceae.

8. Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, (cucumber).

9. **Mid-Semester Examination**

10. Moringaceae and Fabaceae (peas, French beans) and Alliaceae (onion, garlic).

11. Brassicaceae (cabbage, caulifower, radish), Chenopodiaceae and Amaranthaceae.

12. Convolvulaceae, Umbelliferae, Araceae (elephant foot yam, colocasia) and Dioscoreaceae (yam, medicinal Dioscorea).

13. Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (vanilla, dendrobium orchid) and Apiaceae (coriander).


15. Camelliaceae, Rubiaceae, Palmae (coconut, arecanut, palmyrah, oil palm), Sterculiaeae.

16. Oleaceae (malligai, mullai, jathimalli), Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum), Amaryllidaceae and Acanthaceae.

17. Caryophyllaceae, Iradiaceae, Apocynaceae, Graminae, (lemongrass, citrononella, palmarosa, vetiver), Geraniaceae, Labiatae (coleus, patchouli, mint, maruvu) and Scrophulariaceae.

**PRACTICAL SCHEDULE**

Observation and description of the taxonomy and morphological characters of the crops in the families

1. Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin) and musaceae.


3. Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove) and Sapotaceae.

4. Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose).

5. Solanaceae (tomato, brinjal, chilli, potato) and Malvaceae.

6. Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, (cucumber).

7. Moringaceae and Fabaceae (peas, French beans) and Alliaceae (onion, garlic).

8. Brassicaceae (cabbage, caulifower, radish), Chenopodiaceae and Amaranthaceae.

9. Convolvulaceae, Umbelliferae, Araceae (elephant foot yam, colocasia) and Dioscoreaceae (yam, medicinal Dioscorea).

10. Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (vanilla, dendrobium orchid) and Apiaceae (coriander).


12. Camelliaceae, Rubiaceae, Palmae (coconut, arecanut, palmyrah, oil palm) and Sterculiaeae.
13. Oleaceae (malligai, mullai, jathimalli), Amaryllidaceae and Acanthaceae.
14. Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, (pyrethrum)
15. Caryophyllaceae, Iradiaceae, Apocynaceae and Geraniaceae
16. Graminaceae (lemongrass, citronella, palmarosa, vetiver), Labiatae (coleus, patchouli, mint, maruvu) and Scrophulariaceae
17. Orientation for final practical examination.

**COURSE OUTCOMES:**

**CO 1:** The student will be able to differentiate horticultural crops based on its anatomical characters such as root, shoot, leaf, venation etc.

**CO2:** Will be able to classify the plant species based on its economic importance

**CO3:** The student will be able to identify the family to which a particular crop belongs to.

**CO4:** Botanical features and economic importance of different horticultural crop plants belonging to various families will be exposed.

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**REFERENCES**


**E REFERENCES**

AEC 126 - PRINCIPLES OF ECONOMICS (1+1)

LEARNING OBJECTIVES:
- To provide knowledge to students about basic concepts of economics
- To explain its relevance and importance in agricultural science

THEORY

Unit I: Nature and Scope of Economics

Unit II: Theory of Consumption

Unit III: Theory of Production

Unit IV: Theory of Exchange and Distribution

Unit V: Macroeconomic Concepts

Current streams of thought.

PRACTICAL

analysis - Study of demographic changes in India - Measures of human development: Welfare indicators - Human Development Index (HDI) and Physical Quality of Life Index (PQLI).

THEORY LECTURE SCHEDULE
1. Economics: Nature and scope of economics: Agricultural Economics: Definition and scope, importance, subject matter: Science Vs. art, positive science Vs. normative science, deductive method Vs. inductive method
5. Law of Equi-Marginal Utility: Definition, assumptions, limitations and applications - Indifference curve analysis: Definition and properties of indifference curves and budget line.
7. Demand: Definition, Kinds of demand, Demand schedule, Demand curve, Law of Demand, Determinants of demand - Extension and contraction of demand Vs. Increase and decrease in demand.
8. Elasticity of Demand: Own price, cross price and income elasticities of demand, Degrees of price elasticity of demand - Factors influencing elasticity of demand and Importance of Elasticity of demand.
9. Mid Semester Examination.
15. Wages: Real wage and money wage – Wage theories - Interest: Pure interest and gross interest - Theories of interest - Profit: Meaning of economic profit - Profit theories.

PRACTICAL SCHEDULE
3. Indifference curve analysis and consumer equilibrium.
4. Law of Demand, demand schedule - Graphical derivation of individual and market demand.
5. Estimation of own price, income and cross price elasticities of demand.
7. Illustration on Engel’s Law of Family Expenditure.
10. Types and functions of money.
11. Inflation: Analysis of causes of inflation and control measures.
12. Approaches to comptuation of national income.
13. Study of structural changes in the economy.
14. Food grain production in India - Growth rate analysis.
15. Study of demographic changes in India.
16. Measures of human development: Welfare indicators - Human Development Index (HDI) and Physical Quality of Life Index (PQLI).
17. Orientation for final examination

COURSE OUTCOMES:
At the end of the course students will be able to
CO1: Understand the important concepts on micro and macro economics.
CO2: To know the principles of economics, concepts like GDP, GNP, Inflation.
CO3: To acquire the practical exposure on application of economic principles related to agriculture.
CO4: To work out the measurement of Human Development Index, welfare indicators.

CO-PO MAPPING MATRIX

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AHS 127 LIVESTOCK AND POULTRY MANAGEMENT (2+1)
LEARNING OBJECTIVES:
- The course aims to provide the students with holistic knowledge about the livestock and poultry management so that it can be applied at field level.
- To provide hands on training about livestock, poultry-based farming and preparation of dairy products.
- To impart knowledge and latest technologies adopted in livestock industries to infuse entrepreneurial attitude among the students.

THEORY
Unit I: Introduction to Livestock and Poultry Management

Unit II: Dairy Cattle Management

Unit III: Sheep and Goat Management
Breeds - Classification - Economic traits - Systems of rearing - Housing management – Floor space requirement – Care and management of young and adult stock – Nutrition – Feed and fodder – Flushing – Steaming up - Prophylactic and control measures of diseases.

Unit IV: Swine Management

Unit V: Poultry Management
Breeds – Classification - Commercial strains of broiler and layer – Housing – deep litter and cage system – Brooding – Litter management – Care and management of broiler and layer - Nutrition of chick, grower, layer and broiler – Feed conversion ratio - Prophylactic and control measures of diseases. Current streams of thought.

PRACTICALS

THEORY LECTURE SCHEDULE
1. Significance of livestock and poultry in Indian economy - livestock and poultry census.
2. Different livestock development programmes of Government of India and Tamil Nadu.
3. Zoological classification of livestock - common nomenclatures used in Animal Husbandry practices
5. Definition of breed - classification of cattle breeds - breed characteristics of Indian cattle - Sindhi, Gir, Sahiwal, Tharparkar and Kangayam.
8. Estrous cycle – signs of estrous - Artificial Insemination - merits and demerits
9. Housing management - selection of site and floor space requirement for calves, heifer and milch animals.
10. Systems of housing – loose housing – conventional barns - single row system - double row system - head to head and tail to tail arrangement - merits and demerits.
11. Care and management of new born calf, heifer, pregnant and lactating cows.
13. Classification of feed stuff – Importance of green fodder.
15. Factors affecting composition of milk - Pasteurization of milk.
16. Prophylactic and control measures of diseases.
17. **Mid Semester Examination.**
18. Sheep and goat farming - classification of breeds of Indian and exotic origin - economic traits.
19. Systems of rearing - housing management - floor space requirement for adult and young stock.
20. Care and management of young and adult sheep and goat.
22. Prophylactic and control measures of diseases.
24. Economic traits - housing of swine.
25. Care and management of sow, boar and piglets - nutrition - creep feeding.
26. Prophylactic and control measures of diseases.
27. Classification of chicken breeds - commercial strains of broiler and layer.
28. Systems of housing- deep litter and cage system- merits and demerits - floor space requirement.
30. Care and management of grower and layer.
32. Feed conversion ratio / dozen egg or kg of meat production.
33. Prophylactic and control measures of diseases.
34. Vaccination schedule for broiler and layer.

**PRACTICAL SCHEDULE**
1. Study of external parts of cattle
2. Common methods of restraining in cattle
3. Identification methods of livestock
4. Disbudding and deworming in cattle
5. Determination of age in cattle
6. Study and design of cattle shed
7. Selection of dairy cow by score card method
8. Determination of weight in cattle
9. Determination of specific gravity in milk
10. Demonstration of fat percentage and total solids estimation in milk
11. Demonstration of cream separation
12. Demonstration of ice cream making
13. Identification of feed and fodder
14. Identification of poultry farm equipments
15. Measures of performance efficiency in broiler and layer
16. Visit to dairy plant, layer and broiler farms
17. Orientation for final examination

**COURSE OUTCOMES:**

**CO 1:** Basic managemental practices of different livestock enterprises such as cattle, sheep, goat, pig and poultry.

**CO 2:** Clean milk production and its impact on the society.

**CO 3:** Modern rearing practices of sheep and goat for meat and milk production.

**CO 4:** Management practices of swine, broiler and layer farming for egg and meat production.

**CO 5:** Integrated farming system (IFS) along plantation and horticultural crops for income generation and entrepreneurship skill development.

**CO-PO MAPPING MATRIX**

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9. [www.indiagronet.com](http://www.indiagronet.com)
10. [www.foodsci.uoguelph.ca](http://www.foodsci.uoguelph.ca)
11. [www.fil-idf.org](http://www.fil-idf.org)
COM 128 FUNDAMENTALS OF INFORMATION TECHNOLOGY  (1+1)

LEARNING OBJECTIVE

- Create a document in Microsoft Word with formatting that complies with the APA guidelines
- Write functions in Microsoft Excel to perform basic calculations and to convert number to text and text to number
- Create a presentation in Microsoft PowerPoint that is interactive and legible content

THEORY

UNIT I: Computer Basics

UNIT II: Operating System And Software

UNIT III: Computer Networks And Internet

UNIT IV: Computer Programming And Languages

UNIT V: Database Management Systems

THEORY LECTURE SCHEDULE

Introduction to Internet, Internet Applications, Internet Tools, Web Browser and Email client

Mid-semester examination


Introduction to Computer Programming, Algorithm, Flowchart, Decision Tables, Pseudo code and Program Control Structures

Programming paradigms, Introduction to Programming Languages

Generation of Programming Languages, Current Trends in Computer Programming and Languages.

Introduction to Database, Logical and Physical Data Concepts, Data Base Management System and its Architecture, Database Models

Normalization Techniques, Types of Databases, Introduction to Structured Query Language

Data Definition Language, Data Manipulation Language

Current Trends in Database Management Systems.

PRACTICAL SCHEDULE

1. Working with basic Computer Hardware
2. Number System conversion: Decimal, Binary, Octal, Hexa Decimal, Binary addition and subtraction.
3. Conversion between bits, bytes, kilobits, kilobytes, megabits, megabytes, gigabits, gigabytes.
4. Working with MS DOS commands
5. Working with Windows Operating System
6. Working with Linux Operating System
7. Working with Word Processing Software
8. Working with Presentation Software
9. Working with Spreadsheet Software
10. Working with Image Editing Software
11. Working with basic networking commands
12. Working with Web Browsers and Search Engines
13. Working with Emails
15. Working with DBMS softwares
16. Working with SQL commands
17. Orientation for final examination

COURSE OUTCOMES

At the end of the course students will be able to

CO1: Know the basic components of the computer and working of each device
CO2: Understand the representation of data in computer.
CO3: Know the fundamentals of Computer Networking and Database.
CO4: Performing common basic functions like editing, formatting, printing, scanning etc using tools.

CO-PO MAPPING MATRIX

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**REFERENCES**

**E-REFERENCE**
1. [http://pearsoned.co.in/ITLEducationSolutionsLimited/](http://pearsoned.co.in/ITLEducationSolutionsLimited/)

**HOR 210 PRODUCTION TECHNOLOGY OF TROPICAL VEGETABLES (2 + 1)**

**LEARNING OBJECTIVES:**
- To teach them the scope and importance of tropical vegetables.
- To provide them knowledge on advanced production techniques of tropical vegetables.
- To let them know the production constraints in tropical vegetables.

**THEORY**

**Unit-I: Scope and importance of tropical vegetables**

Scope and importance- area and production, global and national scenario, institutions involved in vegetable crops research – export potential – constraints in vegetable production- classification of vegetable crops – types of vegetable nutrition garden, kitchen garden, truck garden, market garden, roof garden, floating garden – vegetable forcing- contract farming- rice fallow cultivation, river bed cultivation, rain fed cultivation, GAP in vegetable production – export standards of vegetables.

**Unit-II: Solanaceous and Malvaceous vegetable crops**

- Tomato, brinjal, chilli, capsicum and bhendi

**Unit-III: Cucurbitaceous vegetable crops**

- Ash gourd, pumpkin, bottle gourd bitter gourd, snake gourd, ribbed gourd, watermelon, musk melon, coccinia, cucumber and gherkin.

**Unit-IV: Legumes and greens**

- Cluster bean, vegetable cowpea, lab-lab, moringa, amaranthus and Indian palak

**Unit-V: Bulbous and Tuber crops**

- Onion, cassava, sweet potato, colocasia, vegetable coleus, elephant foot yam and edible dioscorea. **Current Streams of thought.**

**PRACTICAL**

THEORY LECTURE SCHEDULE
1. Area, production, world scenario and industrial importance.
2. Export potential of vegetables and institutions involved in vegetable crops research.
3. Constraints in vegetable production.
4. Classification of vegetable crops.
5. Effect of climate, soil, water and nutrients on vegetable crop production.
6. Cropping systems in vegetable crops.
7. Types of vegetable farming.
9. Rice fallow cultivation, river bed cultivation and rainfed cultivation.
10. GAP in vegetable production.
12. Tomato
13. Brinjal
14. Chilli
15. Capsicum
16. Bhendi
17. Mid-Semester Examination
18. Pumpkin
19. Ash gourd and Bottle gourd
20. Water melon and Musk melon
21. Snake gourd and Ribbed gourd
22. Bitter gourd and Coccinea
23. Cluster bean
24. Vegetable cowpea
25. Lab lab
26. Moringa
27. Amaranthus and Indian palak
28. Onion
29. Cassava
30. Sweet potato
31. Colocasia
32. Vegetable coleus
33. Elephant foot yam
34. Edible dioscorea

PRACTICAL SCHEDULE
1. Preparation of nursery bed, containerized transplant production and sowing of vegetable seeds.
2. Preparation of field- raising of a transplanted vegetable crop.
3. Preparation of field, sowing of cucurbitaceous, perennial and leafy vegetable and tuber crops.
4. Identification and description of varieties and hybrids of solanaceous and leguminous vegetables.
5. Identification and description of varieties and hybrids of bhendi, cucurbits, root and tuber crops.
6. Planning and lay out of kitchen /nutrition garden.
7. Study of rain fed and padugai land cultivation practices in vegetable crops
8. Practices in manuring and fertilizer application in vegetable crops
9. Practices in irrigation practices of vegetable crops
10. Preparation of plant growth regulator spray solution- their usage in tropical vegetable crops
11. Identification of nutrient deficiencies, physiological disorders and corrective measures in vegetable crops.
12. Maturity indices, harvesting and post-harvest handling of vegetable crops
13. Practices in seed production techniques in vegetable crops
14. Commercial vegetable production in protected structures
15. Project preparation for commercial cultivation of tropical vegetable crops.
16. Visit to commercial vegetable production units
17. Orientation for final practical examination.

**COURSE OUTCOMES:**

**CO 1:** The student will be able to practice the production techniques and constraints in tropical vegetables.

**CO 2:** Can demonstrate important production techniques and diagnose problems in cultivation of tropical vegetables.

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**REFERENCES**


**E RESOURCES**

1. http://www.informaworld.com/smpp/title~db=all~content=g904622674
HOR 211 PRODUCTION TECHNOLOGY OF PLANTATION CROPS, SPICES AND CONDIMENTS (2+1)

LEARNING OBJECTIVES:
- To make them acquire knowledge on the cultivation aspects of plantation crops, spices and condiments.
- To provide knowledge on basic nursery management practices of plantation crops, spices and condiments.
- To acquaint knowledge on post harvest operations such as grading, packing and value addition.

THEORY

Unit-I: Production technology of Plantation Crops I
Scope and importance of plantation crops - constraints- area and production - export potential in plantation crops in India and Tamil Nadu- classification of plantation crops- edible and non edible products- nutritive value - origin and distribution - soil and climate -botany-species, varieties and hybrids – propagation techniques –spacing and planting – irrigation, nutrient and weed management – shade management – mulching, intercrops and cover crops- training and pruning – harvesting – processing – grading – packing and storage of the following crops:
Tea, coffee, cocoa, rubber, cashew.

Unit-II: Production technology of Plantation Crops II
Coconut, arecanut, palmyrah, oil palm, cinchona, wattle.

Unit-III: Production technology of Spices and Condiments I
Scope and importance of spices and condiments constraints in production – Area and production, export potential in spices and condiments in India and Tamil Nadu-classification of species and condiments–origin and distribution - climate and soil – botany of spices, varieties and hybrids – propagation – spacing- planting and support – Irrigation, nutrient and weed management – mulching – intercropping – shade regulation – training and pruning –harvesting processing –Value added products - extraction of essential oils, oleorsins and active principles – grading – packing and storage of the following crops:
Pepper, cardamom, turmeric and/ ginger.

Unit-IV: Production technology of Spices and Condiments II
Coriander, fenugreek, fennel, cumin clove, nutmeg, cinnamon, curryleaf and tamarind.

Unit-V: Production technology of Spices and Condiments III
Vanilla, saffron, garlic and asafoetida and herbal spices. Current Streams of thought.

PRACTICAL
Description and identification of plantation crops, spices and condiments – nursery management practices- planting – training and pruning – manures and fertilizer
application –latex extraction in rubber - harvesting and processing, grading and packing - study of value added products – visit to fields and processing industries.

**THEORY LECTURE SCHEDULE**

1. Scope and Importance and export potential of plantation crops in India and Tamil Nadu
2. Area, production and constraints of plantation crops in India and Tamil Nadu
3. Classification of plantation crops
4. & 5. Cultivation aspects and processing of tea
6. & 7. Coffee
8. Cocoa
9. Rubber
10. Cashew
11. Cinchona and wattle
12. Coconut
13. Areca nut
14. Palmyrah
15. Oil palm
16. Introduction -importance, scope and constraints in spices and condiments in India and Tamil Nadu
17. Mid Semester Examination
18. Area, production and export potential of spices and condiments in India and Tamil Nadu
19. Classification of spices and condiments
20 & 21. Production technology and processing of pepper
22. Cardamom
23. Turmeric
24. Ginger
25. Coriander
26. Fenugreek
27. Fennel and cumin
28. Clove
29. Nutmeg
30. Cinnamon
31. Curry leaf and Tamarind
32. Vanilla and Saffron
33. Garlic and Asafoetida
34. Herbal spices

**PRACTICAL SCHEDULE**

1. Identification of plantation crops, spices and condiments
2. Nursery techniques in plantation crops
3. Processing of tea and coffee
4. Tapping and processing of rubber
5. Processing of cocoa and cashew
6. Edible and non edible products in coconut, cashew nut and palmyrah
7. Propagation techniques in pepper and cardamom
8. Propagation techniques of ginger and turmeric
9. Propagation techniques of seed spices
10. Propagation techniques of tree spices
11. Propagation techniques of herbal spices
12. Processing of major spices
13. Processing of seed and tree spices
14. Special techniques in tree spices
15. Value added products in spice crops
16. Visit to commercial farms of plantation and spice crops
17. Orientation for final practical examination.

**COURSE OUTCOMES:**

**CO 1:** At the end of the course, the students will be able to acquire knowledge on various aspects of plantation, spices and condiments.

**CO 2:** Can demonstrate important production techniques and diagnose problems in cultivation of plantation, spices and condiments.

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**REFERENCES**


**PAT 212 PRINCIPLES OF PLANT PATHOLOGY (2+1)**

**LEARNING OBJECTIVES:**

- To study the basic concepts of Plant Pathology
- To learn the classification and characters of fungal kingdom
- To learn the classification and characters of bacteria, *Candidatus phytoplasma*, virus, viroid, algal and phanerogamic parasites
- To study about epidemiology and plant disease management
- To study the biotechnological approaches for plant disease management

**THEORY**

**Unit-I: Plant Pathogenic organisms**


**Unit-II: Fungal taxonomy based on Kirk et al., (2008)**

Classification of Kingdom - Protozoa - important taxonomic characters, symptoms and life cycle of *Plasmodiophorabassaeceae* - Classification of Kingdom - Chromista- General characters - Classification of Oomycetes. Symptoms and life cycle of *Pythium, Phytophthora, Perenospora, Plasmopara* and *Albugo* - Classification of Kingdom- Chytridiomycota - important characters, symptoms and life cycles of *Synchytrium* and *Zygomycota* - important characters, symptoms and life cycle of *Rhizopus* - Classification of Kingdom- Ascomycota- Important characters, symptoms and life cycles of *Taphrina, Aspergillus, Erysiphe* and *Venturia* and important taxonomic characters and symptoms of
Penicillium, Leveillula, Phyllactinia, Uncinula, Helminthosporium, Alternaria, Cercospora, Curvularia, Fusarium, Verticillium, Colletotrichum, Pestalotia, Macrosporina, and Botryodiplodia. Classification of Kingdom - Basidiomycota - Symptoms and life cycles of Puccinia, Uromyces, Hemileia and Ustilago. Important taxonomic characters of Ganoderma, Agaricus, Pleurotus and Calocybe. Symptoms and important characters of Athelium (Sclerotium), Rhizoctonia and Exobasidium

Unit-III: Bacteria, Candidatus Phytoplasma, Virus, Viroid, Algal and Phanerogamic parasites

Classification, general characteristics and symptoms of bacterial diseases, mode of entry and spread - General characteristics and symptoms of viral, viroid and phytoplasma diseases - General characters of algal parasite Cephaeleuros, Phanerogamic parasites and Non-parasitic diseases.

Unit-IV: Epidemiology and Plant Disease Management


Unit-V: Biological control and biotechnological approaches

Biological control of crop diseases and their scope - bio-control agents - Fungi, bacteria, bacteriophages - use of plant products and antiviral principles in plant disease management. Biotechnological approaches in plant disease management.

PRACTICAL

General characters of fungi - mycelium, spores - asexual, sexual and vegetative spores - sexual and asexual fruiting bodies in fungi. Study of symptoms, host parasite relationship and systematic position of pathogens viz., Plasmodiophora, Pythium, Phytophthora, Plasmopara, Peronospora, Albugo, Rhizopus, Taphrina, Capnodium, Cercospora, (Mycosphaerella), Botryodiplodia (Botryosphaeria), Curvularia, Cochliobolus (Helminthosporium), Alternaria, Venturia, Erysiphe, Leveillula, Phyllactinia, Uncinula, Fusarium (Gibberella), Verticillium, Colletotrichum (Glomerella), Pestalotiopsis (Pestalosphaeria), Macrophomina, Puccinia, Uromyces, Hemileia, Ustilago, Exobasidium, Sclerotium, Rhizoctonia (Thanatephorus) and Ganoderma. Taxonomic characters of Agaricus, Pleurotus and Calocybe. Symptoms of bacterial diseases, Candidatus Phytoplasma, Fastidious Vascular Bacteria, Algal parasite, Phanerogamic parasites and Non-parasitic diseases. Various groups of fungicides and antibiotics - Preparation of Bordeaux mixture and Bordeaux paste - Preparation of fungicidal spray solution - Delivery of fungicides, Production of immunized seedlings in citrus - Biological control agents and their mass production - Trichoderma, and Pseudomonas - Methods of application of bio-control agents - Preparation of botanicals - leaf extracts, oil emulsions and antiviral principles.

THEORY LECTURE SCHEDULE

1. Definition of plant pathology - history of plant pathology
4. Classification of Kingdom - Protozoa - important taxonomic characters and Symptoms and life cycle of Plasmodiophorabassicae
5. Classification of Kingdom - Chromista- General characters - Classification of Oomycetes. Symptoms and life cycle of Pythium and Phytophthora
6. Symptoms and life cycle of Plasmopara, Perenospora and Albugo
7. Classification of Kingdom - Chytridiomycota and Zygomycota - important characters, symptoms and life cycles of Synchytrium and Rhizopus
8. Classification of Kingdom - Ascomycota - important characters
9. Symptoms and life cycles of Taphrina, Aspergillus, Venturia and Erysiphe
10. Symptoms and important characters of Pencillum, Leveillula, Phyllactinia and Uncinula, Helminthosporium, Alternaria, Cercospore and Curcularia, Fusarium and Verticillium
11. Symptoms and important characters of Colletotrichum, Pestalotia, Macrophomina, and Bothryodiopsis
12. Classification of Kingdom - Basidiomycota - important characters
13. Symptoms and life cycles of Puccinia, Uromyces, Hemileia and Ustilago
14. Important taxonomic characters of Ganoderma, Agaricus, Pleurotus and Calocybe
15. Symptoms and important characters of Athelium, Rhizoctonia and Exobasidium
17. Mid semester examination
18. General characters - Common symptoms of virus and viroid diseases - Chlorosis, mosaic, stripe, vein clearing, vein banding, crinkle, enation, necrosis, dwarfing, rosette, bumpy top, bract mosaic and twisting, cadang-cadang of coconut and potato spindle tuber.
19. General characters - Symptoms of phytoplasma diseases - phyllody, witches broom, little leaf, dwarf, yellows and sandal spike and algal parasite - Cephaleuros
20. Phanerogamic parasites - Cuscuta, Orobanche, Loranthus and Striga
21. Epidemiology of crop diseases - weather factors and their role in disease development - temperature, rainfall, relative humidity, dew, sunlight, soil types, soil moisture, soil temperature, soil pH and inoculum potential.
22. Survival and spread of fungal, bacterial and viral pathogen
23. Disease surveillance, assessment and forecasting
24. Principles of disease management exclusion - plant quarantine - domestic and international and embargo - Exotic diseases, phytosanitary certificate- Post entry quarantine
25. Eradication - physical, chemical and cultural methods.
26. Protection - chemical protection, cultural methods.
27. Fungicides formulations and adjuvants - characteristics of an ideal fungicide
28. Fungicides - definition, protectant, eradicant, therapeutant, fungistat. Groups of fungicides - Copper fungicide and Sulphur fungicide,
29. Heterocyclic nitrogen compound, Quinones and miscellaneous fungicides.
30. Systemic fungicides and Antibiotics
31. Methods of application of fungicides - Seed treatment, dry and wet, soil drenching, foliar spray, post harvest treatment, corm injection, root feeding, capsule application and acid delinting and precautions while handling fungicides.
32. Immunization - cross protection - types of resistance, vertical resistance and horizontal resistance, mechanism of resistance - morphological, physical and chemical.
33. Biological control - fungi, bacteria, bacteriophages - methods of application of biocontrol agents - plant products and antiviral principles.
34. Biotechnological approaches of crop disease management - genetic engineering and tissue culture.
PRACTICAL SCHEDULE

1. General characters of fungi – Types of mycelium, asexual, sexual and vegetative spores – types of sexual and asexual fruiting bodies.
2. Study of symptoms, fungal characters and host parasite relationships of Plasmodiophorabrassicae (club root), Pythium (damping-off), Phytophthora (late blight)
3. Study of symptoms, fungal characters and host parasite relationships of Plasmodiophora, Peronospora (Downy mildew), Albugo (White rust) and Rhizopus (Jack fruit rot)
4. Study of symptoms, fungal characters and host parasite relationships of Taphrina (leaf curl), Capnodium (sooty mould), Venturia (Scab), Curvularia and Botryodiplodia
5. Study of symptoms, fungal characters and host parasite relationships of Helminthosporium, Cercospora (Leaf spot), Alternaria (Leaf blight), and Colletotrichum (Anthracnose)
6. Study of symptoms, fungal characters and host parasite relationships of Erysiphe, Leveillula, Phyllactinia and Uncinula (Powdery mildew)
7. Study of symptoms, fungal characters and host parasite relationships of Fusarium, Verticillium (Wilt) and Macrophomina (Root rot)
8. Study of symptoms, fungal characters and host parasite relationships of Puccinia, Uromyces, Helminthosporium (Rust), Ustilago (Smut), Rhizoctonia (Root rot), Exobasidium (Tea Blister blight), Athelium (Sclerotium rot), Ganoderma, Agaricus, Pleurotus and Calocybe (Mushroom)
10. Symptoms and vectors of viral diseases – Chlorosis, mosaic, vein clearing, vein banding, leaf crinkle and leaf curl, enation, necrosis, dwarfing, rosette, bunchy top and bract mosaic
11. Field visit to expose the students on different fungal, bacterial and viral diseases of horticultural crops
12. Symptoms of Candidatus Phytoplasma (little leaf, phylloxy and spike), algal diseases – Cephealeuros, Phanerogamic parasites and Non-parasitic diseases
13. Study of various groups of fungicides and preparation of Bordeaux mixture and Bordeaux paste.
15. Cross protection – demonstration of production of immunized seedling against citrus Tristeza and Preparation of leaf extracts, oil emulsion of neem and other botanicals and antiviral principles
16. Bio-control agents – mass production of Trichoderma viride and Pseudomonas fluorescens and Survey and assessment of crop diseases
17. Orientation for final practical examination

Note: Students should submit 50 well-pressed diseased specimens.

COURSE OUTCOMES:

CO1: Knowledge on Basic principles of Plant Pathology and of different plant pathogens
CO2: Updated on their recent classification and characters of fungi.
CO3: Updated on their classification and characters of bacteria, Candidatus phytoplasma, virus, viroid, algal and phanerogamic parasites
CO4: Knowledge on role of weather factors in disease development and new generation fungicide molecules and their application
CO5: Trained on new bio control agents, mass multiplication, formulation and their uses
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**REFERENCES**


**E- RESOURCES**

1. www.ucmp.berkeley.edu/fungi
2. www.ictv.org
3. www.vivo.library.cornell.edu
4. www.plantdisease.org

**SAC 213  FUNDAMENTALS OF SOIL SCIENCE (2+1)**

**LEARNING OBJECTIVES:**

- Demonstrate basic knowledge of terms and concepts in soil science and apply this knowledge to new problems and situations.
- Learn the key physical, chemical, and biological aspects of soils.
- Form a basic understanding of formative processes for different soil types. The recognition soil as a natural body.

**THEORY**

**Unit I: Earth origin and Weathering of rocks**


**Unit II: Soil Formation and soil forming processes**


**Unit III- Physical properties -1**


**Unit IV- Physical properties -II**

**Unit V - Soil Colloids and Chemical Properties**


**PRACTICAL**

Identification of rocks and minerals, soil profile, collection and processing of soil samples, soil moisture, soil bulk density, particle density, pore space, particle size analysis- feel, international pipette method, Bouyoucos Hydrometer, soil colour, soil pH, soil EC, cation exchange capacity of soil, anion exchange capacity, exchangeable cations in soil, buffering capacity of soil

**THEORY LECTURE SCHEDULE:**

1. History and development of Soil Science and its branches – Origin of the Earth – Composition of Earth’s crust
2. Rocks – definition, formation, classification – igneous, sedimentary and metamorphic rocks. Brief description of important rocks – mineralogical composition
3. Minerals – definition, occurrence, classification of important soil forming primary minerals - silicate and non silicate minerals, ferro and non-ferro magnesium minerals Formation of secondary minerals – clay minerals and amorphous minerals
4. Weathering – types of weathering – physical weathering of rocks – agents of physical weathering and their role
5. Chemical weathering – solution, hydration, hydrolysis, carbonation, oxidation and reduction; Biological weathering – role of flora and fauna in weathering process
8. Fundamental soil forming process – Elluviation, Illuviation and humification. Specific Soil forming processes – podzolization, Laterization, salinization, alkalization, calcification, decalcification, Pedoturbation, melanization
9. Soil profile description – master horizons – pedon and poly pedon
10. Soil and Phases of soils – solid, liquid and gaseous phase-mineral matter, organic matter, water and air – definition and functions of soil and various concepts of soil- Pedalogical and edaphological concepts
13. Genesis of soil structure- importance of soil structure and its management
15. Porosity of soil - factors affecting it - calculation. Soil colour - components - significance of soil colour
16. Soil consistence - cohesion, adhesion, plasticity, Atterberg’s constants - upper and lower plastic limits, plasticity number - significance of soil consistence
17. **Mid Semester examination**
18. Soil water - forces of soil water retention - forms of water - pF concept - Soil water potential - components of water potentials - soil moisture constants - field capacity, wilting coefficient, hygroscopic water and saturation
19. Determining soil moisture constants - pressure plate apparatus - soil moisture content - methods Gravimetric, gypsum block, Tensiometer, TDR and neutron probe
20. Soil water movement - Darcy’s Law - saturated, unsaturated and vapor flows - infiltration, percolation, permeability and drainage. importance of soil water in relation plant growth
21. Soil temperature - sources of heat - heat capacity and conductivity - movement of heat soil-Fourier’s law - factors influencing soil temperature
22. Measurement of soil temperature - importance of soil temperature on crop growth - management of soil temperature
23. Soil air - compositions of atmospheric air and soil air - gaseous exchange - Fick’s law-
24. Influence of soil air on plant growth, soil properties and nutrient availability - measurement of oxygen diffusion rate - measures to improve soil aeration
25. Soil colloids - definition - general properties - shape, surface area, electrical charge, adsorption, flocculation, deflocculation, plasticity, cohesion, swelling, shrinkage, Tyndall effect and Brownian movement. Types of soil colloids - inorganic and organic colloids
26. Layer silicate clays - genesis and classification - 1:1, 2:1 expanding and non-expanding, 2:2 clay minerals, amorphous minerals and iron and aluminum oxides
27. Origin of charge in organic and inorganic colloids - negative and positive charges - organic colloids - differences between organic and inorganic soil colloids
28. Adsorption of ions - types of ion exchange - cation and anion exchange - cation and anion exchange capacities of soil
29. Base saturation - factors affecting ion exchange capacity of soils - importance of Cation Exchange Capacity (CEC) and Anion exchange capacity (AEC) of soils
30. Soil reaction (pH) - definition, pH scale, factors affecting soil pH, buffering capacity - signification Soil Electrical Conductivity - factors affecting EC - significance
31. Soil organic matter - various sources - composition - compounds in plant residues - their decomposability - mineralization and immobilization - humus - definition - synthesis of humus
32. Importance of soil organic matter and humus - fractionation of soil humus - carbon cycle - biomass carbon and nitrogen
34. Soil organisms - soil flora and fauna - beneficial and harmful roles - earth worms - microorganisms and their influence on soil properties

**PRACTICAL SCHEDULE**
1. Identification of rocks and minerals
2. Collection and Preparation of soil samples for laboratory analysis
3. Study of soil profile
4. Estimation of moisture in soil by gravimetric method
5. Determination of bulk density, particle density and pore space by measuring cylinder method
6. Determination of bulk density by clod and core sampler methods and particle density by pycnometer method
7. Determination of particle size analysis – feel method and international pipette methods-1
8. International pipette methods-II
9. Determination of particle size analysis- Bouyoucos Hydrometer
10. Determination of soil colour using Munsell color chart
11. Estimation of pH and EC in soil
12. Estimation of soil organic carbon
13. Estimation of CEC in soil
14. Estimation of exchangeable cations in soil- calcium and magnesium
15. Estimation of exchangeable cations- Potassium and Sodium
16. Determination of base saturation and interpretation
17. Record certification

**COURSE OUTCOMES:**

**CO1:** Students gain the knowledge origin of earth, weathering of rocks and minerals

**CO2:** Students learn to explain soil formation and different soil forming processes.

**CO3:** Students develop individual skills and ability to analysis the soil for Physical and Chemical properties.

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**REFERENCES**


**E-reference:**


**GPB 214 PRINCIPLES OF GENETICS AND CYTOGENETICS** (2+1)

**LEARNING OBJECTIVES:**

- The fundamental concepts of Genetics and Cytogenetics will be presented to the students quoting classical examples.
- To impart knowledge on inheritance and variation and to understand the parallelism between the behavior of chromosomes and genes.
To understand the modern concepts of genetics at molecular level.

THEORY

Unit I: Cytology

Brief history of developments in genetics and cytogenetics; Physical basis of heredity: Structure and function of cell and cell organelles – Differences between Prokaryotes and Eukaryotes. Cell division - mitosis, meiosis and their significance, cell cycle - zygote formation and embryo development - identical and fraternal twins. Chromosome structure, chemical composition, nucleosome, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram – chromosome banding; Types of chromosomes based on position of centromere, based on structure and function: based on the role in sex determination, normal and special chromosomes - B, ring and isochromosomes; Chromosomal aberration: Variation in chromosome structure - genetic and cytological implications; Variation in chromosome number – euploid, aneuploid, Nondisjunction - Klinefelter syndrome and Turner syndrome; Definition of eugenics and euthenics; evolution of wheat, Triticale, cotton, tobacco, Brassicas.

Unit II: Mendelian laws and modifications of Mendelian laws

Pre-Mendelian ideas about heredity – Vapour and fluid theory, Magnetic power theory, Preformation theory, Lamarck’s theory, Darwin’s theory, Germplasm theory and Mutation theory. Mendel’s experiments and laws of inheritance. Rediscovery of Mendel’s work.. Chromosomal theory of inheritance. Allelic interactions – Dominance vs. recessive, Deviation from Mendelian inheritance – Non allelic interaction . Lethal genes, Pleiotrophy, penetrance and expressivity, phenocopy: Multiple alleles-blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isalleles.

Unit III: Modern concept of genetics and mutation

DNA, the genetic material – Griffith’s experiment, experiment of Avery, McCleod and McCarthy – confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment. Chemical structure of DNA – Watson and Crick model – Central dogma of life. Proof for semi conservative method of DNA replication; Models of DNA replication; RNA types - mRNA, tRNA, rRNA; Genetic code, protein synthesis; Regulation of gene expression – operon model of Jacob and Monad; Cistron, muton and recon; Complementation test; exons, introns – split genes –Transposable genetic elements- Ac - Ds system in maize. Functional genomics, Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics. Mutation – characteristics of mutation – micro and macro mutation – CIB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

Unit IV: 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; Types of gene action controlling quantitative traits. Linkage - coupling and repulsion; Experiment on Bateson and Punnet – Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group. Crossing over – significance cytological proof - 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 and physical map.

Unit V: Sex determination, sex linkage and cytoplasmic inheritance

Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination - different types - sex determination in human, fowl, butterfly, grasshopper, honey bee, fumea; Sex determination in plants – Melandrium, papaya, maize. Genic balance theory of Bridges, quantitative theory, hormonal theory, barr bodies, metabolic differentiation theory; Gynandromorphs – sex reversal in chicken. Sex linked
inheriting – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex limited inheritance. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in Mirabilis jalapa - iojap gene of maize, cytoplasmic male sterility in rice, kappa particles of paramecium - plasmid and episomic inheritance.

**PRACTICAL**


**THEORY LECTURE SCHEDULE**

1. Definition of genetics, heredity, inheritance, cytology, cytogenetics; Brief history of developments in genetics and cytogenetics.
2. Physical basis of heredity: Structure and function of cell and cell organelles – Differences between Prokaryotes and Eukaryotes.
5. Types of chromosomes based on position of centromere, based on structure and function: normal and special chromosomes - polytene, lambrush, based on the role in sex determination: autosomes and allosomes, Other types of chromosomes - B, ring and isochromosomes.
7. Chromosomal aberration: Variation in chromosome number – euploid, aneuploid, types of aneuploids and their origin; Nondisjunction - Klinefelter syndrome and Turner syndrome; Definition of eugenics and euthenics.
8. Polyploid - auto and allopolyploids, their characters; meaning of genome; evolution of wheat, Triticale, cotton, tobacco, Brassica
9. Pre-Mendelian ideas about heredity – Vapour and fluid theory, Magnetic power theory, Preformation theory, Lamarck’s theory, Darwin’s theory, Germplasm theory and Mutation theory.
10. Mendel’s experiments and laws of inheritance. Rediscovery of Mendel’s work
12. Chromosomal theory of inheritance. Allelic interactions – Dominance vs recessive, complete dominance, codominance, incomplete dominance, over dominance.
13. Deviation from Mendelian inheritance – Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett’s experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio – i.) Dominant epistasis (12:3:1)
   ii.) Recessive epistasis (9:3:4) iii.) Duplicate and additive epistasis (9:6:1).
   iv.) Duplicate dominant epistasis (15:1)
15. v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); Summary of epistatic ratios (i) to (vi).
16. Lethal genes, Pleiotrophy, penetrance and expressivity, phenocopy: Multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles.
17. **Mid Semester Examination**


19. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits.

20. Linkage - coupling and repulsion; Experiment on Bateson and Punnet – Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group.

21. Crossing over – significance of crossing over; cytological proof for crossing over - Stern’s experiment; Factors controlling crossing over.

22. Strength of linkage and recombination; Two point and three point test cross.

23. Double cross over, interference and coincidence; genetic map, physical map.


25. Genic balance theory of Bridges, quantitative theory, hormonal theory, barr bodies, metabolic differentiation theory; Gynandromorphs – sex reversal in chicken.

26. Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex limited inheritance.


28. DNA, the genetic material – Griffith’s experiment, experiment of Avery, McCleod and McCarthy – confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment.

29. Structure of DNA – Watson and Crick model – Central dogma of life

30. Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication.

31. RNA types - mRNA, tRNA, rRNA; genetic code, protein synthesis - transcription. Translation

32. Regulation of gene expression - operon model of Jacob and Monad; Structural genes and regulator genes.Cistron, muton and recon;

33. Complementation test; exons, introns – split genes – Transposable genetic elements - Ac - Ds system in maize - Functional genomics, Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics

34. Mutation – characteristics of mutation – micro and macro mutation – CIB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

**PRACTICAL SCHEDULE**

1. Use of microscopes

2. Principles of killing and fixing; preparation of stains and preservatives.


4. Study of the mitotic phases in root tips of onion / Aloe sp.

5. Procedure for fixing and observing different meiotic phases in the inflorescence of rice/maize.

6. Procedure for fixing and observing different meiotic phases in the inflorescence in pearl millet/ sorghum/ horticultural crop/forest tree.

7. Repetition of meiotic studies in maize/ sorghum/ pearl millet/ forest tree and making temporary and permanent slides.

8. Observation of bivalents, trivalents, quadrivalents and chromosome banding.
9. Principles of dominance, recessive, back cross, test cross, incomplete dominance, codominance and lethal factor; Chi square test; Monohybrid genetic ratio with dominance, with incomplete dominance and test cross.
10. Dihybrid ratio with dominance, with incomplete dominance and test cross
11. Simple interaction of genes-comb character in fowls; Dominant epistasis.
12. Recessive epistasis, Duplicate and additive epistasis.
13. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
14. Multiple alleles and polygenic inheritance
15. Estimation of linkage with F2 and test cross data; Coupling and repulsion.
16. Problems on two point test cross and three point test cross; Working out interference, coincidence and drawing genetic maps.
17. Orientation for final examination

COURSE OUTCOMES:

CO1: The student will have knowledge in the basic principles of inheritance
CO2: Will be able to understand the modern concepts of genetics
CO3: Will have the capacity to work out the various classical examples in genetics, crossing over and their interactions
CO4: The student will be able to carryout cytological analysis in breeding populations

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REFERENCES

Further reading

E-RESOURCES:
1. www.nmsu.edu
2. www.biology200.gsu.edu
AGR 215 – IRRIGATION AND WEED MANAGEMENT FOR HORTICULTURAL CROPS (1+1)

LEARNING OBJECTIVES:

- The students will gain knowledge on the basic concepts and units in water management.
- The students will understand about water requirement and methods of irrigation for various crops.
- The students will know about quality of irrigation water and using waste water in agriculture.
- The students will understand about different weeds, its impact on crops and different weed control methods.
- The students will be competent on weed management practices in vegetables, flower crops, fruit crops, plantation crops and lawns.

THEORY

Unit-I: Importance, sources and soil – water – plant – relationship
Role of water for growth and development of crops - Need for scientific water management in India. Irrigation systems of India and Tamil Nadu - Soil – plant – water relationship - Soil moisture constant.

Unit-II: Water Requirement, Management and Scheduling of irrigation
Water requirement - Water requirement for important horticultural crops - Factors affecting water requirement - Critical stages for irrigation for fruits and vegetables - Scheduling of irrigation - Different approaches - Water management for different horticultural crops.

Unit-III: Irrigation methods and quality of water

Unit-IV Biology, Ecology and principles of weed management

Unit-V: Herbicides and Weed Management

PRACTICAL


THEORY LECTURE SCHEDULE
1. Role of water for growth and development of crops - Need for scientific water management in India –
2. Water resources of India and Tamil Nadu - Irrigation systems of India and Tamil Nadu.
5. Soil moisture extraction pattern - Crop water requirement - Consumptive use (CU)– PET. Water requirement for different horticultural crops – factors affecting crop water requirement - Critical stages for irrigation for fruits and vegetables.
7. Methods of irrigation - surface (flooding, beds and channels, border strip, ridges and furrows, broad bed and furrows, surge irrigation) and sub – surface method.
8. Micro irrigation system (drip and sprinkler irrigation) – suitability, components, layout, operation, advantage and disadvantage.
9. **Mid Semester Examination.**
10. Quality of irrigation water – Utilization of poor quality water for irrigation
11. Weeds – Definition, classification and characteristics, harmful and beneficial effect of weeds - weed seed dissemination - Seed dormancy
13. Principles and methods of weed management: Preventive, cultural, mechanical, chemical, biological and IWM.
14. Classification and characteristics of herbicides and herbicide formulations – Methods of herbicide application.
15. Adjuvants – Uses – Weed management in major vegetable and fruit and flower crops
16. Weed management in lawns and plantation crops
17. Problematic, parasitic weeds and their control

**PRACTICAL SCHEDULE**
1. Determination of soil moisture content by gravimetric method and other improved devices.
2. Determination of field capacity and wilting point
3. Measurement of irrigation water with weirs, flumes and units.
4. Moisture extraction pattern of vegetable and fruit crops
5. Water use efficiency and methods to improve it.
6. Acquiring skill in different land shaping methods for surface irrigation
7. Layout, operation and maintenance of drip and sprinkler irrigation systems.
9. Identification of wet, dry and garden land weeds
10. Agronomic method of weed control
11. Identification of herbicides and its requirement calculations
12. Herbicides application equipments
13. Management of aquatic, problematic and parasitic weeds
14. WCE and economics of different weed control options.
15. Weed survey and its uses
16. Visit to orchard and nearby farmers field
17. Orientation for final practical examination

**COURSE OUTCOME**
- **CO1:** To gain knowledge on irrigating horticultural crops
- **CO2:** To gain practical exposure to work out water requirement for different horticultural crops
- **CO3:** To understand importance of water quality and waste water utilization in horticultural crops
CO4: To gain exposure on identification of weeds, herbicides in relation to horticultural crops
CO5: To acquire knowledge on raising horticultural crops with modern techniques on irrigation and weed control methods.

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**REFERENCES**


**AEC 216 - PRODUCTION ECONOMICS AND FARM MANAGEMENT (1+1)**

**LEARNING OBJECTIVES:**

- To provide knowledge to the students about the principles of farm management
- To help the students in using different methods and tools for decision making in farm management
- To explain ways for profit maximization through optimizing resource use

**THEORY**

**Unit I: Production Economics and Farm Management - Nature and Scope**

Production Economics - Definition, nature and scope. Farm Management - Definition, objectives, scope of farm management and Farm management decisions - Production economics Vs farm management. Basic terms and concepts: Resources - Fixed, variable, flow and stock resources, choice indicator. Factors of production. Production function - Types/forms - Linear, quadratic and cobb-douglas.

**Unit II: Factor - Product Relationship / Principle of Variable Proportions**

Factor - Product relationship - Meaning, Agricultural Production function - Meaning, definition. Laws of Returns - Law of Constant, increasing and decreasing returns. Law of Diminishing Marginal Returns: Relationship between total, average and marginal products - Classical production function and three stages of production function - Elasticity of production - Determination of optimum input and output: Physical and
economic optimum. Cost principles and cost curves - Total, average, and marginal cost. Economies of scale and economies of size.

**Unit III: Factor - Factor Relationship / Principle of Factor Substitution**


**Units-IV: Product - Product Relationship / Principle of Product Substitution**


**Unit V: Farm Planning and Budgeting**

Farm planning: Meaning - Types - Elements - Farm planning procedure - Characteristics of good farm plan. Farm budgeting: Definition and types - Partial budgeting, complete budgeting and cash flow budgeting - Limitations. Types and systems of farming: Types - Specialized, diversified, and mixed farming - Systems of farming: Co-operative, collective, capitalist, state and peasant farming. Risk and uncertainty: Definition - Types of risk and uncertainty - Safeguards against risk and uncertainty. **Current streams of thought.**

**PRACTICAL**

Problems on factor - product relationship - Determination of least cost combination - Determination of optimum product combination - Computation of cost concepts - Cost of cultivation and cost of production of agricultural crops, horticultural and livestock products - Methods of calculation of depreciation - Farm records and accounts: Analysis of farm records and accounts - Farm inventory analysis: Valuation of farm assets - Net worth statement - Profit and loss statement - Cash flow statement - Preparation of complete and partial budgets - Preparation of farm plan - Graphical solution to linear programming problem.

**THEORY LECTURE SCHEDULE**

1. Production Economics: Definition and nature and scope - Farm Management: Definition - Objectives - Scope of farm management - Farm management decisions.
2. Production Economics Vs Farm Management - Basic terms and concepts: Resources - Fixed, variable, flow and stock resources - Choice indicator.
3. Factors of production - Types/Forms of production function - Linear, quadratic and cobb-douglas.
5. Law of Diminishing Marginal Returns - Relationship between total, average and marginal products - Three stages of production function.
6. Elasticity of production - Determination of optimum input and output - Physical and economic optimum.
7. Cost principles and cost curves.
9. **Mid-Semester Examination**
10. Isoquant map - characteristics / properties - Factor intensity.
11. Marginal rate of technical substitution - Elasticity of factor substitution - Iso-cost line - Principles of cost minimization / Least cost combination of inputs.

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12. Isoclines, ridgelines and expansion path - Effect of input price changes on the least cost combination - Returns to scale.
15. Farm planning: Meaning - Types - Elements - Farm planning procedure - Characteristics of good farm plan - Farm budgeting: Definition and types - Partial budgeting - Complete budgeting and cash flow budgeting - Limitations.
17. Risk and Uncertainty: Definition - Types of risk and uncertainty - safeguards against risk and uncertainty.

PRACTICAL SCHEDULE
1. Estimation of optimum input and output combination.
2. Computation of cost concepts
3. Determination of least cost combination.
4. Determination of optimum product combination
5. Cost of cultivation and cost of production of agricultural crops
6. Cost of cultivation and cost of production of horticultural crops
7. Cost of production of livestock products.
8. Depreciation: Methods of calculating depreciation.
9. Visit to private agricultural farm to collect data/information on farm business.
10. Farm records and accounts: Analysis of farm records and accounts - types.
11. Farm inventory analysis – Methods of valuation of assets
12. Net worth statement - Profit and loss statement
14. Preparation of complete and partial budgets
15. Preparation of farm plan.

17. Orientation for final examination

COURSE OUTCOMES:
At the end of the course students will be able to
CO1: Understand the concepts, nature and Scope of farm management
CO2: Know the importance of farm planning and budgeting.
CO3: Work out the cost of cultivation for different crops
CO4: Importance of farm records and accounts and farm business analysis

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REFERENCES

ENT 217 ECONOMIC ENTOMOLOGY AND NEMATOLOGY (1+1)

LEARNING OBJECTIVES:
- To explain species, morphology, anatomy and biology of bees and silkworms
- To understand the rearing techniques of honey bees, silkworm, and lac insects.
- To discuss about minor productive insects and their uses.
- To study the basic morphology and biology of plant parasitic nematodes
- To discuss important nematodes of horticultural crops

THEORY

Unit-I: Apiculture

Unit-II: Sericulture

Unit-III: Lac Culture and Minor Productive Insects
Importance of Lac insect - species, morphology, biology and secretion of lac. Maintenance of host plants of lac insect.. Lac Processing - Seed lac - Button lac - Shellac. - Uses of lac. Minor Productive Insects - Cochineal insect, Gall insect, Aesthetic and Scientific value of insects

Unit-IV: Morphology, Taxonomy and Biology of Nematodes
Nematology Introduction. - Importance of plant parasitic and entomophilic nematodes. Elementary knowledge on morphology and anatomy of nematodes - Economic losses in Horticultural crop plants

Unit-V: Nematode pests on horticultural crops
Taxonomy of important plant parasitic nematodes - Biology and ecology of important plant parasitic nematodes - *Meloidogyne, Heterodera, Globodera, Tylenchulus, Pratylenchus, Rotylenchulus, Radopholus* and *Ditylenchus*. Plant parasitic nematodes of horticultural crops - vegetables, fruits, spices and plantation crops, flower crops, ornamentals, medicinal and aromatic plants. Current Streams of thought.

PRACTICAL
Acquaintance with honey bee species, structural adaptation, castes, Bee-keeping equipment, bee forage plants, enemies of bees and Handling of bee colonies. Acquaintance with silkworm types, life stages of mulberry silkworm, Mulberry varieties, Rearing appliances for silkworm, Preparation of mulberry cuttings and Handling of silkworm- shelf and shoot rearing - skill involved in brushing - feeding- moulting care - bed cleaning - spacing - mountages -- spinning and cocoon harvest. Identification of pests and diseases of silkworm - symptoms. Identification of lac insect and lac
Minor Productive Insects – Cochineal insect, Gall insect, Aesthetic and Scientific value of insects.


**Assignment:** Each student has to submit an assignment on preparation of crop calendar/Economics of bee keeping/Economics of sericulture/helpful insects/productive insects/Entomophilic nematodes/Plant parasitic nematodes of horticultural crops.

**THEORY LECTURE SCHEDULE**
1. Introduction – Species of bees, morphology, anatomy and structural adaptations.
3. Bee pasturage, Apiary, bee foraging and swarming. Bee enemies and diseases of bees
4. Bee pollination, seasonal management, bee products and their uses.
7. Mulberry silk worm rearing – Chawki rearing and Rearing of late age worms – rearing house– grainage
9. Mid Semester Examination
10. Lac culture- Species of Lac insect- Morphology, biology and secretion of lac.
12. Minor Productive Insects – Cochineal insect, Gall insect, Aesthetic and Scientific value of insects
14. Elementary knowledge on morphology of nematode – Classification based on feeding habits and ecology.
15. Taxonomy of important plant parasitic nematodes.
17. Biology and ecology of important plant parasitic nematodes of horticultural crops – *Pratylenchus*, *Rotylenchulus*, *Radopholus* and *Ditylenchus*.

**PRACTICAL SCHEDULE**
1. Acquaintance with honey bee species, castes of bees and structural adaptation.
2. Acquaintance with Bee-keeping equipment and bee forage plants.
5. Identification of rearing appliances of mulberry silkworm and acquaintance with methods of disinfection. Handling of silkworm in Chawki rearing and Late age rearing.
6. Identification of lac insect, lac products and other minor productive insects.
7. Soil and root sampling. Extraction of nematodes by Cobb’s sieving method, Baermann funnel technique and modified Baermann funnel technique.
8. Extraction of nematodes by sugar flotation technique.
9. Extraction of cysts by conical flask technique, fenwick can method and Incubation and Blender technique.
10. Extraction of nematodes from roots and staining of roots infested with endoparasitic nematodes.
11. Preservation of nematodes and preparation of temporary and permanent slides.
12. Observing morphology of the order Tylenchida and Dorylaimida.
15. Observing the life stages of Rotylenchulus, Radopholus.
16. Identification of symptoms of nematode damage in major crops.
17. Orientation for final practical examination

COURSE OUTCOMES:
CO 1: Discuss bee morphology, biology, behaviour and describe apiary selection, bee pasturage and management of bee colony (Apiculture)
CO 2: Explain silkworm types, voltinism, biology and define mulberry cultivation, rearing techniques of silkworms and cocoon harvesting and processing of silk (Sericulture).
CO 3: Describe biology, strains and cultivation of lac and depict minor productive insects and their uses
CO 4: Explain basic morphology and anatomy of nematodes and describe morphology and biology of major plant parasitic nematodes of horticultural crops

CO-PO MAPPING MATRIX

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REFERENCES
LEARNING OBJECTIVES:

To enable the students to learn about

- Basics concepts related to rural sociology and Basics concepts related to rural sociology in extension education.
- Applications of important sociological and psychological concepts.
- Fundamentals of extension education and Programme planning.
- Educational psychology and rural development.
- Various rural development programmes.

THEORY

Unit–I: Introduction to Extension Education and Extension Programme Planning

Extension Education – meaning, definition, scope, objectives, philosophy, principles; Extension Educational Process; Differences among formal, informal and non-formal education. Extension Programme Planning – definition, principles; meaning of project, plan, calendar of work, plan of work; steps in programme planning.

Unit–II: Introduction to Rural Sociology

Sociology, Rural Sociology and rural society – definitions; rural and urban differences, importance of rural sociology in extension education. Rural society – important characteristics of Indian rural society; Social groups – definition, classification, role of social groups in extension; Culture – concept, cultural traits, characteristics, functions, Ethnocentrism. Structure of Rural Society – patterns of rural settlement, social institutions, social organizations, Social Stratification – concept, functions, types. Social Control – definition; Customs – conventions, folkways, mores, rituals, taboos; Social Interaction Process – definition, basic social processes; Social Change – concept, factors influencing social change; Leadership – definition of leader and leadership, types, functions, characteristics of a good leader, methods of selecting leaders.

Unit–III: Introduction to Educational Psychology

Education – Psychology – Educational Psychology – Social Psychology – definitions, importance of psychology in extension; Basic principles of Human behaviour – Attention, Perception – meaning, characteristics; Intelligence – concept, types, measurement, factors affecting intelligence. Personality – concept, types, measurement, factors influencing personality; Teaching–Learning Process – definition, meaning, principles of teaching, steps in extension teaching; Learning – definition, meaning, principles, learning situation. Motivation – concept, Maslow’s hierarchy of needs, techniques of motivation, importance of motivation in extension; Attitude – concept, factors influencing the development of attitudes.

Unit–IV: Early Rural Development attempts and Major Rural Development Programmes

Historical development of extension in India – Economic Conference of Mysore, Gurgaon Experiment, Sriniketan, Sevagram, Marthandam project, Firka development scheme, Etawah pilot project, Nilokheri Experiment; Extension programmes of Ministry of Agriculture – Training and Visit (T&V) System, Broad Based Extension System (BBES),...
Farming System Research Extension (FSRE), Agricultural Technology Management Agency (ATMA); First line Extension System – KVK, ATIC, Frontline demonstrations. Rural Development – meaning, definition, concept, importance; Democratic Decentralization – Meaning, Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup – CDP, NES, IADP, IAAP, HYVP, IVLP, IRDP. NATP, ITDP, SFDA, MFAL, NREP, RLEG, DPAP, CADP, FFWR, JRY, EAS, IAY, SGSY, SJSRY, PMGSY, SGRY, MGNREGA, PURA, NAIP, NADP (RKVY).

Unit-V: Women and Youth Development Programmes

Women Development Programmes – DWCRA, MSY, TANWA; Youth Development Programmes – TRYSEM, Nehru Yuva Kendra (NYK), ARYA. Current Streams of thought.

PRACTICAL

Visit to District Rural Development Agency (DRDA) to study the organizational set up and rural development programmes; Visit to Panchayat Union office to learn their functions; Exposure to Gram Panchayat activities; Study of the functions of DDH and to learn about ATMA and other schemes; Interaction with a Self-Help Group to study its activities; Exposure to a Non-Governmental Organization (NGO) to study its role in rural development; Study of the activities of State Department of Horticulture to learn their extension activities; Visit to KrishiVigyan Kendra (KVK) to learn their roles and activities; Visit to Social Welfare Department to study the women development programmes; Exercise to assess the awareness and participation of village people in rural development programmes in a rural setting. Visit to a village to study the sociological characteristics of a rural society – patterns of settlement, culture, social stratification, social values, social control, customs, social interaction processes, social change, and social problems; Study of basic social institutions and social organizations and their functions in a village setting; Exercise on selection of leaders in a village; Practice on Personality and Intelligence measurement techniques.

THEORY LECTURE SCHEDULE

1. Extension Education – meaning, definition, scope, objectives, philosophy, principles.
2. Extension Educational Process, Differences among formal, informal and non-formal education.
3. Extension Programme Planning – definition, principles; meaning of project, plan, calendar of work, plan of work; steps in programme planning.
5. Rural society – rural and urban, important characteristics of Indian rural society, differences and relationship, important characteristics of Indian rural society; Social Groups – definitions, classification, role of social groups in extension.
6. Culture – concept, cultural traits, characteristics, functions, Ethnocentrism.
7. Structure of Rural Society – patterns of rural settlement, social institutions, social organizations.
8. Social Stratification – concept, functions, types. Social Control – definition; Customs – conventions, folkways, mores, rituals, taboos;
10. Leadership – definition of leader and leadership, types, functions, characteristics of a good leader, methods of selecting leaders.
11. Education – Psychology – Educational Psychology – Social Psychology – definitions, importance of psychology in agricultural extension.
13. Intelligence – concept, types, measurement, factors affecting intelligence; Personality – concept, types, measurement, factors influencing personality.
15. Learning – definition, meaning, principles, types of learning, learning situation.
16. Motivation – concept, Maslow’s hierarchy of needs, techniques of motivation, importance of motivation in agricultural extension.
17. Attitude – concept, factors influencing the development of attitudes.
18. Mid Semester Examination
19. Historical development of extension in India – Famine Commission, Royal Commission, Scheme of Rural Reconstruction, Economic Conference of Mysore, Gurgaon experiment, Sriniketan.
20. Sevagram attempt, Marthandam Project, Firka Development Scheme, Etawah Pilot project, Nilokheri Experiment.
22. First line Extension System – KrishiVigyan Kendra (KVK), Institution Village Linkage Programme (IVLP), Agricultural Technology Information Centre (ATIC), Frontline demonstrations.
24. Community Development Programme (CDP), National Extension Service (NES).
25. Intensive Agricultural District Programme (IADP), Intensive Agricultural Area Programme (IAAP).
26. High Yielding Variety Programme (HYVP), Institution Village Linkage Programme (IVLP), Integrated Rural Development Programme (IRDP), National Agricultural Technology Project (NATP).
27. Integrated Tribal Development Agency (ITDA), Small Farmers Development Agency (SFDA), Marginal Farmers and Agricultural Labourers Development Agency (MFAL).
28. National Rural Employment Programme (NREP), Rural landless Employment Guarantee Programme (RLEGP), Drought Prone Area Programme (DPAP), Command Area Development Programme (CADP).
29. Food for Work Programme (FFW), Jawahar Rozgar Yojana (JRY), Employment Assurance Scheme (EAS), Indira Awaas Yojana (IAY), Swarna Jayanti Gram Swarozgar Yojana (SGSY).
30. Prime Minister Employment Yojana (PMEY), Swarna Jayanti Shahari Rozgar Yojana (SJSRY), Pradhan Mantri Gram Sadak Yojana (PMGSY), Sampoorna Grameen Rozgar Yojana (SGRY).
32. Women Development Programmes – Development of Women and Children in Rural Areas (DWCRCA), RashtriyaMahilaKosh (RMK), Integrated Child Development Scheme (ICDS), MahilaSamridhi Yojana (MSY), Tamil Nadu Women in Agriculture (TANWA).
33. Women Development Programmes – Development of Women and Children in Rural Areas (DWCRCA), MahilaSamridhiYojana (MSY), Tamil Nadu Women in Agriculture (TANWA).
34. Youth Development Programmes – TRYSEM, Nehru Yuva Kendra (NYK), Attracting Rural Youth towards Agriculture (ARYA).

**PRACTICAL SCHEDULE**

1. Visit to District Rural Development Agency (DRDA) to study the organizational set up and rural development programmes.
2. Visit to a Panchayat Union Office to learn about its functions.
3. Visit to the Office of the Deputy Director of Horticulture to study of the extension activities of the State Department of Horticulture and to understand the reorganized extension system, organizational setup, functions.
4. Exposure to an NGO to study their role in rural development activities.
5. Visit to a nearby KVK to study its role and activities.
6. Visit to the Social Welfare Department to study the social welfare and women development programmes.
7. Understanding the sociological characteristics of a rural society – (Brain storming).
9. Preparation of interview schedule to study the social characteristics of rural society – pattern of settlement, culture, social stratification, social values, social control, customs, social interaction process, social change and social problems (Group exercise).
10. Visit to a village for data collection (Group exercise).
11. Processing of data and presentation of Reports.
12. Preparation of interview schedule to study the basic social institutions and social organizations and their functions in a village setting (Group exercise).
13. Preparatory work for selection of leaders in a village (Group exercise).
14. Visit to a village for data collection (Group exercise).
15. Processing of data and presentation of reports.
16. Practicing Personality measurement techniques (Group exercise) and intelligence measurement techniques (Group exercise).
17. Orientation for final practical examination

**COURSE OUTCOMES :**

At the end of the course students will be able to

CO1: Understand basics concepts related to rural sociology and Basics concepts related
CO2: Apply important sociological and psychological concepts
CO3: Understand fundamentals of extension education and Programme planning
CO4: Gain Knowledge on Educational psychology.
CO5: Identify various rural development programmes

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HOR 220 COMMERCIAL FLORICULTURE (2 + 1)

LEARNING OBJECTIVES:
- The course has been designed to make students acquaint knowledge on production technology of cut flowers and loose flowers.
- To impart basic knowledge on principles of growing commercial flowers.
- To make them explore the activities in concrete extraction units and flower markets.

THEORY

Unit-I: Principles of Growing Commercial Flowers

Unit-II: Production Technology of Loose Flowers
Crossandra, Marigold, Nerium, Gomphrena, Celosia and China aster.

Unit-III: Production Technology of cut flowers I

Unit-IV: Production Technology of cut flowers II
Orchids, anthurium, china aster, bird of paradise, Asiatic lily.

Unit-V: Production Technology of cut flowers III
Heliconias, alstroemeria and flowering fillers viz., limonium, asparagus, ivy, gypsophila and cut foliages- constraints in flower production – future thrust. Current Stream of thought

PRACTICAL

Botany – description and identification of species and varieties in rose, jasmine, crossandra, chrysanthemum, tuberose, marigold, nerium, gomphrena, celosia, cut rose, carnation, gerbera, gladiolus, orchids and anthurium – propagation and planting – seed treatment and sowing – planting of tubers and suckers – lay out and planting of rose and jasmine – media preparation and potting of orchids and anthurium – After culture practices in rose, jasmine, chrysanthemum, marigold and dahlia – harvesting, postharvest handling and storage – extraction of floral concrete from rose, jasmine and tuberose – visit to commercial fields, extraction units and flower markets – working out benefit cost ratio for loose flowers and cut flowers – preparation of project reports for fresh flower production and floral concrete extraction.

THEORY LECTURE SCHEDULE

1. Scope and importance of commercial floriculture in India – area and production – export statistics – Cropping systems in flower crops.
2. Industrial importance – floriculture industry in India and Tamil Nadu – Institutions and developmental agencies involved in promotion of floriculture – TANFLORA, NHM, NHB, APEDA.
5. &8. Chrysanthemum.
6. Tuberose
7. Crossandra
8. Marigold
9. Nerium and Gomphrena
10. Celosia and China aster.
11. Flower forcing and factors affecting flower production under controlled atmospheric conditions.
13. Mid Semester Examination
14. &19. Carnation
15. &21. Gerbera
16. &23. Chrysanthemum
17. &25. Gladiolus
18. &27. Orchids
19. Anthurium
20. Bird of paradise and heliconia
21. Asiatic lily, alstromeria,
22. Foliage and flowering fillers - limonium, asparagus ivy, gypsopals, baby eucalyptus
23. Methods of floral concrete extraction from rose, jasmine and tuberose and other value addition processes in loose flowers.
24. Packaging, grading and export standards for important commercial flowers.
34. Constraints in flower production and future thrust.

**PRACTICAL SCHEDULE**

7. Preparation of project for loose flower production under open conditions.
14. Visit to flower growing areas, industries and Institutions – TANFLORA, Auction centre, APEDA.
15. Rose, jasmine and tuberose – extraction of floral concrete.
16. Preparation of project for cut flower production under controlled conditions.
17. Orientation for final practical examination.

**COURSE OUTCOMES:**

**CO1** - The student will be able to practice production technology of cut flowers, loose flowers and principle of growing commercial flowers.

**CO2** - Student will become eligible to manage a commercial floriculture unit.

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3. www.icar.org.in
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HOR 221 STUDY TOUR (0 + 1)

LEARNING OBJECTIVES:
- To provide exposure on horticulture scenario in South India.
- To give regional exposure on cropping strategies followed for horticultural crops.
- To study the achievements made in the improvement of horticultural crops

DETAILS OF TOUR PROGRAMME
The students will visit various state level institutions related to agriculture, horticulture, forestry and other allied fields in South India. During the tour programme, the students will gain first-hand information on different agro-climatic zones, crops grown, cultivation practices, socio-cultural and economic status of the farming communities. The institutes shall be fixed based on the convenience and ground reality existing during conduct of the tour programme.

Duration: 7 days.

COURSE OUTCOMES:
CO1 - The student will be able to recognize current trends in production of horticultural crops.
CO2 - The student will gain knowledge in agro-climatic zones, crops grown, cultivation practices, socio-cultural and economic status of the farming communities.

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ENT 222 PRINCIPLES OF PEST MANAGEMENT (1+1)

LEARNING OBJECTIVES:
- To understand the basic ecological concepts in relation to insects
- To evaluate influence of abiotic and biotic factors in insect population dynamics and its relevance in Integrated Pest Management (IPM)
- To illustrate various components of IPM and their importance
- To discuss ecological perspectives of insecticides
- To describe IPM in horticultural crops and role of FFS in IPM

THEORY
Unit–I: Insect Ecology
definition, categories – Pest outbreaks and causes for outbreaks. Pest surveillance and monitoring – Forecasting – ETL and EIL.

**Unit-II: Components of IPM**

**Unit-III: Biological and Behavioural pest management Strategies**
Biological methods in IPM – classical biological control, merits and limitations of biological control, Parasitoids, Predators and Pathogens – Mass multiplication and application techniques of important groups of parasitoids, predators, pathogens-Conservation, augmentation and release of bio control agents-Semiochemicals – Allomones, Kairomones and Synomones and their role in pest management, Sterile male technique – Insect growth regulators - Moult inhibitors and JH mimics in IPM

**Unit-IV: Chemicals in Pest Management**

**Unit-V: IPM Strategies in Horticultural Crops**

**PRACTICAL**

**Assignment:** Each student has to submit 15 numbers of insect damaged plant specimens (Herbarium) and five insecticide labels.

**THEORY LECTURE SCHEDULE**
1. Definition and importance of Insect ecology.
3. Effect of biotic and abiotic factors on insect population
4. Definition and categories of pests, biotypes and causes for pest outbreak.
5. Definition of IPM. Concepts, Scope and limitations of IPM. Concepts of Economic Injury Level (EIL) and Economic Threshold Level (ETL)
6. Definition and examples of Cultural, Physical and Mechanical methods of pest management, Host plant resistance in IPM.
7. Botanical insecticides in IPM – Formulation techniques of Botanicals – Legal methods of pest control - Traditional methods in IPM,
8. Biotechnology in IPM – genetic engineering – transgenic crops

9. Mid Semester Examination


11. Microbial control – definition, Important groups of microbial agents, Mode of action. Their role in pest management

12. Pheromones in IPM – Allelochemicals in IPM – Allomones, Kairromones and Synomones. Insect growth regulators in IPM – Moult inhibitors and JH mimics

13. Chemical control – importance and history. Classification of pesticides

14. Toxicity ranges. Basic and newer Formulations of insecticides – Hazards of insecticides. bio accumulation and bio magnification. Compatibility and Phytotoxicity

15. Integrated pest management strategies for Important Vegetables and Fruits


17. Plant clinic centres – Farmers field school and their role in IPM.

**PRACTICAL SCHEDULE**

1. Identification of types of damage and major symptoms caused by crop pests

2. Assessment of insect population and their damage in horticultural crops

3. Practicing common Cultural, Mechanical and Physical methods in pest management

4. Observation on models of traps in pest management

5. Identification of different types of parasitoids, predators and entomopathogens

6. Practicing Mass culturing techniques of *Trichogramma* and *Chrysopa*

7. Practicing Mass culturing techniques of *Chrysopa*

8. Practicing Mass production of NPV and Fungal pathogens

9. Practicing Mass production of Fungal pathogens


11. Identification of different groups of pesticide formulations

12. Recognizing label information, Precautions in pesticide applications, First aid and antidotes informations.

13. Identification of types of Pesticide application equipments and Preparations of spray fluids for field application.


15. IPM Practices for vegetable and fruit pests


17. Orientation for final practical examination.

**COURSE OUTCOMES:**

**CO 1** Depict basic ecological concepts, understand the impact of ecology on the insect population and concepts of IPM, ETL and EIL.

**CO 2** Explain role of biological pest suppression and mass production of various biocontrol agents.

**CO 3** Describe non chemical methods of pest management viz., bio rationally and other novel techniques like sterile insect method.

**CO 4** Discuss classification and formulations of insecticides, their poisoning effects and antidotes.

**CO 5** Describe ill effects of over use of insecticides and define various IPM modules for different crops.

**CO 6** Demonstrate various IPM protocols for horticultural crops
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AGM 223 SOIL AND APPLIED MICROBIOLOGY (2+1)
LEARNING OBJECTIVES:
- To enlighten the students with the knowledge of microbial diversity in soils and their interaction with plants.
- To highlight the role of soil microorganisms in soil fertility and plant growth promotion.
- To develop experimental skills in soil microbiology which includes isolation of beneficial microorganisms from soil and plant and their mass production.
- To make students gain expertise in practical aspects of production of industrial products.

THEORY
Unit I Introduction to Soil Microbiology
Soil Microbiology- definition and scope. Contribution of Beijerinck, Winogradsky, waksman. Diversity of soil microorganisms - culturable (bacteria, actinobacteria, yeasts, moulds and algae) and unculturable microorganisms - metagenomic approach - factors influencing the microbial diversity

Unit II Microbial Processes in soil

Unit III Soil Microorganisms and plants
Rhizosphere, spermosphere, phyllosphere, epiphytic and endophytic microorganisms and their significance. Plant growth promoting rhizobacteria. Soil microorganisms and their interactions – positive and negative interactions

Unit IV Microbial inoculants

**Unit V Industrial Microbiology**

Industrial utilization of microorganisms - Alcohol fermentation – wine and beer. Antibiotics (Penicillin, Streptomycin) and vitamin (B12) production. Microbes in food industry – single cell protein, baker’s and brewer’s yeast and dairy products – cheese and yoghurt. Biofuels- ethanol and biodiesel. Probiotic Microorganisms. **Current Streams of thought.**

**PRACTICAL**


**THEORY LECTURE SCHEDULE**

1. Introduction and historical developments in soil microbiology. Contributions of Beijerinck, Winogradsky, Fleming and Waksman
2. Diversity of soil microorganisms - culturable and unculturable microbial diversity Metagenomic approach
3. Factors influencing the activities of soil microorganisms
4. Carbon cycle – C:N ratio. Role of soil microorganisms in the decomposition of organic matter and humus formation
5. Nitrogen cycle –Mineralization, Ammonification, Nitrification and Denitrification
7. Endophytic and symbiotic microorganisms
10. Phosphorus cycle
11. Microbial transformation of phosphorus - phosphate solubilizer and mycorrhizae
12. Sulphur cycle - sulphur oxidizers;
13. Microbial transformation of K, Zn and Si.
14. Role of soil enzymes in nutrient transformation- Soil fertility and plant growth
15. Role of soil enzymes in degradation of xenobiotics
16. Importance of soil and plant associated microorganisms – rhizosphere, spermosphere, phyllosphere, epiphytic and endophytes
17. **Mid Semester Examination**
18. Soil microorganisms and their interactions – positive and negative interactions.
19. Plant growth promoting Rhizo bacteria (PGPR)
20. Bioinoculants – types carrier based and liquid based - bacterial, fungal (AMF) and algal Bioinoculants
21. Mass production of bacterial biofertilizer
22. Mass production of AMF
23. Mass production of algal biofertilizer and Azolla
24. Quality control of bacterial and fungal biofertilizers
25. Methods of application of bioinoculants and crops recommended
26. Industrial utilization of microorganisms – alcohol fermentation – alcoholic beverages
27. Antibiotics production (Penicillin and Streptomycin)
28. Vitamin production (Vitamin B2 and Vitamin B12).
29. Microbial production of organic acids and their uses in industry
30. Microbial production of industrial enzymes
31. Microbes in food industry – Single Cell Protein, Baker’s and Brewer’s yeast,
32. Dairy products – cheese and yoghurt
33. Biofuels – alcohol and biodiesel production
34. Probiotic microorganisms – role and their importance in human and animal health

PRACTICAL SCHEDULE
1. Enumeration of soil microorganisms - quantitative Conn’s direct microscopic method
2. Buried slide technique
3. Standard plate count technique
4. Enumeration of rhizosphere microorganisms and determination of R:S ratio
5. Study on soil enzyme activity - soil dehydrogenase activity
6. Isolation of *Rhizobium* from root nodules
7. Isolation of *Azospirillum*
8. Isolation of *Gluconoacetobacter* from sugarcane
9. Isolation of phosphobacteria
10. Isolation of PPFM
11. Examination of AM infection in roots and recovery of spores from soil
12. Mass production of bacterial bioinoculants
13. Mass production of AM fungi
14. Mass multiplication of blue green algae and *Azolla*
15. Methods of application of different bioinoculants
16. Wine fermentation
17. Orientation for final Examination

COURSE OUTCOMES:
CO-1: The students would thoroughly understand about the role of microorganisms in soil and industries their influence on the plant growth and industrial production historical perspectives.
CO-2: The students exposed to soil microbial diversity, their functions in soil transformation of nutrient and humus formation.
CO-3: The students would expose to the beneficial and harmful relationships between soil microorganism and different parts of plants.
CO-4: The students gained hands on experience of production and quality control aspects of different microbial inoculants and to have self confidence to become successful entrepreneurship.
CO-5: Further, they would enriched on the industrial production of important products like fermentation products antibiotics, microbial foods, dairy products, etc.

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E. RESOURCES
1. fire.biol.wwu.edu/hooper/416_05Ncycle1.ppt
2. www.fao.org/docrep/009/a0100e/a0100e05.htm

PAT 224 MUSHROOM CULTURE (0+1)

LEARNING OBJECTIVES:
- To study about various edible mushrooms and laboratory techniques.
- To study about spawn production and cultivation of edible mushrooms and their maintenance.
- To know the problems in mushroom cultivation and their management.
- To study about the nutritional value and post harvest practices in Mushroom production.
- To workout cost of cultivation to prepare projects.

PRACTICAL

PRACTICAL SCHEDULE
1. Introduction to mushrooms
2. Types of mushrooms
3. Morphology and life cycle of important edible mushrooms
4. Preparation of culture media
5. Pure culture-maintenance of culture
6. Spawn and types of spawn
7. Cultivation techniques
8. Mid - semester examination
9. Cultivation of oyster mushroom
10. Cultivation of milky mushroom
11. Cultivation of button mushroom
12. Cultivation of paddy straw mushroom
13. Problems in cultivation & its management
14. Post harvest technology
15. Nutritional & medicinal value of mushroom
16. Other uses of mushroom & Cost analysis and project preparation
17. Final Practical Examinations

**COURSE OUTCOMES**

**CO1:** Knowledge about different edible mushrooms and basic aspects of Mushroom cultivation.

**CO2:** Trained in spawn and mushroom cultivation especially indigenous to latest technology.

**CO3:** Knowledge about the precautionary measures to be followed in mushroom cultivation

**CO4:** Knowledge to overcome contaminants, pest and diseases problems.

**CO5:** Expertise in post harvest technology.

**CO6:** Trained to workout cost analysis of mushroom unit and prepare projects to funding agencies.

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**E-RESOURCES**

1. www.nrcmushroom.org
2. www.un.csam.org>tm.mushroom

**GPB 225 PRINCIPLES AND METHODS OF PLANT BREEDING (2+1)**

**LEARNING OBJECTIVES:**

- To expose the students to basic and applied principles of plant breeding.
- To impart knowledge on emasculation and pollination techniques of various crops
- To impart knowledge on application of various genetic principles in crop improvement

**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: Maintenance breeding

PRACTICAL

THEORY LECTURE SCHEDULE
1. Objectives and role of plant breeding - historical perspective – activities in Plant Breeding.
8. TGMS, PGMS, Gametocides, Transgenic Male sterility and applications.
10. Basic biometrics-nature and significance of qualitative and quantitative variation-phenotypic, genotypic and environmental-heritability and genetic advance
11. choice of parents – combining ability - combination breeding and transgressive breeding - steps in hybridization - kinds of emasculation.
17. Backcross breeding – genetic principles – prerequisites – procedures for transferring dominant and recessive genes

18. **Mid Semester examination**

25. Synthetics and composites - steps in development of synthetics and composites – achievements – merits and demerits
28. Wide hybridization-history-importance-barriers and techniques for overcoming barriers-utilization
30. Somaclonal variation - utilization in crop improvement; In vitro selection techniques – Use of doubled haploids in crop improvement. Concept of biotic and abiotic stress resistance Breeding
32. Maintenance Breeding: General seed production techniques – steps in nucleus and breeder seed production – varietal rundown and renovation.
33. Current trends in Plant Breeding: Marker assisted breeding
34. Transgenic crops. Concept of Plant Varietal protection, geographical indications and DUS

**PRACTICAL SCHEDULE**

1. Pollination and reproduction in plants - Alternation of generation and life cycle.
2. Description and drawing different pollination systems - Mechanisms enforcing self and cross pollination in crops; Pollen morphology - Exine structure of different crops. Fertility and sterility in A, B, R and TGMS lines.
3. Breeder kit and its components – uses; Basic steps of selfing and crossing techniques.
4. Emasculation and pollination techniques in field crops.
5. Emasculation and pollination techniques in horticultural crops.
6. Studies on segregating generation and maintenance of records.
7. Maintenance of A, B and R line and TGMS lines - Hybrid seed production techniques
9. Induction of polyploidy using colchicine
10. Studies on different wild species in crop plants and wide hybridization.
12. Germplasm preservation - conservation - records maintained in research stations
13. Calculation of PCV, GCV, heritability, genetic advance
14. Layout of different yield trials - Observing the experimental plots - nucleus and breeder seed production plots.
15. Screening methods – laboratory and field – for biotic and abiotic stresses.
17. Orientation for final examination

COURSE OUTCOMES
CO1: The student will have an idea of the various self and cross pollinated crops
CO2: Will be able to develop expertise in the various crossing and emasculation techniques in various crops
CO3: Students will develop the capacity to carry out independent plant breeding experiments
CO4: The students will be able to multiply and modify the vegetatively propagated crops.

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AEC 226 - AGRICULTURAL MARKETING, TRADE AND PRICES (1+1)
LEARNING OBJECTIVES:
- To give exposure to the Under Graduate students on market concepts
- To understand domestic and export trade
- To study risk in agricultural marketing, marketing institutions involved, price dynamics and the role of government in regulation of markets

THEORY
Unit I: Agricultural Marketing – Nature and Scope

Units II: Marketing Functions and Marketing Efficiency

Units III: Marketing Institutions

Units IV: Trade in Agricultural Products

Units V: Agricultural Prices

PRACTICAL

THEORY LECTURE SCHEDULE
   Market forces and price determination.
4. Producers’ surplus of agricultural commodities. Marketable and marketed surplus -
   Definition, importance, relationship and factors affecting marketable surplus.
5. Marketing functions - Definition and classification. Buying and selling, Assembling
   and distribution, Storage and warehousing Processing and value addition
6. Grading and standardization - Agmark, FPO, BIS, HACCP, FSSAI and ISO. Market
   research - Steps - Market information and intelligence.
7. Market finance and risk in agricultural marketing. Contract farming, forward
   trading, speculation and hedging. Marketing channels - Definition, types and factors
   affecting marketing channels.
8. Market integration - Definition and types. Marketing efficiency - Meaning, marketing
   costs, margins, price spread and factors affecting marketing costs. SCP paradigm -
   Meaning, components, dynamics of conduct and performance.

9. Mid Semester Examination
10. Role of government in promoting agricultural marketing - DMI, Regulated market,
    cooperative marketing, State Agricultural Marketing Board, NAFED, TANFED, State
    trading, FCI, PDS
11. Commodity boards viz., Coffee board, Tea board, Spices board, Rubber board,
    NMPB, NHB, NDDB. Marketing of inputs - Seeds, Fertilizers and Pesticides - E
    marketing.
12. International trade - Definition. Terms of trade - Balance of payments and Balance of
    trade. Theories of trade - Absolute and comparative advantage. India’s foreign trade
    policy - Export potential for agricultural sector - Share of agricultural commodities in
    export.
13. Barriers to trade - Tariff and non tariff measures. Role of institutions like UNCTAD
    and WTO in promoting trade. Free trade agreements - Implications of AoA, market
    access, domestic support and export subsidies.
14. Export promotion organizations - APEDA, MPEDA, Export Promotion Council, AEZ,
    EXIM bank and ITPO. Export - import policy.
15. Agricultural prices - Meaning, functions and importance. Characteristics of
    agricultural product prices. Important terms and concepts - Farm harvest price,
    Wholesale price, Retail price, FOB price, Border price, CIF price, MSP. Procurement
    price, Remunerative price, Parity price, Fair price and SAP.
16. Pricing efficiency - Physical and allocative efficiency. Fluctuations and instability in
    prices - Factors causing price fluctuation, price stabilization measures.
17. Government intervention in pricing of agricultural commodities - Objectives, forms of
    intervention, agricultural price policy in India, Role of CACP.

PRACTICAL SCHEDULE
1. Market survey
2. Estimation of marketable and marketed surplus
3. Identification of marketing channels and estimation of price spread for agricultural
   products.
4. Identification of marketing channels and estimation of price spread for horticultural
   products.
5. Visit to Regulated market.
6. Visit to Cooperative marketing society
7. Visit to Farmers’ market and shandy.
8. Visit to FCI, CWC and TNCSC
9. Visit to Agmark laboratory
10. Visit to agricultural processing units
COURSE OUTCOMES:
At the end of the course students will be able to
CO.1: To understand the marketing channels of different commodities.
CO.2: To gain the practical knowledge of price spread and its implications.
CO.3: To know the role of marketing institutions and trade in agricultural products like WTO and APEDA.
CO.4: Gain practical knowledge on FCI, CWC and regulated market activities.
CO.5: Role of CACP for price fixation, and price stabilization measures.

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STA 227 AGRICULTURAL STATISTICS (1+1)

LEARNING OBJECTIVES:
- To understand and apply fundamental concept of statistical applications in biology
- To acquire about theoretical concept of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.

THEORY

Unit I: Descriptive Statistics
Introduction – Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode – Merits and demerits. Measures of dispersion: Range, Quartile deviation, Mean deviation, standard deviation, and coefficient of variation – Skewness and kurtosis – Merits and demerits.

Unit II: Sampling Theory and Probability Distributions


**Unit III: Testing of Hypothesis**

Null and alternative hypothesis – types of errors - critical region and tests of significance. Large sample test – single mean and difference between two means – single proportion and difference between two proportions.

Small sample tests - F-test - t-test for testing the significance of single mean – independent and paired t test – chi square test for testing the association of r x c contingency table.

**Unit IV: Correlation and Regression**

Correlation – Scatter diagram - Karl Pearson’s correlation coefficient – Spearman’s rank correlation - computation and properties.


**Unit V: Analysis of Variance and Experimental Designs**

Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD).

**THEORY LECTURE SCHEDULE**

1. Introduction – Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode – Merits and demerits. TBI 1-5, TBI 25 - 35
2. Measures of dispersion: Range, Quartile deviation, Mean deviation, standard deviation, and coefficient of variation - Skewness and kurtosis. TBI 41 – 48
5. Binomial and Poisson distribution TBI 58 - 61
6. Continuous distribution: Normal distribution TBI 55 - 57
7. Null and alternative hypothesis – types of errors - critical region and tests of significance. TBI 16-17
8. Large sample test – single mean and difference between two means. Single proportion and difference between two proportions. TBI 20-24
9. Mid Semester Examination
10. Small sample tests – F-test - t-test for testing the significance of single mean TBII 26-28
11. independent and paired t test TBII 29-38
12. Chi square test for testing the association of r x c contingency table. TBII 43-45
13. Correlation – Scatter diagram - Karl Pearson’s correlation coefficient – Spearman’s rank correlation - computation and properties. TBI 142 – 145
15. Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs. TBI 227 - 231
16. Completely Randomized Design (CRD) – Randomized Block Design (RBD). TBI 269 - 284
17. Latin Square Design (LSD). TBI 315 - 320

**PRACTICAL SCHEDULE**
Computation of arithmetic mean, geometric mean, harmonic mean, median and mode
2. Computation of range, standard deviation, variance, coefficient of variance
3. Selection of sample using simple random sampling method
4. Simple problems in Bernoulli distribution
5. Simple problems in Binomial distribution and Poisson distribution
6. Simple problems in Normal distribution
7. Large sample test – test for single proportion and difference between two proportions
8. Large sample test – test for single mean and difference between two means
9. Small samples test – t-test for single mean – t test for difference between two sample means (equal variances only)
10. Paired t-test
11. Chi square test
12. Computation of Karl Pearson’s correlation coefficient
13. Fitting of simple linear regression equation y on x – correlation and regression using MS Excel functions
14. Analysis of Completely Randomised Design (CRD) – for equal replications only
15. Analysis of Randomised Block Design (RBD)
16. Analysis of Latin Square Design (LSD) – analysis of CRD, RBD and LSD

Orientation for final examination

COURSE OUTCOME
CO1: Understand and apply fundamental concept of statistical applications in biology
CO2: Acquire theoretical concept and practical exposure of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.

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REFERENCES

E-RESOURCES
2. www.statsoft.com
ENG 228 SOFT SKILLS OF EMPLOYABILITY (0+1)

LEARNING OBJECTIVES:

- To impart soft skills including life skills for enabling the students to become employable
- To enable the students in advanced speaking and writing skills
- To train the students communicate with confidence and conviction in group discussions and interviews.
- To facilitate learners the corporate skills.

UNIT I – Introduction to Soft Skills

Soft skills – an introduction – career skills and corporate skills - definitions.

UNIT II – Life Skills

1. Attitude
   Attitude - Psychological and sociological definitions – types of attitude - consequences – suggestions to keep good attitude.

2. Emotional Intelligence
   Introduction to Emotional Intelligence – four branch model of EQ - five point scale to measure EI – suggestions to improve EI.

3. Interpersonal skills
   Interpersonal Skills - Study of character traits - formal interpersonal skills - greeting, enquiring, answering, complimenting and acknowledging.

4. Self Development/Empowerment

UNIT III Communication Skills

5. Types of Communication
   Communication - Basic Communication Model - Verbal and Non-verbal Communication.
   Business Communication
   Writing memo - short notes – short reports, Agenda , minutes, Business proposals, newspaper advertisement.

6. Group Dynamics
   Study of affiliation, participation, goal consciousness – Forming, Storming, Norming – Performing.

7. Kinesics
   Definition - personal appearance, posture, gestures, facial expressions, eye contact and movements.

8. MID SEMESTER

UNIT IV – Employability Skills

9. Interview Skills – I

10. Interview Skills – II
    Telephone interview – Skype interview - Panel Interview -Five stages of interview – how to answer the questions
11. Group Discussion
Definition – contexts – why and how? - techniques and skills.

UNIT V – Corporate Skills
12. Leadership qualities
Definition - basic requirements – (responsibility - self – knowledge - rapport with subordinates- knowledge of the assignment- goal setting- decision making – team work) – leadership and vision.

14. Negotiation skills
Select definitions – functions of negotiation – kinds of negotiation – phases of the process – rules – steps to improve negotiation skills.

15. Time management
Basic skills of time management – relationship between stress management and time management – time management techniques for prudent time management – tips for time management.

16. Stress management

17. Final practical Examination

PRACTICAL SCHEDULE
1. Administration of 25 item questionnaire on Emotional Intelligence and introduction to Soft Skills.
2. Attitude, its types and seven steps to overcome challenged attention.
3. Interpersonal Skills, character traits, formal interpersonal skills and demonstration.
4. Self Development, empowerment and goal setting based on the principle of SMART SWOC analysis.
5. Types of communication viz., verbal and non verbal communication and basic communication model.
6. Writing - writing memo, short notes, short reports, agenda, minutes, business proposals, newspaper advertisement.
7. Group dynamics – the study of affiliation, participation, goal consciousness, forming, storming, norming and performing.
8. Definition of kinesics - personal appearance, posture, gestures, facial expressions, eye contact and movements, observation and explanation of the body language of a public speaker.
9. Mid semester examination.
10. Mock interview, group interview, telephone interview, skype interview and panel interview - simulation.
11. The techniques and skills of group discussion – group discussion on select topics.
12. Leadership qualities and the basic requirements of being a leader (responsibility, rapport with subordinates, knowledge of the assignment, goal setting, decision making and team work).
14. Negotiation skills, functions of negotiation, kinds of negotiation and the phases of the process, rules and steps to improve negotiation skills.
15. Stress management and time management – brainstorming.
16. Teacher student interaction on causes of stress in students life.
17. Orientation for final examination

REFERENCE:

REFERENCES

e-books:

Websites :
1. www.softskills.com
2. www.reportingskills.com
3. www.writing-skills.com
4. www.negotiation.com
5. www.businessballs.com
6. www.study-habits.com
7. www.timethoughts.com

AEG 229 FARM POWER, MACHINERY AND RENEWABLE ENERGY (2+1)

LEARNING OBJECTIVES:
This subject will enable the student
- To gain knowledge on the various types of IC engines, types and selection of tractors.
- To understand the construction and working of various farm implements like tillage implements, seed drills, transplanters, plant protection and harvesting equipments.
- To gain knowledge on the various renewable energy sources like solar, wind, biogas and biomass energy.
- To understand the construction and working of various solar energy gadgets, wind mill, bio gas plants and production of bio diesel and ethanol from agricultural produce.
THEORY

UNIT I – Tillage and Tillage Machinery, Sowing, Planting, Intercultural Equipment
Farm power in India- sources-Tillage – Ploughing Methods - Primary Tillage
Implements -Types of plough – Secondary tillage implements -Cultivators, Harrows and
rotavators – Wetland equipment - Puddlers, Tramplers and Cage Wheel. Sowing
Methods - Seed Drills, Seed cum fertilizer drills - Paddy transplanter.

UNIT II –Plant Protection Gadgets, Harvesting Machinery and Equipment for Land
Development
Plant protection, Harvesting equipment - Combine harvesting machinery for
groundnut, Tuber crops and Sugarcane - Tools for horticultural crops, Equipment for
land development – Cost of operation of farm machinery, Implements for intercultural
operations,Tools for horticultural crops.

UNIT III – Agriculture Diesel Engine and Tractors
IC engines- Working principles, Two stroke and four stroke engines, IC engine
terminology, modern agriculture diesel engine, Electronic fuel injection,dual fuel
operation engine , Tractors- Types and Utilities.

UNIT IV: Energy scenario andbiomass energy conversion systems
Introduction – Energy crisis – Classification – Availability -Renewable energy
sources – significance - Potential of Solar, Wind, Biogas, Biomass, and other Renewable
Energy sources achievements in India- Methods of energy conversion - Thermo chemical
conversion methods -Principles of combustion, Pyrolysis and gasification – Types of
gasifiers –Producer gas and its utilization. Briquettes – Types of briquetting machines –
Uses of briquettes – Shredders- biochemical conversion methods - Biogas and Ethanol
Production – Applications. -Biogas technology – Feed stocks – Factor influences biogas
yield-Biogas plants Types - Construction and Working -. Applications.

UNIT V: Solar energy, Wind energy and bio – fuels and its applications
Solar energy – Solar energy applications – Solar collectors-Types – Solar energy
gadgets -Solar air heaters - Solar cookers – Solar water heating systems –Solar grain
dryers – Solar photo voltaic systems and application-Solar lights -Solar pumping systems
– Solar refrigeration system – Solar ponds – Solar space heating and cooling systems.
Wind energy –Types of wind mills – Constructional details and applications. Energy from
agricultural wastes – Liquid Bio fuels – Bio diesel and ethanol from agricultural produce
- Its production and Uses.

PRACTICAL
Study of different components of IC engine, four stroke petrol engine, two stroke petrol
engine. Study of MB plough, disc plough, seed-cum-fertiliser drills, their mechanisms.
Operation of tractor and implements – operation and maintenance of power tiller – Study
of different inter-cultivation equipments – Sprayers and dusters – their operation, repairs
and adjustment - Paddy transplanting. Harvester for paddy, sugarcane, groundnut –
horticultural tools .
Study of constructional details of KVIC and JANATHA type and DeenBandu type bio
gas plants and different types of gasifier and briquette preparation from biomass -Study
andfind the Performance of a solar still, solar dryer and solar cooker –Study about the
working of solar photovoltaic pumping system and solar street light- Study of different
types of wind mills- Study the processing of Bio diesel production from Jatropha.

THEORY LECTURE SCHEDULE:

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<td>Farm power in India – human, animal, mechanical and electrical</td>
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<td>Objectives of Primary tillage, mouldboard ,disc plough, chisel</td>
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<td>plough and subsoiler, components and functions, types,</td>
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<td>Secondary tillage equipment – harrows, land forming equipment – rotavator</td>
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<td>Wet land equipment – puddlers, Green manure trampers and cage Wheels</td>
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<td>Seed Sowing methods and Equipments</td>
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<td>Seed drills, seed cum fertilizer drills - components and functions,</td>
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<td>Paddy transplanters, types, working principle, field and nursery Requirements</td>
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<td>Sprayers and their functions, classification, manually operated Sprayers, power sprayers – dusters, types and uses</td>
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<td>Harvesting tools and equipment- sickles, paddy harvester</td>
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<td>Combine – Harvesting machinery for groundnut, tuber crops and Sugarcane</td>
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<td>Equipment for land development and soil conservation – dozers</td>
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<td>Equipment for intercultural tools levelers, chisel plough, sub soil plough, Blade harrow and bund former</td>
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<td>Implements for intercultural operations – cultivators, sweep, junior hoe, Manual weeders and</td>
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<td>Power operated weeders for wet land and garden land</td>
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<td>IC engines- working principles, two stroke and four stroke engines, Different systems of IC engine</td>
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<td>Electronic fuel injection system, dual fuel operation engine, Tractors- types and utilities.</td>
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<td>Mid-Semester Examination</td>
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<td>Potential of Solar, Wind, Biogas, Biomass, and other Renewable Energy sources achievements in India</td>
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<td>Methods of energy conversion – Thermo chemical conversion methods -Principles of combustion, Pyrolysis</td>
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<td>Gasification – Types of gasifiers -Producer gas and its utilization.</td>
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<td>Briquettes – Types of briquetting machines – Uses of briquettes – Shredders</td>
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<td>Biochemical conversion methods – Biogas and Ethanol Production – Applications</td>
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<td>Biogas technology – Feed stocks – Factor influences biogas yield- Biogas Plants Types – Construction and Working – Applications</td>
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<td>Solar energy– Solar energy applications</td>
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<td>Solar collectors-Types – Solar energy gadgets.</td>
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<td>Solar photo voltaic systems and application</td>
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<td>Solar lights –Solar pumping systems – Solar refrigeration system – Solar ponds</td>
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<td>Solar space heating and cooling systems</td>
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<td>Wind energy –Types of wind mills – Constructional details and applications.</td>
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<td>Energy from agricultural wastes – Liquid Bio fuels</td>
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<td>Bio diesel and ethanol from agricultural produce</td>
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Bio diesel and ethanol production and Uses.

PRACTICAL SCHEDULE:
1. Study of working of two and four stroke IC engines
2. Study of MB plough and disc plough, measurement of plough size, different parts, horizontal and vertical suction,
3. Study of disc harrows, bund former, leveller and rotavator, chisel plough, blade harrow
4. Study of seed-cum-fertiliser drills- furrow opener, metering mechanism and calibration
5. Study of different inter-cultivation equipments.
6. Study of plant protection equipment – power sprayers, knapsack sprayers and dusters – minor repairs and adjustment of sprayers
7. Study of power tiller their operation and maintenance.
8. Study of tractors and Harvesting Machinery - operation and maintenance
9. Study and constructional details of different bio gas plant types
10. Study and constructional details of different types Gasifiers and biomass Briquetting
11. Study of different types of solar collector.
12. Study of working principle of solar water heater and solar air heater.
13. Study the Performance of a solar still, solar dryer and solar cooker
14. Study the working of solar photovoltaic pumping system and solar street light
15. Study the different types of wind mills
16. Study the processing of Bio diesel production from Jatropha
17. Orientation for final examination

COURSE OUTCOME
This student will be able to

CO1: Gain knowledge on the various types of IC engines, types and selection of tractors.

CO2: Understand the construction and working of various farm implements like tillage implements, seed drills, transplanters, plant protection and harvesting equipments.

CO3: Gain knowledge on the various renewable energy sources like solar, wind, biogas and biomass energy.

CO4: Understand the construction and working of various solar energy gadgets, wind mill, bio gas plants and production of bio diesel and ethanol from agricultural produce.

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REFERENCES:

E-RESOURCES:
1. www.agricoop.nic.in/dacdivision/Machinery1/directory.htm
2. www.farmmachineryshow.org
3. www.freesolaronline.com
4. www.rsnz.org
5. www.finwea.org
6. www.mnre.gov.in

AGR 310 – CLIMATE CHANGE AND DISASTER MANAGEMENT (1+0)
LEARNING OBJECTIVES:
• The students will gain competence about climate changes, causes and importance of mitigation.
• The students will acquire knowledge about natural and manmade disaster management
• The students will know about disaster rehabilitation

THEORY
Unit – I : Climate change and its impact
Climate change – Causes – Impact on Agriculture – Mitigation strategies – Global warming – Sea level rise - Ozone layer depletion – Acid rains – Pollution – Pollutants – Types.

Unit – II : Resource conservation

Unit – III : Natural disasters

Unit – IV : Disaster management
Unit – V: Disaster Rehabilitation


THEORY LECTURE SCHEDULE

2. Impact of climate change on Agriculture and mitigation strategies
3. Climate change – global warming, sea level rise, ozone layer depletion and acid rain
4. Environmental pollution causes, effects and control
5. Conservation of resources and remediation measures from different pollutants
6. Basic concepts and principles of Agricultural ecology and environment
7. Manmade disasters and Nuclear disasters
8. Natural disasters – definition – types and effects
9. Mid – semester examination
10. Floods, drought, cyclone, earth quakes and Tsunami
11. Landslides, avalanches, volcanic eruptions, Heat and cold waves
12. Disaster management – efforts to mitigate disasters at national and global levels
13. Disaster response mechanism in India
14. Disaster warning, India’s key hazards, risk and mitigation
15. Financial arrangements – role of NGOs and other organizations.
16. Rehabilitation – Bio shields livelihood options – insurance and compensation
17. Preparedness - EOCs

COURSE OUTCOMES:

1. To gain knowledge about causes of climate change and ways to mitigate it
2. To understand mitigation strategies for various emergencies
3. To understand natural and manmade disasters.
4. To apply various mitigation strategies in emergencies
5. To formulate various disaster rehabilitation measures

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REFERENCES

E-RESOURCES

HOR 311 BREEDING OF HORTICULTURAL CROPS (2+1)

LEARNING OBJECTIVES:
- To provide knowledge on the basics of plant breeding.
- To acquaint knowledge on the breeding strategies of horticultural crops.
- To study the achievements made in the improvement of horticultural crops.

THEORY

Unit–I: Principles of plant breeding

Unit–II: Advanced plant breeding
Self pollinated crops and cross pollinated crops- components of variation- segregation – breeding values – applications of biotechnology to plant breeding – transgenic molecular plant breeding.

Unit–III: Crop improvement in fruit crops
Objectives, breeding strategies and achievements in crop improvement of mango, banana, acid lime, sweet orange, grapes, sapota, papaya, guava and pomegranate.

Unit–IV: Crop improvement in vegetable crops
Objectives, breeding strategies and achievements in crop improvement of tomato, brinjal, chillies, bhendi, cucumber, snake gourd, ridge gourd, bitter gourd, pumpkin, watermelon, peas, beans, onion, potato, tapioca, moringa, amaranthus, cabbage, cauliflower and carrot.

Unit–V: Crop improvement in spices, plantation crops and flower crops
Objectives, breeding strategies and achievements in crop improvement of pepper, cardamom, turmeric, coriander, tea, coffee, cashew, coconut, rose, jasmine, tuberose, chrysanthemum and crossandra. Current Stream of thought

PRACTICAL

THEORY LECTURE SCHEDULE
1. History and importance of breeding.
4. Methods of breeding and hybridization techniques.
5. Components of variation.
6. Segregation – breeding values
7. Application of biotechnology to plant breeding.
8. Transgenic molecular plant breeding.
9. Centres of origin – germplasm – plant genetic resources, conservation, evaluation and utilization- National and international agencies engaged in conservation, gene sanctuaries, exploration etc.,
13. Breeding strategies, and methods of improvement of the following crops:
   Mango and banana.
14. Citrus and grapes
15. Guava and pomegranate.
16. Papaya and sapota

17. Mid Semester Examination
18. Tomato and brinjal.
19. Chillies and bhendi.
21. Pumpkin, ridge gourd and snake gourd
22. Peas and beans.
23. Potato.
24. Tapioca
25. Onion, moringa and amaranthus.
27. Pepper and cardamom.
28. Turmeric and coriander
29. Tea and coffee.
30. Cashew
31. Coconut.
32. Rose.
33. Jasmine and chrysanthemum.
34. Crossandra and tuberose.

PRACTICAL SCHEDULE
1. Study of floral biology and pollination mechanism, practices in selfing and crossing in the following crops: Mango and banana.
2. Citrus and grapes.
3. Sapota and papaya.
5. Tomato and brinjal.
6. Chilies and bhendi.
8. Cucumber and watermelon.
10. Tapioca and sweet potato.
11. Onion, moringa and amaranthus.
12. Pepper, cardamom and coriander.
13. Cashew, cocoa and coconut.
14. Chrysanthemum and marigold.
15. Heterosis breeding and techniques of F1 hybrid production.
16. Study of mutation and polyploidy breeding.
17. Orientation for final practical examination.

COURSE OUTCOMES:

CO1- The student will be able to understand the breeding strategies and outcome of horticultural crops.
CO2- The student will gain skill in hybridization techniques.

CO-PO MAPPING MATRIX

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8. e-resources

HOR 312 BIOTECHNOLOGY OF HORTICULTURAL CROPS (1+1)
LEARNING OBJECTIVES:
- To gain knowledge on the basic techniques of tissue culture.
- To study the components of tissue culture laboratory.
- To highlight the scope and importance of biotechnology.

THEORY
Unit–I: Importance, history, factors affecting tissue culture

Unit–II: Techniques of tissue culture – I

Unit–III: Techniques of tissue culture – II

Unit–IV: Techniques of tissue culture- III
- Protoplast culture – somatic hybridization -- synthetic seed production -- cryopreservation- secondary metabolite production.

Unit–V: Genetic engineering and secondary metabolite production

Current Stream of thought
PRACTICAL
and electrophoresis from leaf DNA.

**THEORY LECTURE SCHEDULE**

1. History of plant tissue culture - concepts and applications of biotechnology.
2. Influence of plant materials, physical and chemical factors on *in vitro* growth and development.
3. Effect of growth regulators on *in vitro* growth and development.
5. Callus culture - initiation and maintenance of callus culture - initiation of cell suspension cultures.
8. Anther culture – isolation procedure for anthers and microspores and pathways leading to haploid plants.

9. **Mid Semester Examination**

10. Ovary and embryo culture – methods of isolation and culture- embyo rescue technique its applications.
11. *In vitro* pollination and fertilization– *invitro* mutation -production of synthetic seeds.
12. Protoplasm culture – techniques for isolation, culture, fusion and production of somatic hybrids.
13. Techniques of cryopreservation.
15. Recombinant DNA technology - vectors - restriction enzymes.
17. Uses of various molecular tools and achievements.

**PRACTICAL SCHEDULE**

1. Study of components of tissue culture laboratory and requirements.
2. Various tissue culture laboratories – layout/design.
5. Sterilization techniques – methods of sterilizing glasswares and media.
8. Inoculation of explants – techniques involved.
9. Sub-culturing techniques.
11. Micropropagation - media, culture of explants.
13. Demonstration of protoplast culture
15. Extraction and quantification of DNA.
16. PCR and electrophoresis from leaf DNA.
17. Orientation for final practical examination.

**COURSE OUTCOMES:**

**CO1**- The student will be able to understand the importance and scope of biotechnology and tissue culture techniques in detail.

**CO2**- The student will gain skill in tissue culture techniques.

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REFERENCES

10. Virtual labhttps://www.amrita.edu

HOR 313 URBAN AND ENVIRONMENTAL HORTICULTURE  (1+1)

LEARNING OBJECTIVES:

- To impart knowledge to students on horticultural techniques associated with urban planning.
- To enlighten the concepts associated with environmental protection and landscape beautification.
- To expose the constraints and environmental issues related to urban environment.

THEORY

Unit-I: Ecology and Global warming: Relationship to Environment and Horticulture


Unit-II: Environmental Pollution and Mitigation

Air, water, soil, noise, thermal and nuclear pollutions: causes, effects and control measures- pollution control through horticultural practices- carbon sequestration: concept, methods and carbon credit – plants in pollution control- solid waste management: causes, effects and control measures of urban and industrial wastes, composting, and modern land fill- sewage and effluent treatment methods and utilization of waste water-Environmental Protection Acts.

Unit-III: Urban Planning and Sustainable Landscapes

Urban Planning: town planning concepts:Geddisian Triad concept, garden city concept, satellite town principles – importance of plants in urban planning – role of plants in managing urban environmental factors and vice-versa – sustainable landscape concepts
for urban: xeriscaping, green belt/green buffers, avenue planting, landscaping schools, villages, gated communities/colonies, railway stations, dam sites, industrial sites, river/lake banks and play grounds.

**Unit-IV: Horticultural concepts for urban well being**

Global trends in urban horticultural concepts- home gardens, container gardening, vertical gardens, herbal garden, roof garden and hydroponics: basics, techniques and layout - social horticulture- physiological and social aspects of ornamental plants-public gardens, theme parks and botanical gardens - horticultural crafts: bonsai, vegetable carving and flower arrangements.

**Unit-V: Therapeutic Horticulture for Health Benefits**

Therapeutic horticulture: definitions and terms - therapeutic horticulture programmes- methods and approaches used in therapeutic programmes - planning, design and construction issues in the design of therapeutic landscapes/gardens, tools, equipment and materials - aroma therapy - definition and applications - aroma garden.

**Current Stream of thought**

**PRACTICAL**


**THEORY LECTURE SCHEDULE**

1. Eco-system concept: Its structure and functions
2. Classification of ecosystems system and their features with special reference to urban and horticultural ecosystem
3. Climate change: causes, consequences and implications in urban environment and horticulture
4. Biodiversity conservation and role of invasive aliens in climate change
5. Environmental pollution: causes, effects and control measures of air, water, soil, noise, thermal and nuclear pollutions
6. Carbon sequestration: concept, methods, carbon credit and highlight on trees for pollution control.
7. Solid waste management: causes, effects and control measures of urban and industrial wastes, composting with special reference to modern land fill
8. Sewage and effluent water treatment: concept, technology and treatment methods and utilization of waste water in urban areas.

9. **Mid Semester Examination**
10. Environment protection, wild life and biodiversity protection acts.
11. Urban Planning: Town planning concepts with a special reference to importance of plants in urban environment
12. Sustainable landscape concepts for urban environment: xeriscaping, green belt/green buffers and avenue planting
13. Sustainable features for landscaping in schools, villages, gated communities/colonies, railway stations, dam sites, industrial sites, river/lake banks and play grounds.
14. Trends and developments in urban horticultural concepts: home gardens, herbal gardens, container gardening and hydroponics
15. Trends and developments in urban horticultural concepts: green walls and roof gardens
16. Gardens for society – psychological and social aspects of ornamental plants. concepts and features of public gardens, theme parks and botanical gardens
17. Therapeutic horticulture: horticultural ways to cure (planning, design and construction issues in the therapeutic gardens) Aroma therapy - definition, approaches and applications.

PRACTICAL SCHEDULE
1. Assessment of various eco-systems.
2. Determination of carbon use efficiency
4. Determination of sound level by using sound level meter.
5. Estimation of air pollution by using portable dust sampler: CO₂, PM₁₀, Methane
6. Determination of total dissolved solids (TDS) in effluent samples.
7. Estimation of species abundance of plants.
8. Visit to Social Service Organization/Corporate companies: To study the role of CSR in pollution control
9. Visit to Environmental Education Centre: To study the recent developments in pollution control practices
10. Visit to a local polluted site: To assess the level of different pollutants and remedial measures
11. Sewage or effluent water treatment plant: To study the technology
12. Reclamation of problem soils for planting (Mine spoil, concrete dump, heavy clay/sandy soils, etc.,).
13. Practicing tree transplanting: balling and bur-lapping
14. Description and design of terrace garden
15. Description and design of grow walls
17. Orientation for final practical examination.
COURSE OUTCOMES:
CO1- Students will be able to understand the issues in urban environment and gain knowledge in urban planning and beautification.
CO2- Student will gain skill in pollution control techniques, urban waste management, sewage water treatment and horticultural therapy

CO-PO MAPPING MATRIX

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REFERENCES

E-RESOURCES

AGM 314 - ENVIRONMENTAL SCIENCE (2+1)

LEARNING OBJECTIVES:
- Student will develop basic knowledge about the environment and ecology
- Student will develop an attitude of concern for the surrounding.
- Student will know the role of different microbes on leading of areas and advanced biochemical methods in controlling environmental pollution.

THEORY
Unit I - Ecology and Ecosystems

Unit II - Natural Resources and Biodiversity
Unit III - Environmental pollution
Pollution-pollutants - contaminants - sources and types of pollution- sources, impacts and control measures of soil, water and air pollution - noise pollution- sources-impacts and control measures- Radioactive - Heavy metal and thermal pollution- Green house gases- Global warming and climate change - impact on environmental and agriculture.

Unit IV Unit – Solid and Liquid waste management
Types of wastes - Industrial wastes - Agricultural waste and Domestic wastes-characteristics and environmental impact-solid waste management techniques -physical, chemical and biological methods-standards for waste water disposal

Unit V- Environmental Protection

PRACTICAL
Environmental Sampling and Preservation - Biodiversity Assessment in natural and agro ecosystems - Water and Effluent quality analysis: Colour, Temperature, Turbidity, pH, EC, TDS, Acidity, Alkalinity, Hardness, DO, BOD, COD and E.coli. - Impact of wastewater irrigation: germination test - Biogas production from wastes - Suspended Particulate Matter (SPM) assessment in the ambient air - Field Visit to sewage water treatment plant and Pollution Control Boards

THEORY LECTURE SCHEDULE
1. Ecology, Environment, Ecosystem and its components
2. Terrestrial biomes (Forest, Desert, etc..)
3. Aquatic biomes (Pond, River, Estuaries and Ocean)
4. Energy flow, Food Chain, Food Web and Ecological pyramids
5. Species interactions
6. Succession and adaptations
7. Natural and Energy resources: Land, Water, Air, Forest, Minerals
8. Energy resources - Renewable and Non-renewable
9. Sustainable Management and Conservation of natural resources
10. Biodiversity: Types, National and Global Status, importance, Hotspots and Threats
11. Conservation of Biodiversity: In-situ and Ex-situ - Biosphere Reserves - National parks, Wildlife Sanctuaries, Botanical Garden, etc..
12. Environmental pollution- types and sources
13. Soil pollution sources, effects
14. Fate of soil pollutants – management – bio and phyto remediation of soil pollutants
15. Water pollution sources and types of waste water
16. Waste water – impact on ecosystems- eutrophication, bio magnification, water borne diseases
17. Air pollution sources effects and control measures
18. Mid-semester examination
19. Air pollution indicators, episodes and monitoring
20. Noise pollution sources effects and control measures
21. Radioactive, heavy metal and thermal pollution sources effects and control measures
22. Green House Gases-Global warming- Climate change-Impact on agriculture and other natural resources
23. Types of wastes - industrial waste, agricultural wastes, domestic waste-characteristic and environmental impact
24. Solid waste management techniques - physical methods
25. Solid waste management techniques - composting and Vermicomposting
27. Waste water recycling and Standards for waste water disposal
28. Global treaties and Conventions for Environmental Protection
29. National and state level organizations: CPCB, TNPCB, etc..
31. Environmental Education
32. Environmental Laws and Acts
33. Afforestation
34. Role of information technology on environment.

PRACTICAL SCHEDULE
1. Sample collection and preservation from contaminated sites.
2. Estimation of microbial communities in Irrigation and polluted water samples
3. Estimation of oligotrophic bacteria
4. Characterization of waste water
5. Assessment of Suspended Particulate Matter (SPM)
6. Estimation of dissolved oxygen in water (DO)
7. Estimation of biological oxygen demand (BOD)
8. Estimation of chemical oxygen demand (COD)
9. Detection of E.coli in water samples
10. Assessment of Microorganisms in air
11. Impact of air pollution on phyllosphere Microflora
12. Solid waste management – Decomposition of cellulose
13. Solid waste management – Vermicomposting
14. Maturity indices of compost
15. Biogas production from organic wastes
16. Visit to water treatment plant
17. Orientation for final examination

COURSE OUTCOMES:
CO-1: The students gained basic understanding of different ecosystem concepts, energy flow, food web and interactions.
CO-2: The students gained knowledge on the natural resources like renewable and non-renewable, Biodiversity concept etc.
CO-3: The students would expose to different types of pollutions and their impact on environment and agriculture.
CO-4: The students gained knowledge on management of different types of solid wastes and waste waters.
CO-5: The students would be exposed to the laws ad acts in forest with respect to environment.

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REFERENCES

E-Books:

SAC 315 SOIL FERTILITY, FERTILIZERS AND MANURES (2+1)

LEARNING OBJECTIVES:
To impart knowledge on essential nutrients, soil fertility, nutrient transformations in soil, manures fertilizers and soil fertility management through various approaches.

THEORY

Unit-I-Essential Nutrients

Unit-II- Nutrient Dynamics
Nutrients - sources, forms, mobility, transformations, fixation, losses and availability of nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc, copper, boron, molybdenum, nickel, chloride in soils - Beneficial elements - Nutrient interactions

Unit-III-Classification of Fertilizers

Unit-IV-Application Methods
Methods of fertilizer application - Seed coating, pelletization, seedling dipping - Nutriseed pack - Soil Application - Foliar spray - Fertigation - water soluble fertilizers, fertigation scheduling (Fertilizer- water interaction, fertilizer solubility, comparison of fertilizer application methods)
Unit-V-Nutrient Management


PRACTICAL


THEORY LECTURE SCHEDULE

1. Soil fertility and productivity - essential nutrients- criteria of essentiality - N, P and K nutrients -functions, deficiency and toxicity symptoms
2. Secondary nutrients, micro nutrients and beneficial elements - functions, deficiency and toxicity symptoms
3. Concepts and approaches of soil fertility evaluation - Liebig's Law, Mitscherlich's law and Bray's nutrient mobility concept. Approaches - Deficiency symptoms, tissue analysis, biological tests and chemical tests
4. Techniques/ methods of soil fertility evaluation - Inductive, deductive, 'A' value technique, crop logging, critical level, DRIS and agronomic approach
5. Sources, forms, mobility, transformation, fixation, losses and availability of nitrogen in soil
6. Sources, forms, mobility, transformation, fixation, losses and availability of phosphorus in soil
7. Sources, forms, mobility, transformation, fixation, losses and availability of potassium in soil
8. Sources, forms, mobility, transformation, fixation, losses and availability of calcium magnesium and sulphur in soil
9. Sources, forms, mobility, transformation, fixation, losses and availability of micro nutrients in soil
10. Nutrient interactions in soil
11. Fertilizers - Definition, classification of N,P and K fertilizers
12. N fertilizers- Urea, ammonium sulphate, ammonium nitrate, CAN, properties and their reactions in soil
13. Manufacture of urea and ammonium sulphate
14. P fertilizers- Rock phosphate, bone meal, basic slag, single super phosphate, diammonium phosphate, triple super phosphate, properties and their reactions in soil
15. Manufacturing of SSP and DAP
16. K fertilizers- MOP and SOP- properties and reactions in soil
17. Mid Semester Examination
18. Synthesis of MOP and SOP
20. Mixed fertilizers-definition, preparation and compatibility
21. Preparation and characteristics and compatibility - Specialty/ Customized fertilizers, Water soluble fertilizers, liquid fertilizers, Micro nutrient mixtures and chelated micronutrients
22. Fertilizer Control Order
23. Organic manures- Definition, classification and sources- Fortified organics
Composting techniques- Aerobic and anaerobic (Bangalore and Coimbatore method) enriched FYM and vermicompost. Composting of organic waste-Sugarcane trash and coir waste

Methods of fertilizer application for different soil types - Fertigation - Definition - water soluble fertilizers

Types of fertigation - Fertilizer schedule

Fertilizer application methods - Seed coating, pelletization, seedling dipping - Nutriseed pack - Soil Application - Foliar spray

Nutrient management concepts - INM, STCR, IPNS, SSNM and RTNM - Tools - DSSIFER and VDK

Nitrogen use efficiency - Slow release N fertilizers - Significance and enhancement techniques

Nutrient use efficiency of P, K and micronutrients and their enhancement techniques

Soil health - Definition - Soil Quality Indices - Physical, chemical and Biological indicators-Soil enzymes

SOM maintenance - Role of SOM in sustaining soil health

Precision farming and organic farming - Concepts and applications

Long term effect of fertilization on soil

PRACTICAL SCHEDULE
1. Estimation of alkaline KMnO₄ N in soil
2. Estimation of Olsen P and Bray P in soil
3. Estimation of Neutral Normal NH₄OAc K in soil
4. Estimation of Ca, Mg by versenate method
5. Estimation of sulphur in soil by turbidimetry
6. Estimation of DTPA extractable micronutrients in soil
7. Fertilizer sampling techniques and Estimation of N in urea
8. Estimation of ammoniacal and nitrate N in ammonium nitrate
9. Estimation of water soluble P in SSP
10. Estimation of citric acid soluble P in rock phosphate - Pemberton's method
11. Estimation of K in KCl and K₂SO₄
12. Estimation of N in FYM / Compost by Macro Kjeldahl method
13. Preparation of triple acid extract - Estimation of P in FYM / Compost by Vanado molybdate yellow colour method
15. Colloquium on establishment of soil testing laboratories -Fertilizer calculations - Soil test based fertilizer prescription
16. Visit to STL and FTL, Visit to fertilizer manufacturing / mixing unit
17. Orientation for final examination.

COURSE OUTCOMES :
CO 1: Students gain a basic knowledge on essential nutrients.
CO 2: Students familiarize with source, forms, mobility, transformation, fixation, losses and availability of macro and micro nutrients.
CO 3: Students acquire themselves with knowledge on manufacturing of fertilizers at industry level.
CO 4: Students acquired practical knowledge on precision farming and organic farming.
CO 5: Students may be visit fertilizer mixing unit.
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REFERENCES


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2. www.springerlink.com/index/IQ11256h8t325054.pdf

AGR 316 – PRODUCTION TECHNOLOGY OF FIELD CROPS (2+1)

LEARNING OBJECTIVES:

- Students will gain knowledge about economic importance and cultivation aspects for cereals.
- Students will acquire knowledge on cultivation aspects of major millets.
- Students will gain knowledge about economic importance and cultivation aspects for pulses.
- The students will acquire the basic knowledge about scientific crop production of oilseeds and sugar crops.
- The students will gain knowledge about fibre crops, tuber crops and narcotics crops and crop cultivation

THEORY

Unit-I: Agronomy of cereals

Rice, Wheat and Maize- Origin, geographic distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and yield.
Unit-II: Agronomy of major millets
Sorghum, Pearl millet and Finger millet – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Unit-III: Agronomy of pulses
Blackgram, Greengram, Redgram and Bengalgram – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Unit-IV: Agronomy of oilseeds and sugar crops
Oil seeds – Groundnut, sesame, sunflower and Rapeseed and mustard – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
Sugar crops: Sugarcane, Sugar beet and sweet sorghum – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Unit-V: Fibres, tuber and Narcotics crops
Fibre crops – Cotton and Jute – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
Tuber crops – Potato and sweet potato – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
Narcotics – Tobacco and betel vine – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Current streams of thought.

PRACTICAL

THEORY LECTURE SCHEDULE
1. Introduction – importance of cereals, millets, pulses and oilseeds.
2. Introduction – importance of sugar crops, fibres
4. Area, production and productivity of major cereals, millets, pulses and oilseeds of India and Tamil Nadu.
5. Importance and area, production and productivity of sugars, fibres, tubers and tobacco of India and Tamil Nadu.
8. Maize – Origin, geographic distribution, economic importance, soil and climatic requirement.
10. Wheat – Origin, geographic distribution, economic importance, Soil and climatic requirement, varieties, cultural practices and yield.
11. Sorghum – Origin, geographic distribution, economic importance, soil and climatic requirement.
13. Pearl millet – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
14. Finger millet – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
15. Blackgram and Greengram – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield – Agronomy of rice fallow pulses.
16. Red gram – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
17. Groundnut – Origin, geographical distribution, economic importance.

18. Mid Semester Examination
21. Sesame – Soil and climatic requirements, varieties, cultural practices and yield
23. Sunflower – Soil and climatic requirements, varieties, cultural practices and yield.
24. Coconut – Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
27. Sugar beet – Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices, yield
28. Cotton – Origin, geographic distribution, economic importance, soil and climatic requirement.
30. Jute – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices – harvesting and retting
31. Potato – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
32. Sweet potato – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
33. Tobacco – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield – curing of tobacco
34. Betel vine – Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural and after cultivation practices and yield.

PRACTICAL SCHEDULE
1. Identification of cereals, millets, pulses, oilseeds, sugar crops, fibres, tubers and narcotics
2. Nursery and main field preparation for rice
3. Nursery and main field preparation for important millets and red gram
4. Nursery preparation and methods of planting for coconut
5. Nursery preparation and methods of planting for sugarcane and tobacco
6. Acquiring skill in different seed treatment techniques for major field crops.
7. Field preparation and sowing of major field crops
8. Estimation of plant population and seed rate requirement for major field crops.
9. Working out fertilizer requirement and fertilizer management for major field crops
10. Observations on growth and yield parameters of major field crops
11. After cultivation practices for major field crops
12. Estimation of yield components and yield of major field crops
13. Assessment of sugarcane maturity
14. Economic analysis of crops
15. Visit to farmer’s field
16. Visit to research stations to study the cultivation techniques of major field crops
17. Orientation for final examination.

COURSE OUTCOMES:

CO1: To have practical knowledge on nursery preparation and crop production for various cereal crops
CO2: To understand the importance of principles of crop production for various major millets.
CO3: To understand knowledge about pulse cultivation and importance of pulse intercropping
CO4: To impart detailed knowledge of sugar crops and oilseeds cultivation.
CO5: To identify various fibre, tuber and narcotic crops along with production technologies viz., fertilizer, plant protection and irrigation management principles

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ENT 317 INSECTS, MITES AND NEMATODE PESTS OF HORTICULTURAL CROPS AND THEIR MANAGEMENT (2+1)

LEARNING OBJECTIVES:

- To study the distribution, bionomics and symptoms of damage of pests of horticultural crops.
- To distinguish various symptoms of damage and identify different life stages of the major pests of horticultural crops.
• To discuss integrated pest management protocols for major horticultural crops and pests
• To perform rearing and collection of major horticultural pests for better understanding of their biology and identification characters

THEORY

Bionomics, symptoms of damage and management strategies for Insects, Mites and Nematode pests of following crops.

Unit-I: Pests of Vegetable and Tuber Crops
Brinjal, Bhendi, Tomato, Crucifers, Cucurbits, Chow chow, Carrot, Beet root, Radish, Turnip, Beans, Palak, Chillies, Onion, Garlic, Moringa, Amaranthus, Potato, Sweet potato, Tapioca, Yam and Colocasia.

Unit-II: Pests of tropical fruit Crops
Mango, Citrus, Guava, Banana, Grapevine, Ber, Sapota, Papaya, Avocado, Mangosteen, Durian, Fig, Hill banana; Pomegranate, Aonla, Pine apple, Custard apple, Wood apple, Jamun, Jack, Bread fruit, Passion fruit and Litchi.

Unit-III: Pests of temperate fruit Crops
Apple, Pear, Peach, Plum, Strawberry, Kiwi, Sweet and Sour cherry, Apricot, Raspberry, Persimmon and Currants.

Unit-IV: Pests of Plantation and Spice Crops
Coconut, Areca nut, Palmyrah, Tea, Coffee, Cashew, Cocoa, Rubber, Ginger, Turmeric, Cardamom, Pepper, Fennel, Cumin, Fenugreek, Clove, Nutmeg, Cinnamon, Coriander, Curry leaf, Asafoetida, Vanilla, Betelvine and Tamarind

Unit-V: Pests of Flower Crops, Medicinal Plants, Lawn and Stored products
Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Gloriosa, Coleus, Phyllanthus, Aswagantha, Vasaka, Senna, Periwinkle, Ocimum, Mint, Lemon grass, Citronella, Vetiver, Lawn and Stored products.

PRACTICAL
Identification of symptoms of damage and life stages of important Insects, Mites and Nematode pests of different horticultural crops: vegetables, tubers, tropical fruits, temperate fruits, plantations, spices, flower crops, medicinal plants, lawn and stored products.

THEORY LECTURE SCHEDULE
1. Pests of Brinjal, Bhendi and Tomato
2. Pests of Crucifers
3. Pests of Cucurbits
4. Pests of Chow Chow, Carrot and Beet root
5. Pests of Radish, Turnip, Beans and Palak
6. Pests of Chillies, Onion and Garlic
7. Pests of Moringa and Amaranthus
8. Pests of Potato, Sweet potato, Tapioca, Yam and Colocasia.
9. Pests of Mango, Citrus and Banana
10. Pests of Guava, Grapevine and Ber
11. Pests of Sapota, Papaya and Avocado
12. Pests of Mangosteen, durian, Fig and Hill banana
13. Pests of Pomegranate, Aonla and Pine apple
14. Pests of Custard apple, Wood apple and Jamun
15. Pests of Jack, Bread fruit, Passion fruit and Litchi
16. Pests of Apple, Pear, Peach, Plum, Strawberry and Kiwi

17. Mid Semester Examination
18. Pests of Sweet and Sour cherry and Apricot
20. Pests of Coconut, Areca nut and Palmyrah
21. Pests of Tea, Coffee and Cashew
22. Pests of Cocoa and Rubber
23. Pests of Ginger and Turmeric
24. Pests of Cardamom, Pepper and Fennel
25. Pests of Cumin, Fenugreek, Clove, Nutmeg and Cinnamon
26. Pests of Coriander, Curry leaf and Asafoetida,
27. Pests of Vanilla, Betelvine and Tamarind
28. Pests of Rose, Jasmine and Crossandra,
29. Pests of Chrysanthemum, Tuberose and Cut flowers
30. Pests of Gloriosa, Coleus and Phyllanthus
31. Pests of Aswagantha, Vasaka and Senna
32. Pests of Periwinkle, Ocimum and Mint
33. Pests of Lemon grass, Citronella, Vetiver and Lawn
34. Pests of Stored products.

**PRACTICAL SCHEDULE**

1. Identification of Pests of Brinjal, Bhendi and Tomato
2. Identification of Pests of Crucifers, Cucurbits, Chow chow, Carrot, Beet root, Radish, Turnip, Beans and Palak
3. Identification of Pests of Chillies, Onion, Garlic, Moringa and Amaranthus
4. Identification of Pests of Potato, Sweet potato, Tapioca, Yam and Colocasia
5. Identification of Pests of Mango, Citrus, Guava and Banana
6. Identification of Pests of Grapevine, Ber, Sapota and Papaya
7. Identification of Pests of Avocado, Mangosteen, Durian, fig, Hill banana, Pomegranate, Aonla, Pine apple, Custard apple and Wood apple
8. Identification of Pests of Jamun, Jack, Bread fruit, Passion fruit, Litchi, Apple, Pear, Peach, Plum and Strawberry
9. Identification of Pests of Kiwi, Sweet and Sour cherry, Apricot, Raspberry, Persimmon and Currants
10. Identification of Pests of Coconut, Areca nut and Palmyrah
11. Identification of Pests of Tea, Coffee, Cashew, Cocoa and Rubber
12. Identification of Pests of Ginger, Turmeric, Cardamom, Pepper, Fennel, Cumin and Fenugreek
13. Identification of Pests of Clove, Nutmeg, Cinnamon, Coriander, Curry leaf, Asafoetida, Vanilla, Betelvine and Tamarind
15. Identification of Pests of Gloriosa, Coleus, Phyllanthus, Aswagantha, Vasaka, Senna, Periwinkle, Ocimum, Mint, Lemon grass, Citronella and Vetiver
16. Identification of Pests of Lawn and Stored products
17. Orientation for final practical examination.

**Assignment:**
- Collection and submission of 25 pests of horticultural crops
- Rearing of 10 insect pests

**COURSE OUTCOMES**

**CO1:** Define bionomics, symptoms of damage and integrated management strategies for pests of Vegetable and Tuber Crops

**CO2:** Discuss bionomics, symptoms of damage and integrated management strategies for pests of tropical fruit Crops

**CO3:** Explain bionomics, symptoms of damage and integrated management strategies for pests of temperate fruit Crops
CO4: Define bionomics, symptoms of damage and integrated management strategies for pests of Plantation and Spice Crops

CO5: Discuss bionomics, symptoms of damage and integrated management strategies for pests of Flower Crops, Medicinal Plants, Lawn and Stored products

CO6: Illustrate identification and biology of major pests of horticultural crops and storage through rearing and collection

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REFERENCES


AEC 318 – AGRI BUSINESS MANAGEMENT AND ENTREPRENEURSHIP (1+1)

LEARNING OBJECTIVES:

- To impart skill, training, proficiency in decision making
- To enhance ability, to direct, to coordinate and control the work at all levels of management for the farm graduates
- To use the knowledge and skill gained for starting new agribusiness and managing the business

THEORY

Unit I: Agri Business Management

Unit II: Management Functions I

Unit III: Management Functions II

Unit IV: Functional Arcas of Management

Unit V: Entrepreneurship

PRACTICAL
Mapping opportunities in Agribusiness sectors and selecting an agribusiness - Identification of the forms of agri business organization - Guest lecture by entrepreneur - Visit - Understanding functional areas of agribusiness firm - Identifying information needs for business plan preparation - Documenting the procedure for establishing agribusiness firms - guest lecture / visit to District Industries Centre - Exercise on forecasting demand for agricultural products - Preparation of production plans for agribusiness firm - Exercise on Inventory Management - types, cost and basic EOQ model - Purchase management and Vendor rating methods - Market survey for understanding customer needs and satisfaction - Pricing of products of small agribusiness - Working out cost of production and cost analysis - Preparation of advertisement and sales promotion programs for an agribusiness firm - Financial performance of firm - Balance sheet and Income Statement of agribusiness and Ratio analysis - Assessment of entrepreneurial skill and competency - Presentation of business plan and discussion - Model project discussion.

THEORY LECTURE SCHEDULE
1. Management - Definition and concepts - Approaches.
3. Agri Business Management - Meaning and definition - Scope characteristics.
9. Mid Semester Examination.
11. Production operations management - Planning and scheduling - Inventory - Materials management - Supply chain management.
14. Marketing mix, market promotion - Promotion mix – Consumer buying behavior.
15. Entrepreneur - Agripreneurs - Agripreneurship - Types, characteristics and process. Innovation, business incubation.
16. EDP - Programmes government schemes and incentives - Government Policy.

PRACTICAL SCHEDULE
1. Mapping opportunities in Agribusiness sectors and selecting an agribusiness (The classes that follow could be based on building up this into a business).
2. Identification of the forms of agri business organization.
3. Guest lecture by entrepreneur.
4. Visit - understanding functional areas of agribusiness firm.
5. Identifying information needs for business plan preparation.
6. Documenting the procedure for establishing agribusiness firms - guest lecture / visit to District Industries Centre.
7. Exercise on forecasting demand for agricultural products.
8. Preparation of production plans for agribusiness firm.
9. Exercise on Inventory Management - types, cost and basic EOQ model.
10. Market survey for understanding customer needs and satisfaction.
12. Preparation of advertisement and sales promotion programs for an agribusiness firm.
14. Assessment of entrepreneurial skill and competency
15. Presentation of business plan and discussion.
16. Model project discussion.
17. Orientation for final examination

COURSE OUTCOMES:
At the end of the course students will be able to
1. To understand the opportunities in agribusiness sectors
2. To understand the marketing mix, and supply chain management in agribusiness.
3. To know the management functions and how to prepare agribusiness project.

CO-PO MAPPING MATRIX

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REFERENCES
LEARNING OBJECTIVES:
- To impart the basics of soil and water conservation engineering to the undergraduate students

THEORY
Unit I Surveying
Surveying and levelling - chain, compass and plane table survey - levelling - land measurement and computation of area - Simpson’s rule and Trapezoidal rule.

Unit II Soil erosion

Unit III Soil conservation and watershed management

Unit IV Irrigation and drainage

Unit V Wells and Pumps
Groundwater occurrence - aquifers - types of wells and sizes - pump types - reciprocating pumps - centrifugal pumps - turbine pumps - submersible pumps - jet pumps - airlift pumps - selection of pumps - operation and their maintenance.

PRACTICAL

THEORY LECTURE SCHEDULE
1. Introduction - land surveying - uses in agriculture.
2. Chain cross staff and compass surveying - computation of angles.
3. Radiation, intersection and traversing.
4. Dumpy level - setting, observation and tabulation of readings - computation of land slope - difference in elevation.
5. Computation of area and volume - Simpson’s rule and Trapezoidal rule.
7. Water erosion - causes - erosivity and erodibility - mechanics of water erosion
8. Splash, sheet, rill and gully erosion - ravines - land slides
10. Effects of water and wind erosion
12. Mechanical measures – contour bund – graded bund - Broad beds and furrows – basin listing – random tie ridging
15. Farm ponds and percolation ponds - storage and its use for domestic and ground water recharge
16. Gully control structures -Check dams - Temporary and permanent
17. Watershed concept – Integrated approach and management
18. Mid semester examination.
19. Irrigation - measurement of flow in open channels - velocity area method
20. Rectangular weir - Cippoletti weir - V notch
21. Orifices - Parshall flume
22. Duty of water - irrigation efficiencies
23. Conveyance of irrigation water - canal lining
24. Underground pipe line system
25. Surface irrigation methods - borders, furrows and check basins
26. Components of drip and sprinkler irrigation system
27. Agricultural drainage – need - surface drainage systems
28. Surface drainage systems - drainage coefficient
29. Groundwater occurrence – aquifers types
30. Types of wells and sizes
31. Pump types – reciprocating pumps – centrifugal pumps
32. Turbine pumps – submersible pumps
33. Jet pumps – Airlift pumps
34. Selection of pumps - operation and their maintenance.

PRACTICAL SCHEDULE
2. Chains and cross staff surveying - linear measurement - plotting and finding areas.
5. Levelling – fly levels – determination of difference in elevation.
6. Computation of area
7. Computation of volume
8. Contouring – Block contouring
10. Drip Irrigation systems.
11. Sprinkler irrigation system
12. Problems on water measurement.
13. Problems on duty of water, irrigation efficiencies.
15. Study of different types of wells and its selection.
16. Study of pumps and Selection of pumps.
17. Orientation for final examination.

COURSE OUTCOME
CO1: Student can understand understanding on basics of soil and water conservation engineering to the undergraduate students
CO2: Can able to define irrigation system and drainage facility for agricultural land

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e-resource
1. http://nptel.ac.in/courses/105107122/13
2. http://soilwater.okstate.edu/courses/lectures-powerpoint

HOR 320 ORGANIC HORTICULTURE AND SYLVI HORTICULTURE (2+1)

LEARNING OBJECTIVES:
- To learn the special techniques followed in organic horticulture and importance of social forests.
- To impart knowledge on bio-inputs and biocontrol methods in organic horticulture.
- To learn the concepts of social forestry, agro forestry and its concepts.
- To provide knowledge in the management of tree species and afforestation.

THEORY
Unit-I: Importance of organic horticulture and soil health
Organic horticulture - definition - scope and importance - principles and concepts of organic farming - merits and demerits - present status - Global and Indian scenario - history and genesis of organic farming in India and around the world soil health - concepts - problem diagnosis - conservation of soil - problem soil reclamation under organic horticulture - soil physical, chemical and biological improvement - organic carbon status and improvement strategies - C:N ratio and its significance.

Unit-II: Bio inputs and bio control agents in organic horticulture
Organic manures - FYM, coirpith - compost, vermicompost, pressmud compost, oil cakes, green manures - bio fertilizers - biodynamic farming - foliar supplements - panchakavya, EM technology, humic acid, sea weed extract, mushroom manchuiran tea, vermiwash, - dasagavya - amirthakaraisal. weeds, pests and disease management under organic horticulture - non-chemical weed
management – non-chemical pest management and non chemical disease management.

Unit–III : Certification and economics in organic horticulture
Certification process – agencies involved – export potential and marketing of organic produce – sustainability indices for evaluating long term and indirect benefits – economic evaluation of organic horticultural technologies.

Unit–IV: Social and agro forestry

Unit–V : Silviculture, waste land and afforestation

Current Streams of thought.

PRACTICAL

THEORY LECTURE SCHEDULE
1) Scope and importance of organic horticulture and its merits and demerits.
2) Global and Indian scenario of organic horticulture.
3) History and development of organic farming in India and world, principles and concepts of organic farming.
4) Soil problems and its reclamation through organic horticulture.
5) Soil physical, chemical and biological properties and conservation of soil resource under organic horticulture.
6) Importance of C:N ratio, its influence on nutrient availability and methodology to improve organic carbon status.
7) Bulky organic manures.
8) Concentrated organic manures.
9) Green manures, biofertilizers and bio dynamic farming.
10) Panchakavya, EM technology and humic acid.
11) Sea weed extract, mushroom, Manchurian tea and vermiwash.
12) Nonchemical methods of weed control.
13) Nonchemical methods of pest and disease control
14) Organic certification – standards and agencies – marketing and export avenues for organic produce.
15) Sustainability indices for evaluating indirect benefits of organic farming.
16) Economic evaluation of organic horticultural technologies – net returns and B:C ratio.

17) **Mid-semester examination**

- 18) Role of forest – Global and Indian forest status – National forest policy
- 19) Social forestry – definition – objectives – components
- 20) Joint forest management – Tamil Nadu afforestation programme
- 21) Agroforestry – definition – components – different terminologies – distinction between agroforestry and social forestry
- 22) Benefits of agroforestry systems – increased food production – improvement of soil fertility and soil conservation
- 23) Classification of agroforestry systems – primary system – Hori silviculture – silvipasture – Hori silvipasture – and mixed woodlots
- 24) Subsystems – shifting cultivation – Taungya cultivation – alley cropping – importance of hedge row planting
- 25) Subsystem – home garden, multitier cropping – wind break and shelter belts – differences, importance – design of shelter belts and species composition
- 26) Role of agroforestry in soil, water and ecological conservation – industrial agroforestry – constraints in agroforestry
- 27) Silvi culture practices for casuarina and eucalyptus
- 28) Silvi culture practices for tamarind and neem
- 29) Silvi culture practices for Jamun and ber
- 30) Silvi culture practices for teak and cashew
- 31) Silvi culture practices for pungam, silkcotton, palmyrah
- 33) Suitable agroforestry systems for different problem soils and wastelands
- 34) Planting techniques and afforestation for wastelands

**PRACTICAL SCHEDULE**

1) Estimation of soil physical, chemical (pH, EC and ESP) and biological parameters.
2) Estimation of nutrient content of farm wastes/agro industrial wastes.
3) Agro techniques for composting farm wastes and agro industrial wastes.
4) Recycling of crop wastes through vermiculture.
5) Preparation of panchakavya, dasagavya, amirthakaraisal and EM solution
6) Application of various mulch materials to horticultural crops.
7) Study of bio agents for crop protection.
8) Preparation of organic formulations for pest and disease control.
9) Economic evaluation of organic horticulture system.
10) Identification and description of agroforestry tree species and fuel, fodder and green manure trees in the locality
11) Production of presprouted seeds in agroforestry tree species by different seed treatment methods
12) Nursery methods for agroforestry and avenue planting
14) Visit to woodlots of casurina, eucalyptus, neem, tamarind, observing, spacing, height, girth and calculating tree volume using the formula
15) Visit to agroforestry systems in farmers holding and recording the spacing and assessing the growth and yield
16) Working out economics of cultivation of tree species like casuarina, eucalyptus
17) Visit to social forestry plantation and identification of tree species – recording espacement and purpose
COURSE OUTCOMES:
CO1- Students will be able to grasp the importance of organic horticulture.
CO2- Will become skillful in practicing organic cultivation practices in farms and organic certification industry
CO3- will be able to understand the importance of growing trees as livelihood for the village communities and establishing of tree nurseries.
CO4- will gain skills on arboriculture and agro forestry management.

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REFERENCES

E-RESOURCES
www. uky.edu/jmlhjt2/courses/for350
http://orgprints.org/6683
http://orgprints.org/8138

HOR 321 PRODUCTION TECHNOLOGY OF TEMPERATE AND SUB TROPICAL FRUITS (2 + 1)

LEARNING OBJECTIVES:
- To acquire knowledge on the cultivation aspects of temperate and subtropical fruits.
- To provide knowledge on basic nursery management practices of fruit crops.
- To explore the sub tropical and temperate zones and study more about temperate and sub tropical fruits.
THEORY
Unit-I: Importance of temperate and sub tropical fruit crops
Subtropical, temperate and humid zones of India and Tamil Nadu – classification of temperate and subtropical fruits – area, production, scope and importance, role of temperate and subtropical fruit crops on national economy.

Unit-II: Production technology of Temperate Fruits -I

Unit-III: Production technology of Temperate Fruits -II
Sweet and sour cherry, black and raspberry, currants, apricot, kiwi and persimmon.

Unit-IV: Production technology of Sub Tropical Fruits – I
Hill banana, mandarin, grapefruit, pummelo and avocado.

Unit-V: Production technology of Sub Tropical Fruits – II
Pineapple, mangosteen, litchi, loquat, rambutan, carambola, durian, passion fruit and rose apple. Current Streams of thought

PRACTICAL
Description and identification of important varieties of sub tropical and temperate fruit and nuts – selection, pre-treatment and intercultural operations in hill banana – systems of training, pruning, propagation methods – physiological disorders and remedies in major fruit crops – study of varieties and propagation methods in mangosteen, loquat, carambola, pine apple – planting systems and growth regulation in pine apple – description of varieties, propagation and growth regulation in apple, pear, plum and peach – identification and description of temperate crops – study of maturity indices in major sub tropical and temperate fruit crops – visit to sub tropical and temperate zones to study sub tropical and temperate fruit crops.

THEORY LECTURE SCHEDULE
1. Temperate, subtropical and humid zones of India and Tamil Nadu.
2. Classification of temperate and subtropical fruits.
3. Area, production, scope and importance, role of temperate and sub tropical fruits on national economy.
7 & 8. Package of practices for Pear.
9 &10. Package of practices for Peach.
11. Production technology for Plum.
13. Production technology for Cherries.
15. Cultivation aspects of Apricot.
17. Mid Semester Examination
18. Cultivation aspects of Kiwi.
19 & 20. Package of practices for Hill Banana.
21 & 22. Production technology for Mandarin.
25. Production technology for Avocado.
26 & 27. Production technology for Pineapple.
28. Cultivation aspects of Mangosteen.
29. Cultivation aspects of Loquat.
30. Cultivation aspects of Litchi.
31. Cultivation aspects of Rambutan.
32. Cultivation aspects of Carambola.
33. Package of practices for Durian and Rose apple.
34. Package of practices for Passion fruit.

**PRACTICAL SCHEDULE**
1. Description of apple and pear varieties.
2. Study of propagation and growth regulation in apple and pear.
3. Description of plum and peach varieties.
4. Study of propagation and growth regulation in plum and peach.
5. Identification and description of strawberry and kiwi.
8. Description of varieties of mandarin, pummelo and grape fruit and propagation practices.
10. Identification and description of varieties of avocado, litchi and passion fruit.
11. Study of varieties and propagation in pineapple.
13. Description of varieties and propagation methods of mangosteen, loquat and carambola.
14. Study of maturity indices in major sub tropical and temperate fruit crops.
15. Visit to sub – tropical orchards and identification of sub – tropical fruit varieties.
16. Visit to temperate orchards and identification of temperate fruit crops.
17. Orientation for final practical examination.

**COURSE OUTCOMES:**

**CO1** - Students will be able to understand the cultivation aspects of temperate and sub tropical fruit crops and its nursery management practices.

**CO2** - Will gain skill on important cultivation techniques in temperate and subtropical fruits.

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HOR 322 PRODUCTION TECHNOLOGY OF TEMPERATE AND SUBTROPICAL VEGETABLES (2+1)

LEARNING OBJECTIVES:
- To acquire knowledge on production technology of temperate and sub tropical vegetables.
- To acquire knowledge on special techniques and post harvest handling.
- To explore cold storage and processing centers.

THEORY

Unit-I: Overview
Area, production, world scenario, economic and industrial importance, export potential - Scope and importance of vegetable growing - classification - seed production techniques and constraints in temperate and sub tropical vegetable crops.

Unit-II: Cruciferous vegetables
Composition and uses - origin and distribution - area and production - climate and soil requirements - season - tropical and temperate types - varieties and hybrids - seed rate - nursery practices - containerized transplant production and transplanting - preparation of field - spacing - planting systems and planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - use of chemicals and plant growth regulators - cropping system - constraints in production - harvest indices and maturity standards - yield-post-harvest handling - storage methods of the following vegetable crops:
- Cabbage, Cauliflower, Sprouting broccoli, Brussels sprouts, Chinese cabbage, Knol-khol and Chow-chow

Unit-III: Bulbous and root vegetables
- Garlic, Leek, Onion, Potato, Carrot, Beet root, Radish and Turnip.

Unit-IV: Leguminous vegetables
- Peas, French bean, Butter bean, Cluster bean, Dolichos bean and vegetable soya bean

Unit-V: Leafy and salad vegetables
- Lettuce, Palak, Celery, Asparagus, Globe artichoke, Rhubarb, Spinach, Basella and Portulaca, Current Streams of thought

PRACTICAL
Identification and description of temperate and subtropical vegetable crops - nursery practices for transplanted vegetable crops - preparation of field and...
sowing/planting for direct sown/transplanted vegetable crops – uses of herbicides in vegetable culture – top dressing of fertilizers and inter culture – use of plant growth regulators – identification of nutrient deficiencies – physiological disorders and their management – harvest indices, maturity standards and harvesting practices – project preparation for commercial cultivation of temperate and subtropical vegetable crops-visit to various vegetable research stations and commercial farms.

**THEORY LECTURE SCHEDULE**

1. Area, production, world scenario, economic and industrial importance and export potential.
2. Scope and importance.
3. Constraints in vegetable production.
4. Composition, origin, distribution, types, varieties, climate and soil, nursery management, seed treatment, use of chemicals and PGRs, mulching, weed management, nutrient requirement, nutrient deficiency, physiological disorders and corrective measures. Irrigation methods, inter culture, maturity standards, harvesting, Post-harvest handling and storage methods, grading and marketing of the following crops, Cabbage.

5. Cauliflower
6. Knol – khol
7. Sprouting broccoli
8. Brussels sprouts
9. Chinese cabbage
10. Chow-chow
11. Garlic
12. Leek
13. Onion
14. Potato
15. Carrot
16. Beet root
17. **Mid Semester Examination**
18. Radish
19. Turnip
20. Peas
21. French beans
22. Butter beans
23. Cluster beans
24. Dolichos bean
25. Vegetable soybean
26. Lettuce
27. Palak
28. Celery
29. Asparagus
30. Globe artichoke
31. Rhubarb
32. Spinach
33. Basella
34. Portulaca

**PRACTICAL SCHEDULE**

1. Identification and description of temperate vegetable crops
2. Identification and description of subtropical vegetable crops
3. Nursery practices for transplanted vegetable crops
4. Preparation of field and sowing/planting for direct sown/transplanted vegetable crops.
5. Application of herbicides in temperate and sub - tropical vegetable crops.
6. Top dressing of fertilizers, fertigation and inter - cultural operations
7. Use of chemicals and plant growth regulators in vegetable crops
8. Identification of nutrient deficiencies and corrective measures
9. Physiological disorders and their management
10. Harvest indices, maturity standards and harvesting practices
11. Post-harvest handling of temperate and sub tropical vegetables
12. Protected cultivation of temperate vegetables
13. Visit to commercial farms
14. Visit to cold storage/market/processing centers.
15. Project preparation for commercial cultivation of important temperate vegetable crops
16. Project preparation for commercial cultivation of important sub - tropical vegetable crops.
17. Orientation for final practical examination.

**COURSE OUTCOME:**

**CO1** - At the end of the course the students will gain knowledge on the scenario of vegetable cultivation, advanced production technologies and post harvest handling of temperate and subtropical vegetable crops.

**CO2** - Will gain skill on important cultivation techniques in temperate and subtropical vegetable crops.

**CO-PO MAPPING MATRIX**

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**REFERENCES**


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**HOR 323 ORNAMENTAL AND LANDSCAPE GARDENING (2+1)**

**LEARNING OBJECTIVES:**

- To enable better understanding of basic principles and practices of landscape gardening.
To highlight the different styles of gardens and special features in a garden.
To make them plan designs with garden themselves and principles manually and also by using various softwares.

THEORY

Unit-I: History of Gardening and Principles of Landscaping

Unit-II: Softscape Elements

Unit-III: Hardscape Elements

Unit-IV: Landscape Designing and Executions.

Unit-V: Conceptual Gardening and Horticultural Crafts

Current Streams of thought

PRACTICAL

THEORY LECTURE SCHEDULE
1. Garden components, basic functions and utility.
2. Trees and shrubs in landscaping.
3. Creepers, climbers in landscaping.
4. Herbs, annuals, hedges and edges in landscaping.
5. House plants and indoor gardening.
6. Study of ferns, cacti and succulents.
7. Topiary, trophy, flower beds and other living components in landscaping.
8. Propagation of ornamental plants.
9. Training, pruning, care and maintenance of ornamental plants.
10. Lawn - establishment and maintenance.
11. Psychological and social aspects of ornamental plants
12. Hardscape elements in landscape.
13. Basic function, utility, fabrication and maintenance of non-living components.
15. Light, lamp posts and other ornamental structures.
16. Living and non-living components for special situations.
17. Mid Semester Examination
18. Site analysis, cliental preference and principles of landscape drawing.
19. Elements of beauty
21. Computer Aided Designing in landscape
22. Landscape designing for Residence.
23. Landscape designing for educational institutes
24. Landscape designing for industry
25. Landscape designing for public park/theme park
26. Landscape designing for traffic island
27. Oxygenating plants and xeriscaping
29. Studies on modern day special types of garden.
31. Flower arrangements
32. Terrarium
33. Cut foliages-importance of cut foliages
34. Vegetable and fruit carving, plant jewels

PRACTICAL SCHEDULE
1. Identification of ornamental plants.
2. Identification of different components – their form, size, shape, texture flowering and other beauty components.
3. Evaluation of different garden sites in campus.
4. Description of trees, shrubs, herbs and annuals.
5. Description of climbers, creepers, flowers and foliage beds.
6. Art of topiary, trophy and carpet beds.
7. Identification of lawn grasses.
8. Methods of establishment of lawn grasses.
10. Description of non-living components.
11. Study on beauty components.
12. Principles and fundamentals of designing garden.
13. Practices on manual and computer aided landscape designing
15. Preparation of landscape plan for public parks
17. Orientation for final practical examination.

**COURSE OUTCOME:**

**CO1** - At the end of this course, the students will able to plan and design gardens with all the elements of garden and principles.

**CO2** - The student will gain skill in manual drawing and execution of garden.

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2. www.toptropicals.com
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**PAT 324 DISEASES OF HORTICULTURAL CROPS AND THEIR MANAGEMENT (3+1)**

**LEARNING OBJECTIVES:**

- To study the causes and classification of plant diseases.
- To study the symptoms, etiology, epidemiology and management of diseases Horticultural crops.
To learn to identify and manage post harvest diseases of Horticultural crops.

THEORY

Unit I: Diseases of fruit crops


Unit II: Diseases of Plantation crops, Medicinal and aromatic plants

Tea, coffee, cocoa, rubber, coconut, Areca nut, Vanilla, Aloe vera, Ashwagandha, Medicinal coleus, gymnema, dioscorea, gloriosa, stevia, lemon grass, citronella, palmarosa, vettiver, geranium, patchouli, mint, ocimum, lavender and sandal wood

Unit III: Diseases of Vegetable and Tuber crops

Brinjal, tomato, bhendi, cucurbits, crucifers, beans, lettuce, amaranthus, peas, Potato, sweet potato, beet root, radish, yam, colacasia and cassava

Unit VI: Diseases of Spices, condiments and Ornamentals

Onion, garlic, chillies, nutmeg, cardamom, pepper, betel vine, turmeric, ginger, fenugreek, coriander, clove, cinnamon. Jasmine, rose, crossandra, chrysanthemum, tuberose, marigold, orchid and gladiolus.

Unit V: Post-harvest diseases.

Post-harvest diseases of fruit, vegetable crops, tubers, spices, condiments and ornamental crops. Current Streams of thought.

PRACTICALS

Definition for plant diseases, Causes of plant diseases, Classification of plant diseases, Etiology and symptoms of plant diseases, Study of symptoms and host parasite relationship of the following crops: Fruit crops, Plantation crops, Medicinal plants, Aromatic plants, Vegetable crops, Tuber crops, Spices crops, Condiments, Ornamentals, Post-harvest diseases of Horticultural crops- Field visit

Assignment: Students should submit 50 well-preserved diseased specimens.

THEORY LECTURE SCHEDULE

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

1. Definition and Causes of plant diseases
2. Classification of plant diseases, Etiology and symptoms of plant diseases
3. Mango
4. Banana - Fungal diseases
5. Banana - Bacterial and Viral diseases
6. Citrus
7. Grapes
8. Guava
9. Pomegranate and jack
10. Annona and sapota
11. Papaya and pineapple
12. Ber, fig and litchi
13. Apple
14. Peach and Plum
15. Tea
16. Coffee and Vanilla
17. Cocoa
18. Rubber
19. Coconut and Areca nut
20. Aloe vera, Ashwagandha, Medicinal coleus
21. Gymnema, dioscorea, Gloriosa and stevia
22. Lemon grass, palmarosa, vettiver and citronella,
23. Geranium, patchouli and mint
24. Ocimum, lavender and sandal wood
25. **Mid semester Examination**
26. Brinjal and Bhendi
27. Tomato
28. Bhendi
29. Cucurbits
30. Crucifers
31. Beans, lettuce, amaranthus and peas
32. Potato and sweet potato
33. Beet root and radish
34. Cassava, Yam and colocasia
35. Field visit
36. Onion and Garlic
37. Pepper
38. Turmeric and Cardamom
39. Ginger and fenugreek
40. Coriander and Clove
41. Nutmeg and Cinnamon
42. Jasmine, Crossandra and Chrysanthemum
43. Rose
44. Tuberose and marigold
45. Orchid and gladiolus
46. Post-harvest diseases of fruits
47. Post- harvest diseases of vegetables
48. Post- harvest diseases of spices and condiments
49. Post harvest diseases of tubers and ornamentals
50. Post -harvest diseases of ornamentals
51. Post-harvest disease management Practices

**PRACTICAL SCHEDULE**

1. Identification of diseases specimen
2. Classification of plant diseases
3. Diseases of fruit crops
4. Diseases of fruit crops
5. Diseases of plantation crops
6. Diseases of plantation crops
7. Diseases of medicinal and aromatic plants
8. Diseases of vegetable crops
9. Diseases of vegetable crops
10. Diseases of tuber crops
11. Diseases of spices
12. Diseases of spices
13. Diseases of condiments
14. Diseases of ornamental crops
15. Diseases of ornamental crops
16. Identification of Post Harvest diseases
17. Market visit
18. Final Practical Examinations

**Assignment:** Students should submit 50 well preserved diseased specimens.
COURSE OUTCOME

- Having knowledge about biotic, abiotic and mesobiotic agents causing diseases and their classification.
- Knowledge about Integrated Crop Management / Integrated Disease Management of Horticultural crops.
- Knowledge about epiphytological conditions required for plant disease development on various diseases at the end of course
- Trained in identifying and managing post harvest diseases of crops.

CO – PO MAPPING MATRIX

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4. www.vivo.library.cornell.edu

HOR 325 PROTECTED CULTIVATION AND PRECISION HORTICULTURE (2+1)

LEARNING OBJECTIVES:

- To provide knowledge on protected cultivation of horticultural crops.
- To provide better understanding on basis of protected cultivation.
- To teach them techniques in precision farming for horticultural crops.

THEORY

Unit-I: Importance and basics of protected cultivation


Unit-II: Environmental control

Unit-III: Water and nutrient management

Unit-IV: Concept and introduction of precision horticulture
Importance of precision horticulture - definition, principles and concepts – role of geographic information systems (GIS) – global positioning systems (GPS) – mobile mapping system and its application in precision farming -- role of computers in developing comprehensive systems needed in site specific management (SSM) – georeferencing and photometric correction

Unit-V: Precision farming techniques for horticultural crops
Precision farming techniques for grapes, banana, tomato, capsicum, cucumber, cut roses, cut chrysanthemum, carnation and gerbera.

Current Stream of thought

PRACTICAL

THEORY LECTURE SCHEDULE
1. Prospects and constraints of protected cultivation in India
2. Types of protected structures - green house, poly house, net house, poly tunnels, protected nursery house etc.
3. Study of environmental factors influencing protected cultivation
4. Classification of greenhouses - based on shape, utility, construction materials, covering materials etc.,
5. Designing and erection of protected structures – cladding/glazing/covering materials
7. Environment control – heating and cooling systems
8. Environment control – light regulation and CO2 enrichment
9. Containers and growing media – soil/media decontamination.
11. Hydroponics – nutrient film techniques, aeroponic culture
12. Protected cultivation techniques for tomato
13. Protected cultivation techniques for capsicum
15. Protected cultivation techniques for roses and gerbera
16. Protected cultivation techniques for chrysanthemum and carnation.
17. Mid Semester Examination
18. Protected cultivation techniques for anthurium and orchids.
20. Precision horticulture - definition, principles and concepts.
21. Geographic information system (GIS) and its application in precision farming.
22. Global positioning system (GPS) and its application in precision farming.
24. Precision equipments for seeding and chemical application
25. Role of computers in developing comprehensive system needed in site specific management (SSM) system and postharvest process management (PPM)
27. Georeferencing and photometric correction
28. Sensors for information gathering, geostatistics and robotics in horticulture
29. Design, layout and installation of drip and fertigation in precision farming
30. Information and data management, crop growth models and GIS based modeling.
31. Precision farming techniques for grapes and banana.
32. Precision farming techniques for tomato and Capsicum
33. Precision farming techniques for rose and Carnation
34. Precision farming techniques Gerbera and chrysanthemum.

PRACTICAL SCHEDULE
1. Study of different protected structures – designs, components, orientation and construction of greenhouse.
2. Types and structures of auto control system in green house.
3. Study of heating and cooling systems in green house.
4. Study of different growing media.
5. Solarization and fumigation in green house.
6. Study of special cultural practices for production of vegetable crops under protected cultivation.
7. Study of special cultural practices for flower crops under protected cultivation.
8. Visit to protected culture units.
9. Project preparation for protected cultivation of important horticultural crops.
11. Study of soil salinity, soil compaction, soil test crop response (STCR) and gird soil sampling.
12. Practicing design and layout of precision farming system
13. Canopy management in precision farming
14. Water use efficiency in annuals, perennials and landscape horticulture
15. Visit to commercial computerized irrigation control unit.
16. Project preparation for precision cultivation in important horticultural crops
17. Orientation for final practical examination.

COURSE OUTCOME:
CO1 - Students will be able to understand the protected cultivation of horticultural crops, its advances and precision horticulture.
CO2 - The student will gain skill in managing precision horticulture units.

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REFERENCES
LEARNING OBJECTIVES:

- To provide knowledge on the principles of post-harvest technology.
- To highlight the importance of post-harvest technology.
- To import knowledge on post harvest packaging and export preservative storage and value addition techniques.

THEORY

Unit-I: Principles of Post-Harvest Technology
Importance and scope of post-harvest technology and causes of post-harvest losses – Maturity indices and time of harvesting – pre and post-harvest physiological changes in Horticultural produce – pre harvest factors influencing post-harvest life – pre harveststand post-harvest treatments to enhance shelflife

Unit-II: Post-Harvest Treatments and Storage

Unit-III: Packaging and Export of Horticultural Produce
Unit-IV: Methods of Preservation

Status and scope of fruit and vegetable processing industries in India – Principles of preservation – Preservation with sugar, salt– chemicals or bio – preservatives-drying and dehydration-types of driers-canning-preparation of canned products and fermented beverages.

Unit–V: Recent Technologies in Fruit and Vegetable Processing

Minimal processing of fruits and vegetables-techniques involved-Recent trends in processing-processing by irradiation- principles, methods,suitability-application of irradiation in food processing-waste and by- product utilization from processing industry.Current Streams of thought

PRACTICALS

Practice in judging the maturity of various horticultural crops – studies on harvesting or delaying ripening of treated produce- types of packaging materials and packaging methods – equipments in food processing unit- preparation of squash, jam, RTS, syrup, candy, ketchup, sauce, pickles, chutney (hot and sweet), dehydrated products, brining – comparative study of ambient and refrigerated storage – visit to food processing units.

THEORY LECTURE SCHEDULE

1. Importance and scope of post-harvest technology of fruits and vegetables.
2. Post-harvest technology of spices, plantation crops and cutflowers
3. Causes for post-harvest loses and maturity indices for fruits and vegetables.
4. Pre and post-harvest physiological changes during development, maturity and ripening of fruits.
5. Pre harvest factors influencing post-harvest life.
6. Methods to hasten or delay ripening of fruits.
7. Post-harvest treatments like pre-cooling, washing, grading, vapourheat treatment and fumigation.
8. Waxing of fruits and vegetables
9. Role of ethylene in post-harvest technology.
10. Storage methods-Low temperature storage, refrigerated storage
11. Controlled Atmospheric Storage, Modified Atmospheric Storage and hypobaric storage
12. Low cost storage technology
13. Methods of storage for local and distant market.
14. Handling of cut flowers and methods to extend the shelf life.
15. Packaging technology for export by road, air and sea for fruits
16. Packagingtechnology for export by road, air and sea for vegetables.
17. Mid Semester Examination
18. Packaging technology for export by road, air and sea for cut flowers.
19. Packaging technology for export by road, air and sea for spices and plantation crops.
20. Controlled and modified atmospheric packaging, vaccum and edible packaging.
21. WTO guidelines for export of horticultural produce.
22. CODEX standards and export standards for fruits, vegetables and cutflowers.
23. Food safety standards.
24. & 25. Importance and scope of vegetable preservation industry in India – principles of preservation.
26. Preservation with sugar.
27. Preservation with salts, chemicals and bio preservatives.
30. Principles of preservation by fermentation.
31. Processing of dehydrated spice products.
32. Minimal processing of fruits and vegetables.
33. Irradiation in food processing.
34. Utilization of wastes from fruit and vegetable processing industries.

**THEORY LECTURE SCHEDULE**

1. Practice in judging the maturity of horticultural produce.
2. Pre harvest treatments to enhance the post-harvest life
3. Assessment of physical, physiological and biochemical changes during ripening
4. Determination of physiological loss in weight and quality
5. Preharvest treatments to enhance the post-harvest lifestorage studies
6. Packaging studies for fruits and vegetables
7. Packaging studies for cut flowers and dry flowers.
8. Waxing
9. Identification and study of working of equipments used in processing units.
10. Preparation of squash, RTS and syrup.
11. Preparation of Jam.
13. Preparation of sauce and ketch-up.
15. Preparation of dehydrated products.
16. Visit to food processing units.
17. Orientation for final practical examination

**COURSE OUTCOME:**

**CO1** - Students will able to understand the post harvest technology aspects, handling methods, storage methods, packaging and preservation.

**CO2** - Will gain skill in doing post harvest operations pertaining to Horticultural products.

**CO3** - Will gain skills to operate post harvest practices in industries.

**CO-PO MAPPING MATRIX**

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3. www.fao.org

AEC 327 - AGRICULTURAL FINANCE, BANKING AND CO-OPERATION (1+1)
LEARNING OBJECTIVE:
- To impart knowledge on principles of finance, banking and cooperation, and farm financial analyses
- To understand the functions of various institutions involved in farm financing
- To understand different crop insurance products implemented in India

THEORY
Unit 1: Agricultural Finance - Nature and Scope
Agricultural Finance: Definition - Importance - Nature and scope. Agricultural credit: Meaning - Definition - Need and classification - Sources of credit. Role of institutional and non-institutional agencies: Types - Roles - Advantages and disadvantages. Rural indebtedness: Consequences and control measures of rural indebtedness - History and development of rural credit in India.

Unit 2: Farm Financial Analysis
Principles of credit - 5C's, 3R's and 7 P's of credit, Project cycle and management. Preparation of bankable projects / Farm credit proposals - Feasibility - Time value of money: Compounding and discounting - Appraisal of farm credit proposals - Undiscounted and discounted measures - Repayment plans. Farm financial statements: Balance sheet - Income statement - Cash flow statement - Financial ratio analysis.

Unit 3: Financial Institutions
Institutional lending agencies - Commercial banks: Nationalization - Agricultural development branches - Area approach - Priority sector lending - Regional Rural Banks. Lead bank: Role and functions - Preparation of District annual credit plan and scale of finance - Kisan Credit Card (KCC) Scheme and Know Your Customer (KYC). Rural credit policies followed by State and Central Government - Subsidized farm credit, Differential Interest Rate (DIR) Scheme - Relief measures and Loan Waiver Scheme. Higher financial institutions: RBI, NABARD, AFC, ADB, World Bank and Deposit Insurance and Credit Guarantee Corporation of India - Role and their functions in rural credit. Microfinance:
Definition and its role in poverty alleviation - Self-Help Groups: Characteristics, role, functions, growth and development in India - Role of Non-Governmental Organizations in promoting SHGs.

**Unit 4: Banking and Insurance**


**Unit 5: Cooperation**

Cooperation: Philosophy and Principles - History of Indian co-operative credit movement: Pre and Post - Independence periods and co-operation in different plan periods. Co-operative credit institutions: Two tier and three tier structure - Functions: provision of short term and long term credit - Strength and weakness of cooperative credit system - Policies for revitalizing cooperative credit: Salient features of Vaithiyathan Committee - Report on revival of rural co-operative credit institutions - Reorganization of co-operative credit structure in India and single window system. Special Co-operatives: LAMPS, FSS, National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd. (NAFSCOB): Objectives, role and functions. **Current streams of thought.**

**PRACTICAL**

Visit to a farm to study the credit needs, problems and suggestions in the use of farm credit - Preparation of Bankable Projects / Farm Credit Proposals - Project preparation and appraisal - Undiscounted methods - Discounted methods - Preparation of Balance Sheet and Income Statement - Preparation of Cash flow Statement and Exercise on preparation of Repayment plans - Exercise on Financial Ratio Analysis - Appraisal of farm credit proposals - Visit to Commercial Bank / Lead Bank to study its role and functions - Visit to NABARD to study its role and functions - Visit to Regional Rural Bank to study its role and functions - Visit to Primary Agricultural Cooperative Bank (PACB) to study its role, functions and procedures for availing loan - Visit to District Central Co-operative Bank (DCCB) to study its role, functions and procedures for availing loan - Fixation of Scale of Finance - Visit to Cooperative Agricultural and Rural Development Bank (Land Development Bank) to study procedures for availing long term credit - Visit to Self-Help Group to study its characteristics, roles and functions - Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.

**THEORY LECTURE SCHEDULE**

1. Agricultural Finance: Definition - Importance - Nature and scope. Agricultural credit:
   Meaning – Definition - Need and classification.
2. Sources of credit. Role of institutional and non-institutional agencies: Types - Roles - Advantages and disadvantages. Rural indebtedness: Consequences and control measures of rural indebtedness - History and development of rural credit in India.
3. Principles of credit - 5C's, 3R's and 7 P's of credit, Project cycle and management. Preparation of bankable projects / Farm credit proposals – Feasibility.
4. Time value of money: Compounding and discounting - Appraisal of farm credit proposals - Undiscounted and discounted measures.


7. Lead bank: Role and functions - Preparation of district annual credit plan and scale of finance - Kisan Credit Card (KCC) Scheme and Know Your Customer (KYC). Rural credit policies followed by State and Central Government - Subsidized farm credit, Differential Interest Rate (DIR) Scheme - Relief measures and Loan Waiver Scheme.

8. Higher financial institutions: RBI, NABARD, AFC, ADB, World Bank and Deposit Insurance and Credit Guarantee Corporation of India - Role and their functions in rural credit. 

9. **Mid Semester Examination**

10. Microfinance: Definition and its role in poverty alleviation - Self-Help Groups: Characteristics, role, functions, growth and development in India - Role of Non-Governmental Organizations in promoting SHGs.

11. Negotiable Instruments: Meaning - Importance and Types - Central bank: RBI - functions - Credit control - Objectives - CRR, SLR and Repo rate - Credit rationing - Dear money and cheap money.


15. Cooperative credit institutions: Two tier and three tier structure - Functions: provision of short term and long term credit - Strength and weakness of cooperative credit system.

16. Policies for revitalizing co-operative credit: Salient features of Vaithiyathan Committee - Report on revival of rural cooperative credit institutions - Reorganization of cooperative credit structure in India and single window system.

17. Special Co-operatives: LAMPS, FSS, National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd. (NAFSCOB): Objectives, role and functions.

**PRACTICAL SCHEDULE**

1. Visit to a farm to study the credit needs, problems and suggestions in the use of farm credit.

2. Preparation of Bankable Projects / Farm Credit Proposals.

3. Project preparation and appraisal - Undiscounted methods.

4. Project preparation and appraisal - Discounted methods.

5. Preparation of Balance Sheet and Income Statement.


7. Exercise on financial ratio analysis.

8. Appraisal of farm credit proposals.

9. Visit to Commercial Bank / Lead Bank to study its role and functions.

10. Visit to NABARD to study its role and functions.
11. Visit to Regional Rural Bank to study its role and functions.
12. Visit to Primary Agricultural Co-operative Bank (PACB) to study its role, functions and procedures for availing loan.
13. Visit to District Central Cooperative Bank (DCCB) to study its role, functions and procedures for availing loan - Fixation of Scale of Finance.
14. Visit to Cooperative Agricultural and Rural Development Bank (Land Development Bank) to study procedures for availing long term credit.
15. Visit to Self-Help Group to study its characteristics, roles and functions.
16. Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.

17. Orientation for final examination

COURSE OUTCOMES:

At the end of the course students will be able to

CO 1: To understand the functions of various institutions involved in farm financing.
CO 2: To know the principles of credit, 5c’s, 3R’s and time value of money.
CO 3: To gain on knowledge on microfinance, role of SHG’s, NGO.
CO 4: To understand risk mitigating measures like agricultural insurance schemes available for the benefits of famers.

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AEX 328-EXTENSION METHODOLOGIES AND TRANSFER OF AGRICULTURAL TECHNOLOGY (1+1)

LEARNING OBJECTIVES

- Extension methods and approaches used for transfer of agricultural technology.
- Various models of communication and communication barriers.
- e-Extension and Agricultural journalism
- Skills on preparation of different extension teaching methods.

THEORY

Unit I Extension Education and Transfer of Technology

Unit II Communication
Communication – Meaning, definition and types, Communication models (Aristotle, Shanon-Weaver, Berlo, Schramm, Leagans, Rogers and Shoemaker) – elements and their characteristics - Barriers in communication

Unit III Extension Teaching Methods
Extension teaching methods – meaning, definition, functions, classification (Individual, Group, Mass contact methods), Merits and Demerits; Audio aids, Visual aids and Audio-Visual aids – definition, classification – Factors influencing selection and use of audio visual aids Participatory Extension Approaches – RRA, PRA and PTD.

Unit IV e-Extension and Agricultural journalism
e-Extension - Internet, video and teleconferencing, Interactive Multimedia Compact Disc (IMCD), Agri portals, Information Kiosks, Kisan Call Centre (KCC), Mobile phone, Expert System Village Knowledge Centre (VKC) and DEMIC. Agricultural journalism (Print media) – Definition, principles, importance, ABC of news, types of news.

Unit V Diffusion of Innovations
Diffusion of Innovations – definition, elements; Innovation – definition, attributes; Adoption – meaning, steps in adoption process, innovation decision process, adopter categories, factors influencing adoption of innovations; Consequences of innovations.

Current Streams of thought.

PRACTICAL
Study of communication methods followed by State Department of Agriculture; Planning and writing script for radio, television and print media; Planning and preparation of visual aids – posters, charts and graphs, flash cards, flannel graph and extension literature; Planning and practice in conduct of method demonstration and brainstorming. Practicing PRA techniques in a village setting; Practice in handling of digital camera. Study of spread and acceptance of Agricultural technologies.

THEORY LECTURE SCHEDULE
1. Extension Education - Meaning, definition and importance, Agricultural Extension – Meaning, definition. Linkage between Research, Extension and Clientele systems
2. TOT- Meaning and definition, components of TOT, models and approaches of TOT – Importance of TOT in Agricultural Extension
3. Communication – meaning, definition, types and modules communication (Aristotle Shanon and Weaver, Berlo, Schramm, Leagans, Rogers and Shoemake)
4. Elements of communication and their characteristics - Barriers of communication.
6. Group contact methods – Method demonstration, group meeting, small group training, field day or Farmers’ day, study tour, lecture, debate, workshop, seminar, forum, conference, symposium, panel discussion brainstorming, buzz session.
9. Mid semester Examination.
10. e-Extension-Internet, video and teleconferencing, Interactive Multimedia Compact disc (IMCD)
11. Agri portals, Information kiosks, Kisan Call Centre (KCC)
12. Mobile phone, Expert System, Village Knowledge Centre (VKC), DEMIC
13. Agricultural journalism (Print media) – Definition, principles, importance, ABC of news, types of news.
15. Participatory Technology Development – Meaning and steps
17. Adopter categories - Factors influencing adoption of innovations - Consequences of innovations.

PRACTICAL SCHEDULE
1. Understanding the communication methods followed by the State Department of Agriculture for TOT.
2. Planning and preparation of posters and charts.
3. Planning and preparation of flash cards and flannel graph.
4. Planning and preparation of extension literature- leaflet, folder and pamphlet
5. Practice on conduct of method demonstration in a village.
6. Exercise on conducting brain storming.
7. Practice on script writing for Radio.
8. Practice on script writing for television.
9. Practice on script writing for newspapers.
10. Visit to local press (newspaper agency) to study their media activities
11. Practice on handling of digital camera.
13. Practicing PRA techniques in a village setting.
14. Preparation of interview schedule to study the spread and acceptance of Agricultural technologies
15. Visit to village to study the spread and acceptance of Agricultural technologies
16. Processing of data, preparation and presentation of reports.
17. Orientation for final examination

COURSE OUTCOMES:
At the end of the course students will be able to
CO 1: Understand extension methods and approaches used for transfer of agricultural technology.
CO 2: Understand various models of communication and communication barriers.
CO 3: Gain expertise on e-Extension and Agricultural journalism
CO 4: Prepare and use of different extension teaching methods.

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REFERENCES
HOR 329 PRODUCTION TECHNOLOGY OF MEDICINAL AND AROMATIC CROPS (2+1)

LEARNING OBJECTIVES

- To provide knowledge on the scope, importance and cultivation aspects of medicinal and aromatic crops.
- To highlight the advancement and developments of the production of medicinal and aromatic crops.
- To provide knowledge on technology involved in processing of medicinal and aromatic crops.

THEORY


Unit I Production technology of medicinal plants -I
Senna- coleus- ashwagandha- glory lily- sarpagandha

Unit II Production technology of medicinal plants -II
Dioscorea sp. aloe -phyllanthus- kalmegh- medicinal solanum- gymnema

Unit III Production technology of medicinal crops- III
Isabgol- ipecac- periwinkle- poppy- safed musli- stevia

Unit IV Production technology of aromatic crops -I
Palmarosa- lemon grass- citronella- vettiver- geranium- mentha- artemisia

Unit V Production technology of aromatic crops -II
Ocimum- eucalyptus- rosemary- thyme- patchouli- lavender- marjoram- origanum,

Current Stream of thought
PRACTICAL

THEORY LECTURE SCHEDULE
1. Herbal industry, WTO scenario, export and import status.
2. Indian systems of medicine, indigenous traditional knowledge of medicinal plants.
3. Classification of medicinal plants and systems of cultivation.
   Climate and soil requirements, varieties-site selection, season and method of propagation, pre sowing treatment, irrigation and nutrient management, intercultural operations, plant protection measures, maturity indices-harvesting and post harvest management of the following crops:
   4. Senna
   5. Coleus
   6. Ashwagandha
   7. Glory lily
   8. Sarpagandha
   9. Dioscorea and aloe
   10. Phyllanthus and kalmegh
   11. Gymnema
   12. Medicinal solanum and ipecac
   13. Isabgol and safedmusli
   14. Poppy
   15. Periwinkle and stevia
   16. Phytochemical extraction techniques
   17. Mid-semester examination
18. Aromatic industry-WTO scenario- export and import status
19. Indian perfumery industry- history-advancements in perfume industry
20. Palmarosa and lemongrass
21. Citronella and vettiver
22. Geranium and artemisia
23. Mint
24. Ocimum
25. Patchouli
26. Rosemary and thyme
27. Origanum and marjoram
28. Lavender and eucalyptus
29. Organic production of medicinal and aromatic crops
30. IPR issues for medicinal and aromatic crops
31. Role of institutions and NGO’s in production and regulations for herbal raw materials
32. Distillation methods, advanced methods-solvent extraction process, steam distillation
33. Perfumes from non-traditional plants.
34. Quality analysis, value addition, aroma chemicals, quality standards and regulation.

**PRACTICAL SCHEDULE**

Botanical description of species - improved cultivars - propagation techniques - maturity standards - harvest and post harvest handling of the following crops:

1. Senna and coleus
2. Aloe vera and ashwagandha
3. Gymnema, sarpagandha and poppy
4. Phyllanthus, kalmegh and ipecac
5. Medicinal solanum, safedmusli and dioscorea
6. Periwinkle, isabgol and stevia
7. Aromatic grasses
8. Geranium and mint
9. Ocimum and patchouli
10. Vettiver and eucalyptus
11. Rosemary, thyme, oreganum and marjoram
12. Extraction of secondary metabolites in medicinal crops
13. Extraction of essential oils from aromatic crops
14. Project preparation for commercially important medicinal and aromatic crops
15. Field visit to commercial medicinal plantations
16. Field visit to commercial aromatic plantations
17. Visit to herbal extraction units, distillation and value addition units

**COURSE OUTCOMES:**

**CO1** - Students will be able to understand the cultivation aspects, advances and developments in production and processing of medicinal and aromatic crops.

**CO2** - Will become eligible to manage medicinal plant cultivation units.

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Guidance to students

For each batch of students, there will be a designated RAWE teacher from the Department of Agricultural Extension, who will continuously guide, supervise and monitor the work of students during their placements in rural areas. The designated Teachers from the courses related to the subject matter areas will also visit and guide the students on technological aspects and to solve the problems, which are beyond the competence of students as well as to evaluate the performance of the students on the concerned subject. They will also support the students during the extension educational activities.

It will consist of general orientation by different faculties for one week followed by village attachment. The students would be required to record their observations in field on daily basis and will prepare their project report based on these observations. The detailed outline of the work to be carried in each subject during Village stay period is as follows:

RHWE AEX 410 (Village Attachment and Technology Transfer (0 + 5) (Team Teaching Agricultural Extension and Horticulture)

- Study of rural situation – village settlement pattern, demography, climate, land utilization pattern, resources inventory, infrastructural facilities, rural institutions, organizations, groups, customs, beliefs and value systems.
- Study of cropping pattern, extent of adoption of latest technologies and identify the constraints in Horticultural crops.
- Conducting need based method demonstrations in the village.
- Organization of field visits and group discussion with farmers.
- Organization of farmers/ rural youth training programme.
- Participation in village social service work.
- Identification of communication media in the transfer of technologies.
- Study on-going central/state sponsored rural development and extension programmes related to Horticultural Crops.
- Visit to village institutions to study their role in development programmes and extension work.
- Exposure visit to block and district level Horticultural research and extension institutions.

COURSE OUTCOMES:

At the end of the course students will be able to

CO 1: Understand rural situation, institutions and organizations.
CO 2: Understand customs and value systems of the villagers.
CO 3: Familiarize with cropping pattern and extent of adoption horticultural practices
CO 4: Undertake field visits and demonstrations related to Horticulture crop production.
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### RHWE AGR 411 Agronomical Interventions (0 + 2)
- The student will involve themselves in actual day-to-day Agricultural operations along with their adopted farmers.
- A calendar of operations for the entire semester will be prepared in consultation with the host farmer, course teacher and Programme Officer.
- The course teacher will provide the recommendations for major crops grown in the village and in turn the students will compare these with farmer’s practice and get opinion about improved technology.
- The students will maintain a record of daily work done in the prescribed proforma.
- Each student shall cover a minimum of three corps, preferably from among cereals, oilseeds and pulse crops.
- If such crop diversification is not available, the student shall collect information on any three crops either with the host farmer or other farmer in or near by village.
- Observations on crop growth and yield attributes shall be recorded as per the proforma.

### COURSE OUTCOMES:
- **CO 1:** To gain knowledge on the crop growth and yield of the crops grown by the contact farmer.
- **CO 2:** To formulate different cropping systems according to the various agro eco system.
- **CO 3:** To understand information pertaining to the different crops and their cultivation methods.
- **CO 4:** To formulate recommendation practices for the major crops grown in their village.
- **CO 5:** To analyse the various indigenous technologies practiced by farmers

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### RHWE HOR-412 Horticultural Interventions (0 + 3)
- The student will involve themselves in actual day-to-day horticultural operations along with their adopted farmers.
- A calendar of operations for the entire semester will be prepared in consultation with the host farmer and the course teacher.
- The course teacher will provide the recommendations for major horticultural crops grown in the village and in turn the students will compare these with the farmer’s practice and get opinion about improved horticultural technologies.
• The students will maintain a record of daily work done in the prescribed proforma.
• Each student shall learn from the farmers cultivating Horticultural crops and study the technologies adopted by farmers.

**COURSE OUTCOMES:**
CO1: Student will learn basic field knowledge and practical problems in production of horticultural crops
CO2: Can learn to prepare calender of operations for all horticultural crops
CO3: Can become eligible to manage horticultural farms.

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**RHWE CPT-413 Crop Protection Interventions (Entomology and Plant Pathology (0 + 4))**
• The students will get an opportunity to work with the farmers in the field and acquainted with various plant protection problems of the standing crops.
• They have to collect data on pest damage every week.
• They shall maintain record of plant protection work undertaken in the prescribed Proforma given to them by the Department of Entomology and Plant Pathology for this purpose.
• The student will also conduct a survey on adoption of recommended plant protection measures and the incidence/occurrence of different diseases and insect pests on different crops in the village.
• Students shall submit 15 herbarium specimens each of insect damage and plant disease symptoms for any of the crops grown in the village.
• Information on other plant disorders, nematode problems, bird and rodent damage if any, shall also be mentioned in the plant protection record separately.
• The students will also demonstrate preparation of fungicidal / insecticide spray fluids for important plant protection measures.

**COURSE OUTCOMES:**
CO 1: Illustrate identification of pest problems in farmers’ fields
CO 2: Analyse various pest management practices practiced by farmers
CO 3: Demonstrate practical applications of pest management techniques learnt
CO 4: Manage real field situations in pest management scenarios

**CO-PO MAPPING MATRIX**

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**LEARNING OBJECTIVES**

The course will provide an opportunity to the students to study the functioning of important National Institutes related to Horticulture and allied fields.

**SYLLABUS**

Visit to important National institutes related to agriculture, horticulture, forestry and allied fields in various regions of the country. Exposure to various agro-climatic zones, crops grown, cultivation practices, socio-economic and cultural features of the farming community in different parts of the country.

**COURSE OUTCOMES:**

**CO 1:** Understand the functioning of important National institutes related to Horticulture

**CO 2:** Understand the functioning of important National institutes related to Horticulture allied fields

**CO 3:** Get exposure on various agro-climatic zones and their features

**STUDENT READY COMPONENT –II-HIA 415 HORTICULTURAL INDUSTRIAL ATTACHMENTS (0+6)**

**LEARNING OBJECTIVES**

1. To make the students understand the commercial scale industrial operations of the horticultural industries and constraints faced by the industry.
2. To understand agricultural technologies being practiced in commercial scale and to impart skills needed for running an industry.

The students will be attached to any one of the horticultural industries like Coffee Processing, Tea Processing, Cashew Processing, Fruit and vegetable processing industries, Floriculture units, landscape companies, nursery units, etc. for a period of eight weeks inclusive of orientation and report preparation. The activities are only indicative. The course teacher in consultation with the HOD and the Dean shall make necessary changes based on the prevailing situations. Weekly activities are given below:

1. Orientation
2. Acquaintance with industry and staff
3. Study of structure, function, objectives, issues / procedures in starting a unit
4. Study of various processing units and hands on training under supervision of industry staff
5. Skill development in all crucial tasks of the industry
6. Export – Import guidelines- financial support and regulations
7. Documentation of the activities, and tasks performed
8. Preparation of a business proposal

**COURSE OUTCOMES:**

At the end of the course students will be able to

**CO 1:** Have practical knowledge on different Horti-based industries situated in and around the neighboring districts

**CO 2:** Start own business and become an entrepreneur
STUDENT READY COMPONENT 3 - EXPERIENTIAL LEARNING/SKILL DEVELOPMENT (0+20)

For experiential learning the student can choose any two courses from the professional packages indicated below. The Head of the Department in consultation with the Dean shall restrict the number of professional packages according to the practical feasibility and climatic conditions.

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<td>EXP HOR 421</td>
<td>Commercial Horticultural Nursery</td>
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<td>EXP HOR 422</td>
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<td>EXP HOR 424</td>
<td>Organic vegetable production</td>
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EXP HOR 421 COMMERCIAL HORTICULTURAL NURSERY (0+10)

LEARNING OBJECTIVES:
1. To promote entrepreneurial skills and knowledge through meaningful hands-on - experience through a business model enterprise.
2. To provide skills in various propagation methods and care of nursery plants.
3. To provide an excellent opportunity to observe, think, analyse, synthesize, evaluate and apply the acquired knowledge with respect to commercial nursery business.

ACTIVITIES
Students shall prepare a plan to start a commercial nursery and analyse its technical and financial viability. Undertake end to end approach to achieve the objectives of the approved project. Hands-on-training will be given right from project development, execution, procurement of raw materials, production, care, marketing, decision-making, individual and team coordination, approach to problem solving, accounting, marketing and resolving conflicts, etc

COURSE OUTCOMES

**CO1**-Students can become eligible to undertake end to end technical and management aspects of a commercial nursery

**CO2**- Can practice skills in various propagation methods and care of nursery plants.

**CO3**- Will gain ability to manage a commercial horticultural nursery business

CO-PO MAPPING MATRIX

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E-Resources

EXP HOR 422 PROTECTED CULTIVATION OF VEGETABLE CROPS (0+10)

LEARNING OBJECTIVES:
1. To promote entrepreneurial skills and knowledge through meaningful hands-on experience through a business model enterprise.
2. To provide skills in greenhouse maintenance and production techniques in hi-tech vegetable production unit.
3. To provide an excellent opportunity to observe, think, analyse, synthesise, evaluate and apply the acquired knowledge with respect to protected cultivation unit for vegetable crops.

ACTIVITIES
Students shall prepare a plan to start a protected cultivation unit for vegetable crops and analyse its technical and financial viability. Undertake end to end approach to achieve the objectives of the approved project. Hands-on-training will be given right from project development, execution, procurement of raw materials, production, care, marketing, decision-making, individual and team coordination, approach to problem solving, accounting, marketing and resolving conflicts, etc.

COURSE OUTCOMES
CO1-Students can become eligible to undertake end to end technical and management aspects of a protected cultivation unit for vegetable crops
CO2- Can practice skills related to greenhouse maintenance and production techniques in hi-tech vegetable production unit.
CO3- Will gain ability to manage a protected cultivation unit for vegetable production.

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E-RESOURCES
EXP HOR 423 PROTECTED CULTIVATION OF CUT FLOWER CROPS (0+10)

LEARNING OBJECTIVES:
1. To promote entrepreneurial skills and knowledge through meaningful hands-on-experience through a business model enterprise.
2. To provide skills in greenhouse maintenance and production techniques in hi-tech cut flower production unit.
3. To provide an excellent opportunity to observe, think, analyse, synthesise, evaluate and apply the acquired knowledge with respect to protected cultivation unit for cut flowers.

ACTIVITIES
Students shall prepare a plan to start a protected cultivation unit for cut flowers and analyse its technical and financial viability. Undertake end to end approach to achieve the objectives of the approved project. Hands-on-training will be given right from project development, execution, procurement of raw materials, production, care, marketing, decision-making, individual and team coordination, approach to problem solving, accounting, marketing and resolving conflicts, etc

COURSE OUTCOMES
CO1- Students can become eligible to undertake end to end technical and management aspects of a protected cultivation unit for cut flowers
CO2- Can practice skills related to greenhouse maintenance and production techniques in hi-tech floriculture units.
CO3- Will gain ability to manage a protected cultivation unit for cut flower production.

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E RESOURCES
1. www.icar.org.in/ciphet.html
2. www.jains.com
3. www.gisdevelopment.net
4. www.lasercladding.com
5. www.epa.gov

EXP HOR 424 ORGANIC VEGETABLE PRODUCTION (0+10)
LEARNING OBJECTIVES:
- To promote entrepreneurial skills and knowledge through meaningful hands-on-experience through a business model enterprise.
- To provide skills in various organic production techniques and regulatory practices
- To provide an excellent opportunity to observe, think, analyse, synthesize, evaluate and apply the acquired knowledge with respect to organic production of vegetable crops.

ACTIVITIES
Students shall prepare a plan to start a organic cultivation unit for vegetable crops and analyse its technical and financial viability. Undertake end to end approach to achieve the objectives of the approved project. Hands-on-training will be given right from project development, execution, procurement of raw materials, preparation of value added compost, biostimulants and organic foliar supplements, production, care, marketing, regulatory practices including organic certification, decision-making, individual and team coordination, approach to problem solving, accounting, marketing and resolving conflicts,

COURSE OUTCOMES
CO1- Students can become eligible to undertake end to end technical and management aspects of a organic vegetable production unit
CO2- Can practice skills in various various organic production techniques and regulatory practices
CO3- Will gain ability to manage a organic vegetable production unit and expert in organic regulatory certification process.

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