



**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.

**2.2. State Government:** State Government means the Government of 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 1<sup>st</sup> 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 upto 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 readmission 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.

Sl. No.	Degree	Duration requirements (Semester)		Credit requirements
		Min.	Max	
1.	B.Sc. (Hons.) Horticulture	8	16	180

#### 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.

9.1. Course with both theory and practical					
S. No.	Particulars	Mid-semester examination	Final Practical examination	Final Theory examination	Total
1	Written test/Practical	20	25*	40	
2	Assignment	-	5		
3	Record	-	5		
4	Viva voce	-	5		
	<b>Total</b>	<b>20</b>	<b>40</b>	<b>40</b>	<b>100</b>

9.2. Course with only Theory/ Practical**		
S. No.	Particulars	Marks
I.	Mid-semester examination	40
II.	Final Theory / Practical examination**	60
	<b>Total</b>	<b>100</b>
* 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.

E	Incomplete (due to attendance deficiency)
AB	Absent
RR	Re-registration
RA	Re-appearance
IE	Improvement Examination
EE	Incomplete for reasons other than attendance

#### 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.

Particulars	Max. marks
Attendance and routine activities	60
Behaviour	15
Participation in tournaments	25
<b>Total</b>	<b>100</b>

##### 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.

Paper	Title of the paper	Mode	Hours of instruction
1	Principles and Practices of Yoga	Regular	20
2	Yoga Practical		40
<b>Total</b>			<b>60</b>

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.

S.No.	Particulars	Max. marks
1	Written Examination PART - A Two Marks Questions 10 out of 12 ( $10 \times 2 = 20$ ) PART - B Five Marks Questions 2 out of 3 ( $2 \times 5 = 10$ ) PART - C Ten Marks Questions 1 out of 2 ( $1 \times 10 = 10$ )	40
2	Yoga Practical Examination	30
3	Viva - Voce Examination	10
4	Record	20
<b>Total</b>		<b>100</b>

##### 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.

S. No.	Particulars	Marks
1	NSS Regular Programme (15 +15 +15 +15)	60
2	NSS Special camp not exceeding 10 days duration (Attendance-30 & Activity 10)	40
	<b>Total</b>	<b>100</b>

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)

S. No.	Particulars	Mid-semester examination	Final examination
1	Written test	30	40
2	Continuous evaluation	10	-
3	Assignment	-	5
3	Record	-	5
4	<i>Viva voce</i>	-	10
	<b>Total</b>	<b>40</b>	<b>60</b>

#### 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.

Particulars	Max marks	Evaluation by
Observation Note book	20	By Teacher in-charge
Skills learned	20	
<b>Final examination</b>		
Commendable activities	10	By the Examiners
Detailed project report presentation and Record	30	
<i>Viva voce</i>	20	
<b>Total</b>	<b>100</b>	

#### 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.

Particulars	Max marks	Evaluation by
Attendance	20	Accompanying staff
Behaviour	20	
<b>Final examination</b>		
Tour Diary	20	By the organising staff/Examiner
Tour record	30	
<i>Viva voce</i>	10	
<b>Total</b>	<b>100</b>	

#### 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 14<sup>th</sup> 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.

Particulars	Max marks	Evaluation by
Observation Note book	20	By Teacher in-charge
Project report	20	
<b>Final examination</b>		
Record	20	By the Examiners
Power point presentation	20	
<i>Viva voce</i>	20	
<b>Total</b>	<b>100</b>	

#### 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 incharge 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

S.No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Entrepreneurship Skills	10
7.	Technical Skill Development/ Business networking skills	20
8.	Report Writing Skills	10
9.	Final Presentation	10
	<b>Total</b>	<b>100</b>

### 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.

		Marks
i.	Fill up the blanks @ ½ mark for 10 questions out of 12	5
ii.	Definition @ 1 mark for 5 questions out of 7	5
iii.	Short notes @ 2½ marks for 2 questions out of 3	5
iv.	Essay type @ 5 marks for 1 question out of 2	5
	<b>Total</b>	<b>20</b>

For courses with only Theory, 40 marks will be apportioned as shown below.

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

- 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.

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

### Question pattern for theory papers with maximum 60 marks

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

- 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 re-appearance 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 re-appearance 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 re-appearance examination at a time.
- 12.7. The candidates for the re-appearance 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 re-appearance 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

<b>OGPA</b>	<b>Class</b>
9.00 and above	Distinction
8.00 to 8.99	I Class
7.00 to 7.99	II Class
6.50 to 6.99	Pass

#### **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.

## **B.Sc. (HONS.) HORTICULTURE**

### **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.**

**ANNAMALAI UNIVERSITY**  
**DEPARTMENT OF HORTICULTURE**

**B.Sc.(Hons.) Horticulture --Semester-wise Course Distribution**

**I Semester**

S.No.	Course No.	Title	Credits
01.	HOR 110	Fundamentals of Horticulture	2+1
02.	AGR 111*	Fundamentals of Agricultural Meteorology	1+1
03.	SAC 112*	Principles of Analytical Chemistry	1+1
04	GBP 113*	Fundamentals of Plant Physiology	2+1
05	TAM 114* or ENG 114	தமிழ் இலக்கியங்களில் வேளாழ் மைற்று அறிவியல் தமிழ் பயற்சி பாற்று (Or) Development Education	0+1
06.	ENG 115*	English for Effective Communication	0+1
07	PED 116*	Physical Education	0+1
08.	PED 117*	Principles and practices of yoga	0+1
09.	NSS/NCC 118*	National Service Scheme/National Cadet Corps	0+1
10.	HOR 119	Plant Propagation and Nursery Management	1+1
		<b>Total</b>	<b>7+10 =17</b>

**II Semester**

S.No.	Course No.	Title	Credits
01	HOR 120	Production Technology of Tropical and Arid Zone Fruits	2+1
02	HOR 121	Growth and Development of Horticultural Crops	1+1
03.	ENT 122*	Fundamentals of Entomology	2+1
04.	AGM 123*	Fundamentals of Microbiology	2+1
05	SAC 124 *	Fundamentals of Biochemistry	2+1
06.	GPB 125	Botany of Horticultural Crops	1+1
07.	AEC 126*	Principles of Economics	1+1
08	AHS 127	Livestock and Poultry Management	2+1
09.	COM 128*	Fundamentals of Information Technology	1+1
		<b>Total</b>	<b>14+9=23</b>

**III Semester**

S.No.	Course No.	Title	Credits
01.	HOR 210	Production Technology of Tropical Vegetables	2+1
02.	HOR 211	Production Technology of Plantation Crops, Spices and Condiments	2+1
03.	PAT 212	Principles of Plant Pathology	2+1
04.	SAC 213*	Fundamentals of Soil Science	2+1
05.	GPB 214*	Principles of Genetics and Cytogenetics	2+1
06.	AGR 215	Irrigation and Weed Management	1+1
07.	AEC 216*	Production Economics and Farm Management	1+1
08.	ENT 217	Economic Entomology and Nematology	1+1
09.	AEX 218	Rural Sociology, Educational Psychology and Dimensions of Extension Education	2+1
		<b>Total</b>	<b>15+9=24</b>



**IV Semester**

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

**V Semester**

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

**VI Semester**

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



### VII Semester

S.No.	Course No.	Title	Credits
01.	RHWE AEX 410	Village attachment and Technology Transfer (Team teaching, Agrl.Extension and Horticulture)	0+5
02.	RHWE AGR 411	Agronomical Interventions	0+2
03.	RHWE HOR 412	Horticultural Interventions	0+3
04.	RHWE CPT 413	Crop Protection Interventions (Entomology and Plant Pathology)	0+4
05.	AEX 414	All India Study Tour	0+1
06.	HIA 415	Horticultural Industrial Attachment	0+6
Total			0+21= 21

### VIII Semester

S.No.	Course No.	Title	Credits
1.	EXP XXX 42X	Experiential Learning - I	0+10
2.	EXP XXX 42X	Experiential Learning - II	0+10
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

Semester	No of Courses	Credit hours		
		Theory	Practical	Total
I	10	7	10	17
II	9	14	9	23
III	9	15	9	24
IV	10	11	10	21
V	10	16	9	25
VI	9	19	10	29
VII	6	0	21	21
VIII	2	0	20	20
<b>Total</b>	<b>65</b>	<b>82</b>	<b>98</b>	<b>180</b>

#### Department wise Course Distribution

### Horticulture

S.No.	Semester	Course No.	Title	Credits
01.	I	HOR 110	Fundamentals of Horticulture	2+1
02.	I	HOR 119	Plant Propagation and Nursery Management	1+1
03.	II	HOR 120	Production Technology of Tropical and Arid Zone Fruits	2+1
04.	II	HOR 121	Growth and Development of Horticultural Crops	1+1
05.	III	HOR 210	Production Technology of Tropical Vegetables	2+1

S.No.	Semester	Course No.	Title	Credits
06.	III	HOR 211	Production Technology of Plantation Crops, Spices and Condiments	2+1
07.	IV	HOR 220	Commercial Floriculture	2+1
08.	IV	HOR 221	Study Tour	0+1
09.	V	HOR 311	Breeding of Horticultural Crops	2+1
10.	V	HOR 312	Biotechnology of Horticultural Crops	1+1
11.	V	HOR 313	Urban and Environmental Horticulture	1+1
12.	VI	HOR 320	Organic Horticulture and Sylvi Horticulture	2+1
13.	VI	HOR 321	Production Technology of Temperate and Subtropical Fruits	2+1
14.	VI	HOR 322	Production Technology of Temperate and Subtropical Vegetables	2+1
15.	VI	HOR 323	Ornamental and Landscape Gardening	2+1
16.	VI	HOR 325	Protected Cultivation and Precision Horticulture	2+1
17.	VI	HOR 326	Processing and Post Harvest Management of Horticultural Crops	2+1
18.	VI	HOR 329	Production Technology of Medicinal and Aromatic Crops	2+1
18.	VII	RHWE HOR 412	Horticultural Interventions	0+3
19.	VII	HIA 415	Horticultural Industrial Attachment	0+6
			<b>Total</b>	<b>30+27=57</b>

### Agronomy

S.No.	Semester	Course No.	Title	Credits
01.	I	AGR 111*	Fundamentals of Agricultural Meteorology	1+1
02.	III	AGR 215	Irrigation and Weed Management	1+1
03.	V	AGR 310*	Climate Change and Disaster Management	1+0
04.	V	AGR 316	Production Technology of Field Crops	2+1
05.	VII	RHWE AGR 411	Agronomical Interventions	0+2
			<b>Total</b>	<b>5+5=10</b>

### Genetics and Plant Breeding

S.No.	Semester	Course No.	Title	Credits
01.	I	GBP 113*	Fundamentals of Plant Physiology	2+1
02.	II	GPB125	Botany of Horticultural Crops	1+1
03.	III	GPB 214*	Principles of Genetics and Cytogenetics	2+1
04.	IV	GPB 225	Principles and Methods of Plant Breeding	2+1
			<b>Total</b>	<b>7+4=11</b>

### Soil Science and Agricultural Chemistry

S.No.	Semester	Course No.	Title	Credits
01.	I	SAC 112*	Principles of Analytical Chemistry	1+1
02.	II	SAC 124*	Fundamentals of Biochemistry	2+1
03.	III	SAC 213*	Fundamentals of Soil Science	2+1
04.	V	SAC 315*	Soil Fertility, Fertilizers and Manures	2+1
			<b>Total</b>	<b>7+4=11</b>

### Agricultural Entomology

S.No.	Semester	Course No.	Title	Credits
01.	II	ENT 122*	Fundamentals of Entomology	2+1
02.	III	ENT 217	Economic Entomology and Nematology	1+1
03.	IV	ENT 222	Principles of Pest Management	1+1
04.	V	ENT 317	Insects, Mites and Nematode Pests of Horticultural Crops and their Management	2+1
05.	VII	RHWE CPT 413	Crop Protection Interventions	0+2
			<b>Total</b>	<b>6+6=12</b>

### Plant Pathology

S.No.	Semester	Course No.	Title	Credits
01.	III	PAT 212	Principles of Plant Pathology	2+1
02.	IV	PAT 224	Mushroom Culture	0+1
03.	VI	PAT 324	Diseases of Horticultural Crops and their management	3+1
04.	VII	RHWE CPT 413	Crop Protection Interventions	0+2
			<b>Total</b>	<b>5+5=10</b>

### Agricultural Microbiology

S.No.	Semester	Course No.	Title	Credits
01.	II	AGM 123*	Fundamentals of Microbiology	2+1
02.	IV	AGM 223*	Soil and Applied Microbiology	2+1
03.	V	AGM 314*	Environmental Science	2+1
			<b>Total</b>	<b>6+3=9</b>

### Agricultural Economics

S.No.	Semester	Course No.	Title	Credits
01.	II	AEC 126*	Principles of Economics	1+1
02.	III	AEC 216*	Production Economics and Farm Management	1+1
03.	IV	AEC 226*	Agricultural Marketing, Trade and Prices	1+1
04.	V	AEC 318*	Agri Business Management and Entrepreneurship	1+1
05.	VI	AEC 327*	Agricultural Finance, Banking and Cooperation	1+1
			<b>Total</b>	<b>5+5=10</b>

### Agricultural Extension

S.No.	Semester	Course No.	Title	Credits
01.	III	AEX 218	Rural Sociology, Educational Psychology and Dimensions of Extension Education	2+1
02.	VI	AEX 328*	Extension Methodologies and Transfer of Agricultural Technology	1+1
03.	VII	RHWE AEX 410	Village Attachment and Technology Transfer	0+5
04.	VII	AEX 414	All India Study Tour	0+1
			<b>Total</b>	<b>3+8=11</b>

### Animal Husbandry

S.No.	Semester	Course No.	Title	Credits
01.	II	AHS 127	Livestock and Poultry Management	2+1
			<b>Total</b>	<b>2+1=3</b>

### Courses offered by other Departments

#### Computer Science

S.No.	Semester	Course No.	Title	Credits
01.	II	COM 128*	Fundamentals of Information Technology	1+1
			<b>Total</b>	<b>1+1=2</b>

#### Engineering

S.No.	Semester	Course No.	Title	Credits
01.	IV	AEG 229*	Farm Power, Machinery and Renewable Energy	2+1
02.	V	AEG 319*	Fundamentals of Soil and Water Conservation Engineering	2+1
			<b>Total</b>	<b>4+2=6</b>

#### Statistics

S.No.	Semester	Course No.	Title	Credits
01.	IV	STA 227*	Agricultural Statistics	1+1
			<b>Total</b>	<b>1+1=2</b>

#### Languages

S.No.	Semester	Course No.	Title	Credits
01.	I	TAM 114 (Or) ENG 114	தமிழ் இலக்கியங்களில் வேளாழ் மைழ் அறிவியல் தமிழ் பயல் பாழ் (0 + 1) (Or) Development Education	0+1
02.	I	ENG 115*	English for Effective Communication	0+1
03.	IV	ENG 228	Soft Skills of Employability	0+1
			<b>Total</b>	<b>0+3=3</b>

## Common Courses

Sl. No.	Semester	Course code	Title	Credit
01.	I	PED 116	Physical Education	0+1
02.	I	PED 117	Principles and practices of yoga	0+1
03.	I	NSS/NCC 118	National Service Scheme / National Cadet Corps	0+1
04.	VI	EXP XXX 4XX	Experiential Learning - I	0+10
05.	VIII	EXP XXX 4XX	Experiential Learning - II	0+10
			<b>Total</b>	<b>0+23=23</b>

## Department wise Credit distribution

Departments	Credit Hours		
	T	P	Total
Agronomy	5	5	10
Genetics and Plant Breeding	7	4	11
Soil Science and Agricultural Chemistry	7	4	11
Agricultural Entomology	6	6	12
Plant Pathology	5	5	10
Agricultural Microbiology	6	3	09
Agricultural Economics	5	5	10
Agricultural Extension	3	8	11
Animal Husbandry	2	1	03
Horticulture	30	27	57
Computer Science	1	1	02
Engineering	4	2	06
Statistics	1	1	02
Languages	0	3	03
Common Courses	0	23	23
<b>Total</b>	<b>82</b>	<b>98</b>	<b>180</b>

## HOR 110 FUNDAMENTALS OF HORTICULTURE (2+1)

### 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**

Scope and importance of horticultural crops – divisions of Horticulture – area and production – export and import – global scenario – classification of horticultural crops – nutritive value – horticultural zones of India and Tamil Nadu – research institutes related with development of horticulture.

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

Establishment of orchard – principles, planning and layout – different planting systems – Factors limiting Horticultural crop production – manures and manuring – weed management – irrigation methods- influence of soil – physical and chemical properties and climatic factors – light, temperature, photoperiod, relative humidity, rainfall, micro climate, pollution – influence of biotic and abiotic stresses on crop production

#### **Unit-III: Nursery Management and Cropping System**

Nursery techniques – vegetable garden – nutrition garden, kitchen garden and other types of gardens – cropping systems – intercropping, multi-tier cropping – cover cropping – planting methods – mulching – principles of organic farming.

#### **Unit-IV: Growth and Development**

Bearing habits – flowering, pollination and fruit set – unfruitfulness – fruit drop – causes and prevention – training and pruning – use of growth regulators – rejuvenation of old orchards.

#### **Unit-V: Protected Cultivation and Post-Harvest Technology**

Basics of protected cultivation – green house components – structure for environmental control – post-harvest technology – importance and causes for post-harvest losses – maturity indices – harvesting methods.

### PRACTICAL

Different features of orchard – planning and layout of orchard – tools and implements – different planting systems – nursery beds – training and pruning of fruit crops – preparation of fertilizer mixtures and field application – use of growth regulators – assessment of bearing habits – weed management – irrigation systems – structures for protected cultivation – judging the maturity indices of horticulture crops – harvesting methods and post-harvest handling.

### 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.
7. Principles, planning and layout of Orchard.
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.
13. Weed management and methods of weed control.
14. Methods of irrigation in relation to horticultural crops.
15. Study of cropping systems.
16. Study of multi – tier, inter cropping and cover crops – planting methods.
- 17. Mid Semester Examination**
18. Mulching – role of mulching – types of mulches for horticultural crop production.
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.
24. Principles and methods of training in horticulture crops.
25. Principles and methods of pruning in horticulture crops.
26. Methods of rejuvenation of old orchards.
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

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	2	-
CO2	3	2	3	3	1	-	-	-

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## 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

Solar radiation - solar constant and energy balance - Light intensity, quality, direction and duration - Air and Soil temperature - Diurnal variation - importance in crop production- Heat unit and its importance in agriculture. Relative Humidity and its importance.

#### 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**

Clouds - types and their classification. Precipitation - forms - monsoons of India and Tamil Nadu - rainfall variability drought, flood and their effect - Cloud seeding - Evapotranspiration - transpiration - PET / reference crop  $ET_0$ .

#### **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
4. Solar radiation - solar constant and energy balance - Wave length characteristics and their effect on crop production - Light - effect of intensity, quality, direction and duration on crop production.
5. Air temperature - Factors affecting temperature. Diurnal and seasonal variation in air temperature - Isotherm, Heat unit and its use - Heat and cold injuries.
6. Role of temperature in crop production. Soil temperature - Importance in crop production. Factors affecting soil temperature, diurnal and seasonal variation in soil temperature.
7. Humidity - Types - Dew point temperature - Diurnal variation in Relative humidity and its effect on crop production - Wind and its role on crop production.
8. Atmospheric pressure, diurnal and seasonal variation - causes for variation - Isobar - Low, depression, anticyclone, Tornado, hurricane.
9. **Mid Semester Examination**
10. Precipitation - Forms of precipitation - Isohyet - Monsoon - Different monsoons of India - Rainfall variability - Drought and flood - Impact on crop production.
11. Evaporation - Transpiration, evapotranspiration - Potential evapotranspiration / references crop  $ET_0$  - 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.
16. Remote sensing and its application on crop production.
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
8. Measurement of Dew - dew gauge.
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
16. Mapping of agro climatic Zones of India and Tamil Nadu and its characterization.
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 knowledgewith 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

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	1	-	-	1	-	-	-	-
CO 2	3	-	-	1	1	-	1	-
CO 3	-	-	1	1	1	-	2	1
CO 4	2	-	1	1	-	-	1	-
CO 5	-	-	1	1	-	-	1	1

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3. <https://www.scribd.com/doc/119183030/PRINCIPLES-OF-AGRONOMY-AND-AGROMETEROLOGY>

### SAC 112 PRINCIPLES OF ANALYTICAL CHEMISTRY (1 +1)

#### 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

Volumetric analysis - preparation of primary and secondary standards - standardization. Theory of indicators and buffers - acidimetry, alkalimetry, oxidimetry, complexometry and thio-cyanometry.

##### 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

Radiation chemistry - radioactivity - radiation decay, detection and measurements - radiological safety - stable isotopes - mass spectroscopy- use of radioactive and stable isotopes in agriculture.

#### PRACTICAL

Analytical techniques and concepts - Gravimetry - Volumetry- Acidimetry - Alkalimetry- Permanganimetry - Dichrometry- Iodimetry, Complexometry - Potentiometry - Conductometry -Colorimetry - Spectrophotometry -Turbidimetry - Flame Photometry - Atomic absorption spectrophotometry- Radioactivity.

#### 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.
3. Volumetric analysis - preparation of primary standard solutions.
4. Volumetric analysis - preparation of primary and secondary standard solutions - standardization.
5. Theory of indicators and buffers. Preparation of indicator and buffer solutions.
6. Theory of acidimetry, alkalimetry, oxidimetry, complexometry and thiocyanometry - titration curve.
7. Gravimetric analysis - Principles - techniques.
8. Precipitation - solubility product - common ion effect - conditions of precipitation.
9. **Mid Semester Examination.**

10. Filtration and choice of filters - washing - washing solutions and washing technique.
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.
14. Radiation chemistry - radioactivity.
15. Radiation - detection and measurement of radio activity - radiological safety.
16. Stable isotopes - Mass spectroscopic measurements and their application in agricultural research.
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 KMnO<sub>4</sub>
6. Dichrometry - Standardization of Ferrous Sulphate
7. Iodimetry - Estimation of Copper
8. Complexometry - Estimation of Calcium and Magnesium
9. Principles of Gravimetry - Moisture Estimation
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.

### CO-PO MAPPING MATRIX

CO/PO	PO1	PO 2	PO3	PO 4	PO 5	PO6	PO7	PO8
CO 1	1	-	-	-	-	-	-	-
CO 2	-	1	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	-

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### GPB 113 FUNDAMENTALS OF PLANT PHYSIOLOGY (2+1)

#### 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

Importance of Crop Physiology in Agriculture - cell organelle- plasma membrane, chloroplast, mitochondria, peroxisome and vacuole - Structure and role of water - water potential and its components - diffusion - osmosis - imbibition - plasmolysis - Field Capacity and Permanent Wilting Point- Mechanisms of water absorption - Pathways of water movement - Apoplast and symplast - Translocation of water - ascent of sap - mechanisms - Transpiration - significance - structure of stomatal pore- mechanisms of stomatal opening and closing - guttation - antitranspirants.

##### 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 - C<sub>3</sub> and C<sub>4</sub>, CAM - difference between three pathways - Factors affecting photosynthesis- Photorespiration - 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 Cytokinin 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
2. Structure and role of water -water potential and its components - Diffusion - 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 - C<sub>3</sub> and C<sub>4</sub> 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
17. Growth - phases of growth - factors affecting growth - Hormones- classifications
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,

	PSO1	PSO2	PSO3	PSO4	PSO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-

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4. [www.plantphysiol.org](http://www.plantphysiol.org)

### TAM -114 jkpH; ,yf;fpa';fspy; ntshz;ika[k; mwptpay; jkpH;g; gad;ghLk; (0+1)

bjhy;fhg;gpak; fhl;Lk; Kjw;bghUs;/ fUg;bghUs; - r';f ,yf;fpaj;jpy; ntshz; bjhHpy; El;g';fs; - gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ikmwptpay; - gs;S ,yf;fpa';fs;/ VbuGgJ/ ,yf;fpaj;jpy; ntshz; bghwpapay; - njhl;ltpay; - tdtpay; kidapay; - NHypay; ntshz;ikg; gHbkhHpf; - ,yf;fpak; fhl;Lk; thH;tpay; bewpKiwfs; - ,f;fhy ,yf;fpa';fspy; ntshz;ikr; rpe;jidfs; - gpiHapd;wpvGJk; Kiwfs; - ,yf;fpaj;jpy; bkd;jpwd;fs; - mwptpay; jkpH; tsh;r;rpepiyfs; fiyr;brhy;yhf;fk; - bkhHpbgah;g;ghsh; - Ml;rpj; jkpH; - cHth;fSf;fhdmwptpg;g[fisbtspapLjy; - fl;Liur; RUf;fk; vGJjy; - fzpdpcyfy; jkpH;

### bra;Kiwg; gapw;rpfs;

1. bjhy;fhg;gpak; fhl;Lk; Kjw;bghUs;/ fUg;bghUs; tHpnstshz; kug[fismwpy;
2. r';f ,yf;fpaj;jpy; ntshz; bjhHpy; El;g';fs; - (vl;Lj;bjhif/ gj;Jg;ghl;L)
3. gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ikmwptpay;
4. gs;S ,yf;fpa';fs;/ VbuGgJ – cHth; thH;tpay; bewpKiwfSk; ntshz;ikj; bjhHpy; El;g';fSk;
5. ,yf;fpaj;jpy; ntshz; bghwpapay; - njhl;ltpay; - tdtpay; - kidapay; - NHypay;
6. ntshz;ikg; gHbkhHpf; - cHt[ tpjmwptpay; - ehw;WeLjy; - vU ,Ljy; - ePh;g;ghrdk; - fisnkyhz;ik – gaph;ghJfhg;g[ - mWtil – cHth; rKjhak;
7. ,yf;fpak; fhl;Lk; thH;tpay; bewpKiwfs;
8. ,f;fhy ,yf;fpa';fspy; ntshz;ikr; rpe;jidfs; - ghujp/ ghujpjhrd; gilg;g[fs; - g[Jf;ftpij – rpWfij – g[jpdk;
9. ,ilepiyg; gUtj;njh;t[
10. gpiHapd;wpvGJk; Kiwfs; - vGj;Jg; gpiHfs; - brhw;gpiHfs; - brhw; gphpg;g[g;gpiH – thf;fpag;gpiH – bka;g;g[; jpUj;jk;
11. ,yf;fpaj;jpy; bkd;jpwd;fs; - jiyikg;gz;g[ - fhynkyhz;ik
12. MSikg;gz;g[ nkk;ghL – kdpj cwt[j;jpwd;fs; tsh;j;jy;
13. mwptpay; jkpH; tsh;r;rpepiyfs;/ ntshz; E}y;fs;/ ntshz; ,jH;fs;
14. fiyr;brhy;yhf;fk; - ntshz; fiyr; brhw;fiscUthf;Fk; Kiw – jug;gLj;Jjy; - ,yf;fpantshz; fiyr;brhw;fs;/ tl;lhuntshz;iktHf;Fr; brhw;fs; - mfuhjpapay;
15. bkhHpbgah;g;g[ - Kf;fpapjpf; - goepiyfs; - bkhHpbgah;ghshpd; ,d;wpaikah; gz;g[fs; - ntshz; bra;jpfisbkhHpbgah;j;jy;
16. Ml;rpj; jkpH; - murhizfs; mYtyf; foj';fs; - cHth;fSf;fhdmwptpg;g[f;fisbtspapLjy; - fl;Liur; RUf;fk; vGJjy;
17. fzpdpcyfy; jkpH; - xU';FFwpaPLgapw;Wtpj;jy; - tiyg; g{f;fs; - tpf;fpgPoah – ntshz; bra;jpfisg; gjpntw;wk; bra;jy; - ntshz; bra;jpfis ,izajstHpmwpy;

### LEARNING OUTCOME (fw;wypd; btspghLfs;)

CO1: gz;ilaf; fhye;bjhl;L ,yf;fpa';fspy; fhzg;gLk; ntshz;ik Fwpj;j bra;jpfis mwpe;J bfhs;tu;/ mjd;tHp jw;fhy ntshz;ikf;fhd jPu;t[fs; fpilf;Fk;/

CO2: gHbkhHpf;. kug[j; bjhl;fs; tHp ntshz;ik rhu;e;j bra;jpfis mwpa[k; jpwd; bgw;wpUg;gu;/



- CO3: fiyr;brhw;fSf;fhd bghUis mwpe;J bfhs;tnjhL. gpw bkhHpapypUe;J jkpGf;F ntshz;ik rhu;e;j fiyr;brhw;fis cUthf;Fk; jpwd; khztu;fSf;F Vw;gLk;/
- CO4: ntshz;ik rhu;e;j fl;Liufs; vGJtjw;fhd gapw;rp bfhLf;fg;gLtjhy;. gpiHapd; El;gkhd tifapy; fl;Liufs; vGJtu;/
- CO5: ngr;Rg; gapw;rp mspf;fg;gLtjhy;. tpthrak; rhu;e;j bra;jpfis Clf;fSf;F tpsf;fpf; TWk; mDgtk; Vw;gLfpwJ/

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	-	X		
CO2	-	-	-	-	-	-		
CO3	-	-	-	X	-	X		
CO4	-	-	-	-	X	-		
CO5	-	-	-	-	-	-		

#### nkW;ghh;it E}y;fs;

- fe;jrhkp.,y.br.ntshz;ika[k; gz;ghLk;/ jkpH;ehLntshz;ikg; gy;fiyf;fHfk;/ nfhak;g[j;J}h;/ 1974
- fe;jrhkp. ,y.br. ,yf;fpaj;jpy; ntshz;ik/ jkpH;ehL ntshz;ikg; gy;fiyf;fHfk;/ nfhak;g[j;J}h; 1981.
- fe;jrhkp. ,y.br.ntshz;ikgHbkhHpfs;/ fiyr;bry;tk; gjpg;gfk;/ nfhak;g[j;J}h; 1983.
- FHe;jrhkp.th.br.mwptpay; jkpH;/ ghujpgjg;gfk;/ brd;id
- kPdhl;rpRe;juk;. kh. kw;Wk; V.,y.tprayl;Rkpjfty; bjhlh;gpy; jkpH; bkhHpg;gad;ghL/nf.Mh;.v.Mg;brl; gphpz;lh;/ nfhit – 2002
- kzpknfiy.k.jkpH; bkhHpj; jl;jpy; ntshz; mwptpaypd; RtLfs;/ njtpgjg;gfk;/ jpUr;ruphg;gs;sp/ 2002
- ,yf;fpaKk; ntshz;ika[k;/ mid;jpe;jpamwptpay; jkpH;f; fHfk;/ j";rht{h;}/ 2006
- jkpHhpd; kug[r;bry;t';fs;/ cyfj; jkpHuha;r;rpepWtdk;/ brd;id
- re;jpunfud;/ ,uh/ bkhHpg;ghlk; - gilg;ghf;fj;jpwd; tsh;j;jy;
- ntshz;fiyr;brhy; ngufuhjp/ jkpH; ehLntshz;ikg; gy;fiyf;fHfk;/ nfhak;g[j;J}h;}/ 2008.
- ghnte;jd;/ ,uh/ jkpHpy; mwptpay; ,jH;fs;/ rhKnty;/ @gp#; fpwpd; gjpg;gfk;/ nfhak;g[j;J}h;
- lhf;lh; ,uhjhby;yg;gd;/ fiyr;brhy;yhf;fk;/ jkpH;g; gy;fiyf;fHfk;/ j";rht{h;

### ENG 114 DEVELOPMENT EDUCATION (0+1) (Alternate courses for non-Tamil students)

#### LEARNING OBJECTIVES:

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

#### THEORY LECTURE SCHEDULE

1. Basic principles of learning. Binary terms viz – growth and development, education – for – life and life – long education, motivation and morale –
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

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
16. Entrepreneur – intrapreneur – Managing an intrapreneur – motivation and entrepreneurship development – planning, monitoring and evaluation.
- 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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	-	X	-	-
CO2	-	-	-	-	X	-	-	-
CO3	-	-	-	X	X	X	-	-
CO4	-	-	-	-	X	-	-	-
CO5	-	-	-	-	-	-	-	-

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### 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**

Introduction to English Phonology - English Phonemes - Stress and Intonation - Influence of Language 1 on Language 2 - Oral Discourse skills - Principles of speech preparation - Presentation skills - Techniques of 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-making - 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-making-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.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	-	X	-	-
CO2	-	-	-	-	X	-	-	-
CO3	-	-	-	X	X	X	-	-
CO4	-	-	-	-	X	-	-	-
CO5	-	-	-	X	-	-	-	-
CO6	-	-	-	-	X	X	-	-

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4. Jones Daniel, English Pronouncing Dictionary 2006, Cambridge University Press.
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6. Martin Cutts, Oxford Guide to Plain English, 2004, Oxford University Press.
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15. Team of authors - Cambridge IELTS Books 1 to 5, 2006, Cambridge University.
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## E-RESOURCES

1. [www.esl--lab.com](http://www.esl--lab.com)
2. [www.webenglishteacher.com](http://www.webenglishteacher.com)
3. [www.eflweb.com](http://www.eflweb.com)
4. [www.softskills.com](http://www.softskills.com)
5. [www.teachingenglish.org.uk](http://www.teachingenglish.org.uk)
6. [www.reportingskills.com](http://www.reportingskills.com)
7. [www.essays.com](http://www.essays.com)
8. [www.writing-skills.com](http://www.writing-skills.com)
9. [www.onestopenglish.com](http://www.onestopenglish.com)
10. [www.negotiation.com](http://www.negotiation.com)
11. [www.tealit.com](http://www.tealit.com)
12. [www.businessballs.com](http://www.businessballs.com)
13. [www.eltweb.com](http://www.eltweb.com)
14. [www.study-habits.com](http://www.study-habits.com)

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| 15. <a href="http://www.angelfire.com">www.angelfire.com</a>                       | 16. <a href="http://www.timethoughts.com">www.timethoughts.com</a>               |
| 17. <a href="http://www.primesl.com">www.primesl.com</a>                           | 18. <a href="http://www.appliesl.com">www.appliesl.com</a>                       |
| 19. <a href="http://www.learnbusinessEnglish.com">www.learnbusinessEnglish.com</a> | 20. <a href="http://www.teachersdesk.com">www.teachersdesk.com</a>               |
| 21. <a href="http://www.bogglesworld.com">www.bogglesworld.com</a>                 | 22. <a href="http://www.flexbilelearning.net.au">www.flexbilelearning.net.au</a> |

## PED 116 PHYSICAL EDUCATION (0+1)

### 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 impact 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 dispensable 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 pursue and defence skills.

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

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

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

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

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

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

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

#### ATHLETICS

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

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

(c) **Throws** : Grip, momentum, pre shift, sub phase, the wind up, foot work, entry to the turn, shift, angle of release, follow throw, delivery, front cross step, rear cross step, hop step, fuck method paryobrine, discopot, 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.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	X	X	-	-
CO2	-	-	-	X	-	-	-	-
CO3	-	-	-	X	-	X	-	-

#### 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

Hatha yoga techniques: Introduction – meaning – Definition – Techniques- Asana - Pranayama – Mudra – Bandha and Shat Kriya

### 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
6. Pranayama –Kapalabathi,Sectional Breathing, NadiShuddhi, Sitkari, Sadanta, Nada-Anu-Sandana
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
9. Kriya -Kapalpathi, Trataka-Jothi trataka, Jatrutrataka; Neti-Jalaneti, Sutra neti; Dhouti –Vamana dhouti
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.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	X	X	-	-
CO2	-	-	-	X	X	-	-	-
CO3	-	-	-	X	X	X	-	-

### REFERENCES

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2. ShivanandaSaraswati, Yoga Therapy, Bihar School of yoga, Munger,1998
3. Swami SatyanandaSaraswati, Asana, Pranayama, Mudra and Bandha, Bihar School of Yoga , Munger, 2002



4. Swami Vishnu Devananda, Mantra and Meditation, International Sivananada Yoga centre, 2002
5. Hatha yoga Pradipika, Swami SatyanandaSaraswati, Bihar School of Yoga , Munger, 2004

## **NSS/NCC 118 NATIONAL SERVICE SCHEME/NATIONAL CADET CORPS**

### **NSS**

Orientation – NSS origin – motto – symbol – NSS administration at different levels – programme planning – Rural Projects – Urban projects – Government schemes – Career guidance – Self help groups – Environment protection – Use of natural energy – Conventional energy resources – Soil and Water conservation – Community health programmes – Women and child welfare – Education for all – National days – Commemorative days – NSS thematic programmes – literacy and computer awareness campaigns.

### **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**

General - Military History – Introduction to NCC – Aims of NCC – Principles of NCC, NCC organization, Duties of good citizen – system of NCC training – Foot drill – Arms drill – Guard of Honour – Ceremonial Drill – Weapon training – First aid – Rifle and Light machine gun – Map reading – Civil defence – Leadership.

### **PRACTICAL SCHEDULE**

1. NCC song – Aims and Motto of NCC – Motivation of cadets
2. History of NCC and organization of NCC
3. Foot drill – General and word of Command
4. Human Resource Development – Motivation – Duties of Good citizen
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



12. Signals – introduction to radio, telephony procedures
13. Field Engineering – principles and applications, camouflage and concealment
14. Adventure training introduction, different types
15. First Aid – methods and practices
16. Environment and Ecology – conservation
17. Besides the above schedule, NCC cadets will be involved during important occasions during convocation, Independence day, Republic day, etc.

## **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**

Seed propagation – seed dormancy- internal and external factors – nursery techniques – protray culture – apomixis – monoembryony, polyembryony – principles – utilization.

#### **Unit-III: Propagation structures**

Propagation structures – mist chamber – cold frames – hot beds- humidifiers – green houses – glass houses –tools and implements – use of growth regulators in seed and vegetative propagation – physiological and anatomical basis of vegetative propagation.

#### **Unit-IV: Asexual propagation techniques**

Methods and techniques of cuttings, layering, grafting and budding – factors influencing rooting of cuttings, layering, budding, grafting – stock scion relationship – root stock influences – Propagation through specialized organs – tuber, bulb, corm, bulbils, rhizome, runner, offshoot, crown, slips and sucker.

#### **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**

Nursery bed preparation – seed treatments – seed sowing- – tools implements - Potting medium – containers for propagation of nursery plants - potting – repotting - liquid manures- propagation structures -- mist chamber, coldframes, hot beds, poly house, shade net house – raising of rootstocks and scion preparation – different techniques and practices of cutting, layering, grafting and budding – use of specialized organs – rejuvenation – project preparation for commercial nurseries – visit to private nurseries and tissue culture laboratory – working out economics.

### **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.
12. Grafting and budding methods and techniques of preparation.
13. Study of stock scion relationship.
14. Influence of root stock on scion - bud wood selection.
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.
6. Raising of rootstocks and scion preparation.
7. Mist propagation techniques.
8. Practice in propagation by cuttings.
9. Practice in propagation by layering.
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.

#### **CO-PO MAPPING MATRIX**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	2	-	-	1	-
CO2	2	3	2	2	-	-	-	1

#### **REFERENCES**

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3. Edmond, J.B., T.L. Senna, F.S. Andrews and R.R. Halfacre. 1990. Fundamentals of Horticulture. Tata McGraw Hill Publishing Co. Ltd.
4. Hartmann, H.T., D.E. Kester, F.T. Davies and R.L. Greeneve. 1997. Plant

- propagation – Principles and Practices. Prentice Hall of India Private Ltd., New Delhi.
5. Palanisamy, H, S.and K.V. Peter 2007.Tuber and Root Crops Horticultue Science Series. New India Publishing Agency
  6. Peter, K.V. S. Rajan and Baby Lissy Markose. 2007. Propagation of Horticultural
  7. Crops. Horticulture Science Series-6. New India Publishing Agency
  8. Singh, R.S., R. Bhagava. 2014. Propagation of Horticultural Plants Arid and Semi-Arid Regions. New India Publishing Agency
  9. Reddy, Y.T.N., T. Janakiram and D. Satyanarayana Reddy. 2001. Scientific Nursery Management. The House of Sarpan (Media), Bangalore.
  10. Prasad, S. and V. Kumar. 1999. Green House Management of Horticultural Crops. Agrobios India, Jodhpur.

#### Web resource

1. [www.fruits.com](http://www.fruits.com)
2. <http://www.ishs.org>

## 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 Acidlime
21. Package of practices for Acidlime
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.
13. Study of varieties of Jack, Annona and Aonla and their propagation.

14. Assessment of maturity standards for tropical and arid zone fruits.
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.

### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	3	2	-	2	1	-
CO2	2	2	3	2	-	1	2	3

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2. <http://agritech.tnau.ac.in/horticulture>
3. <http://nhb.gov.in/fruit>

## **HOR 121 GROWTH AND DEVELOPMENT OF HORTICULTURAL CROPS (1+1)**

### **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 and deficiency and toxicity symptoms-uptake of nutrients from the soil solution-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 and fruit ripening.

#### **Unit-IV: Physiology of Flowering**

Flowering- factors affecting flowering- physiology of flowering- photoperiodism- long day, short day and day neutral plants-vernalisation and 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 fruit, bulb and tuber growth 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
7. Identification of nutrient deficiencies and physiological disorders in fruit crops.
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:**

**CO 1:** Students will be able to understand the physiology of growth and development and the role of growth regulators.

**CO 2:** Will be able to recommend growth regulation techniques and PGRs for production problems in horticultural crops

#### **CO-PO MAPPING MATRIX**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	2	-	-	-	2
CO2	2	3	3	3	-	-	2	1

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2. Hudson, T., Hartmann, Dale, E. Kester 1989. Plant Propagation – Principles and Practices .VI Edn. Prentice Hall of India Pvt. Ltd. New Delhi.
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4. Leopold, A.C. and P.E.Kriedermann, 1985. Plant growth and development. 3rd Ed. Mc Graw Hill, New York.



5. Frank B. Salisbury and Cleon W. Ross. 2004. Plant Physiology. Calif: Wadsworth. Belmont.
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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

Entomology as a science – branches of Entomology – History of Entomology in India – Scope of Entomology. Origin of insects – Position of insects in the animal kingdom – Classification and Characters of Phylum Arthropoda. Relationship of Class Insecta with other Classes of Arthropoda. Reasons for insect dominance.

#### Unit-II : Morphology and Behaviour

Body segmentation, Structure and functions of insect cuticle – cuticular appendages and moulting. 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)

Taxonomy, systematics and nomenclature – Classification of insects – Orders and examples. Distinguishing characters of agriculturally important non insect orders – Collembola, Protura and Diplura and Insect orders Archaeognatha and Zygentoma. Paleoptera – Ephemeroptera and Odonata. Neoptera – Polyneoptera – Plecoptera, Dermaptera, Embioptera, Zoraptera, Orthoptera, Phasmatodea, Grylloblattodea and Mantophasmatodea, Mantodea, Blattodea (Cockroach), Blattodea (Termites), Paraneoptera – Psocodea (free living), Psocodea (parasitic), Thysanoptera and Hemiptera (Tingidae, Reduviidae, Miridae, Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belostomatidae, Gerridae, Cimicidae, Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerridae, Lophopidae and Psyllidae).

#### Unit V : Taxonomy of Endopterygota

Distinguishing characters of agriculturally important orders of Endopterygota – Neuroptera (Chrysopidae, Myrmeleontidae, Mantispidae, Ascalaphidae), Megaloptera, Raphidioptera, Coleoptera (Cicindellidae, Carabidae, Dytiscidae, Curculionidae, Apionidae, Staphylinidae, Coccinellidae, Lampyriidae, Hydrophilidae, Scarabaeidae, Dynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae,

Meloidae, Cetoniidae, 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, Cochliidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae, Metarbelidae and Hesperiiidae) and Hymenoptera (Tenthredinidae, Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Ichneumonidae, Braconidae, Platygasteridae, Bethylinidae, Evaniidae, Chalcididae, Encyrtidae, Eulophidae and Trichogrammatidae).

### **PRACTICAL**

Observations on segmentation and external features of Grasshopper/Cockroach/Blister beetle. Methods of collection and preservation of insects including immature stages. Observations on structure and various types of insect head orientation, antennae, mouthparts, legs, wings, wing venation, wing coupling apparatus and abdominal appendages. Studies on metamorphosis in insects and their immature stages. Demonstration and observation of digestive system and male and female reproductive systems in grasshopper/cockroach. Observing the characters of agriculturally important orders and their families - Collembola, Diplura, Protura, Archaeognatha and Zygentoma. Paleoptera - Ephemeroptera and Odonata. Neoptera - Polyneoptera - Plecoptera, Dermaptera, Embioptera, Zoraptera, Orthoptera, Phasmatodea, Grylloblatodea, Mantophasmatodea, Mantodea, Blattodea (Cockroach), Blattodea (Termites) Paraneoptera - Psocodea (free living), Psocodea (parasitic), Thysanoptera and Hemiptera. Endopterygotes - Neuroptera, Megaloptera, Raphidioptera, Coleoptera, Strepsiptera, Diptera, Mecoptera, Siphonaptera, Trichoptera, Lepidoptera and Hymenoptera.

### **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**
18. Elementary knowledge on circulatory system in insects – haemocoel and dorsal vessel – circulation of blood – composition of haemolymph – haemocytes and their functions
19. Elementary knowledge on nervous system in insects – structure of neuron –types of nervous systems
20. Elementary knowledge on nerve impulse conduction – axonic and synaptic transmissions
21. Elementary knowledge on male and female reproductive systems in insects –structure and modifications. Spermatogenesis and Oogenesis. Structure of male and female genitalia
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
26. Distinguishing characters of orders Collembola, Protura, Diplura, Archaeognatha and Zygentoma.
27. Distinguishing characters of Paleoptera orders– Ephemeroptera and Odonata.
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, Raphidioptera, 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)

9. Observation on distinguishing characters of Collembola, Protura, Diplura and Archaeognatha, Zygentoma, Ephemeroptera and Odonata. Plecoptera, Dermaptera, Embioptera, Zoraptera and Orthoptera (Acrididae, Tettiigonidae, Gryllidae and Gryllotalpidae).
10. Observation on distinguishing characters of Phasmatodea, Grylloblattodea, Mantophasmatodea, Mantodea, Blattodea (Cockroach), Blattodea (Termites) Psocodea - free living, Psocodea (parasitic) and Thysanoptera.
11. Observation on distinguishing characters of Hemiptera (Families: Reduviidae, Pentatomidae, Miridae, Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belastomatidae, Gerridae, Cimicidae, Tingidae, Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerridae, Lophopidae and Psyllidae)
12. Observation on distinguishing characters of Neuroptera, Megaloptera and Raphidioptera.
13. Observation on distinguishing characters of Coleoptera (Families: Cicindellidae, Carabidae, Dytiscidae, Curculionidae, Apionidae, Staphylinidae, Coccinellidae, Gyrinidae, Lampyriidae, Hydrophilidae, Scarabaeidae, Dynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae, Meloidae, Cetonidae, Buprestidae, Elateridae and Bostrychidae)
14. Observation on distinguishing characters of Strepsiptera, Mecoptera, Siphonaptera, Trichoptera, Diptera (Families: Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Pipunculidae, Drosophilidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae)
15. Observation on distinguishing characters of Lepidoptera (Families: Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochlidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae, Metarbelidae and Hesperidae)
16. Observation on distinguishing characters of Hymenoptera (Families: Tenthredinidae, Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Ichneumonidae, Braconidae, Platygasteridae, Bethylinidae, Evaniidae, Chalcididae, Encyrtidae, Eulophidae and Trichogrammatidae)

**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

**CO-PO MAPPING MATRIX**

COs / POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	1	1	1	1	1	1	2	1
CO 2	1	1	1	1	1	1	2	1
CO 3	1	1	1	1	1	1	2	1
CO 4	1	1	1	1	1	1	2	1
CO 5	1	1	1	1	1	1	2	1

## REFERENCES

1. Awasthi, V.B. 2007. *Introduction to General and Applied Entomology* (II edition), Scientific Publishers, Jodhpur. 394p.
2. Norman F. Johnson, Charles A. Triple Horn. 2004. *Borror and Delong's Introduction to the Study of Insects* (VII Edition). Thomson Publication, New York. 888p.
3. Richards O.W. and R.G. Davies. 1977. *Imm's General Text Book of Entomology*, Vol. I and II. Chapman and Hall Publication, London. 692p.
4. Gullen, P.J. and P.S. Cranston. 2011. *The Insects - An Outline of Entomology* (IV Edition). Wiley- Blackwell. UK. 565p.
5. Selvanarayanan, V. and S. Arivudainambi. 2004. *Introductory Entomology*. Manivasagar Padhippagam, Chennai. 262p.

## e-resources:

1. <http://www.itis.usda.gov/itis/>
2. [www.zin.ru/animalia](http://www.zin.ru/animalia)
3. <https://courses.cit.cornell.edu/ent201/content/anatomy2.pdf>
4. [www.insectsexplained.com/03external.htm](http://www.insectsexplained.com/03external.htm)
5. [www.earthlife.net/insects/anatomy.html](http://www.earthlife.net/insects/anatomy.html)
6. [Www.insectidentification.org/orders\\_insect.asp](http://Www.insectidentification.org/orders_insect.asp)

## 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

Definition and scope of microbiology. Historical roots of microbiology; biogenesis and abiogenesis theory; germ theory of diseases and fermentation. Contributions of Antonie Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Alexander Fleming and Waksman.

#### 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

Evolutionary relationship among the living organisms. Whittaker's Five Kingdom concept of living organism and Carl Woese systems. Three domains of life - similarities and differences; Modern approach to the bacterial systematics; Differentiation of bacteria, archaea and eukaryotes; Systematic bacteriology; prokaryotic diversity - Bergey's Manual of Systematic Bacteriology. Cell biology - bacterial size, shape and arrangement; cell structure and components of bacteria. Morphology of fungi and algae.

#### 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**

General properties of viruses: different types; overview of bacteriophages; morphology of bacteriophages: Lytic and lysogenic cycles; lytic and temperate phages. Mutation types and mutagens. Genetic recombinations: Transformation, transduction and conjugation. Basic concepts of immunology - antigen - antibody reactions and vaccines.

### **PRACTICAL**

Safety in Microbiology laboratory. Microscopes - Micrometry - Sterilization techniques and equipment - Growth media preparation - bacteria, fungi and actinobacteria. Isolation, purification and preservation of bacteria yeast and moulds. Staining techniques: Simple and differential staining spore staining Measurement of bacterial growth. Identification of microorganisms: cultural, physiological and biochemical tests for bacteria and actinobacteria. Morphological identification of yeasts, moulds and algae. Molecular identification of bacteria (16s rDNA). Isolation of bacteriophages. Isolation of mutants employing physical or chemical mutagens.

### **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
3. Contributions of John Tyndall, Joseph Lister, Edward Jenner, Robert Koch, Alexander Fleming and Waksman. Germ theory of fermentation and disease
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**
19. Bacterial growth population growth and growth cycle - continuous culture - chemostat and turbidostat; synchronous culture
20. Conditions for growth temperature requirements aerobes and anaerobes - factors influencing growth and methods of assessment of growth
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



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 carryout 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.

#### **CO-PO MAPPING MATRIX**

COs/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6
CO 1	1	-	1	1	1	-
CO 2	-	1	-	-	1	-
CO 3	2	1	-	1	1	-
CO 4	1	1	1	1	2	1
CO 5	1	2	2	1	1	-



## REFERENCES

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2. Michael J. Pelczar, JR., E.C.S. Chan, Noel R.Krieg, 2005. Microbiology
3. Ebook: LuisM.de la Maza, Marie T. Pezzlo and Ellen Jo Baron 1997. Color Atlas of diagnostic Microbiology, Published by Mosby- Year Book Inc.
4. Ebook: Michael J. Leboffee and Burton E.Pierce 2011. A photographic Atlas for the Microbiology Laboratory 4<sup>th</sup> edition, Marton Publishing Company
5. Hans G. Schlegel, 2012. General Microbiology, 7<sup>th</sup> edition
6. Ronald M. Atlas, 1997. Principles of Microbiology, Second edition
7. Tortora, G.J., B.R.Funke and C.L. Case, 2009. Microbiology- An Introduction, 9<sup>th</sup> edition
8. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.

## e-resources

1. <http://www.microbes.info>
2. <http://aem.asm.org>
3. <http://microbelibrary.com>
4. <http://www.rapidmicrobiology.com>

## 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

Amino acids- classification and structure. Essential amino acids. Properties of amino acids- amphoteric nature and isomerism. Classification of protein based on functions and solubility- structure of proteins- primary structure, secondary structure, tertiary structure and quaternary structure – protein folding and denaturation. Properties and reactions of proteins. Enzymes – properties, classification and nomenclature. Mechanism of enzyme action. Factors affecting enzyme activity. Enzyme inhibition – competitive, non- competitive and uncompetitive inhibition. Allosteric enzymes, co-enzymes, co-factor and iso-enzymes.

#### Unit III- Lipids:

Lipids – occurrence and classification. Storage lipids- fatty acids, triacyl glycerol, essential fatty acids, waxes. Structural lipids – role of lipids in biological membrane – glycolipids and phospholipids – types and importance. Sterols – basic structure and their importance. Physical and chemical constants of oils. Rancidity of oils.

#### Unit IV- Metabolism

Carbohydrate metabolism – breakdown of starch by amylases, glycolysis, TCA cycle and pentose phosphate pathway. Respiration – electron transport chain and oxidative phosphorylation. Bioenergetics of glucose- lipid metabolism- lipases and phospholipases. Beta-oxidation of fatty acids and bioenergetics – Bio synthesis of fatty

acids and triacyl glycerol. General catabolic pathway for amino acids- transamination, deamination and decarboxylation. Ammonia assimilating enzymes. Metabolic interrelationship.

### **Unit V – Secondary Metabolites**

Secondary metabolites – occurrence, classification and functions of phenolics, terpenes and alkaloids. Vitamins – Definition – general characteristics and classification. Plant Hormones – definitions – Roll of Auxins, Gibberellins, Cytokinins and other natural growth hormones in plants.

### **PRACTICAL**

Qualitative tests for Glucose, Fructose, Sucrose, Lactose, Maltose, Starch and Dextrin. Quantitative estimation of Carbohydrates. Analysis proteins, lipids- various chemical constants and assay of Vitamins.

### **THEORY LECTURE SCHEDULE**

1. Introduction to Biochemistry, Carbohydrates - occurrence and classification.
2. Structure of monosaccharide, oligosaccharides and polysaccharides.
3. Physical properties of carbohydrates - Mutarotation, optical activity, isomerism.
4. Chemical reactions of carbohydrates.
5. Amino acids - Classification and structure.
6. Properties of amino acids - amphoteric nature, isomerism, essential amino acids.
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.
11. Mechanism of enzyme action. Factors affecting enzyme activity.
12. Enzyme inhibition - competitive, non-competitive, uncompetitive and allosteric enzymes.
13. Coenzymes, cofactors and isoenzyme.
14. Lipids - occurrence and classification.
15. Storage lipids – Structural lipids - types and importance.
16. Sterols - basic structure and their importance.

### **17. Midsemester Examination**

18. Physical and chemical constants of oils. Rancidity of oils.
19. Carbohydrate metabolism - breakdown of starch by amylases
20. Glycolysis - Reactions and bioenergetics.
21. TCA cycle - Reactions and bioenergetics.
22. Pentose phosphate pathway - Reactions.
23. Respiration - electron transport chain and oxidative phosphorylation.
24. Lipid metabolism - lipases and phospholipases.
25. Beta-oxidation of fatty acids and bioenergetics.
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.
30. Secondary metabolites - occurrence, classification and functions of phenolics.
31. Occurrence, classification and functions of terpenes and alkaloids.
32. Vitamins – Definition – general characteristics and classification.
33. Plant Hormones – definitions – Roll of Auxins, Gibberellins in plants.
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.

#### CO-PO MAPPING MATRIX

CO/PO	PO1	PO 2	PO3	PO 4	PO 5	PO6	PO7	PO8
CO 1	1	-	-	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-	-

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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

Systematic botany- terminology, morphological description and classification - root, stem, leaf, inflorescence, flower and fruit - flowering mechanism - modes of pollination - asexual/vegetative reproduction - floral biology - fertilization and fruit set. Principles involved in nomenclature, ICBN rules and recommendations with special reference to names of hybrids and names of cultivated plants.

#### 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, Caesalpiniaceae, Camelliaceae, Rubiaceae, Arecaceae (Palmae) (coconut, arecanut, palmyrah, oil palm), Sterculiaceae (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), Scrophulariaceae.

### 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.
3. Flowering mechanism – modes of pollination – asexual/vegetative reproduction – floral biology – fertilization and fruit set. Botany, floral biology, pollination, fruit set and economic part in the families- ICBN rules and recommendations – special reference to names of hybrids and cultivated plants
4. Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin) and Musaceae.
5. Moraceae, Vitaceae, Caricaceae, 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, cauliflower, 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).
14. Myristicaceae, Lauraceae, Leguminosae and Caesalpiniaceae.
15. Camelliaceae, Rubiaceae, Palmae (coconut, arecanut, palmyrah, oil palm), Sterculiaceae.
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
2. Moraceae, Vitaceae and Caricaceae.
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, cauliflower, 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).
11. Myristicaceae, Lauraceae, Leguminosae and Caesalpiniaceae.
12. Camelliaceae, Rubiaceae, Palmae (coconut, arecanut, palmyrah, oil palm) and Sterculiaceae.

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. Graminae (lemongrass, citrononella, 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.

### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	3	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-

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## 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

Economics: Nature and scope of economics: Science Vs. art, positive science Vs. normative science, deductive method Vs. inductive method - Basic concepts: Goods, services, value, cost, price, wealth and welfare - Wants: Characteristics and classification - Definitions of Economics: Wealth, welfare, scarcity and growth - Different economic systems: merits and demerits - Divisions of Economics - Microeconomics and macroeconomics - Agricultural Economics: Definition and scope, importance and subject matter.

#### Unit II: Theory of Consumption

Utility: Definition - Measurement: Cardinal and ordinal utility - Total and Marginal utility - Law of Diminishing Marginal Utility and Law of Equi-Marginal Utility: Definition, assumptions, limitations and applications - Indifference curve analysis: Definition and properties of indifference curves and budget line - Standard of Living: Definition, Engel's Law of Family Expenditure - Consumer surplus: Definition and importance. 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 - Elasticity of demand: Types - Degrees of price elasticity of demand - Factors influencing elasticity of demand - Importance of elasticity of demand.

#### Unit III: Theory of Production

Concept of production - Factors of production - Land: Characteristics of land - Labour: Characteristics of labour - Division of labour, Malthusian and modern theories of population - Capital: Characteristics of capital - Capital formation - Phases of capital formation - Entrepreneur: Characteristics and functions of entrepreneur. Supply: Definition - Law of Supply - Factors influencing supply - Elasticity of supply.

#### Unit IV: Theory of Exchange and Distribution

Exchange: Market - Equilibrium price determination. Distribution: Definition - Marginal productivity theory of distribution - Pricing of factors of production: Rent : Ricardian theory of rent and quasi rent - Wages: Real wage and money wage - Wage theories - Interest: Pure interest and gross interest - Theories of interest - Profit: Meaning of economic profit - Profit theories.

#### Unit V: Macroeconomic Concepts

Macroeconomics: Definition and subject matter - National income: Concepts - GNP, GDP, NNP, disposable income and per capita income. Money: Definition, types and functions of money. Inflation: Meaning - Types of inflation. Public finance: Meaning - Principles - Public revenue: Meaning - Classification of taxes - Canons of taxation - Public expenditure: Principles. Welfare Economics - Meaning.

### Current streams of thought.

### PRACTICAL

Law of Diminishing Marginal Utility - Law of Equi-Marginal Utility - Indifference curve analysis and consumer equilibrium - Law of Demand, demand schedule - Graphical derivation of individual and market demand - Estimation of own price, income and cross price elasticities of demand - Estimation of Consumer surplus - Illustration on Engel's Law of Family Expenditure - Law of supply - Estimation of supply elasticity - Equilibrium price determination. Types and functions of money - Inflation: Analysis of causes of inflation and control measures. Approaches to computation of national income - Study of structural changes in the economy. Food grain production in India - Growth rate



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
2. Basic concepts - Goods, services, use value and exchange value, cost, price, wealth and welfare - Wants: Characteristics and classification of wants.
3. Definitions of Economics - Wealth, welfare, scarcity and growth - Divisions of Economics: Micro economics and macroeconomics Different economic systems: merits and demerits.
4. Utility: Definition, Measurement: Cardinal and ordinal utility - Marginal utility - Law of Diminishing Marginal Utility.
5. Law of Equi-Marginal Utility: Definition, assumptions, limitations and applications - Indifference curve analysis: Definition and properties of indifference curves and budget line.
6. Standard of Living - Definition, Engel's Law of Family Expenditure - Consumer surplus: Definition and importance.
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.**
10. Concept of production - Factors of production - Land and its characteristics.
11. Labour: Characteristics of labour - Division of labour - Malthusian and modern theories of population.
12. Capital: Characteristics of capital - Capital formation: Phases of capital formation - Entrepreneur: Characteristics and functions of entrepreneur.
13. Supply: Definition, Law of Supply, Factors influencing supply - Elasticity of supply.
14. Exchange: Market - Definition - Equilibrium price determination. Distribution: Definition - Marginal productivity theory of distribution - Pricing of factors of production: Rent: Ricardian theory of rent and quasi rent.
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.
16. Macroeconomics: Definition and subject matter - National income: Concepts - GNP, GDP, NNP, disposable income and per capita income - Money: Definition, Types and functions of money - Inflation: Meaning and Types of inflation.
17. Public Finance: Meaning, Principles - Public revenue: Meaning, Classification of taxes - Canons of taxation - Public expenditure: Principles. Welfare Economics: Meaning.

### **PRACTICAL SCHEDULE**

1. Exercise on Law of Diminishing Marginal Utility.
2. Exercise on Law of Equi-Marginal Utility.
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.

6. Estimation of Consumer surplus.
7. Illustration on Engel's Law of Family Expenditure.
8. Law of supply - Estimation of supply elasticity.
9. Equilibrium price determination.
10. Types and functions of money.
11. Inflation: Analysis of causes of inflation and control measures.
12. Approaches to computation 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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	2	2
CO4	-	-	-	-	-	2	-	3

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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

Significance of Livestock and Poultry in Indian Economy - Livestock and Poultry census - Different livestock development programs of Government of India and Tamil Nadu - Zoological classification of livestock and common nomenclatures used in Animal Husbandry practices - Various systems of livestock rearing - extensive - semi intensive - intensive- farming systems - mixed- integrated and specialized farms.

### **Unit II: Dairy Cattle Management**

Breeds - Classification - Breed characteristics - Red Sindhi, Gir, Sahiwal, Tharparkar, Kangayam-exotic-Jersey- Holstein Friesian-Buffalo breeds- Murrah- Surti and Toda - Breeding - Cross breeding- Upgrading - Economic traits- Culling - Estrus Cycle - Artificial Insemination - Housing - floor space requirement for young and adult stock - systems of housing - Care and management of calf, heifer, pregnant and lactating cows - Nutrition - ration - balanced ration - characteristics of ration and classification of feed and fodder - Milking methods - Factors affecting composition of milk - Clean milk production - Pasteurization of milk - Prophylactic and control measures of diseases.

### **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**

Breeds - Classification - Economic traits - Housing - Nutrition - creep feeding - Care and management of young and adult stock - Prophylactic and control measures of diseases.

### **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**

Study of external parts of cattle - Common methods of restraining - Identification methods of livestock -- Disbudding and deworming in cattle - Determination of age in cattle - Study and design of cattle shed - Selection of dairy cow by score card method -- Determination of weight in cattle-- Determination of specific gravity of milk - Demonstration of fat percentage and total solids estimation in milk - Demonstration of cream separation - Ice cream making- Identification of feed and fodder -Identification of poultry farm equipments- Measures of performance efficiency in broiler and layer - Visit to dairy plant, layer and broiler farms.

### **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
4. Various systems of livestock rearing - extensive - semi intensive - intensive - farming systems - mixed - integrated and specialized farms.
5. Definition of breed - classification of cattle breeds - breed characteristics of Indian cattle - Sindhi, Gir, Sahiwal, Tharparkar and Kangayam.
6. Breed characteristics of exotic cattle - Jersey and Holstein friesian - Indian buffaloes - Murrah, Surti and Toda.
7. Breeding - cross breeding - upgrading - economic traits of cattle - culling and its importance.

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, heifers, pregnant and lactating cows.
12. Nutrition – concentrate and roughage – dry matter – TDN - ration - balanced ration - desirable characteristics of a ration
13. Classification of feed stuff – Importance of green fodder.
14. Milking methods - Clean milk production.
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.
21. Nutrition- feed and fodder - flushing – steaming up.
22. Prophylactic and control measures of diseases.
23. Swine farming – merits and demerits – breeds – classification.
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.
29. Brooding management - Common litter material - litter management - care and management of broiler.
30. Care and management of grower and layer.
31. Nutrition - feed formulation - composition of chick, grower, layer - broiler -starter and finisher mashes.
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 management 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

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8
CO1	-	-	-	2	-	-	-	-
CO2	-	-	-	1	-	-	1	1
CO3	-	-	-	3	-	-	1	1
CO4	-	-	-	3	-	-	1	1
CO5	1	-	-	3	-	-	1	1

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## **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**

Introduction to Computer - Evolution and Generation of Computers - Classification of Computers - Computer Organization and Architecture - Data Representation - Memory and Storage - Input Output Media - Current Trends in Computer.

#### **UNIT II: Operating System And Software**

Introduction to Software - Categories - System Software - Evolution and Types of Operating System - Functions of Operating System - Application Software - Installation and Un-installation - Office Automation Software - Word Processing - Spread sheet - Presentation - Multimedia and its Building Blocks - Multimedia Applications - Virtual Reality - Current Trends in System and Application softwares.

#### **UNIT III: Computer Networks And Internet**

Introduction to Computer Networks- Topologies - Communication Protocol - Network Devices - Introduction to Internet - Internet Applications - Internet Tools - Web Browser - Email client - Search Engines - Instant Messaging - Computer Security - Current Trends in Computer Networks and Internet.

#### **UNIT IV: Computer Programming And Languages**

Introduction to Computer Programming - Algorithm - Flowchart - Decision Tables - Pseudo code - Program Control Structures - Programming paradigms - Introduction to Programming Languages - Generation of Programming Languages - Current Trends in Computer Programming and Languages.

#### **UNIT V: Database Management Systems**

Introduction to Database -Logical and Physical Data Concepts - Data Base Management System - DBMS Architecture - Database Models - Normalization Techniques - Types of Databases - Introduction to Structured Query Language - SQL Commands - Current Trends in Database Management Systems.

### **THEORY LECTURE SCHEDULE**

- 1 Introduction to Computer, Evolution of Computers, Generation of Computers and Classification of Computers.
- 2 The Computer System, Computer Organization and Architecture, Central Processing Unit, Inside a Computer.
- 3 Data Representation in Computers, Computer Memory and Storage, Input Output Media and Current Trends in Computer.
- 4 Introduction to Software, Categories of Software, System Software, Evolution of Operating System, Types of Operating System, Functions of Operating System.
- 5 Introduction to Application Software, Installation and Un-installation of software, Software Piracy, Software Terminologies, Office Automation Software, Word Processing, Spread sheet, Presentation.
- 6 Introduction to Multimedia, Building Blocks of Multimedia, Multimedia Systems, Multimedia Applications, Virtual Reality. Current Trends in System and Application softwares.
- 7 Introduction to Computer Networks, Network Topologies, Communication Protocol, Network Devices



- 8 Introduction to Internet, Internet Applications, Internet Tools, Web Browser and Email client
- 9 **Mid-semester examination**
- 10 Search Engines, Instant Messaging, Computer Security. Current Trends in Computer Networks and Internet.
- 11 Introduction to Computer Programming, Algorithm, Flowchart, Decision Tables, Pseudo code and Program Control Structures
- 12 Programming paradigms, Introduction to Programming Languages
- 13 Generation of Programming Languages, Current Trends in Computer Programming and Languages.
- 14 Introduction to Database, Logical and Physical Data Concepts, Data Base Management System and its Architecture, Database Models
- 15 Normalization Techniques, Types of Databases, Introduction to Structured Query Language
- 16 Data Definition Language, Data Manipulation Language
- 17 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
- 14 Working with Programming basics : Algorithm, Flowchart, Pseudo Code and Coding
- 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

	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	X	X	X	-	-
CO2	-	-	-	X	X	X	-	-
CO3	-	-	-	X	X	X	-	-
CO4	-	-	-	X	X	X	-	-



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## 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

Origin and distribution -area and production-composition and uses - climate and soil requirements - season-varieties and hybrids - seed rate- nursery practices - containerized transplant production and transplanting - preparation of field - spacing - cropping system - planting methods - manuring and nutrient management - water and weed management - mulching- nipping- fertigation - nutrient deficiencies- physiological disorders - growth regulators - sex expression- maturity indices- harvest -yield- seed production and storage of the following 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

Identification and description of tropical vegetable crops - layout of kitchen garden - nursery practices and transplanting - preparation of field and sowing/planting for direct sown/transplanted vegetable crops - manures and fertilizer application/fertigation schedule and intercultural operations - mulching - growth regulators - nipping - identification of nutrient deficiencies - physiological disorders - harvest indices and maturity standards - post-harvest handling and storage - marketing - cost of cultivation - project preparation for commercial cultivation - visit to commercial vegetable growing areas.

## 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.
8. Contract farming.
9. Rice fallow cultivation, river bed cultivation and rainfed cultivation.
10. GAP in vegetable production.
11. Origin and distribution -importance and uses - climate and soil requirements - season - varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting methods- manuring and nutrient management - water and weed management -fertilization - nutrient deficiencies - physiological disorders - use of chemicals and growth regulator - sex expression- constraints in production - harvest - yield and storage of the following crops:
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.

#### **CO-PO MAPPING MATRIX**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	3	2	-	2	1	-
CO2	2	2	3	2	-	1	2	3

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## **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**

Cocount, 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 identificationof 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. Arecanut
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.

### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	3	2	-	2	1	-
CO2	2	2	3	2	-	1	2	3

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### 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, *Candidatusphytoplasma*, 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

Plant Pathology: definition, history – Pathogens: Protozoa, chromista, fungi, bacteria, virus, viroid, virusoid, *Candidatus Phytoplasma*, Fastidious Vascular Bacteria, Spiroplasma, Algae and Phanerogamic parasites - Non parasitic diseases - Koch's postulates - Types of parasitism.

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

Classification of Kingdom – Protozoa - important taxonomic characters, symptoms and life cycle of *Plasmodiophorabraceae* - 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, Macrophomina, 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 *Cephaleuros*, Phanerogamic parasites and Non-parasitic diseases.

### **Unit- IV: Epidemiology and Plant Disease Management**

Epidemiology of crop diseases - role of weather factors in disease development. Survival and spread of plant pathogens - Disease Surveillance and Forecasting. Principles of crop disease management - prophylaxis: exclusion, eradication, direct protection and immunization : cross protection and host plant resistance. Fungicides - classification - characteristics of an ideal fungicide - group of fungicides - non systemic and systemic. New generations fungicides- formulations - methods of application of fungicides- special methods of application - Precautions and safety measures in handling of fungicides.

### **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), Pestalotia (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
2. Cause of Plant diseases - pathogen - fungi - bacteria, viroid, virusoid virus and *Candidatus Phytoplasma*. Fastidious Vascular Bacteria, Spiroplasma, Algal and Phanerogamic parasite - Koch's postulates.
3. General characters of fungi - mycelium - Spore-asexual, sexual and vegetative spores - Asexual and sexual fruiting bodies.
4. Classification of Kingdom - Protozoa - important taxonomic characters and Symptoms and life cycle of *Plasmodiophorabraceae*
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 *Penicillium*, *Leveillula*, *Phyllactinia* and *Uncinula*, *Helminthosporium*, *Alternaria*, *Cercospora* and *Curvularia*, *Fusarium* and *Verticillium*
11. Symptoms and important characters of *Colletotrichum*, *Pestalotia*, *Macrophomina*, and *Botryodiplodia*,
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*
16. Plant pathogenic bacteria- general characters - Symptoms, mode of entry and spread of bacterial diseases - leaf spot, streak, blight, canker, scab, wilt, crown gall, ring rot, head rot and soft rot.
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, bunchy 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, eradicator, therapeutic, 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 *Plasmiodiophorabraceae* (club root), *Pythium* (damping-off), *Phytophthora* (late blight)
  3. Study of symptoms, fungal characters and host parasite relationships of *Plasmopara*, *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*, *Hemileia* (Rust), *Ustilago* (Smut), *Rhizoctonia* (Root rot), *Exobasidium* (Tea Blister blight), *Athelium* (Sclerotium rot), *Ganoderma*, *Agaricus*, *Pleurotus* and *Calocybe* (Mushroom)
  9. Symptoms of bacterial diseases – leaf spot, blight, canker, scab, crown gall, wilt and soft rot.
  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, phyllody and spike), algal diseases – *Cephaleuros*, Phanerogamic parasites and Non-parasitic diseases
  13. Study of various groups of fungicides and preparation of Bordeaux mixture and Bordeaux paste.
  14. Methods of application of fungicides – seed treatment, dry, wet – foliar spraying and soil drenching, root feeding, corm injection, and capsule application, acid delinting, pairing and pralinage and post harvest treatment.
  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

## CO - PO MAPPING MATRIX

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	2	-	2	2	1	1	3	-
CO 2	-	1	3	3	1	-	3	-
CO 3	2	1	3	2	1	1	3	-
CO 4	-	-	3	2	2	-	2	2
CO 5	-	-	3	-	1	3	3	1

## REFERENCES

1. Agrios, G.N. 2005. Plant Pathology.. 5<sup>th</sup> Edition Academic Press, New York
2. Alice, D. and Jeyalakshmi, C. 2014. Plant Pathology, AE Publications, Coimbatore
3. Nene, Y.L. and Thapliyal, P. N. 1998. Fungicides in Plant Disease Control. Oxford and IBH Publishing Co. Ltd., New Delhi.
4. Prakasam, V., Raguchander, T. and Prabakar, K. 1998. Plant Disease Management, A.E. Publications, Coimbatore.
5. Vidhyasekaran, P. 1993. Principles of Plant Pathology, CBS Publishers, New Delhi.

## E- RESOURCES

1. [www.ucmp.berkeley.edu/fungi](http://www.ucmp.berkeley.edu/fungi)
2. [www.ictv.org](http://www.ictv.org)
3. [www.vivo.library.cornell.edu](http://www.vivo.library.cornell.edu)
4. [www.plantdisease.org](http://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

History and development of Soil Science and its branches.. Origin of earth - theories - planetesimal and nebular hypothesis - Composition of Earth's crust .Soil forming rocks and minerals-origin-classification. Weathering of rocks and minerals-physical, chemical and biological weathering.

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

Soil formation- soil forming factors-active and passive. Soil forming processes - fundamental and specific soil forming processes .Soil profile-master horizons, subordinate horizons.-Definition of soil- Soil composition Pedological and edaphological concepts

#### Unit III- Physical properties -1

Soil physical properties and their significance -Soil texture-classification of soil separates, properties of soil separates, Particle size analysis - Stokes law assumptions and limitations, textural classes. Soil structure-classification, soil aggregates, evaluation of soil structure, significance. Pore space types, factors affecting porosity, manipulation. Bulk density and particle density - relationships, factors, significance and manipulation. Soil colour-factors, attributes and significance. Soil consistency-forms, factors, limits and significance.

#### Unit IV- Physical properties -1I

Soil water classification, potentials, Soil moisture constants, movement of soil water- saturated and unsaturated flow – Infiltration, hydraulic conductivity, percolation, permeability. Soil air- composition, gaseous exchange, influence of soil air on plant growth. Soil temperature-thermal properties of soils, flow of heat, soil temperature regimes, influence of soil temperature on plant growth.

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

Soil Chemical properties- Soil colloids – Properties, types and significance – Layer silicate clays – their genesis and sources of charges – Ion exchange – CEC, AEC and Base saturation – Factors influencing Ion exchange – significance. Soil reaction, Buffering capacity and EC Soil Organic matter – sources- chemical composition-decomposition-humus formation-role and functions of organic matter in soil-. Soil organisms - Beneficial and harmful effects

#### **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
6. Soil formation – soil forming factors – classification – active and passive. And their role in soil formation – catena – definition
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- Pedological and edaphological concepts
1. 10. Soil physical properties- soil texture – definition – various inorganic components in soil and their properties – particle size analysis – methods – various textural classes in soil and their properties
11. Stoke’s Law – assumptions and limitations – significance of soil texture
12. Soil structure – classification – types, classes and grades of soil structure – - factors affecting soil structure
13. Genesis of soil structure- importance of soil structure and its management
14. Density of soil – bulk density and particle density – factors affecting density parameters – importance of bulk density of soil – soil compaction – its importance

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
33. Carbon: nitrogen (C:N) ratio of commonly available organic residues – significance of C:N ratio in soil fertility . Functions of soil organic matter in soil
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-1I
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.

#### CO-PO MAPPING MATRIX

CO/PO	PO1	PO 2	PO3	PO 4	PO 5	PO6	PO7	PO8
CO 1	1	-	-	-	-	-	-	-
CO 2	-	1	-	-	-	-	-	-
CO3	-	-	1		-	2	2	-

#### REFERENCES

1. Brady N.C. and Ray, R. Weil. 2002. The Nature and Properties of Soils. Pearson Education Inc., New Delhi.
2. Dilip Kumar Das. 2015. Introductory Soil Science. Kalyani Publishers, Ludhiana.
3. Sahai, V.N. 2001. Fundamentals of Soil, Kalyani Publishers, Ludhiana
4. Rathinasamy, A and B.BakiyathuSaliha.2014 Fundamentals of Soil Science. Scientific Publishers. Jodhpur
5. R.K.Mehra. 2006. Text Book of Soil Science. ICAR. New Delhi
6. Kolay A.K. 2008. Basic concepts of Soil Science. New Age International Publishers. New Delhi
7. Rajput, S.G.2012. Concepts of Soil Science. Kalyani Publishers, Ludhiana
8. Dipak Sarkar and Abhijit Haldar. 2010. Physical and chemical methods in soil analysis New Age International Publishers. New Delhi

#### E-reference:

1. <http://www.sciencedirect.com/science/books>
2. <http://ftp.wcc.nrcs.usda.gov/H...soil> order

### 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 eutherics; 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, isoalleles.

### 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



inheritance - 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

Study of microscopes - Preparation of fixatives and stains - pre treatment of materials for mitosis and meiosis - study of mitosis and meiosis. Study of genetic ratios of - monohybrid, dihybrid - incomplete dominance. Gene interaction - multiple alleles and multiple factors. Study of linkage, estimation of strength of linkage and recombination frequency in two point and three point test cross data and F<sub>2</sub> data - Drawing of genetic map - interference and coincidence

### 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.
3. Cell division - mitosis, meiosis and their significance, cell cycle; zygote formation and embryo development - identical and fraternal twins.
4. Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram - chromosome banding.
5. Types of chromosomes based on position of centromere, based on structure and function: normal and special chromosomes - polytene, lampbrush, based on the role in sex determination: autosomes and allosomes, Other types of chromosomes - B, ring and isochromosomes.
6. Chromosomal aberration: Variation in chromosome structure - deletion, duplication, inversion and translocation - genetic and cytological implications.
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
11. Terminologies: gene, allele, locus, homozygous, heterozygous, hemizygous, genotype, phenotype, monohybrid, dihybrid, trihybrid, polyhybrid.
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)
14. 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

18. Quantitative inheritance - Multiple factor hypothesis - Nilsson Ehle experiment on wheat kernel colour.
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 Punnett - 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.
24. 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.
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.
27. 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.
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 Monod; 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.
3. Study of behavior of chromosomes in mitosis.
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 F<sub>2</sub> 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 carry out cytological analysis in breeding populations

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	3	-	-	-	-	-
CO2	3	-	2	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-

### REFERENCES

1. Gupta P.K., 1997. Cytogenetics. Rastogi Publications, Meerut
2. Verma, P.S. and V.K. Agarwal. 2007. Genetics. S.Chand and Company Ltd./ New Delhi.
3. Stansfield, W.D. 1990. Theory and problems of genetics. Mc-Graw Hill Book Co., New York
4. Pundhansingh. 2014. Elements of Genetics. Kalyani Publishers

#### Further reading

1. Benjamin Lewin. 2005. Genes IX Oxford University Press, Oxford.
2. Russel, P.J. 2000. Fundamentals of genetics. Addition Wesley Longman Publishers, USA
3. Daniel Sundararaj, G. Thulasidas and M. Stephen Dorairaj, 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai -15.
4. Strickberger. M.W. 1996. Genetics. Prentice-Hall of India Pvt. Ltd. New Delhi.
5. Singh, B.D. 2004. Fundamentals of Genetics, Kalyani Publishers, Chennai.

### E-RESOURCES:

1. [www.nmsu.edu](http://www.nmsu.edu),
2. [www.biology200.gsu.edu](http://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

Irrigation methods - surface, sub-surface and advanced methods - drip, sprinkler - layout, suitability, merits and demerits. Merits of fertigation - water soluble fertilizers. Quality of irrigation water - Utilization of poor quality water (saline, effluent and sewage water) for irrigation.

#### Unit-IV Biology, Ecology and principles of weed management

Weeds - Definitions - harmful and beneficial effects - propagation and dissemination - Seed dormancy- Crop weed competition and allelopathy - Concepts of weed prevention - Methods of weed management: Cultural, chemical, biological methods - Integrated weed management.

#### Unit-V : Herbicides and Weed Management

Herbicides - classification - formulation - methods of application; Introduction to Adjuvants and their use in herbicides - Weed management in major vegetable, flower and fruit crops - lawns and plantation crops. Aquatic and problematic weeds and their management. **Current streams of thought.**

### PRACTICAL

Determination of soil moisture, field capacity and wilting point - Measurement of irrigation water - units - moisture extraction pattern - WUE - Methods to enhance WUE - Acquiring skill in different surface and sub surface irrigation - design and operation of sprinkler and drip irrigation - calculation in irrigation Agronomy - Identification of Wet, Dry and Garden land weeds - Agronomic method of weed management- Herbicides - Classification - Formulations - Calculations - Equipments - WCE - Economics - Problematic weeds - Weed survey.

### 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.

3. Soil – plant – water relationship - Soil water movement - Water movement along soil plant atmosphere system
4. Soil moisture constants - saturation - field capacity - permanent wilting point - Available soil moisture - moisture equivalent - hygroscopic coefficient - determination - uses.
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.
6. Scheduling of irrigation - different approaches - Climatological approach, empirical methods, crop co-efficient.
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
12. Crop weed competition and Allelopathy - Concept of weed prevention .
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.
8. Calculations irrigation Agronomy.
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.

#### CO-PO MAPPING MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8
CO 1	3	1	1	1	-	-	-	-
CO 2	2	1	2	-	1	-	-	-
CO 3	3	1	-	1	-	-	-	-
CO 4	2	1	-	1	1	1	-	-
CO 5	2	2	-	2	1	-	-	-

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#### 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**

Factor - Factor relationship - Meaning. Isoquant: Definition, types, isoquant map - characteristics / properties - Factor Intensity - Marginal Rate of Technical Substitution - Elasticity of factor substitution - Iso-cost line. Principle of Cost Minimization / Least Cost Combination of Inputs - Isoclines, Ridgelines and Expansion path - Effect of input price changes on the least cost combination - Returns to scale.

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

Product - Product relationship: Meaning - Enterprise relationship: Joint products, complementary, competitive and supplementary products - Production Possibility Curve - Marginal Rate of Product Substitution - Iso-revenue line - Optimum product combination - Principle of Equi-Marginal Returns - Opportunity cost principle - Principle of comparative advantage - Minimum loss principle.

### **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.
4. Factor - Product relationship: Meaning - Agricultural production function: Meaning, definition - Laws of Returns: Law of constant, increasing and decreasing returns.
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.
8. Economies of scale - Economies of size - Factor - Factor relationship: Meaning - isoquant: Definition - Types.
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.



12. Isoclines, ridgelines and expansion path - Effect of input price changes on the least cost combination - Returns to scale.
13. Product – Product relationship - Meaning - Production possibility curve - Marginal rate of product substitution.
14. Enterprise relationship: Joint products, complementary, competitive and supplementary products - Iso-revenue line - Optimum product combination - Principle of equi-marginal returns - Opportunity cost principle - Principle of comparative advantage - Minimum loss principle.
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.
16. Types and systems of farming: Types - Specialized, diversified, and mixed farming - Systems of farming: Co-operative, collective, capitalist, state and peasant farming.
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
13. Preparation of cash flow statement.
14. Preparation of complete and partial budgets
15. Preparation of farm plan.
16. Graphical solution to linear programming problem.
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

### **CO-PO MAPPING MATRIX**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	2	-	-	-	-
CO2	-	-	-	-	3	-	-	-
CO3	-	-	-	2	-	-	-	2
CO4	-	-	-	2	-	2	-	2

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## 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

Importance of Apiculture – Species and castes of bees, morphology, Colony organization, bee pasturage, bee foraging, swarming. Apiary – selection of site – bee-keeping equipment and seasonal management. Bee enemies, diseases of bees, bee pollination in relation to horticultural crops.

#### Unit-II: Sericulture

Importance of Sericulture – Silkworm Types- mulberry and non -mulberry silkworms (Eri, Tassar and Muga silkworms). Voltinism – multivoltine – bivoltine – hybrids. Biology of mulberry silkworm, Moriculture – varieties – mulberry cultivation – harvesting – preservation of leaves. Mulberry silk worm rearing – rearing house – room and bed disinfectants – Chawki rearing – Rearing of late age worms. Mounting – mountages – harvesting of cocoons. Pests and diseases of mulberry silkworm and their management. Uses of Silk.

#### 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

processing. Minor Productive Insects - Cochineal insect, Gall insect, Aesthetic and Scientific value of insects.

Survey and sampling for plant parasitic nematodes. Extraction of plant parasitic nematodes and cysts from soil and roots (Cobb's sieving technique, Baermann funnel technique, conical flask technique, Sugar floatation technique, Fenwick can method, Incubation and Blender technique). Mounting of plant parasitic nematodes - Diagnostic characters of Orders *Tylenchida* and *Dorylaimida*. Identification of important plant parasitic nematodes of major horticultural crops - *Meloidogyne*, *Heterodera*, *Globodera*, *Tylenchulus*, *Radopholus*, *Rotylenchulus*, *Ditylenchus*, *Hirschmanniella*, *Aphelenchoides* and *Pratylenchus*.

**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.
2. Colony organization and life history - bee castes - duties - social behaviour.
3. Bee pasturage, Apiary, bee foraging and swarming. Bee enemies and diseases of bees
4. Bee pollination, seasonal management, bee products and their uses.
5. Types of silkworm - Non - mulberry, Eri, Tasar and Muga silkworms. Voltinism - Morphology and biology of mulberry silkworm
6. Mulberry cultivation - soil type - mulberry varieties - Methods of propagation - Nursery preparation - Main field preparation - Methods of planting - Nutritional requirements - Water management- Pruning methods - Methods of harvesting - preservation of leaves - Pests of mulberry plants.
7. Mulberry silk worm rearing - Chawki rearing and Rearing of late age worms - rearing house- grainage
8. Mounting - mountages - harvesting of cocoons. Pests and diseases of mulberry silkworm and their management - Uses of silk.
9. **Mid Semester Examination**
10. Lac culture- Species of Lac insect- Morphology, biology and secretion of lac.
11. Host plants of lac insect -Inoculation of Lac insect and Yield. Enemies of lac insect - Lac Processing, Uses of lac.
12. Minor Productive Insects - Cochineal insect, Gall insect, Aesthetic and Scientific value of insects
13. Nematology - Introduction -Importance of plant parasitic nematodes of horticultural crops - entomophilic nematodes and Economic losses.
14. Elementary knowledge on morphology of nematode - Classification based on feeding habits and ecology.
15. Taxonomy of important plant parasitic nematodes.
16. Biology and ecology of important plant parasitic nematodes of horticultural crops - *Meloidogyne*, *Heterodera*, *Globodera*, *Tylenchulus*.
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.
3. Studies on seasonal management and identification of enemies of honey bees.

4. Identification of Silkworm types - mulberry, Eri, Tasar and Muga silkworms and acquaintance with life stages of mulberry silkworm. Acquaintance with Mulberry varieties and preparation of mulberry cuttings.
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.
13. Identification of nematodes - Meloidogyne, Heterodera, Globodera, Tylenchulus, Radopholus, Rotylenchulus, Ditylenchus Hirschmanniella, AphelenchoidesPratylenchus and Tylenchulus.
14. Observing the life stages of *Meloidogyne*.
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

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	1	1	3	1	3	3	2
CO 2	3	1	1	3	1	3	3	2
CO 3	1	1	1	2	1	2	2	2
CO 4	1	1	2	2	3	3	3	2

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## **AEX 218 RURAL SOCIOLOGY, EDUCATIONAL PSYCHOLOGY AND DIMENSIONS OF EXTENSION EDUCATION (2+1)**

### **LEARNING OBJECTIVES:**

#### **To enable the students to learn about**

- Basics concepts related to rural sociology and Basics concepts related
- 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 - Teaching - 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, RLEGP, DPAP, CADP, FFW, 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.
4. Sociology, Rural Sociology, rural society - Definitions, rural - urban differences, importance of rural sociology in extension education.
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;
9. Social Interaction Process - definition, basic social processes. Social Change - concept, factors influencing social change.
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.
12. Basic principles of Human behaviour - Sensation, Attention, Perception - meaning, characteristics.



13. Intelligence – concept, types, measurement, factors affecting intelligence; Personality – concept, types, measurement, factors influencing personality.
14. Teaching–Learning Process – Teaching – definition, meaning, principles of teaching, steps in extension teaching.
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.
21. 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).
22. First line Extension System – KrishiVigyan Kendra (KVK), Institution Village Linkage Programme (IVLP), Agricultural Technology Information Centre (ATIC), Frontline demonstrations.
23. Rural Development – meaning, definition, concept and importance. Democratic Decentralization –Meaning, Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup.
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 Jayanthi Gram Swarozgar Yojana (SGSY).
30. Prime Minister Employment Yojana (PMEY), Swarna Jayanthi ShahariRozgar Yojana (SJSRY), Pradhan Mantri Gram Sadak Yojana (PMGSY), Sampoorna Grameen Rozgar Yojana (SGRY).
31. Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Providing Urban Amenities to Rural Areas (PURA), National Agricultural Innovation Project (NAIP), NADP (RKVY).
32. Women Development Programmes – Development of Women and Children in Rural Areas (DWCRA), 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 (DWCRA), 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).
8. Data collection methods – survey, questionnaire, mailed questionnaire, interview schedule, observation method, case study.
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

#### CO-PO MAPPING MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	-	-	1	-	-	1	-	-
CO2	-	2	-	-	2	-	-	-
CO3	-	-	1	-	-	-	3	3
CO4	-	2	-	2	-	-	-	-
CO5	1	-	2	-	-	2	3	-

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5. [www.panchayat.gov.inwed.nic.in](http://www.panchayat.gov.inwed.nic.in)
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7. [mhupa.gov.in](http://mhupa.gov.in)

### 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**

Scope and importance of commercial floriculture in India – distribution of important flower crops – area and production – export potential – international and national floral industry. Institutions and developmental agencies involved in promotion of floriculture – TANFLORA, NHM, NHB, APEDA – cropping systems in flower crops – flower forcing- soil and climate – botany – species and varieties – propagation – principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – intercultivation – harvest - yield and post harvest handling of the following loose flower crops: Rose, Jasmine, Chrysanthemum and Tuberose.

##### **Unit-II: Production Technology of Loose Flowers**

Crossandra, Marigold, Nerium, Gomphrena, Celosia and China aster.

##### **Unit-III: Production Technology of cut flowers I**

Soil and climate – Botany – species and varieties – propagation – principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – inter cultivation – Harvest - yield and post harvest handling of the following cut flower crops: cut roses, carnation, gerbera, cut chrysanthemum and gladiolus.

##### **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, alstromeria and flowering fillers viz., limonium, asparagus, ivy, gypsophila and cut foliage- 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.
- 3.&4.Importance and uses - origin and history - area and production - botany - species and varieties - classification - propagation - soil, climate, season and planting - nutrition and irrigation - management practices - role of growth regulators - pruning - plant protection - harvest - yield and post harvest handling of the following loose flower crops: Rose.
5. &6. Jasmine .
- 7.& 8. Chrysanthemum.
9. Tuberose
10. Crossandra
11. Marigold
12. Nerium and Gomphrena
13. Celosia and China aster.
14. Flower forcing and factors affecting flower production under controlled atmospheric conditions.
- 15.&16. Importance and uses - origin and distribution - area and production - botany and varieties - propagation and planting - environmental factors - pruning - pinching - production constraints - inter culture - nutrient requirement in fertigation systems - plant protection - harvesting - yield and post harvest handling of the following cut flower crops: Cut rose.
17. **Mid Semester Examination**
18. &19.Carnation
20. &21.Gerbera
22. &23.Chrysanthemum
24. &25.Gladiolus
26. &27.Orchids
28. Anthurium
29. Bird of paradise and heliconia
30. Asiatic lily, alstromeria,
31. Foliage and flowering fillers - limonium, asparagus ivy, gypsopals, baby eucalyptus
32. Methods of floral concrete extraction from rose, jasmine and tuberose and other value addition processes in loose flowers.
33. Packaging, grading and export standards for important commercial flowers.

34. Constraints in flower production and future thrust.

### PRACTICAL SCHEDULE

1. Rose – identification and description of species and varieties – propagation and planting – pruning management.
2. Jasmine sp. – identification and description of species and varieties – propagation and planting – pruning management.
3. Tuberose and crossandra – identification, description of species and varieties, propagation and planting.
4. Chrysanthemum and marigold – identification and description of species and varieties – propagation and planting.
5. Nerium and gomphrena – identification, description of species and varieties, nursery raising and planting.
6. Celosia and china aster – identification, description of species and varieties, nursery raising and planting.
7. Preparation of project for loose flower production under open conditions.
8. Cut rose – identification and description of species and varieties – media – planting netting – pruning and other important inter cultural practices.
9. Carnation and gerbera – identification and description of species and varieties – media – planting – harvesting.
10. Cut chrysanthemum and gladiolus – identification and description of species and varieties – media – planting – plant propagation – pinching and dis – budding.
11. Anthurium and orchids – identification and description of species and varieties – media preparation – planting.
12. Bird of paradise and heliconia – identification and description of species and varieties – propagation – media preparation – planting – planting material – shade requirement.
13. Asiatic lily, alstromeria, flowering and foliage fillers – identification and description of species/varieties – propagation – media preparation – planting.
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.

### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	3	2	-	2	1	-
CO2	2	2	3	3	-	1	2	3

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#### E-RESOURCES

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2. [www. Hitech horticulture.com](http://www. Hitech horticulture.com)
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4. [www.wikihow.com](http://www.wikihow.com)
5. [www.theflowerexpert.com](http://www.theflowerexpert.com)
6. [www.keralaagriculture.gov.in](http://www.keralaagriculture.gov.in)

### HOR 221 STUDY TOUR (0 + 1)

#### LEARNING OBJECTIVES:

- To provides 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.

#### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	3	2	2	1	2	-
CO2	2	3	3	3	2	3	2	2

### 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

Insect Ecology - Introduction and definition -Balance of life in nature - Trophic level, food chain, food web. Population dynamics -abiotic factors and biotic factors. Pest -

definition, categories – Pest outbreaks and causes for outbreaks. Pest surveillance and monitoring–Forecasting – ETL and EIL.

### **Unit-II: Components of IPM**

Integrated Pest Management – Definition; Advantages and limitations of IPM. Components of IPM – Cultural, Mechanical, Physical and Legal methods, Host plant resistance in IPM, Botanical insecticides in IPM – antifeedants and repellants. Formulation techniques of botanicals. Traditional methods in IPM, Biotechnology in 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 – Moulting inhibitors and JH mimics in IPM

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

Chemical methods – Classification of pesticides- mode of action – formulation types – Toxicity ranges –. Basic and newer formulations of insecticides. Safety and Hazards of insecticides –Bioaccumulation and Biomagnification. Compatibility and phytotoxicity. Insecticide resistance, Resurgence and residue management- pesticide appliances – methods of spraying

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

Integrated Pest Management in different ecosystems – Vegetables, Fruits, Plantation crops and Flower crops – Present status of IPM in Horticultural Crops in India- Plant clinic centres – Farmers field school and their role in IPM. **Current Streams of thought.**

### **PRACTICAL**

Study of different types and symptoms of insect damage. Sampling techniques for the estimation of insect population and damage. Practices in Cultural, Mechanical and Physical methods. Studies on distinguishing characters of resistant varieties. Traps in pest management. Identification of parasitoids and predators. Mass culturing techniques of *Trichogramma* and *Chrysopa*. Mass production of NPV and Fungal pathogens. Identification of plants of insecticidal value. Preparation of Botanical formulations. Practices in Traditional methods of pest management. Different groups of pesticide formulations and label information. Precautions in pesticide applications – first aid and antidotes in case of insecticide poisoning. Pesticide application equipments – types and uses. Preparation of spray fluids for field application. Calculation of dose/concentration of insecticides. Compatibility of pesticides and phytotoxicity of insecticides. Application techniques of insecticides.

**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.
2. Balance of life in nature – Trophic level –food chain, food web. Population -biotic potential and Life table
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**
10. Biological methods – classical biological control, merits and limitations, Parasitoids and Predators – definition – difference between a predator and a parasitoid – Types of parasitoids – Types of parasitism.
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, Kairomones and Synomones. Insect growth regulators in IPM – Moulting 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
16. Integrated pest management strategies for Important Plantation crops and Flower crops.
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
10. Preparation of Botanical formulations.
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.
14. Calculation of doses/concentrations of insecticides.
15. IPM Practices for vegetable and fruit pests
16. IPM Practices for plantation and flower 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 rationals 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



## CO-PO MAPPING MATRIX

COs/Pos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	1	1	1	2	2	1	3	2
CO 2	3	2	3	3	3	3	3	2
CO 3	2	1	2	3	1	1	2	2
CO 4	3	1	1	3	1	2	2	2
CO 5	3	1	2	1	2	1	3	2
CO 6	3	1	2	2	2	2	3	2

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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 high lighten 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

Organic matter decomposition and humus formation- C:N ratio. Carbon cycle. Nitrogen cycle - biological nitrogen fixation (BNF) – nodulation and biochemistry of BNF. Phosphorus cycle and sulphur cycle. Microbial transformation of potassium, zinc and silica in soil – role of soil enzymes-Nutrient transformation – Xeno biotic degradation

### 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

Bioinoculants – types of bioinoculants- carrier based and liquid based – nitrogen fixers, P, K, Zn and Si solubilizers and phosphate mobilizers, sulphur oxidizers and PPFM. BGA and Azolla. Mass production and quality control of bacterial and fungal bioinoculants. Methods of application of bioinoculants.

### **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**

Enumeration of soil microbial population - quantitative and qualitative methods. Organic matter decomposition. Isolation of symbiotic nitrogen fixing bacteria, free living, associative and endophytic nitrogen fixing bacteria. Isolation of phosphobacteria and sulfur oxidizing bacteria. Isolation of zinc and silicate solubilizing and potassium releasing bacteria. Isolation of plant growth promoting rhizobacteria (*Pseudomonas* sp) and phyllosphere (PPFM) microbes. Examination of AM fungal infection in plants and recovery of AM spores from soil. Isolation of Blue Green algae. Mass production of bacterial bioinoculants, blue green algae, azolla and AM fungi. Isolation of yeast and *Lactobacillus*. Industrial products – wine and sauerkraut fermentation.

### **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
6. Biological nitrogen fixing microorganisms – free living, associative N fixers.
7. Endophytic and symbiotic microorganisms
8. Nodulation in *Rhizobium*- legume and *Frankia* – actinorhizal symbioses.
9. Biochemistry of nitrogen fixation – assimilation and dissimilation pathway of N<sub>2</sub> fixation
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 Bionoculants
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 o 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.

### CO - PO MAPPING MATRIX

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	1	3	1	1	1
CO 2	1	1	2	2	2	-
CO 3	1	1	2	1	1	1
CO 4	2	1	2	2	1	1
CO 5	3	1	3	3	1	1

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## E.RESOURCES

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2. [www.fao.org/docrep/009/a0100e/a0100e05.htm](http://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

Introduction to mushrooms – edible and poisonous type – edible mushrooms – *Pleurotus*, *Agaricus*, *Volvariella* and *Calocybe* - preparation of culture media – pure culture techniques – sterilizing techniques – media – glassware – maintenance of culture – mother spawn production – types of spawn – polybag method – multiplication of spawn mushroom cultivation techniques – maintenance of spawn running and cropping room – harvest – packing and storage of mushroom – problems in cultivation – pests, diseases and weed moulds – management – strategies – nutritional value – post-harvest technology – methods of preservation – other uses of mushroom – cost analysis and project preparation – Record certification.

### 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.

### CO - PO MAPPING MATRIX

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	1	-	1	-	3	-	3	-
CO 2	1	-	2	1	3	3	1	1
CO 3	-	-	-	2	3	2	3	-
CO 4	1	-	2	-	3	2	2	-
CO 5	-	-	1	2	3	3	2	1
CO 6	-	-	-	-	3	3	1	-

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5. Henry, L.D.C. and Lewin, H. 2011. Crop Diseases - Identification, Treatment and Management, New India Publishing Agencies, New Delhi.
6. Ram Dutta. 2007. Advances in Mushroom Science. Satish Serial Publishing House, New Delhi.

### E-RESOURCES

1. [www.nrcmushroom.org](http://www.nrcmushroom.org)
2. [www.un.csam.org>tm.mushroom](http://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

Objectives and role of plant breeding - historical perspective - activities in Plant Breeding. Centres of origin - contribution of Vavilov, Harlan, Zhukovsky - law of homologous series. Plant genetic resources - importance - germplasm - types - activities

- gene erosion - gene bank - collection - conservation - types of conservation - agencies - quarantine. Germplasm: evaluation - use of descriptors, documentation, utilization; Agencies - national and international; germplasm exchange - quarantine. Modes of reproduction - sexual - asexual - self and cross fertilization - significance of pollination. Self incompatibility - classifications - mechanisms - application - measures to overcome and limitations. Sterility - male sterility - classification - CMS, GMS, CGMS - inheritance and applications. TGMS, PGMS, Gametocides, Transgenic Male sterility and applications. Apomixis - introduction - classification - applications; Parthenocarpy and its types.

### **Unit II: Breeding methods of self pollinated crops**

Basic biometrics - nature and significance of qualitative and quantitative variation - phenotypic, genotypic and environmental - heritability and genetic advance. Plant introduction as a breeding method - types of introduction - objectives - quarantine - acclimatization - achievements - merits and demerits. Genetic basis of self pollinated crops - Vilmorin principle of progeny selection - Johannsen's pure line theory. Breeding methods for self pollinated crops without involving artificial hybridization: Pure line selection - merits and demerits - achievements; Mass selection in self pollinated crops - types - comparison of mass and pureline selection - achievements. Breeding methods of self pollinated crops involving artificial hybridization: Creating variability in self pollinated crops - Hybridization and selection -- choice of parents - combining ability - combination breeding and transgressive breeding - kinds of emasculation. Pedigree breeding - mass pedigree - merits - demerits - achievements; Bulk breeding - merits - demerits - achievements. Comparison of pedigree and bulk breeding methods. Single Seed Descent (SSD) method - application - merits and demerits. Backcross breeding - prerequisites - procedures for transferring dominant and recessive genes - merits - demerits - multi lines and multi blends - population improvement approach in self-pollinated crops.

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

Genetic structure of a population in cross pollinated crop - Hardy Weinberg law - gene frequencies in random mating population - principles in population improvement. Breeding methods of cross pollinated crops without involving artificial hybridization: Mass selection in cross pollinated crops - modified mass selection - unit selection - mass selection with progeny testing - half sib family selection - full sib family selection. Breeding methods of cross pollinated crops involving artificial hybridization: Recurrent selection principles - types - merits and demerits. Heterosis breeding - theories - genetic basis - hybrid vigour - estimation of heterosis - inbreeding depression - development of inbreds. Heterosis breeding - procedure - use of male-sterility systems and manual emasculation in hybrid seed production - maintenance of parental lines -types of hybrids - achievements - merits and demerits - hybrid variety - merits and demerits. Synthetics and composites - steps in development of synthetics and composites - achievements - merits and demerits. Genetic characters of asexual reproduction - breeding methods - clonal selection - hybridization and clonal selection - merits and demerits - achievements; Chimeras and its types; Tree breeding - clonal orchards.

### **Unit IV: Special breeding methods**

Polyploidy breeding - classification - induction of polyploidy - diploid x tetraploid and diploid x hexaploid crosses - achievements - limitations. Wide hybridization-history - importance-barriers and techniques for overcoming barriers-utilization. Shuttle Breeding - Mutation breeding: mutation - types - mutagens - breeding procedure - applications - achievements - limitations. Ideotype concept. 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.

### **Unit V: Maintenance breeding**



Types of cultivars – procedure for release of new varieties – stages in seed multiplication – concept of seed certification and TC plants certification. Maintenance Breeding: General seed production techniques – steps in nucleus and breeder seed production – varietal rundown and renovation. Current trends in Plant Breeding: Marker assisted breeding , Transgenic crops. Concept of Plant Varietal protection, DUS testing, geographical indications. **Current streams of thought.**

#### **PRACTICAL**

Observation on pollination and reproduction in plants - Alternation of generation and life cycle. Description and drawing different pollination systems - Mechanisms enforcing self and cross pollination in crops; Pollen morphology - Exine structure of different crops. Assessment of pollen fertility and sterility in A, B, R and TGMS lines. Breeder kit and its components – uses; Basic steps of selfing and crossing techniques. Emasculation and pollination techniques in field crops and horticultural crops. Studies on segregating generation and maintenance of records. Maintenance of A, B and R line and TGMS lines - Hybrid seed production techniques. Estimation of heterosis. Induction of polyploidy using colchicines. Studies on different wild species in crop plants and wide hybridization. Irradiation - dosimetry - half life period - procedure for irradiation of seeds and planting materials. Chemical mutagenesis - molar solution preparation - procedure for chemical mutagenesis of seeds and planting materials. Germplasm preservation – conservation - records maintained in research stations. Calculation of PCV, GCV, heritability, genetic advance. Layout of different yield trials - Observing the experimental plots - nucleus and breeder seed production plots. Screening methods – laboratory and field – for biotic and abiotic stresses -marker assisted selection.

#### **THEORY LECTURE SCHEDULE**

1. Objectives and role of plant breeding - historical perspective – activities in Plant Breeding.
2. Centres of origin – contribution of Vavilov, Harlan, Zhukovsky – law of homologous series.
3. Plant genetic resources – importance – germplasm – types – activities – gene erosion - gene bank – collection - conservation – types of conservation – agencies – quarantine.
4. Germplasm: evaluation – use of descriptors, documentation, utilization; Agencies – national and international; germplasm exchange – quarantine.
5. Modes of reproduction – sexual – asexual - self and cross fertilization – significance of pollination.
6. Self incompatibility – classifications – mechanisms – application – measures to overcome and limitations.
7. Sterility – male sterility – introduction – classification – CMS, GMS, CGMS - inheritance and applications.
8. TGMS, PGMS, Gametocides, Transgenic Male sterility and applications.
9. Apomixis – introduction - classification-applications; Parthenocarpy and its types.
10. Basic biometrics-nature and significance of qualitative and quantitative variation-phenotypic, genotypic and environmental-heritability and genetic advance
11. Plant introduction as a breeding method – types of introduction – objectives – quarantine - acclimatization – achievements - merits and demerits.
12. Genetic basis of self pollinated crops – Vilmorin principle of progeny selection - Johanssen’s pure line theory.
13. Breeding methods for self pollinated crops without involving artificial hybridization: Pure line selection – procedure – merits and demerits – achievements; Mass selection in self pollinated crops – procedure - types – comparison of mass and pureline selection – achievements.
14. Breeding methods of self pollinated crops involving artificial hybridization: Creating variability in self pollinated crops - Hybridization and selection – objectives types –



- choice of parents – combining ability - combination breeding and transgressive breeding – steps in hybridization - kinds of emasculation.
15. Pedigree breeding – procedure – mass pedigree – merits – demerits – achievements; Bulk breeding – procedure – merits – demerits – achievements.
  16. Comparison of pedigree and bulk breeding methods. Single Seed Descent (SSD) method – procedure – application – merits and demerits.
  17. Backcross breeding – genetic principles – prerequisites – procedures for transferring dominant and recessive genes
  - 18. Mid Semester examination**
  19. Back cross breeding – merits – demerits – multi lines and multi blends - population improvement approach in self-pollinated crops.
  20. Genetic structure of a population in cross pollinated crop – Hardy Weinberg law – gene frequencies in random mating population – principles in population improvement.
  21. Breeding methods of cross pollinated crops without involving artificial hybridization: Mass selection in cross pollinated crops – modified mass selection – unit selection – mass selection with progeny testing – half sib family selection – full sib family selection.
  22. Breeding methods of cross pollinated crops involving artificial hybridization: Recurrent selection principles – types – merits and demerits.
  23. Heterosis breeding – theories - genetic basis – hybrid vigour – estimation of heterosis – inbreeding depression – development of inbreds.
  24. Heterosis breeding – procedure – use of male-sterility systems and manual emasculation in hybrid seed production – maintenance of parental lines -types of hybrids – achievements – merits and demerits – hybrid variety – merits and demerits.
  25. Synthetics and composites - steps in development of synthetics and composites – achievements – merits and demerits
  26. Genetic characters of asexual reproduction – breeding methods – clonal selection – hybridization and clonal selection – merits and demerits – achievements; Chimeras and its types; Tree breeding – clonal orchards.
  27. Polyploidy breeding – classification – induction of polyploidy – diploid x tetraploid and diploid x hexaploid crosses - achievements – limitations.
  28. Wide hybridization-history-importance-barriers and techniques for overcoming barriers-utilization
  29. Mutation breeding: mutation – types – mutagens – breeding procedure – applications – achievements – limitations. Ideotype concept
  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
  31. Types of cultivars – procedure for release of new varieties – stages in seed multiplication – concept of seed certification and TC plants certification.
  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
8. Estimation of heterosis.
9. Induction of polyploidy using colchicine
10. Studies on different wild species in crop plants and wide hybridization.
11. Irradiation - dosimetry - half life period - procedure for irradiation of seeds and planting materials. Chemical mutagenesis - molar solution preparation - procedure for chemical mutagenesis of seeds and planting materials.
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.
16. Procedure for marker assisted selection.
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.

### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	2	3	-
CO4	-	3	-	-	3	-	-	-

### REFERENCES

1. Singh, B.D. 2005. Plant breeding - Principles and methods. Kalyani Publishers, New Delhi.
2. Allard, R. 1989. Principles of Plant breeding. John Wiley and Sons, New Delhi.
3. D.N.Bharadwaj.2012. Breeding Field Crops. Agrobios (India), Jodhpur
4. Chahal, G.S. and S.S.Gosal. 2002. Principles and Procedures of Plant Breeding: Biotechnological and Conventional Approaches. Narosa Publishing House (India)

### 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

Market and marketing - Definitions. Agricultural marketing - Concepts, scope and subject matter. Classification of markets. Approaches to study of marketing.

Characteristics of agricultural marketing. Marketing of agricultural and manufactured goods. Selling behaviour of farmers. Market forces and price determination. Producers' surplus of agricultural commodities: Marketable and marketed surplus - Definition, importance, relationship and factors affecting marketable surplus.

### **Units II: Marketing Functions and Marketing Efficiency**

Marketing functions - Definition and classification. Buying and selling - Assembling and distribution - Storage and warehousing - Processing and value addition - Grading and standardization: Agmark, FPO, BIS, HACCP, FSSAI and ISO - Steps in market research - Market information and intelligence - Market finance - Risk in agricultural marketing: Contract farming, forward trading, speculation and hedging. Marketing channels - Definition, types and factors affecting marketing channels. 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.

### **Units III: Marketing Institutions**

Role of government in promoting agricultural marketing: DMI - Regulated market - Cooperative marketing - State Agricultural Marketing Board - NAFED - TANFED - State trading - FCI - PDS - Commodity boards viz., Coffee board, Tea board, Spices board, Rubber board, NMPB, NHB, NDDB. Marketing of inputs - Seeds, fertilizers and pesticides - E marketing.

### **Units IV: Trade in Agricultural Products**

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. 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. Export promotion organizations - APEDA, MPEDA, Export Promotion Council, AEZ, EXIM bank and ITPO. Export - import policy.

### **Units V: Agricultural Prices**

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. Pricing efficiency - Physical and allocative efficiency. Fluctuations and instability in prices - Factors causing price fluctuation - Price stabilization measures. Government intervention in pricing of agricultural commodities - Objectives, forms of intervention, agricultural price policy in India, Role of CACP. **Current streams of thought.**

### **PRACTICAL**

Market survey - Estimation of marketable and marketed surplus - Identification of marketing channels - Marketing efficiency - Estimation of price spread for agricultural and horticultural products - Study of organized and unorganized markets: Regulated market, Cooperative marketing society, Farmers market and shandy. Visit to FCI, CWC, TNCSC and Agmark laboratory - Visit to agricultural processing units - Farm input marketing - Visit to cashew export unit - Commodity boards - Time series analysis: Trend, seasonal, cyclical and irregular variations - Construction of index numbers - Case studies on implications of trade liberalization.

### **THEORY LECTURE SCHEDULE**

1. Market and marketing - Definition. Agricultural marketing - Concepts, scope and subject matter. Classification of markets.
2. Approaches to study of marketing. Characteristics of agricultural marketing.

3. Marketing of agricultural and manufactured goods. Selling behaviour of farmers. 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

11. Farm input marketing
12. Visit to cashew export unit
13. Commodity boards
14. Time series analysis
15. Construction of index numbers
16. Case studies on implications of trade liberalization.
- 17. Orientation for final examination**

### 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.

### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	-	2	2	2
CO2	-	-	-	-	-	1	2	2
CO3	-	-	1	2	-	X	2	2
CO4	-	-	-	-	-	2	1	2
CO5	-	-	-	-	-	-	-	2

### REFERENCES:

1. Acharya S.S. and Agarwal, N.L., 2011, Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Jhingan, M.L., 2011, International Economics, Vrinda Publications (P) Ltd., New Delhi.
3. Francis Cherunilam, 2000. International Economics, Oxford and IBH, New Delhi.
4. Kahlam A.S. and S.D. Tyagi, 2000, Agricultural Price Policy in India, Allied Publishers Pvt. Ltd., Bombay.
5. Acharya S.S. and Agarwal, N.L., 1994. Agricultural Prices - Analysis and Policy, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

## 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

Sampling theory - population - sample - parameter and statistic - sampling distribution - sampling vs complete enumeration -Types of sampling - simple random sampling - selection using random numbers - Stratified - Systematic sampling.

Probability distributions - Discrete distributions: Bernoulli, Binomial and Poisson. Continuous distribution: Normal distribution - definitions and properties.

### **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  $r \times c$  contingency table.

### **Unit IV: Correlation and Regression**

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

Regression - simple linear regression - fitting of simple linear regression equation - properties of regression coefficient.

### **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. TBII 41 - 48
3. Sampling theory - population - sample - parameter and statistic - sampling distribution - sampling vs complete enumeration -Types of sampling - simple random sampling - selection using random numbers Stratified - Systematic sampling. TBII 316 - 321
4. Probability distributions - Discrete distributions: Bernoulli TBI 55 - 57
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. TBII 16-17
8. Large sample test - single mean and difference between two means. Single proportion and difference between two proportions. TBII 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  $r \times c$  contingency table. TBII 43-45
13. Correlation - Scatter diagram - Karl Pearson's correlation coefficient - Spearman's rank correlation - computation and properties. TBI 142 - 145
14. Regression - simple linear regression - fitting of simple linear regression equation - properties of regression coefficient. 157 - 165
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**



1. 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
17. **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.

### CO/PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	X	X	-	-
CO2	-	-	-	-	X	X	-	-

### REFERENCES

1. Rangaswamy, R. 2009, A Text book of Agricultural Statistics, Wiley Eastern Limited, New Delhi.
2. Dhamu. K. P and K. Ramamoorthy. 2007. Statistical Methods. Agrobios (India), Jodhpur.
3. Gupta.S.C and V.K.Kapoor. 1977. Fundamentals of Applied Statistics. Sultan Chand and Sons, New Delhi.
4. Gupta S.P, Statistical Methods, 2004, Sultan Chand and Sons, New Delhi.
5. S.C. Gupta and V.K. Kapoor. 2003. Fundamentals of Mathematical Statistics. Sultan Chand and Sons, New Delhi.
7. Panse. V. G and P.V. Sukhatme. 1954. Statistical methods for agricultural workers. ICAR, New Delhi.
8. Dhamu. K. P and K. Ramamoorthy. 2009. Fundamentals of Agricultural Statistics. Scientific Publishers (India), Jodhpur.
9. Kailasam. G and R.Gangaiselvi. 2010. Applied Statistics. Kalyani Publishers. New Delhi.

### E- RESOURCES

1. <http://www.statistics.com/resources/glossary/>
2. [www.statsoft.com](http://www.statsoft.com)
3. [http://www.iasri.res.in/ebook/EB\\_SMAR/index.htm](http://www.iasri.res.in/ebook/EB_SMAR/index.htm)



4. [www.stats.gla.ac.uk/steps/glossary/index.html](http://www.stats.gla.ac.uk/steps/glossary/index.html)
5. <http://davidmlane.com/hyperstat/>
6. <http://www.stattrek.com/>
7. [http://www.businessbookmall.com/Statistics Internet Library.htm](http://www.businessbookmall.com/Statistics%20Internet%20Library.htm)
8. <http://www.stat-help.com/>
9. [www.statsci.org/jourlist.html](http://www.statsci.org/jourlist.html)

## 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

Self Development - Empowerment - SWOC Analysis - Goal setting based on the principle of SMART - self motivation strategies.

### 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

Definitions of interview - two types of interview - preliminary requirements for success - Resume writing - CV writing - Job application - Cover Letter-Specially designed interviews.

#### 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**

Definition of stress –kinds - stress at work – causes, effects and solution - stress and stroke –different kinds of stroke – stress in interview.

## **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).
13. Goal setting and decision making – exercises.
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:**

1. Alex, *Soft skills Know yourself and know the world*. S. Chand and Co. Publishing House, New Delhi, 2009.
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### 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, Trampers and Cage Wheel. Sowing Methods - Seed Drills, Seed cum fertilizer drills - Paddy transplanters.

### 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 and biomass 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 and find 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 Jatropa.

### THEORY LECTURE SCHEDULE:

1.	Farm power in India – human, animal, mechanical and electrical energy sources	TB1: 1-10
2.	Objectives of Primary tillage, mouldboard ,disc plough, chisel plough and subsoiler, components and functions, types,	TB1: 177-179

	advantages and disadvantages	
3	Secondary tillage equipment – harrows, land forming equipment – rotavator	TB1: 177-198
4	Wet land equipment – puddlers, Green manure trawlers and cage Wheels	TB1:216-221
5	Seed Sowing methods and Equipments	TB1:223-225
6	Seed drills, seed cum fertilizer drills – components and functions,	TB1:222-227
7	Paddy transplanters, types, working principle, field and nursery Requirements	TB1:232-235
8	Sprayers and their functions, classification, manually operated Sprayers, power sprayers – dusters, types and uses	TB1:261-271
9	Harvesting tools and equipment- sickles, paddy harvester	TB1:273-280
10	Combine – Harvesting machinery for groundnut, tuber crops and Sugarcane	TB1:273-288 TB1:293-297
11	Equipment for land development and soil conservation – dozers	TB1:323-327
12	Equipment for intercultural tools levelers, chisel plough, sub soil plough, Blade harrow and bund former	TB1:185-211
13	Implements for intercultural operations – cultivators, sweep, junior hoe, Manual weeders and	TB1:213-221
14	Power operated weeders for wet land and garden land	TB5:216-222
15	IC engines- working principles, two stroke and four stroke engines, Different systems of IC engine	TB1:22-35 TB2:1-21
16	Electronic fuel injection system, dual fuel operation engine, Tractors- types and utilities.	TB1:107-117 TB2:313-319
17	Introduction – Energy crisis – Classification – Availability – Renewable energy sources – significance.	TB3:387-411
<b>18</b>	<b>Mid-Semester Examination</b>	
19	Potential of Solar, Wind, Biogas, Biomass, and other Renewable Energy sources achievements in India	TB4:1-44
20	Methods of energy conversion – Thermo chemical conversion methods –Principles of combustion, Pyrolysis	TB3:428-438
21	Gasification – Types of gasifiers –Producer gas and its utilization.	TB4:385-433
22	Briquettes – Types of briquetting machines – Uses of briquettes – Shredders	TB4:387-420
23	Biochemical conversion methods – Biogas and Ethanol Production – Applications	TB3:439-464
24	Biogas technology – Feed stocks – Factor influences biogas yield- Biogas Plants Types – Construction and Working – Applications	TB4:311-381
25	Solar energy- Solar energy applications	TB5:1-16
26	Solar collectors-Types – Solar energy gadgets.	TB5:89-155
27	Solar air heaters – Solar cookers – Solar water heating systems – Solar grain dryers.	TB5:156-199
28	Solar photo voltaic systems and application	TB5:433-487
29	Solar lights –Solar pumping systems – Solar refrigeration system – Solar ponds	TB5:488-500 TB5:288-311
30	Solar space heating and cooling systems	TB5:346-370 TB5:387-402
31	Wind energy –Types of wind mills – Constructional details and applications.	TB4:227-310
32	Energy from agricultural wastes – Liquid Bio fuels	TB4:414-418
33	Bio diesel and ethanol from agricultural produce	TB4:418-430

34	Bio diesel and ethanol production and Uses.	
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#### 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.

#### CO-PO MAPPING MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	-	-	-	-	X	X	X	X
CO 2	-	-	-	-	X	X	X	X
CO 3	-	-	-	-	X	X	X	X
CO 4	-	-	-	-	X	X	X	X

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### **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**

Conservation of resources - Agricultural ecology - Ecosystem - Remediation measures - Manmade disasters.

##### **Unit - III : Natural disasters**

Natural disasters - Meaning - Types - floods - Cyclone - Earth quakes, Tsunami, landslides - Avalanches - Volcanic eruptions - Heat and cold waves - Nuclear disaster, chemical disasters and biological disaster.

##### **Unit - IV : Disaster management**

Disaster management - Concepts - Efforts to mitigate natural disasters - National and global levels - Hazards - Risk - Mitigation.



## Unit - V : Disaster Rehabilitation

National disaster management frame work - Disaster Response Mechanisms in India - Financial arrangement - Disaster warning - Rehabilitation - Bio shields livelihood options - Insurance and compensation - Emergency operations centers (EOCs). India's key hazards and vulnerabilities and disaster response mechanism. **Current streams of thought.**

### THEORY LECTURE SCHEDULE

1. Climate change - definition - concepts - causes - issues.
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

### CO-PO MAPPING MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	-	-	1	1	-	-	1	-
CO 2	1	1	1	1	-	-	-	-
CO 3	1	-	-	1	2	-	2	-
CO 4	-	1	1	2	1	-	2	-
CO 5	-	-	-	1	1	1	-	-

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## 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

Origin – putative parents, evaluation distribution of wild and allied species – genetic resources – sterility – male sterility – self incompatibility steps of breeding – methods of breeding – hybridization – heterosis breeding – genetic basis of self pollinated crops and cross pollinated crops – merits and demerits for improvement of asexually propagated crops

#### 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 melon, 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

Study of floral biology – anthesis – pollination mechanism and practicing selfing and crossing in major horticultural crops- heterosis breeding and techniques of F1 hybrid production- mutation and mutagenic treatments – methods of induction of polyploidy – breeding strategies in fruits, vegetables, flowers, spices and plantation crops.

### THEORY LECTURE SCHEDULE

1. History and importance of breeding.
2. Sterility – male sterility – introduction – classification.
3. Self incompatibility – classification – inheritance and application.
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.,
10. Breeding strategies and methods of improvement of sexually propagated crops.
11. Breeding strategies and methods of improvement of self pollinated crops.

12. Breeding strategies and methods of improvement of cross pollinated crops.
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.
20. Bitter gourd, cucumber and watermelon.
21. Pumpkin, ridge gourd and snake gourd
22. Peas and beans.
23. Potato.
24. Tapioca
25. Onion, moringa and amaranthus.
26. Cabbage, cauliflower and carrot.
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.
4. Guava and pomegranate.
5. Tomato and brinjal.
6. Chillies and bhendi.
7. Bitter gourd, and snake gourd.
8. Cucumber and watermelon.
9. Peas and beans.
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**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	1	3	-	2	2	1

CO2	3	2	2	3	-	2	1	1
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## 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

Plant, cell and tissue culture – history, concepts and applications – general techniques – harnessing biotechnology in horticultural crops – factors affecting *in vitro* growth and development of tissues – organogenesis – plant growth regulators – somatic embryogenesis – concepts and applications.

#### Unit-II: Techniques of tissue culture - I

Callus culture – cell suspension culture – micropropagation – phases – advantages – meristem culture – somaclonal variations and its applications.

#### Unit-III: Techniques of tissue culture - II

Anther/ pollen culture – development of haploids – ovary and embryo culture – wide hybridization – Embryo rescue – *in vitro* pollination and fertilization – *in vitro* mutation.

#### 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

Genetic engineering – recombinant DNA technology – cloning vectors – restriction enzymes – techniques of gene transfer – molecular tools – achievements.

#### Current Stream of thought

### PRACTICAL

Study of components of tissue culture laboratory – preparation of nutrient media – sterilization techniques – isolation of explants for clonal propagation – callus culture – sub-culturing techniques – regeneration of plantlets from callus – organogenesis and embryogenesis – anther and ovule cultures – demonstration of protoplast culture – hardening techniques – DNA extraction and quantification – Polymerase Chain Reaction

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.
4. Somatic embryogenesis - induction factors and stages in development of somatic embryoids.
5. Callus culture - initiation and maintenance of callus culture - initiation of cell suspension cultures.
6. Micropropagation- explants - steps - advantages and disadvantages.
7. Meristem culture and its applications - production of virus free plants- somaclonal variations.
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- embryo rescue technique its applications.
11. *In vitro* pollination and fertilization- *invitro* mutation -production of synthetic seeds.
12. Protoplast culture - techniques for isolation, culture, fusion and production of somatic hybrids.
13. Techniques of cryopreservation.
14. Production of secondary metabolites.
15. Recombinant DNA technology - vectors - restriction enzymes.
16. Direct and indirect methods of gene transfer.
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.
3. Specifications of laboratory equipments - uses and methods of operation.
4. Nutrient media - components and preparation of media.
5. Sterilization techniques - methods of sterilizing glasswares and media.
6. Isolation of explants - sources - techniques.
7. Surface sterilization - methods of sterilization of plant tissue - use of sterilants.
8. Inoculation of explants - techniques involved.
9. Sub-culturing techniques.
10. Callus culture - initiation, proliferation and regeneration.
11. Micropropagation - media, culture of explants.
12. Anther culture - media, isolation and culture of anthers.
13. Demonstration of protoplast culture
14. Hardening techniques - types of media - methods.
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.

#### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	2	-	2	2	1
CO2	3	3	3	3	-	2	1	1

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## 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

Concept of ecosystems –structure and functions of ecosystem: energy flow, different cycle in eco system and their integration – classification of ecosystems and their features – urban eco system- ecosystem of horticultural production- climate change: global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust – causes and consequences- implications of climate change in urban environment and horticulture- biodiversity: conservation and invasive aliens concepts – biodiversity acts.

### 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**

Eco-system - estimation of species abundance of plants - carbon use efficiency - estimation of carbon sequestration done by trees - noise pollution determination - estimation of air pollution: CO<sub>2</sub>, PM<sub>10</sub>, Methane - water pollution: total dissolved solids (TDS) - social organizations and corporate social responsibility in pollution control - visit to a local polluted site for assessment and remedial measures: industrial/domestic sewage disposal/treatment unit, solid waste dumping site, incinerator units - reclamation of problem soils/mining site through horticultural crops - urban planning - assessing different urban landscape sites *viz.*, avenues, school gardens, railway stations, dam sites, industrial sites, gated communities/colonies, river/lake bank and play grounds - tree transplanting: balling and bur-lapping techniques- description and design of terrace garden, container gardening and garden walls - horticultural crafts for social welfare - bonsai culture, vegetable carving and flower arrangement.

#### **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
3. Estimation of carbon sequestration done by trees.
4. Determination of sound level by using sound level meter.
5. Estimation of air pollution by using portable dust sampler: CO<sub>2</sub>, PM<sub>10</sub>, 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
16. Horticultural crafts for social welfare: bonsai culture and flower arrangements.
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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	2	2	3	3	2	2
CO2	-	-	-	2	1	3	3	2

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5. <https://www.undeerc.org/pcor/sequestration/whatissequestration.aspx>

## 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

Ecology -Relevance to man - Ecosystem - Components - Terrestrial - Biomes - Forest - Desert - Aquatic - Pond - River - Estuaries - Ocean - Energy flow - Food Chain, Food Web and Ecological pyramids --Species interactions - Succession

#### Unit II - Natural Resources and Biodiversity

Natural resources - Land - Water - Air - Forest - Minerals - Energy Resources - Renewable - Non-renewable - Sustainable Management and Conservations -Biodiversity -importance- Hotspots - Threats - Conservation - *In-situ* - *Ex-situ* - Biosphere Reserve - National parks and Wildlife Sanctuaries - Botanical Garden

### 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

Global treaties - conventions -national and state level organization- Tamilnadu Pollution Control Board (TNPCB) - Central Pollution Control Board (CPCB) - Environmental Impact Assessment (EIA) Environmental Laws and Acts - Environmental Education- afforestation - role of information technology on environment. **Current Streams of thought.**

### 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
26. Waste water treatment methods –physical, chemical and biological methods.
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..
30. Environmental impact assessment- stages and monitoring.
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 o 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.

#### CO - PO MAPPING MATRIX

COs/PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	1	-	1	3	-
CO 2	3	1	-	1	2	-
CO 3	1	2	1	2	2	1
CO 4	1	2	1	2	2	1
CO 5	1	-	-	1	1	1

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- Chiras D.D., 2016. Environmental Science, Tenth Edition.
- Jones and Bartlett Learning, Burlington, MA. ISBN: 978-1-284-05705-8, 708 Pages.

### **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**

Soil fertility and productivity. Essential nutrients- functions, deficiency and toxicities. Concepts and methods of soil fertility evaluation.

##### **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**

Fertilizers - Definition and classification, sources, properties and reactions of primary, secondary and micro nutrient fertilizers in soil - Manufacture of urea, ammonium sulphate, SSP, DAP, MOP and SOP. Complex, mixed fertilizers, customized / Specialty fertilizers -Water soluble fertilizers, liquid fertilizers. Micro nutrient mixtures and chelated micronutrients - Preparation, characteristics and compatibility -Fertilizer Control Order (FCO). Manures- classification, nutrient contents. Composting techniques.

##### **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

Nutrient management concepts - INM, STCR, IPNS, SSNM and RTNM. Nutrient use efficiencies of major and micronutrients and enhancement techniques (Soil, Cultural and Fertilizer strategies). Soil health -Quality indices and their management - Organic farming and Precision Farming - Long term effect of fertilization on soil. **Current Streams of thought.**

### PRACTICAL

Soil Nutrient Analysis - Available nutrient status (N, P, K, S and DTPA extractable micronutrients) in soils- Fertilizer Nutrient Analysis- Analysis of nutrient contents in urea, ammonium nitrate, SSP, RP, MOP and SOP- Manure Analysis-Determination of nutrient contents (N, P and K) in FYM/GM - Colloquium on Soil testing laboratories - Soil test based fertilizer prescription - Visit to fertilizer mixing unit.

### 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
19. Complex fertilizers- definition, manufacture of ammonium phosphate, nitro phosphate and N,P,K complexes
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

- 24 Composting techniques- Aerobic and anaerobic (Bangalore and Coimbatore method) enriched FYM and vermicompost. Composting of organic waste-Sugarcane trash and coir waste
- 25 Methods of fertilizer application for different soil types - Fertigation - Definition - water soluble fertilizers
- 26 Types of fertigation - Fertilizer schedule
- 27 Fertilizer application methods - Seed coating, pelletization, seedling dipping - Nutriseed pack - Soil Application - Foliar spray
- 28 Nutrient management concepts - INM, STCR, IPNS, SSNM and RTNM - Tools - DSSIFER and VDK
- 29 Nitrogen use efficiency - Slow release N fertilizers - Significance and enhancement techniques
- 30 Nutrient use efficiency of P, K and micronutrients and their enhancement techniques
- 31 Soil health - Definition - Soil Quality Indices - Physical, chemical and Biological indicators-Soil enzymes
- 32 SOM maintenance - Role of SOM in sustaining soil health
- 33 Precision farming and organic farming - Concepts and applications
- 34 Long term effect of fertilization on soil

#### **PRACTICAL SCHEDULE**

1. Estimation of alkaline  $\text{KMnO}_4$  N in soil
2. Estimation of Olsen P and Bray P in soil
3. Estimation of Neutral Normal  $\text{NH}_4\text{OAc}$  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  $\text{K}_2\text{SO}_4$
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
14. Estimation of K in FYM / Compost by Flame Photometry.
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.



## CO-PO MAPPING MATRIX

CO/PO	PO1	PO 2	PO3	PO 4	PO 5	PO6	PO7	PO8
CO 1	-	-	-	-	-	-	-	-
CO 2	-	1	2	3	-	-	-	-
CO3	-	-	-	3	-	-	-	-
CO4	-	-	-	3	1	-	-	-
CO5	-	-	2	2	1	-	-	-

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## 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 narcotic 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**

Identification of crops and crop varieties – Nursery preparation, mainfield preparation for field crops – Seed treatment techniques. Sowing and manuring – Seeding implements – Estimation of plant population – Study of growth and yield attributes, yield calculations. Harvesting and yield estimation of field crops – Cost analysis.

## **THEORY LECTURE SCHEDULE**

1. Introduction – importance of cereals, millets, pulses and oilseeds.
2. Introduction – importance of sugar crops, fibres
3. Introduction – importance of tuber crops and Narcotics.
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.
6. Rice – Origin – geographic distribution – economic importance – varieties – soil and climatic requirement.
7. Rice – cultural practices – Deficiency symptoms for major and micronutrients – yield – economic benefits – Special type of Rice cultivation – SRI – Aerobic rice cultivation
8. Maize – Origin, geographic distribution, economic importance, soil and climatic requirement.
9. Maize – Varieties, cultural practices and yield.
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.
12. Sorghum – varieties, cultural practices and yield.
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**
19. Groundnut – Soil and climatic requirements – varieties, cultural practices yield and economics.
20. Sesame – Origin, geographical distribution, economic importance.
21. Sesame – Soil and climatic requirements, varieties, cultural practices and yield
22. Sunflower – Origin, geographical distribution, economic importance.
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.
25. Sugarcane – Origin, geographical distribution, economic importance, soil and climatic requirements – Varieties, main field preparation – preparation of setts for planting – cultural and after cultivation practices and yield.
26. Sugarcane – Crop logging, maturity and ripening – gur manufacture – byproduct utilization.
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.
29. Cotton – Varieties, cultural practices, yield and quality parameters.
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

#### **CO-PO MAPPING MATRIX**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	-	-	-	1	-	-	1	-
CO 2	-	-	-	1	1	1	-	-
CO 3	-	-	-	1	1	1	-	-
CO 4	-	-	-	-	-	-	-	1
CO 5	-	-	-	1	1	1	-	-

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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, Arecanut, 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
19. Pests of Raspberry, Persimmon and Currants.

20. Pests of Coconut, Arecanut 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, Tuberoses 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, Arecanut 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
14. Identification of Pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberoses and Cut flowers
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

#### CO-PO MAPPING MATRIX

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	X	-	X	X	X	X	X	X
CO 2	X	-	X	X	X	X	X	X
CO 3	X	-	X	X	X	X	X	X
CO 4	X	-	X	X	X	X	X	X
CO 5	X	-	X	X	X	X	X	X
CO 6	X	-	X	X	X	X	X	X

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#### 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

Management: Definition and concepts - Approaches - Principles of management. Agri business management: Meaning and definition - Scope - Characteristics. Forms of agri business firms: Sole, partnership, joint stock, cooperative and state enterprises. Small, medium, tiny and micro enterprises - Importance.



## **Unit II: Management Functions I**

Management Functions: Planning, organizing, staffing, directing, controlling. Planning: Meaning - Objective - Steps - Types - Importance. Organizing: Meaning - Structure - Types - - basis for departmentation Importance.

## **Unit III: Management Functions II**

Staffing: Meaning - Nature and importance - Human Resource Management (HRM) - Job analysis - Recruitment and selection process. Directing: Principles - Techniques and importance. Co-ordination and control - Objectives - Steps - Methods - Importance.

## **Unit IV: Functional Arcas of Management**

Production / Operations management planning and scheduling - Inventory - Materials management. Supply Chain Management in agribusiness. Financial management - Concept and financial planning for agri business. Marketing management - Market environment - Market segmentation - Marketing mix - Market promotion - Promotion mix - Consumer buying behavior.

## **Unit V: Entrepreneurship**

Entrepreneur - Agripreneurs - Agripreneurship - Types, Characteristics and Process. Innovation, business incubation. Entrepreneurship development - Programmes - Government schemes and incentives - Government policy - Agri Clinics and Agri Business Consortium (ACABC). **Current streams of thought.**

## **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.
2. Principles of Management.
3. Agri Business Management - Meaning and definition - Scope characteristics.
4. Forms of agri business firms - Sale, partnership, joint stock, cooperative and state enterprises - Small, medium, tiny and micro enterprises - Importance.
5. Management Functions: Planning, organizing, staffing, directing, controlling. Planning: Meaning, objective, steps - Types and importance.
6. Organizing - Meaning - Structure - Types - Departmentation - Importance.
7. Staffing - Meaning - Nature and importance HRM - Job analysis - Recruitment and selection.
8. Directing - Principles - Techniques - Importance.
9. **Mid Semester Examination.**
10. Co-ordination and control - Objectives steps - Methods - Importance.
11. Production operations management - Planning and scheduling - Inventory - Materials management - Supply chain management.

12. Financial management - Concept and financial planning for agri business.
13. Marketing management - Market environment - Market segmentation.
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.
17. Agri Clinics and Agri Business Consortium (ACABC).

#### **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.
11. Pricing of products of small agribusiness - Cost analysis - Working out cost of production.
12. Preparation of advertisement and sales promotion programs for an agribusiness firm.
13. Balance sheet and Income Statement of agribusiness and ratio analysis.
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**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	1	-
CO2	-	-	-	-	-	2	1	-
CO3	-	-	-	-	2	2	-	2

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## AEG 319 FUNDAMENTALS OF SOIL AND WATER CONSERVATION ENGINEERING (2+1)

### 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

Soil Erosion – causes and evil effects of soil erosion – geologic and accelerated erosion - water erosion - causes - erosivity and erodibility - mechanics of water erosion - splash, sheet, rill and gully erosion - ravines - land slides – wind erosion - factors influencing wind erosion - mechanics of wind erosion – suspension, saltation, surface creep

#### Unit III Soil conservation and watershed management

Erosion control measures for agricultural lands – biological measures – contour cultivation – strip cropping – cropping systems – vegetative barriers - windbreaks and shelterbelts - shifting cultivation - mechanical measures – contour bund – graded bund – broad beds and furrows – basin listing – random tie ridging – mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall – Rain water harvesting – insitu soil moisture conservation – Runoff Computation – runoff water harvesting -- Farm ponds and percolation ponds - storage and its use for domestic and ground water recharge. Gully control structures -Check dams – Temporary and permanent. Watershed concept – Integrated approach and management

#### Unit IV Irrigation and drainage

Irrigation - measurement of flow in open channels - velocity area method - rectangular weir - Cippoletti weir - V notch - orifices - Parshall flume - duty of water - irrigation efficiencies - conveyance of irrigation water - canal lining - underground pipe line system - surface irrigation methods - borders, furrows and check basins - drip and sprinkler irrigation- agricultural drainage - surface drainage systems – sub-surface drainage systems - drainage coefficient-design of open ditches.

#### 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

Study of survey instruments - chains and cross staff surveying - linear measurement - plotting and finding areas. Compass survey - observation of bearings - computation of angles- radiation, intersection. Levelling – fly levels – determination of difference in elevation – Computation of area and volume - Contouring. Design of contour bund and graded bund. Drip systems and Sprinkler irrigation systems. Problems on water measurement. Problems on duty of water, irrigation efficiencies. Problems on water requirement - agricultural drainage. Study of different types of wells and its selection. Study of pumps and its selection.

### 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.

6. Soil Erosion - causes and evil effects of soil erosion - geologic and accelerated erosion
7. Water erosion - causes - erosivity and erodibility - mechanics of water erosion
8. Splash, sheet, rill and gully erosion - ravines - land slides
9. Wind erosion - factors influencing wind erosion - mechanics of wind erosion - suspension, saltation, surface creep
10. Effects of water and wind erosion
11. Erosion control measures for agricultural lands - biological measures - contour cultivation - strip cropping - Cropping systems - vegetative barriers - Windbreaks and shelterbelts - shifting cultivation
12. Mechanical measures - contour bund - graded bund - Broad beds and furrows - basin listing - random tie ridging
13. Mechanical measures for hill slopes - contour trench - bench terrace - contour stone wall
14. Rain water harvesting - insitu soil moisture conservation - Runoff Computation - runoff water harvesting
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**

1. Study of survey instruments - chains - compass - plane table - dumpy level.
2. Chains and cross staff surveying - linear measurement - plotting and finding areas.
3. Compass survey - observation of bearings - computation of angles.
4. Compass - radiation, intersection.
5. Levelling - fly levels - determination of difference in elevation.
6. Computation of area
7. Computation of volume
8. Contouring - Block contouring
9. Design of contour bund and graded bund.
10. Drip Irrigation systems.
11. Sprinkler irrigation system
12. Problems on water measurement.
13. Problems on duty of water, irrigation efficiencies.

14. Problems on water requirement - agricultural drainage.
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 under gain 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

#### CO-PO MAPPING MATRIX

	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	X	X	X	X	X
CO2	-	-	-	X	X	X	X	X

#### REFERENCES

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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**

Role of forests - status of forests - global forest scenario - Indian forests - National forest policy, 1988. social forestry - concept - definition - objectives - components - social forestry projects in Tamil Nadu - agroforestry - definition - concepts - benefits -constraints -criteria for selection of tree species for agroforestry - classification - primary systems- sub systems - industrial agroforestry - role of agroforestry in soil and water conservation.

### **Unit-V : Silviculture, waste land and afforestation**

Silviculture of important agroforestry species viz., cashew, tamarind, pungam, neem, jamun, ber, palmyrah, teak, silk cotton, casuarina and eucalyptus. Wastelands - definition - classification and extent - suitable tree species for different types of problem soils and wastelands - planting techniques for wastelands - afforestation in difficult sites.

**Current Streams of thought.**

## **PRACTICAL**

Estimation of soil physical, chemical and biological parameters - estimation of nutrient content of farm wastes - recycling of crop wastes - preparation of panchakavya, dasagavya, amirtha karaisal and EM solution - application of various mulch materials - nursery bed solarization - bioagents of crop protection - preparation of organic formulations for pest, disease control - economic evaluation of organic horticulture. Identification of trees - seeds and seedlings of important agroforestry species - forest nursery - types - layout -bed preparation - nursery technology of important tree species - forest mensuration - visit and study of different agroforestry systems- economics - visit to social forestry plantations -TAP -hillock afforestation site - assessing fodder and fuel requirements of a village -assessing people's involvement in forest based activities.

## **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 - Horti silviculture - silvipasture - Horti 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, silk cotton, palmyrah
- 32) Wasteland -definition-classification-suitable tree species
- 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
- 13) Measurement of light transmission ratio - soil temperature - air temperature under few tree species in relation to open conditions.
- 14) Visit to woodlots of casuarina, 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.

### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	1	2	3	1
CO2	3	2	3	3	-	2	2	1
CO3	3	3	3	3	2	1	2	1
CO4	2	2	2	2	3	2	1	1

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### E- RESOURCES

[www.uky.edu/jmlhjt2/courses/for350](http://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

Composition and uses – origin and distribution – varieties, soil and climatic requirements- propagation – planting density and cropping systems –nutrients, water and weed management – training and pruning – flowering, pollination and fruit set – use of plant growth regulators – physiological disorders and remedies – maturity indices and harvest – post-harvest handling -- production constraints of the following crops: Apple, pear, peach, plum and strawberry.

### 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.
- 4,5 & 6. Composition and uses – origin and distribution – species and cultivars – soil and climate requirements – propagation – main field preparation –planting density – cropping systems – nutrient, water and weed management, training and pruning – use of plant growth regulators – physiological disorders and remedies – maturity indices – harvest – post-harvest handling of the following crops : Apple.
- 7 & 8. Package of practices for Pear.
- 9 &10. Package of practices for Peach.
11. Production technology for Plum.
12. Production technology for Strawberry.
13. Production technology for Cherries.
14. Production technology for Raspberry, Black Berry and Currants.
15. Cultivation aspects of Apricot.
16. Cultivation aspects of Persimmon.
17. **Mid Semester Examination**
- 18 . Cultivation aspects of Kiwi.
- 19 & 20. Package of practices for Hill Banana.
- 21 & 22. Production technology for Mandarin.
- 23 & 24. Production technology for Grape fruit and Pummelo.

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.
6. Study of physiological disorders, nutrient deficiencies and their remedies in temperate fruits.
7. Hill banana –planting – crop management practices.
8. Description of varieties of mandarin, pummelo and grape fruit and propagation practices.
9. Study of physiological disorders, nutrient deficiencies and their remedies in subtropical fruits.
10. Identification and description of varieties of avocado, litchi and passion fruit.
11. Study of varieties and propagation in pineapple.
12. Planting systems and growth regulation 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.

### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	2	1	2	2	2
CO2	3	3	3	3	-	2	1	2

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11. Vishal Nath, V.Panday,D.Panday and Dineshkumar,2009. Fruits for the future.Vol.2: Lesser known tropical and sub-tropical fruits. Satish Serial Publishing House, Azadpur, Delhi.

#### E-RESOURCES

1. [www.icar.org.in](http://www.icar.org.in)
2. [www.tnau](http://www.tnau.ac.in) agri portal
3. <http://www.iihr.ernet.in>

### 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**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	-	3	3	2
CO2	3	3	3	2	-	2	-	2

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2. Gopalakrishnan, T.R. Vegetable crops (Horticulture Series Vol-4) New India Publishing Agency – New Delhi
3. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. Modern technology in vegetable production. New India Publishing Agency, New Delhi.
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5. Sasanka Barooah. 1993. Vegetable growing In India, Kalyani Publishers, New Delhi

#### **E-RESOURCES**

1. <http://www.sciencedirect.com/science>
2. <http://www.agnet.org/library/eb/476>
3. <http://msucare.com/crops/hightunnels/index.html>
4. <http://gbpihed.gov.in/envis/HTML/>
5. <http://www.docstoc.com/docs/49102917/The-use-of-supplemental-lightingfor-vegetable-crop-production>

### **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

Ornamental and Landscape Horticulture – definitions – scope – importance of gardening – history of gardening – types of gardens – Hindu, Buddhist, Persian, Mughal, Japanese, English, French and Italian garden – formal, informal and beauty elements – basic principles of gardening.

### Unit-II: Softscape Elements

Softscape elements (Living Components) – trees – shrubs – shrubbery – creepers – climbers – herbs – annuals – hedges – edges – topiary – trophy – flowers and foliage beds – carpet beds – palmatum – ferns – rosarium – rockery – sunken garden – hanging baskets – cacti and succulents plants – basic function and utility – their culture – training and pruning – lawn – lawn grasses – methods of establishment – Maintenance of lawn – house plants – Indoor gardening – psychological and social aspects of ornamental plants.

### Unit-III: Hardscape Elements

Hardscape elements (Non – living component) – garden adornments – fences – gates – arches – pergolas – walks – paths – roads – paving – borders and edges – water features – fountains, pools and ponds – cascades – falls – bridges – fountains – lights and lamp posts – garden seats – statues – decks – Bird’s bath – sundials – urban – planter boxes – trellis – gazebo – designing – basic function and utility – fabrication – establishment and maintenance – non living components for special situations.

### Unit-IV: Landscape Designing and Executions.

Basic concepts of designing gardens – site analysis – client preference – landscape drawing – types of drawing – plan view – elevation and perspective diagrams – manual drawing – computerized drawing – plan to scale/not to scale – symbols/legends – designing for residences – educational Institute – industrial garden – public parks – amusement and theme parks – traffic islands.

### Unit-V: Conceptual Gardening and Horticultural Crafts

Bio-aesthetic planning – water garden – floating plants – oxygenating plants – bog garden – vertical garden – rock garden – roof garden – modern day special types of gardens – yoga and meditation garden – instant garden – xeriscaping – bonsai – plants for bonsai – methods of bonsai culture – terrarium – flower arrangement – types of flowers – concepts – styles – purpose – methods – cut foliage – its uses in flower arrangement – importance in flower arrangement – dry flower making – vegetable and fruit carving – plant jewels.

### Current Streams of thought

## PRACTICAL

Identification of ornamental plants and garden components – study of form, size shape, texture, flowering season and flower colour of different living components – Identification and description of trees, shrubs, flowers beds, foliage beds, climbers and creeper, hedges, edges, cacti, succulents, ferns and palms. Evaluation of different garden sites in the campus based on the basic principles – Study of different styles of garden – lawn – study of types of grasses – establishment, care and maintenance of lawn – art of topiary – identification, planning and designing of non – living components – principles and concepts in garden designing – preparation of landscape design plan for home, institution and industries – study on special types of garden – preparation of landscape project – study on horticultural crafts – bonsai, terrarium and flower arrangement – visit to various gardens.



## 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.
14. Water features, fountains, fences, gates, arches, pergolas and garden paths in landscaping.
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
20. Fundamentals of manual drawing - plan view, elevation and perspective diagrams.
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
28. Bog, vertical and roof garden.
29. Studies on modern day special types of garden.
30. Horticultural crafting - bonsai and bonsai culture.
31. Flower arrangements
32. Terrarium
33. Cut foliage-importance of cut foliage
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.
9. Maintenance 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

14. Preparation of landscape plan for home, Institute and Industry gardens.
15. Preparation of landscape plan for public parks
16. Practices on Horticultural crafts – bonsai, terrarium and flower arrangements, Vegetable and fruit carving.
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.

#### **CO-PO MAPPING MATRIX**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	3	2	3	2
CO2	3	2	2	3	3	2	1	1

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11. Valasalakumari, P.K., P.K. Rajeevan and P.K. Sudhadevi. 2008. Flowering Trees – Horticulture Science Series -12. New India Publishing Agency.

#### **E-RESOURCES**

1. [www.bestgarden.net](http://www.bestgarden.net)
2. [www.toptropicals.com](http://www.toptropicals.com)
3. [www.gardenadornments.com](http://www.gardenadornments.com)
4. [www.gardentools.com](http://www.gardentools.com)
5. Software -Auto CAD – 2010 Edition

### **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

Definition for plant diseases - Causes of plant diseases - Classification of plant diseases - etiology and symptoms of plant diseases. Mango, banana, citrus, grapevine, guava, sapota, pomegranate, papaya, jack, pineapple, ber, apple, peach, litchi, fig and plum.

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

Tea, coffee, cocoa, rubber, coconut, Arecanut, 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 Arecanut
20. Aloe vera, Ashwagandha, Medicinal coleus

21. Gymnema, dioscorea, Gloriosa and stevia
22. Lemon grass, palmarosa, vetiver 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 colacasia
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

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	2	2	3	2	-	-	-
CO 2	2	3	2	3	3	2	1	-
CO 3	1	2	1	3	2	-	-	1
CO 4	1	3	3	3	1	2	1	1
CO 5	1	1	-	3	-	3	3	-

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## 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

Prospects and constraints of protected cultivation in India - types of protected structures - study of environmental factors influencing green house production-classification of greenhouses - designing and erection of protected structures - cladding/glazing/covering materials.

### Unit-II: Environmental control

Environment control - ventilation - heating and cooling systems - CO<sub>2</sub> enrichment - light regulation - containers and growing media - soil/media decontamination.

### **Unit-III: Water and nutrient management**

Water and nutrient management- micro irrigation and fertigation systems - design, layout and installation of drip and fertigation in horticultural crops- water soluble fertilizers-automation- mulch films-weed mat- hydroponics - NFT - aeroponics.

### **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, banan, tomato, capsicum, cucumber, cut roses, cut chrysanthemum, carnation and gerbera.**Current Stream of thought**

### **PRACTICAL**

Study of different kinds of protected structures - designs, components and construction - types and structures of auto control systems in green house - study of heating and cooling systems - study of different media, solarization and fumigation - study of special horticultural practices for vegetables/flowers under protected cultivation - visit to protected cultivation units. Positioning systems viz., GPS and positioning accuracy - understanding GPS Specifications - utilization of GIS software - soil salinity and compaction - Soil test crop response (STCR) - Grid soil sampling - canopy management in precision farming - water use efficiency in annuals, perennials and landscape horticulture - visit to commercial units.

### **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
6. Environment control - management and manipulation of temperature, light, humidity, air and CO<sub>2</sub> - ventilation.
7. Environment control - heating and cooling systems
8. Environment control - light regulation and CO<sub>2</sub> enrichment
9. Containers and growing media - soil/media decontamination.
10. Micro irrigation and fertigation management in protected culture.
11. Hydroponics - nutrient film techniques, aeroponic culture
12. Protected cultivation techniques for tomato
13. Protected cultivation techniques for capsicum
14. Green house cultivation techniques for cucumber.
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.
19. Post-harvest handling techniques - Precooling, sorting, grading, packing, storage - quality standards.
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.

23. Mobile mapping systems 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)
26. Remote sensing and its application in precision farming.
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.
10. Positioning systems understanding of GPS, positioning accuracy specifications and utilization of GIS software.
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.

#### **CO-PO MAPPING MATRIX**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>
<b>CO1</b>	2	3	3	3	-	2	2	3
<b>CO2</b>	2	3	3	3	-	2	2	3

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5. [www.agritech.tnau.in](http://www.agritech.tnau.in)
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### HOR 326 PROCESSING AND POST-HARVEST MANAGEMENT OF HORTICULTURAL CROPS (2+1)

#### 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 harvest and post-harvest treatments to enhance shelflife

##### Unit-II: Post-Harvest Treatments and Storage

Handling methods - pre-cooling-cooling methods - washing and grading - waxing - vapour heat treatment - fumigation -ripening methods-ethylene in post-harvest technology. storage methods -low temperature storage-refrigerated storage-storage using evaporative coolers- hypobaric, controlled and modified atmospheric storage techniques - storage disorders - handling of cut flowers - shelf life extension.

##### Unit-III: Packaging and Export of Horticultural Produce

Packaging of horticultural produce - type of containers and cushioning materials - methods of packing - controlled and modified atmospheric packaging - vacuum, edible packaging. WTO guidelines for export of horticultural produce- CODEX standards and export standards for major fruits, vegetables and cutflowers-food safety standards.

#### **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.
28. Sterilization – pasteurization – dehydration.
29. Principles of preservation by canning.

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.
12. Preparation of Jelly and marmalade.
13. Preparation of sauce and ketch-up.
14. Preparation of pickles.
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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	3	-	2	3	1
CO2	-	-	-	3	-	2	3	1
CO3	-	-	-	3	-	3	3	1

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### 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**

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. Financial inclusion and exclusion: Credit widening and credit deepening monetary policies. New generation private sector banks. Credit gap: Factors influencing credit gap. Non- Banking Financial Institutions (NBFI). Assessment of crop losses - Determination of compensation - Crop Insurance: Schemes - Coverage - Advantages and limitations in implementation - Estimation of crop yields - Livestock insurance schemes - Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.

#### **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 Vaithyanathan 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.

5. Repayment plans. Farm financial statements: Balance sheet - Income statement - Cash flow statement - Financial ratio analysis.
6. Institutional lending agencies - Commercial banks: Nationalization - Agricultural development branches - Area approach - Priority sector lending - Regional Rural Banks.
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.
12. Financial inclusion and exclusion: Credit widening and credit deepening monetary policies. New generation private sector banks. Credit gap: Factors influencing credit gap. Non-Banking Financial Institutions (NBFI).
13. Assessment of crop losses - Determination of compensation - Crop Insurance: Schemes - Coverage - Advantages and limitations in implementation - Estimation of crop yields - Livestock insurance schemes - Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.
14. Cooperation: Philosophy and Principles - History of Indian co-operative credit movement: Pre and Post - Independence periods and cooperation in different plan periods.
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 Vaithyanathan 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.
6. Preparation of Cash flow Statement and Exercise on preparation of Repayment plans.
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.

### **CO-PO MAPPING MATRIX**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	3	-	-	1	-
CO2	-	-	-	3	-	-	-	1
CO3	-	-	-	-	-	2	-	2
CO4	-	-	-	2	2	-	-	2

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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**

Extension Education - Meaning, definition and importance, Agricultural Extension - Meaning, definition. Research - Extension - Clientele linkage systems, TOT - Meaning and definition, components of TOT, models and approaches of TOT - Importance of TOT in Agricultural Extension.



## **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 brain storming. 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 Shoemaker)
4. Elements of communication and their characteristics - Barriers of communication.
5. Extension teaching methods – Meaning, definition, functions and classification. Individual contact methods – Farm and home visit, Farmers call, Personal letter, Result demonstration.
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.
7. Mass contact methods – Campaign, Exhibition, Farmers Day, Field trips, Radio, Television Farm publications – Circular letter, Leaflet, Folder, Pamphlet, Newsletter, Newspaper.
8. Audio aids, Visual aids, Audio-Visual aids – Definitions, classification, Factors influencing selection and use of audio visual aids.
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.
14. Participatory Extension Approaches - Meaning, Definition, Importance, Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA) – Resource Mapping, Transect Walk, Matrix ranking, Venn diagram, Seasonal calendar.
15. Participatory Technology Development – Meaning and steps
16. Diffusion of Innovations – Definition, elements; Innovation – definition, attributes. Adoption – meaning, steps in adoption process, Innovation Decision process.
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.
12. Art of public speaking.
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.

### PO-CO MAPPING MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8
CO1	3	-	2	2	2	-	-	-
CO2	-	2	-	1	-	2	-	-
CO3	3	-	3	-	-	3	-	-
CO4	-	3	-	-	3	-	-	-

### REFERENCES

1. Chauhan Nikulsingh. 2013. Use of ICTs in Agricultural Extension, Biotech Books.
2. Indu Grover, Sushma Kaushik, Lalit, Yadav and S.K. Varma, 2002. Communication and Instructional Technology, Agrotech Publishing Academy, Udaipur.

3. Narayanasamy, N. 2009. Participatory Rural Appraisal: Principles, Methods and Application, Sage Publications India Pvt. Ltd., New Delhi.
4. Pandey, V.C. 2003. Information Communication Technology and Education (The Changing World ICT Governance), Isha Publishers.
5. Ray, G.L and Sagar Mandal. 2010. Journalism, Farm Journalism and Communication skills. Kalyani publishers, Calcutta.
6. Ray, G.L. 2012. Extension Communication and Management, Kalyani publishers, Naya Prakash, 2006, Bidhan Sarani, Calcutta.
7. Reddy Adivi, A. 1993. Extension Education, Shree Lakshmi Press, Bapatla, Andhra Pradesh.
8. Rogers, E.M. 2003. Diffusion of Innovations, The Free Press, New York.
9. Santha Govind, Tamilselvi, G and J. Meenambigai. 2011 Extension Education and Rural Development, Agrobios (India), Jodhpur.
10. Saravanan, R. 2010. (Ed.)ICTs for Agricultural Extension: Global Experiments, Innovations and Experiences, New India publishing Agency (NIPA), New Delhi.

#### e- resources

1. [www.i4d.com](http://www.i4d.com)
2. [www.panasia.org](http://www.panasia.org)
3. [www.joe.org](http://www.joe.org)

## 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

History and background – scope and importance – uses and demands in phyto chemicals and AYUSH – Medicinal and aromatic plants wealth of India and Tamil Nadu – area and production – export and imports – conservation strategies – exsitu and insitu – classification – based on family, habit, climate, soil and ecological factors – organized production – GAP, GMP guidelines, contract farming – constraints and challenges in production and maintenance – Institutions for promotion of medicinal and aromatic crops – propagation and planting – after care cultural practices – training and pruning – manuring and irrigation – harvesting and post – harvesting – processing and storage methods of medicinal and aromatic crops.

#### **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

Identification and description of medicinal and aromatic crops, parts used and their products -Nursery raising and planting of senna- coleus- ashwagandha- glory lily- sarpagandha, Dioscorea sp. aloe -phyllanthus- kalmegh- medicinal solanum- gymnema, isabgol- ipecac- periwinkle- poppy- safed musli- stevia, palmarosa- lemon grass- citronella- vetiver- geranium- mentha- artemisia, ocimum- eucalyptus- rosemary- thyme- patchouli- lavender- marjoram- organum. study of varieties and propagation techniques in medicinal and aromatic crops – harvesting, curing and processing – distillation units – extraction and identification of alkaloids and essential oils from medicinal and aromatic crops – preparation of project reports and working out economics of cultivation.

## 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 vetiver
22. Geranium and artemisia
23. Mint
24. Ocimum
25. Patchouli
26. Rosemary and thyme
27. Organum 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.

### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	-	3	3	1
CO2	2	2	3	3	-	2	3	1

### REFERENCES

1. Atal, C.K. and B.M. Kapur. 1982. Cultivation and Utilization of Medicinal Plants. RRL, CSIR, Jammu.
2. Farooqi, A. A. and B.S.Sriramu. 2001. Cultivation Practices for Medicinal and Aromatic Crops. University Press, Hyderabad.
3. Farooqi, A. A., M.M. Khan. and M. Vasundhara. 2001. Production Technology of Medicinal and Aromatic Crops. Natural Remedies Pvt. Ltd.
4. Hota, D. 2007. Bio Active Medicinal Plants. Gene Tech Books.
5. Jain, S.K. 2000. Medicinal Plants. National Book Trust.
6. Khan, I.A. and A. Khanum. 1998. Role of Bio Technology in Medicinal and Aromatic Plants. Vol. 3. Ukaaz Publ.
7. Kurian, A. and M. Asha Sankar. 2007. Medicinal Plants. Horticulture Science Series, New India Publ. Agency.
8. Panda, H. 2002. Medicinal Plants Cultivation and their Uses. Asia Pacific Business Press.
9. Prajapati, S. S., H. Paero, A.K. Sharma. and T. Kumar. 2006. A Hand book of Medicinal Plants. Agro Bios.
10. Ramawat, K.G. and J.M. Merillon. 2003. BioTechnology-Secondary Metabolites. Oxford and IBH.

11. Skaria, P., Baby, Samuel Mathew, Gracy Mathew, Ancy Joseph. and Ragina Joseph. 2007. Aromatic Plants. New India Publ. Agency.

## VII SEMESTER

### STUDENT READY COMPONENT -I: RURAL HORTICULTURAL WORK EXPERIENCE (RHWE)

#### 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.

## CO-PO MAPPING MATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	3	3	-	-
CO2	-	-	2	2	-	-	-	-
CO3	3	-	3	-	2	3	-	-
CO4	-	3	-	2	-	3	-	-

### 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 crops, 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

## CO-PO MAPPING MATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	1	1	1	1	1	-	-
CO2	-	-	1	1	1	-	-	-
CO3	2	1	1	1	-	-	-	-
CO4	2	1	1	1	1	1	-	-
CO5	2	-	-	2	-	-	2	1

### 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 calendar of operations for all horticultural crops

**CO3:** Can **become** eligible to manage horticultural farms.

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	2	2	2	2	2
CO2	3	3	3	3	3	2	2	2
CO3	3	3	3	3	3	2	2	2

**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**

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	1	1	2	3	3	3
CO2	1	1	2	2	3	2	3	3
CO3	3	1	3	3	3	1	3	2
CO4	3	1	2	2	2	1	3	3

## AEX 414 ALL INDIA STUDY TOUR (0+1)

## AEX 414 ALL INDIA STUDY TOUR (0+1)

### 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**

### CO-PO MAPPING MATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	3	3	2	3	3	2
CO2	3	-	2	3	2	3	3	3
CO3	3	-	3	3	3	3	2	3

## 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

CO 3: Prepare project report

#### CO-PO MAPPING MATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	2	3	2	1	-	2
CO2	3	3	3	3	2	2	-	1
CO3	2	2	2	3	2	1	-	1

#### 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.

S. No.	Course No.	Title	Credit
1	EXP HOR 421	Commercial Horticultural Nursery	0+10
2	EXP HOR 422	Protected cultivation of vegetable crops	0+10
3	EXP HOR 423	Protected cultivation of cut flower crops	0+10
4	EXP HOR 424	Organic vegetable production	0+10

#### 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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	2	3	2	1	-	2
CO2	3	3	3	3	2	2	-	1
CO3	2	2	2	3	2	1	-	1

#### REFERENCES

1. Bose T.K.S.K. Mitra, M.K. Sadhu, B. Mitra., 2001 Propagation of tropical and subtropical horticultural crops, Naya Prakash 206, Bidhan Sarani, Calcutta, Six. India.
2. Hartmann, H.T., D.E. Kester, F.T. Davies and R.L. Greeneve. 2006 Plant Propagation. Principles and Practices. Prentice Hall of India Private Ltd., New Delhi.
3. Rajan, S. and B.L. Markose. 2007. Propagation of Horticultural Crops. New India Publishing, New Delhi.

#### E-Resources

1. <http://www.horticulture/propagation.com>
2. <http://www.fruitcrops.propagation.com>
3. <http://www.micropropagation/propagationtechniques.com>
4. <http://www.biotech/tissue culture techniques.com>

### 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, synthesize, 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.

#### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	3	3	-	2	2	2
CO2	2	3	3	3	-	2	2	2
CO3	2	2	3	3	-	2	2	1

#### REFERENCES

1. Kumar, N. 1990. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.
2. Prasad, S. and U. Kumar. 2010. Green House management for Horticulture crops. Agrobios (India).
3. Salokhe V.M. and A.K. Sharma. 2006. Green house technology and applications, Agrotech Publishing Academy, Udaipur.

#### E-RESOURCES

1. [www.icar.org.in/ciphet.html](http://www.icar.org.in/ciphet.html)
2. [www.jains.com](http://www.jains.com)
3. [www.gisdevelopment.net](http://www.gisdevelopment.net)
4. [www.lasercladding.com](http://www.lasercladding.com)
5. [www.epa.gov](http://www.epa.gov)

### 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, synthesize, 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.

#### CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	3	3	-	2	2	2
CO2	1	1	3	3	-	2	2	2
CO3	1	1	3	3	-	2	2	2

#### REFERENCES

1. Bose TK, Maiti RG, Dhua RS & Das P. 1999. Floriculture and Landscaping. NayaPrakash.
2. Nelson PV. 1978. Green House Operation and Management. Reston Publ.Co.
3. Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios
4. Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra RL. 2007. Hightech Floriculture. Indian Society of Ornamental Horticulture, New Delhi.

#### E RESOURCES

1. [www.icar.org.in/ciphet.html](http://www.icar.org.in/ciphet.html)
2. [www.jains.com](http://www.jains.com)
3. [www.gisdevelopment.net](http://www.gisdevelopment.net)
4. [www.lasercladding.com](http://www.lasercladding.com)
5. [www.epa.gov](http://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.

## CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	-	2	2	2
CO2	3	3	3	3	-	2	2	2
CO3	2	3	3	3	-	2	3	3

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