



ANNAMALAI UNIVERSITY

(Accredited with 'A' grade by NAAC)



FACULTY OF AGRICULTURE

(Accredited by ICAR)

**BACHELOR OF SCIENCE (HONS) IN
HORTICULTURE**

Academic Regulations and Syllabus

**Under Choice Based Credit System (CBCS)
with Outcome based Education**

2021-22 Onwards

ANNAMALAI UNIVERSITY
FACULTY OF AGRICULTURE
B.Sc. (Hons) Horticulture
Academic Regulations and Syllabi
(With effect from 2021-2022)

1. Title and Scope

1.1. These academic Regulations shall be called “Annamalai University Faculty of Agriculture B.Sc. (Hons) Horticulture Academic Regulations 2021” for obtaining bachelor’s degree in the Faculty of Agriculture.

1.2. The regulations provided herein shall apply to the students admitted from the academic year 2021-22 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 year: An academic year is a period during which a cycle of study is completed. There shall be two semesters in an academic year. The Academic Calendar will be developed by the University from time to time and notified accordingly by the Registrar in advance.

2.4. Semester: A semester shall consist of 95 instructional days with additional 15 days for examination. Thus, a semester will consist of 110 working days.

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 prefix, code number, title and credits. Each course is denoted by specific code number, which has specific meaning. The first three alphabets stand for the department offering the course. First digit is related to the year; Second and third digit is related to number of courses offered by a department in a particular year i.e “AGR 101 Fundamentals of Agronomy” “AGR” stands for the Department of Agronomy. The first digit (1) stands for the year and the third digit (1) stands for the first subject offered by the department in the particular year. The middle digit Zero refers to credit course and 1 refers to non-gradual course.

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 undergoes 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 a measure of the 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 taken during that semester.

2.12. Overall Grade Point Average (OGPA): It is a 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 the second decimal place.

2.13. The OGPA shall be rounded off to the second digit of the decimal point on the basis of third digit. If the third digit of the 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	18
ii.	Total credit points till the end of last semester	140.50
iii.	Total credit hours in the current semester	22
iv.	Total credit points obtained in the current semester	156
v.	Total credit hours including the current semester	$(18+22)=40$
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 programme 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. The decision of the University is final in deciding the procedure of admission and finalization of number of seats. Reservation rules 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 organised 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. Dean shall nominate a co-ordinator from amongst the teaching faculty.
- 4.2. Student ward counsellors will be nominated soon after the students' admission. The counsellor shall be nominated from amongst the teaching faculty.
- 4.3. A student should register the courses for each semester in consultation with the sectional coordinator and **submit the registration card within five working days** from the date of reopening of that semester.

5. Curriculum and programme of study

The students admitted in the University shall be required to follow the curriculum as prescribed, revised by the Faculty and approved by the Academic Council from time to time.

6. Award of Degree, duration and credit requirements

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.

Degree	Duration requirements (Semester)		Credit requirements
	Min	Max	
B.Sc. (Hons) Horticulture	8	16	182

7. Medium of Instruction

The medium of instruction in the 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 of study, separately in theory and practical shall not be permitted to appear for both theory and practical examinations in that course and shall be given 'E' (incomplete) and will be required to repeat the course 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 the student secures minimum 50 per cent of attendance in practical and theory classes and that to for genuine medical 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 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		Marks
Mid Semester Examination		20
Practical Examination (Written = 25, Record = 5 Specimen collection/ Assignment/Viva-Voce = 10)		40
Theory Examination		40
Total		100
9.2 Course with only Theory / Practical		Marks
Mid Semester Examination		40
Final Semester Examination		60
Total		100

- 9.3. The students should register for the examination in the online portal of the University and shall pay the examination fees as prescribed by the university from time to time.
- 9.4. **Evaluation of course work:** The results of the course shall be indicated by grade points ranging from 0 to 10.0. The minimum grade point to be secured for the successful completion of a course will be 6.50. Securing a grade point less than 6.50 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 60% mark separately in theory and practical with an aggregate of 65 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
EE	Incomplete for reasons other than attendance

- 9.5. **Evaluation pattern for courses with only practical:** The evaluation pattern of courses with only practical is grouped and mark distribution is furnished below.
- a. **PEY 111 Physical Education and Yoga Practice (0+1)**

Each student enrolled in PEY 111 should attend two semesters (I and II). The student has to undergo 60 hours of face to face course work in a year out of which 30 hours for physical education and 30 hours for yoga practice. The students will be evaluated for 100 marks at the end of the second semester. The course teachers will evaluate the

performance of students in the classes and marks will be awarded at the end of the second semester as detailed below. The final practical examination will be conducted in the last practical class of the second semester and the course teacher shall send the marks awarded to the Controller of Examinations through the Dean, Faculty of Agriculture.

Particulars	Physical Education	Yoga practice	Total Marks
	Max. marks	Max. marks	
Attendance and routine activities	20	20	40
Participation in special practices	10	10	20
Practical Examination	20	20	40
Total	50	50	100

b. **NSS 111/ NCC 111 (0+1)**

The duration of NCC/NSS training is for four semesters (I, II, III and IV). A student should register either NCC or NSS course in the first semester and evaluated at the end of fourth semester.

NSS: A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two years. Different activities will include orientation lectures and practical works. 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. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

Marks will be awarded as follows.

S. No.	Particulars	Marks
1	NSS Regular Programme (15 +15 +15 +15) (15 Marks/semester)	60
2	NSS Special camp not exceeding 7 days duration (Attendance-30 and Activity -10)	40
	Total	100

NCC: A 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 ($2.5 \times 40 = 100$).

c. **HOR 305 Crop Production (Practicals)**

S. No.	Particulars	Mid-semester examination	Final examination
1	Field evaluation	20	20
2	Written examination	20	25
3	Record	-	5
3	Assignment	-	5
4	<i>Viva-Voce</i>	-	5
	Total	40	60

d. **HOR 211 Educational Tour I (Horticulture) & EXT 411 Educational Tour II (Agricultural Extension)**

Educational tour courses HOR 211 Educational Tour-I and EXT 411 Educational Tour-II (All India Tour) are compulsory. The tours will be undertaken during the second and final year, respectively. The duration of HOR 211 shall not exceed 7 days and that of EXT 411 shall not exceed 14 days. The tours will be arranged by the respective departments of the study in consultation with the Dean, Faculty of Agriculture. The final examination will be conducted at the end of the semester by the University. The Marks for the tours are to be awarded as follows

Particulars	Max marks	Evaluation by
Attendance	20	Accompanying staff
Behaviour	30	
Final examination		
Tour Diary	20	Examiners
Tour record/ Report	20	
Viva Voce	10	
Total	100	

e. **Student READY programme (Rural and Entrepreneurship Awareness Development Yojana) to assure employability and to develop entrepreneurs**

This will be undertaken by the students during the seventh and eighth semesters. Student READY shall be run for full year by making two groups and rotating activities of the final year in two groups. **To get the eligibility for registering for the Student READY programme, the students should have completed all the courses successfully up to sixth semester. No student should be allowed to take up the Student READY programme with backlog/repeat courses.**

The students shall register for the three components listed below. The minimum attendance required for this programme is 85% in each component. Any student in the event of recording shortage of attendance has to re-register when that component is offered next by paying the necessary fee.

1. Experiential Learning (EL)/Hands on Training (HOT) - 20 credits (24 weeks)
2. Rural Agriculture Work Experience (RAWE) 10 credits (10 weeks)
3. In Plant Training/Industrial attachment - 10 credits (10 weeks)

Experiential Learning (EL) aims towards practical work experience in real life situation among the students and therefore it helps the student become “job provider rather job seeker”. EL provides students an excellent opportunity to develop entrepreneurial skills through meaningful hands-on experience and confidence. As the programme is enterprise oriented, students and faculty are to attend the activities of the enterprise even on institutional holidays with total commitment. Each EL unit shall have the organizational set-up as follows:

Chief Executive Officer- HoD

Managing Director - Senior Teacher in the group

Board of Directors - Other teachers in the group

Manager - Student representative from the group

Deputy Manager – Another student from the group

10. Mid-semester examination (MSE)

- 10.1. MSE will be conducted as per the Timetable prepared by the Dean, Faculty of Agriculture. For every subject, two question papers should be prepared by the Faculty nominated by the respective head of the departments two weeks before the commencement of MSE.
- 10.2. 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 examination. Such 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.
- 10.3. 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.
- 10.4. The MSE marks will be furnished to the Dean, Faculty of Agriculture through 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.
- 10.5. The MSE of theory will be one hour duration. For courses with both theory and practical, 20 marks will be apportioned as shown below.

	Model	Marks
i.	Definition @ 1 mark for 5 questions out of 7	5
ii.	Short notes @ 2 marks for 5 questions out of 7	10
iii.	Essay type @ 5 marks for 1 question out of 2	5
	Total	20

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

	Model	Marks
i.	Definition @ 2 marks for 5 questions out of 7	10
ii.	Short notes @ 3 marks for 5 questions out of 7	15
iii.	Essay type @ 7.5 marks for 2 questions out of 3	15
	Total	40

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

	Model	Marks
i.	Definition @ 1 mark for 5 questions out of 7	5
ii.	Short notes @ 2 marks for 5 questions out of 7	10

iii.	Essay type @ 5 marks for 1 question out of 2	5
iv.	Practical activity/Field evaluation	20
	Total	40

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

10.7. A student who fails to attend a mid-semester examination due to unavoidable circumstances /who doesn't secure 65% marks in the MSE shall be permitted to reappear once with prior approval of the Dean to take up missing examination/reappearance of the particular course, on payment of fee prescribed by the University. Such tests should be completed ordinarily within 15 working days after the respective MSE. In such case the marks obtained in the reappear MSE is final.

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 as per Bloom's taxonomy by the course teacher nominated by the concerned Head of the Department.

For courses with theory and practical, the 40 marks for the theory examination will be apportioned as shown below.

	Model	Marks
i.	Objective type @ 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) (one question must represent K7 level of Bloom's taxonomy)	25
	Total	40

For courses with only Theory, 60 marks will be apportioned as shown below.

	Model	Marks
i.	Objective type @ 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) (one question must represent K6 level of blooms taxonomy)	25
	Total	60

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** will be conducted separately towards the end of each semester. Practical examination will be conducted separately as per the schedule proposed by the Dean, Faculty of Agriculture and approved by the University. 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.

For the courses with theory and practical, the 40 marks for the final practical examination will be apportioned as mentioned below:

	Model	Marks
i.	Practical activity	25
ii.	Specimen collection / Assignment	5
iii.	Record Notebook	5
iv.	Viva-voce	5
	Total	40

- 11.6. If a student secures a 'pass' in the practical examination of a particular course and fails in the theory examination, then, the practical examination marks obtained in the first attempt will be added to the supplementary examinations also and he/she doesn't require to reappear for practical examination.
- 11.7. If a student fails in practical examination of a particular subject, then he/she should reappear for both practical and theory examination.
- 11.8. For student READY components, the final examination will be conducted at the end of the 8th semester
- 11.9. Two examiners and one skilled assistant nominated by Head of the Department and recommended by the Dean, Faculty of Agriculture will conduct the practical examination.
- 11.10. Students should possess hall ticket for writing practical and final examinations.
- 12. Re-appearance in the examination**
- 12.1. As per the clause 11.6 and 11.7, re-appearance for the theory and practical examinations will be permitted (retaining marks obtained in mid-semester examination) 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. The camp requirement in NSS and NCC may be allowed along with juniors if the student has secured less than 80 % attendance in the regular courses.
- 12.4. Those who miss the study tours for any valid reason must undertake the tour along with juniors to complete the degree programme.
- 12.5. 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) Agriculture Degree Programme (private candidate) cannot appear for more than 16 subjects in the re-appearance examination at a time.

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

13. Malpractices in examinations

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

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

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

14. Regulations of student conduct and discipline

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

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

14.3. **Ragging - An offence:** Extract of Tamil Nadu Government Gazette - Extra ordinary dt.29.01.1997 (Tamil Nadu Prohibition of Ragging Act, 1997). In this Act, unless the context otherwise requires, "Ragging" means display of noisy, disorderly conduct, doing any act which causes or is likely to cause physical or psychological harm or raises apprehension or fear or shame or embarrassment to a student in any educational Institution and includes: teasing, abusing or playing practical jokes on or causing hurt to such student or asking the student to do any act or perform something which such student will not, in the ordinary course willingly act or perform. Ragging within or outside any educational institution is prohibited. Whoever 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 students 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 the entire graduation requirement 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 182 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. Percentage equivalence and Class ranking

In calculation of percentage and class equivalent for OGPA, the following formula shall be adopted.

$$\text{Percentage equivalent for OGPA} = \frac{\text{Sum of marks obtained by the candidates in all the Courses}}{\text{Sum of maximum marks in all the Courses}} \times 100$$

In calculation of percentage and class equivalent for OGPA the following classification shall be adopted.

OGPA	Percentage	Class
9.00 and above	90.00 and above	Distinction
8.00 to 8.99	80.00 to 89.99	I Class
7.00 to 7.99	70.00 to 79.00	II Class
6.50 to 6.99	65.00 to 69.99	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 2021 - 2022. 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.

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B.Sc. (Hons) Horticulture	
PROGRAMME OUTCOMES	
1.	Graduates will understand basics and advances in plant propagation, nursery management crop improvement, crop physiology, production, and protection technologies, cost of cultivation in horticulture crops.
2.	Graduates will be able to develop expertise in the various techniques and illustrate efficiency in identifying symptoms & pests, farm budgeting, weather analysis, irrigation and nutrient management.
3.	Graduates will be successful professionals in agro-industries with problem solving skills, critical thinking, market intelligence and decision-making and will be able to organize, facilitate and participate effectively and demonstrate innovativeness and creativity.
4.	Graduates will become eligible to get employment in managing vegetable seed production units, organic farms, estate operations, precision horticulture units, orchards, banking sector, post harvest industries, execution and management of landscape projects.
5.	Graduates will learn appropriate traditional/indigenous/organic 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.
6.	Graduates 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.

PO and CO Mapping Matrix

Correlation levels 1, 2 and 3 are as defined below:

1 - Low, 2- Moderate/ Medium, 3 - Substantial /High

Arrangement of Courses

I year	Basic and fundamental courses (Traditional)
II Year	Principles (Technology)
III Year	Production system (For improving Talent)
IV Year	Skill and entrepreneurship development (For federating Trading)

Summary of credit hours

S. No.	Title	Credit
1	Core Courses-57	142
2	RHWE & ELP-9	40
	Total	182

Abstract of Distribution Pattern of Courses and Credit

Semester	Number of Courses	Credit
I	11	21 (11+10)
II	10	25 (15+10)

III	10	21 (12+9)
IV	11	24(14+10)
III/IV	1	1(0+1)
V	9	23 (14+9)
VI	9	26 (15+10)
VII	2	20 (0+20)
VIII	2	20 (0+20)
VII/VIII	1	1(0+1)
Total		182 (83+99)

Discipline Wise Summary of Credit

S.No.	Discipline	Credit
1	Horticulture	59 (35+24)
2	Agronomy	10 (5+5)
3	Genetics & Plant Breeding	11 (7+4)
4	Soil Science & Agricultural Chemistry	6 (3+3)
5	Entomology	12 (8+4)
6	Plant pathology	11 (7+4)
7	Agricultural Microbiology	7 (4+3)
8	Agricultural Economics	7 (5+2)
9	Agricultural Extension	4 (2+2)
10	Engineering	2 (1+1)
11	Plant Biochemistry and Biotechnology	2 (1+1)
12	Statistics	2 (1+1)
13	Computer Science	2 (1+1)
14	English	2 (1+1)
15	NSS/NCC/Physical Education & Yoga Practices *	2 (0+2)
16	Educational Tour *	2 (0+2)
17	Tamil / Agricultural Heritage*	1 (1+0)
18	Bridge Courses	
	Total	142
19	RHWE & ELP	40
	Total	182

* Non-gradual courses

Bridge courses

Bridge courses in biology and mathematics will be conducted for those candidates who have not undergone the respective courses during their higher secondary programme. These courses will be offered for 8 weeks @ 2 hours /week from the date of commencement of the programme.

Sl. No.	Semester	Course code	Title	Credit
1.	I	MAT 001**	Elementary Mathematics (Contact Hours 2)	-
2.	I	GPB 002**	Introductory Biology (Contact Hours 2)	-

Non Gradual Compulsory Courses

Sl. No.	Semester	Course code	Title	Credit
1	I, II	PEY 111*	Physical Education & Yoga	1(0+1)
2	I, II, III, IV	NSS 111*/ NCC 111*	NSS/NCC	1(0+1)
3	I	TAM 111*/ EXT 111*	Tamil / Agricultural Heritage	1(1+0)
4	III/IV	HOR 211*	Educational Tour I (Horticulture)	1(0+1)
5	VII/VIII	EXT 411*	Educational Tour II (Agri. Extension)	1(0+1)
Total				5(1+4)

Department wise List of Courses Horticulture

Sl. No.	Semester	Course code	Title	Credit
1.	I	HOR 101	Fundamentals of Horticulture	3(2+1)
2.	I	HOR 102	Plant Propagation and Nursery Management	2(1+1)
3.	II	HOR 103	Tropical and Sub Tropical Fruits	3(2+1)
4.	II	HOR 104	Tropical and Sub Tropical Vegetable Crops	3(2+1)
5.	II	HOR 105	Potato and Tuber Crops	2(1+1)
6.	II	HOR 106	Growth and Development of Horticultural Crops	2(1+1)
7.	III	HOR 201	Temperate Fruit Crops	2(1+1)
8.	III	HOR 202	Temperate Vegetable Crops	2(1+1)
9.	III	HOR 203	Ornamental Horticulture	2(1+1)
10.	III	HOR 204	Dryland and Silvi Horticulture	3(2+1)
11.	VI	HOR 205	Breeding of Vegetable, Tuber and Spice Crops	3(2+1)
12.	IV	HOR 206	Spices and Condiments	3(2+1)
13.	IV	HOR 207	Principles of Landscape Architecture	2(1+1)
14.	IV	HOR 208	Breeding of Fruit and Plantation Crops	3(2+1)
15.	IV	HOR 209	Orchard and Estate Management	2(1+1)
16.	V	HOR 301	Commercial Floriculture	3(2+1)
17.	V	HOR 302	Precision Farming and Protected Cultivation	3(2+1)
18.	V	HOR 303	Post Harvest Management of Horticultural Crops	3(2+1)
19.	V	HOR 304	Breeding and Seed Production of Flower and Ornamental Crops	3(2+1)
20.	V	HOR 305	Crop Production (Vegetable crops /Flower crops)	1(0+1)
21.	VI	HOR 306	Plantation Crops	3(2+1)

22.	VI	HOR 307	Medicinal and Aromatic Crops	3(2+1)
23.	VI	HOR 308	Processing of Horticultural Crops	3(1+2)
Total				59(35+24)

Agronomy

S. No.	Semester	Course code	Title	Credit
1.	II	AGR 101	Agrometeorology and Climate Change	2(1+1)
2.	II	AGR 102	Weed and Water Management in Horticultural Crops	2(1+1)
3.	IV	AGR 201	Introduction to Major Field Crops	2(1+1)
4.	IV	AGR 202	Introductory Agroforestry	2(1+1)
5.	VI	AGR 301	Organic Farming	2(1+1)
Total				10 (5+5)

Genetics and Plant Breeding

Sl. No.	Semester	Course code	Title	Credit
1.	I	GPB 101	Introductory Crop Physiology	2(1+1)
2.	II	GPB 102	Principles of Genetics and Cytogenetics	3(2+1)
3.	III	GPB 201	Principles of Plant Breeding	3(2+1)
4.	VI	GPB 301	Seed Production of Vegetable, Tuber and Spice Crops	3(2+1)
Total				11(7+4)

Soil Science and Agricultural Chemistry

Sl. No.	Semester	Course code	Title	Credit
1.	I	SOL 101	Fundamentals of Soil Science	2(1+1)
2.	III	SOL 201	Soil Fertility and Nutrient Management	2(1+1)
3.	IV	SOL 202	Soil, Water and Plant Analysis	2(1+1)
Total				6(3+3)

Agricultural Entomology

S. No.	Semester	Course code	Title	Credit
1.	II	ENT 101	Fundamentals of Entomology	3(2+1)
2.	IV	ENT 202	Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops	3(2+1)
3.	V	ENT 301	Insect Pests of Vegetable, Ornamental and Spice Crops	3(2+1)
4.	VI	ENT 302	Apiculture, Sericulture and Lac Culture	3(2+1)
Total				12 (8+4)

Plant Pathology

S. No.	Semester	Course code	Title	Credit
1.	I	PAT 101	Fundamentals of Plant Pathology	3(2+1)
2.	III	PAT 201	Diseases of Vegetable, Ornamental and	3(2+1)

			Spice Crops	
3.	IV	PAT 202	Nematode Pests of Horticultural Crops and their management	2(1+1)
4.	V	PAT 301	Diseases of Fruit, Plantation, Medicinal and Aromatic Crops	3(2+1)
Total				11(7+4)

Agricultural Microbiology

Sl. No.	Semester	Course code	Title	Credit
1.	I	AGM 101	Introductory Microbiology	2(1+1)
2.	III	AGM 201	Fundamentals of Food Technology	2(1+1)
3.	IV	AGM 202	Environmental Studies & Disaster Management	3(2+1)
Total				7(4+3)

Agricultural Economics

Sl. No.	Semester	Course code	Title	Credit
1.	II	AEC 101	Economics and Marketing	3(2+1)
2.	VI	AEC 301	Horti- Business Management	2(2+0)
3.	VI	AEC302	Entrepreneurship Development and Business Management	2(1+1)
Total				7(5+2)

Agricultural Extension

Sl. No.	Semester	Course code	Title	Credit
1.	I	EXT 101	Fundamentals of Extension Education	2(1+1)
2.	V	EXT 301	Communication Skills and Personality Development	2(1+1)
Total				4(2+2)

Mechanical Engineering

Sl. No.	Semester	Course code	Title	Credit
1.	III	AEG 201	Farm Machinery, Power and Renewable Energy Sources (Mech)	2(1+1)
Total				2(1+1)

Plant Biochemistry and Biotechnology

Sl. No.	Semester	Course code	Title	Credit
1	II	BIO 101	Fundamentals of Plant Biochemistry and Biotechnology	2(1+1)
Total				2(1+1)

Statistics

Sl. No.	Semester	Course code	Title	Credit
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1.	VI	STA 301	Statistical Methods	2(1+1)
Total				2(1+1)

Computer Science

Sl. No.	Semester	Course code	Title	Credit
1.	V	COM 301	Information and Communication Technology	2(1+1)
Total				2(1+1)

English

Sl. No.	Semester	Course code	Title	Credit
1	I	ENG 101	Comprehension & Communication Skills in English	2(1+1)
Total				2(1+1)

Semester Wise Curriculum

I Semester

S. No.	Department	Course code	Title	Credit
1.	Horticulture	HOR 101	Fundamentals of Horticulture	3(2+1)
2.	Horticulture	HOR 102	Plant Propagation and Nursery Management	2(1+1)
3.	Genetics and Plant Breeding	GPB 101	Introductory Crop Physiology	2(1+1)
4.	Soil Science and Agricultural Chemistry	SOL 101	Fundamentals of Soil Science	2(1+1)
5.	Agricultural Microbiology	AGM 101	Introductory Microbiology	2(1+1)
6.	Pathology	PAT 101	Fundamentals of Plant Pathology	3(2+1)
7.	Agricultural Extension	EXT 101	Fundamentals of Extension Education	2(1+1)
8.	English	ENG 101	Comprehension & Communication Skills in English	2(1+1)
Total				18(10+8)
9.	Tamil/ Agricultural Extension	TAM 111*/ EXT 111*	jkpH; ,yf;fpa';fspy; ntshz;ika[k; mwptpay; jkpH;g; gad;ghLk / Agricultural Heritage	1(1+0)
10.	NSS/NCC	NSS 111*/ NCC 111*	NSS/NCC	1(0+1)
11.	Physical Education/ Centre for Yoga	PEY 111*	Physical Education & Yoga Practice	1(0+1)

	Studies			
Total				3(1+2)
	Maths	MAT 001**	Elementary Mathematics	
	Genetics and Plant Breeding	GPB 002**	Introductory Biology	
Total				21(11+10)
*Non Gradual course, ** Bridge Course				

II Semester

Sl. No.	Department	Course code	Courses	Credit
1	Horticulture	HOR 103	Tropical and Sub Tropical Fruits	3(2+1)
2	Horticulture	HOR 104	Tropical and Sub Tropical Vegetable Crops	3(2+1)
3	Horticulture	HOR 105	Potato and Tuber Crops	2(1+1)
4	Horticulture	HOR 106	Growth and Development of Horticultural Crops	2(1+1)
5	Agronomy	AGR 101	Agrometeorology and Climate Change	2(1+1)
6	Agronomy	AGR 102	Weed and Water Management in Horticultural Crops	2(1+1)
7	Genetics and Plant Breeding	GPB 102	Principles of Genetics and Cytogenetics	3(2+1)
8	Bio-Chemistry and Bio-Technology	BIO 101	Fundamentals of Plant Bio-Chemistry and Biotechnology	2(1+1)
9	Entomology	ENT 101	Fundamentals of Entomology	3(2+1)
10	Agricultural Economics	AEC 101	Economics and Marketing	3(2+1)
Total				25(15+10)

III Semester

Sl. No.	Department	Course code	Courses	Credit
1	Horticulture	HOR 201	Temperate Fruit Crops	2(1+1)
2	Horticulture	HOR 202	Temperate Vegetable Crops	2(1+1)
3	Horticulture	HOR 203	Ornamental Horticulture	2(1+1)
4	Horticulture	HOR 204	Dryland and Silvi Horticulture	3(2+1)
5	Horticulture	HOR 205	Breeding of Vegetable, Tuber and Spice Crops	3(2+1)
6	Genetics and Plant Breeding	GPB 201	Principles of Plant Breeding	3(2+1)
7	Soil Science and Agricultural Chemistry	SOL 201	Soil Fertility and Nutrient Management	2(1+1)
8	Pathology	PAT 201	Diseases of Vegetable, Ornamental and Spice Crops	3(2+1)
9	Engineering	AEG 201	Farm Power and Machinery	2(1+1)

			(Mech)	
10	Agricultural Microbiology	AGM 201	Fundamentals of Food Technology	2(1+1)
			Total	24(14+10)

IV Semester

Sl. No.	Department	Course code	Courses	Credit
1	Horticulture	HOR 206	Spices and Condiments	3(2+1)
2	Horticulture	HOR 207	Principles of Landscape Architecture	2(1+1)
3	Horticulture	HOR 208	Breeding of Fruit and Plantation Crops	3(2+1)
4	Horticulture	HOR 209	Orchard and Estate Management	2(1+1)
5	Agronomy	AGR 201	Introduction to Major Field Crops	2(1+1)
6	Agronomy	AGR 202	Introductory Agroforestry	2(1+1)
7	Soil Science and Agricultural Chemistry	SOL 202	Soil Water and Plant Analysis	2(1+1)
8	Entomology	ENT 202	Insect Pests of Fruit, Plantation, Medicinal and Aromatic crops	3(2+1)
9	Pathology	PAT 202	Nematodes Pests of Horticultural Crops and their Management	2(1+1)
10	Agricultural Microbiology	AGM 202	Environmental Studies and Disaster Management	3(2+1)
			Total	24(14+10)

III/IV Semester

Sl. No.	Department	Course code	Courses	Credit
1	Horticulture	HOR 211	Educational tour I (Non Gradiual Course)	1(0+1)

*HOR 211 Educational Tour I (0+1) (Horticulture) will be offered either during III or IV semester

V Semester

Sl. No.	Department	Course code	Courses	Credit
1	Horticulture	HOR 301	Commercial Floriculture	3(2+1)
2	Horticulture	HOR 302	Precision Farming and Protected Cultivation	3(2+1)
3	Horticulture	HOR 303	Post Harvest Management of Horticultural Crops	3(2+1)
4	Horticulture	HOR 304	Breeding and Seed Production of Flower and Ornamental Crops	3(2+1)
5	Horticulture	HOR 305	Crop Production (Vegetable crops /Flower crops)	1(0+1)
6	Entomology	ENT 301	Insect Pests of Vegetable, Ornamental and Spice crops	3(2+1)
7	Pathology	PAT 301	Diseases of Fruit, Plantation,	3(2+1)

			Medicinal and Aromatic Crops	
8	Agricultural Extension	EXT 301	Communication Skills and Personality Development	2(1+1)
9	Computer Science	COM 301	Information and Communication Technology	2(1+1)
			Total	23(14 +9)

VI Semester

Sl.No.	Department	Course code	Courses	Credit
1	Horticulture	HOR 306	Plantation crops	3(2+1)
2	Horticulture	HOR 307	Medicinal and Aromatic Crops	3(2+1)
3	Horticulture	HOR 308	Processing of Horticultural Crops	3(1+2)
4	Agronomy	AGR 301	Organic Farming	2(1+1)
5	Genetics and Plant Breeding	GPB 301	Seed Production of Vegetables, Tuber and Spice Crops	3(2+1)
6	Entomology	ENT 302	Apiculture, Sericulture and Lac Culture	3(2+1)
7	Agricultural Economics	AEC 301	Horti Business Management	2(2+0)
8	Agricultural Economics	AEC 302	Entrepreneurship Development and Business Management	2(1+1)
9	Statistics	STA 301	Statistical Methods	2(1+1)
			Total	23(14+9)

VII & VIII Semesters

1. Experiential Learning (EL)/Hands on Training (HOT) - 20 credits (24 weeks)
2. Rural Horticulture Work Experience (RHWE) 10 credits (10 weeks)
3. In Plant Training/Industrial attachment - 10 credits (10 weeks)
4. EXT 411 - Educational Tour

HOR 101 FUNDAMENTALS OF HORTICULTURE (2+1)

Learning objectives

- This course aims to impart the importance of horticulture to students.
- To impart basic knowledge on various branches of horticulture.
- To acquaint basic techniques on cropping systems of horticulture crops
- To impart knowledge on establishment and management of orchard
- To acquaint advanced technologies in horticulture.

Theory

Unit I: Scope and Importance of Horticulture

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

Unit-II: Establishment of orchard, production techniques and rejuvenation of old orchards

Establishment of orchard - principles, planning and layout - different planting systems - manures and manuring- fertility management in horticultural crops - weed management - irrigation methods- production practices for fruit, vegetable and floriculture crops- rejuvenation of old orchards - top working and frame working.

Unit III: Nursery management, cropping systems and factors influencing crop production

Nursery techniques - vegetable garden - nutrition garden, kitchen garden and other types of gardens - cropping systems - intercropping, multi-tier cropping - cover cropping -mulching - factors limiting horticultural crop production - influence of soil - physical and chemical properties and climatic factors - light, temperature, photoperiod, relative humidity, rainfall, microclimate, pollution - influence of biotic and abiotic stresses on horticultural crop production.

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

Unit V: Organic farming and post-harvest technology

Principles of organic farming - post-harvest technology - importance and causes for post-harvest losses - maturity indices - harvesting methods - market chain management.

Practical

Different features of orchard - planning and layout of orchard - tools and implements - identification of horticultural crops - digging of pits for fruit crops - different planting systems - training and pruning of fruit crops - preparation of fertilizer mixtures and field application - use of plant growth regulators -weed management - irrigation systems - assessment of bearing habits -judging the maturity indices of horticultural crops - harvesting methods and post-harvest handling.

Lesson Plan

Theory Schedule

1. Scope and importance of horticultural crops.
2. Classification and nutritive value of horticultural crops.
3. Divisions of horticulture.
4. Area and production of horticultural crops.
5. Export and import of horticultural crops and their products - global scenario.
6. Different climate zones of India in relation to horticultural crops.
7. Different climate zones of Tamil Nadu in relation to horticultural crops.

8. Research institutes related with development of horticulture.
9. Principles, planning and layout of orchard.
10. Different planting systems.
11. Manures and manuring and fertility management in horticultural crops.
12. Weed management and methods of weed control.
13. Methods of irrigation in relation to horticultural crops.
14. Production practices for fruit, vegetable and floriculture crops
15. Rejuvenation of old orchards, top working and frame working.
16. Nursery techniques for horticultural crops.
- 17. Mid Semester Examination**
18. Types of vegetable garden - nutrition garden, kitchen garden and other types of gardens for vegetable production.
19. Study of cropping systems
20. Study of intercropping, multi - tier cropping, and cover cropping.
21. Mulching - role of mulching - types of mulches for horticultural crop production.
22. Factors limiting horticultural crop production.
23. Soil and climate factors in relation to horticultural crop production.
24. Influence of biotic and abiotic stresses on horticultural crop production.
25. Bearing habits of horticultural crops.
26. Study of flowering, pollination and fruit set in horticultural crops.
27. Unfruitfulness - causes and prevention in horticultural crops.
28. Fruit drop - causes and prevention in horticultural crops.
29. Principles and methods of training and pruning in horticultural crops.
30. Role of growth regulators in horticultural crops.
31. Principles of organic farming.
32. Post harvest technology - importance and causes for post - harvest losses.
33. Maturity indices - climacteric and non - climacteric fruits and harvesting methods.
34. Market chain management.

Practical Schedule

1. Study of different features of orchard.
2. Planning, layout and planting of fruit trees.
3. Identification of tools and implements.
4. Digging of pits for fruit crops
5. Different planting systems for horticultural crops
6. Practicing training of fruit trees.
7. Practicing pruning of fruit trees.
8. Preparation of fertilizer mixtures and field application.
9. Identification of growth regulators, preparation and application.
10. Practicing weed management including chemical weed control.
11. Layout of different irrigation systems and irrigation methods.
12. Study of bearing habits of horticultural crops.
13. Study of different media for horticultural crops.
14. Practices in judging the maturity indices of fruits and vegetables.
15. Study of harvesting methods.
16. Post- harvest handling of horticultural crops.
- 17. Final practical examination**

Course Outcomes

CO 1- The students will understand scope, importance, status, research scenario, soil, climatic zones of horticulture in India and Tamil Nadu.

CO 2- The students can demonstrate cropping systems related with horticulture and orchard management.

CO 3- The students will understand the factors limiting horticultural crop production.

CO 4- The students will gain knowledge on bearing habits, training, pruning and fruitfulness of horticultural crops.

CO 5- The Students will gain knowledge on organic farming and post harvest handling of horticultural crops.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	3	1	2	1	0
CO 2	2	0	2	2	2	0
CO 3	2	3	2	1	1	0
CO 4	3	2	1	3	1	0
CO 5	2	2	1	3	3	1

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2. <http://www.horticulture.com.au/export/hmac.asp>
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HOR 102 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 plant propagation of horticultural crops.
- To make the students learn on different propagation structures.
- To familiarize the students with micro-propagation of horticulture crops.

Theory

Unit I: Basics of propagation

Importance and scope of plant propagation - sexual and asexual methods of propagation-advantages and disadvantages.

Unit -II: Seed germination and seed dormancy

Seed dormancy - types of dormancy - internal and external factors - methods of breaking dormancy - nursery techniques - apomixes - monoembryony and polyembryony in seeds - types and stages of seed germination with examples.

Unit III: Propagation structures, tools / implements and growth regulators

Mist chambers - humidifiers - greenhouses - glasshouses - cold frames - hot beds - poly-houses - phytotrons - cost of establishment of propagation structures - Types of nursery - nursery tools and implements - use of growth regulators in propagation.

Unit IV: Methods and physiology of vegetative propagation

Vegetative propagation - methods and techniques - cutting - layering - grafting - formation of graft union - factors affecting healing of graftage and budding, physiological and biochemical basis of rooting - factors influencing rooting of cuttings and layering - graft incompatibility - anatomical studies of bud union - selection and maintenance of mother trees - collection of scion wood stick - scion-stock relationship and their influence - bud wood certification - techniques of propagation through specialized organs - corm -runners - suckers - chimera and bud sports.

Unit V: Micro propagation

Micro grafting - meristem culture - callus culture - anther culture - organogenesis - somaclonal variation - hardening of tissue cultured plants - primary hardening - secondary hardening - Nursery Registration Act - insect pests / diseases control in nursery.

Practical

Media for propagation - potting and repotting - preparation of nursery beds and sowing of seeds-raising of rootstock - Seed treatments - practicing different types of cuttings - layering - grafting and budding - mist chambers in propagation and hardening of plants - plant growth regulators - tissue culture laboratory - labeling and packing of nursery plants - maintenance of nursery records - nursery tools and implements -cost of establishment of a mistchamber - greenhouse - glasshouse - poly house and their maintenance - nutrient and plant protection applications during nursery.

Lesson Plan

Theory Schedule

1. Plant propagation - definition, need and potential for commercial nursery activities
2. Sexual vs asexual methods of propagation, its prospects and constraints.
3. Pollination, fertilization and seed development, seed - definition - germination requirements - types of germination - viability and longevity.
4. Dormancy in seeds - dormancy mechanism - types of dormancy - mechanism of breaking dormancy in seeds.
5. Plant propagation structures - principles and uses.
6. Application of growth regulators in propagation.
7. Vegetative propagation through cutting and physiological basis of rooting.
8. Methods of layering in horticultural crops.
9. **Mid Semester Examination**
10. Mother plant selection - maintenance - bud wood certification and Nursery Registration Act.
11. Propagation through grafting.
12. Propagation through budding.
13. Grafting incompatibility and stock-scion relationship.

14. Propagation through specialized plant organs
15. Tissue culture techniques in horticultural crops - micro grafting.
16. Plant protection in horticultural nurseries.
17. Cost of establishment of propagation structures.

Practical Schedule

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

17. Final practical examination

Course Outcomes

- CO 1-** The students will be able to understand the basics of plant propagation and its importance
- CO 2-** The students can demonstrate sexual propagation and nursery management of horticulture crops
- CO 3-** The students can demonstrate advanced methods of asexual propagation and nursery management of horticultural crops
- CO 4-** The students will gain knowledge on propagation structures, tools and implements required for nursery management.
- CO 5-** The students can demonstrate micro propagation techniques of horticultural crops

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	1	1	1	1	0
CO 2	3	2	1	2	1	0
CO 3	2	1	2	2	1	0
CO 4	2	2	1	2	1	0
CO 5	1	0	1	1	1	0

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GPB 101 INTRODUCTORY CROP PHYSIOLOGY 2(1+1)

Learning objectives

- To impart basic knowledge on various functions and processes related to horticultural 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: Introduction

Importance of Crop Physiology in Horticulture - Role of water in plant metabolism - water potential and its components - diffusion - osmosis - imbibition - plasmolysis - Field capacity and permanent wilting point

Unit II: Plant water Relation

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 III: Stress Physiology

Classification of stresses - drought, flooding, high and low temperature, and salinity - Mechanism of tolerance - stress alleviation - Global warming - green house gases - physiological effects on crops - Carbon Sequestration.

Unit IV: 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 - Biological nitrogen Fixation

Unit V: Photosynthesis and Respiration

Photosynthesis - Light reaction - Photosystems - Photophosphorylation - Photosynthetic pathways - C₃ and C₄, CAM - difference between three pathways - Factors affecting photosynthesis - Photorespiration - pathway and its significance - Secondary metabolites - Plant defense.

Practical

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 Transpiration - 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 proline - Field visit for foliar diagnosis

Lesson Plan

Theory Schedule

1. Importance of Crop Physiology in Horticulture - Structure and role of water - water potential and its components
2. 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. Stress Classification - Drought - High and low temperature stress - physiological changes - adaptation - compatible osmolytes - alleviation
7. Salt stress - physiological changes - adaptation - compartmentalization - alleviation
8. Flooding stresses - physiological changes - adaptation
9. **Mid -Semester Exam**
10. Global warming - green house gases --physiological effects on crop productivity- Carbon Sequestration
11. Mineral nutrition - criteria of essentiality - classification of nutrients - macro, micro, mobile and immobile - mechanism of nutrient uptake
12. Physiological functions and disorders of macro nutrients - micro nutrients - Hidden hunger
13. Foliar nutrition- root feeding and fertigation - sand culture, hydroponics and aeroponics
14. Photosynthesis - Light reaction - photolysis of water and photophosphorylation
15. Photosynthetic pathways - C₃, C₄ cycles and CAM pathway - difference between three pathways -
16. Factors affecting photosynthesis- Photorespiration - pathway and its significance
17. Secondary metabolites - plant defence

Practical Schedule

1. Preparation of different types of solutions
2. Measurement of plant water potential by different methods
3. Determination of stomatal index and stomatal frequency
4. Measurement of leaf area by different methods - Linear and Gravimetric
5. Measurement of leaf area by different methods - Graphical
6. Measurement of transpiration - Bell Jar Experiment
7. Estimation of photosynthetic pigments - chlorophylls
8. Estimation of photosynthetic pigments - Carotenoids
9. Physiological disorders in Horticultural plants
10. Nutritional disorders in Horticultural plants
11. Estimation of chlorophyll stability Index
12. Estimation of Relative Water Content
13. Determination of photosynthetic efficiency in crop plants - soluble protein
14. Estimation of Proline

15. Study of Plant Movement
16. Field visit for foliar diagnosis
17. Final practical **examination**

Course Outcomes

- CO 1:** Students will acquire basic knowledge on various functions and processes related to horticultural crop productivity
- CO 2:** In addition, hands on exposure to preparation of solutions, analysis of pigment composition, estimation of growth analytical parameters,
- CO 3:** Know about the various plant growth regulators and environmental stresses.
- CO 4:** Will be able to identify the mineral nutrient deficiencies and their symptoms in horticultural plants
- CO 5:** Will be able to diagnose nutrient deficiencies in crops and ameliorate them and will be competent in enzyme assays and applications of plant growth regulators

CO-PO Mapping Matrix

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

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SOL 101 FUNDAMENTALS OF SOIL SCIENCE (1+1)

Learning objectives

- To impart knowledge about basic concept of soil alumino silicate minerals and rocks
- To understand the process of soil formation and soil classification through soil survey and remote sensing
- To gain knowledge on physical properties of soils and processes in relation to plant growth.

- To make students familiarize with soil colloids and ion exchange phenomenon and its influence on soil properties and crop growth.
- To impart knowledge on various soil constraints and role of microorganisms on soil health

Theory

Unit - I: Rocks, Soil texture, Soil density

Composition of earth's crust, Rock & Minerals classification, Pedogenic process, soil as a natural body - major components. Eluviations and alleviations, formation of various soils. Physical parameters; texture - definition, methods of textural analysis, stock's law, assumption, limitations, textural classes, use of textural triangle absolute specific gravity/particle density, definition, apparent specific gravity/bulk density - factors influencing, field bulk density. Relation between BD (bulk density), AD - practical problems. Pore space - definition, factors affecting capillary and non-capillary porosity.

Unit -II: Soil structure, Colour, Consistency, Soil air

Soil structure, definition, classification, clay prism like structure, factors influencing genesis of soil structure, soil colour - definition, its significance, colour variable, value hue and chroma. Munsell colour chart, factors influencing soil colour, soil consistency, plasticity, Atterberg's constants. Soil air, air capacity, composition, factors influencing, amount of air space, soil air renewal,

Unit -III: Soil water, Soil temperature and Soil colloids

Soil water, forms, hygroscopic, capillary and gravitational, soil moisture constants, hygroscopic coefficient, wilting point, field capacity, moisture equivalent, maximum water holding capacity, energy concepts, PF scale, measurement, gravimetric - electric and Tensiometer methods - pressure plate and pressure membrane apparatus - Neutron probe - soil water movement soil temperature, sources and distribution of heat, factors influencing, measurement, Chemical properties, soil colloids, organic, humus, inorganic, secondary silicate, clay, hydrous oxides. Ion exchange, cation- anion importance.

Unit IV: Soil survey and Remote sensing

Methods and objective of soil survey, soil orders, aerial photography, land capability classification; soil of different eco-systems and their properties, principles of remote sensing, Remote sensing application in soil and plant Studies.

Unit V: Soil constraints

Soil degradation, Management of Soil Crusting, Soil Compaction and Soil Compression. Soil Biology benefits and harmful effect. Objectives of soil science research institute in India (NBSS & LUP, ISSS, and LTFE & NSSTL). Current stream of thoughts

Lesson Plan

Theory Schedule

1. Origin of earth - Theories - Planetesimal and Nebular hypothesis - Geological time scale - Age of earth- Composition of earth's crust
2. Rocks - Definition - Classification - Igneous - Sedimentary rock - Their formation - Classification - Brief description of important rocks. Metamorphic rocks - Their formation, classification and brief description of important rocks.
3. Minerals - Definition - Occurrence-classification -Formation of primary minerals - Ferro and non-ferro magnesium minerals. Secondary minerals - Clay minerals. Non-silicate minerals
4. Soil forming processes-Fundamental pedogenic processes--Eluviation and illuviation-

Description of typical soil profile- Master and Subordinate horizons-Specific pedogenic processes.

5. Physical properties-Soil texture- definition- Textural analysis-International pipette method- Stoke's law-textural classes- textural triangular diagram- particle density/bulk density. Pore space – definition. Factors affecting pore space- Soil compaction-internal surface area- Factors influencing soil compaction
6. Soil structure- classification- types, classes and grades of soil structure- importance of soil structure and management-
7. Soil colour-Significance – Munsell colour chart-hue, value and Chroma-Factors influencing soil colour.
8. Soil consistence- consistence of wet and dry soils- Cohesion-Adhesion- Soil Crusting- Plasticity- Atterberg's constant- Upper and lower plastic limits, plastic number.
- 9. Mid semester examination**
10. Soil air- composition – atmospheric and soil air- Gaseous exchange- influence of soil air on plant growth- soil properties and nutrient availability
11. Soil water- forms – soil moisture constants- energy concepts- pF scale- measurement of soil water- gravimetric – electric and Tensiometer methods – pressure plate and pressure membrane apparatus – Neutron probe.- soil water movement.
12. Soil temperature- sources of heat- heat capacity and conductivity- factors influencing soil temperature-Measurement of soil temperature- importance to plant growth.
13. Soil pH- EC- factors affecting soil pH- its impact on crop growth.-soil colloids- types- soil humus- secondary silicate minerals – Ion exchange- types – Anion exchange- Cation exchange.
14. Soil survey- types- soil orders- aerial photography- land capability classification- Remote sensing- principles of remote sensing- applications.
15. Soil degradation- management of soil crusting- soil compaction- soil compression.
16. Soil biology- benefits and harmful effects.
17. Objectives of soil science research institute in India (NBSS & LUP, ISSS, and LTFE & NSSTL). Current stream of thoughts

Practical Schedule

1. Quantification of minerals and their abundance.
2. Collection and preparation of soil samples
3. Description of soil profile in the field.
4. Estimation of soil moisture(Thermo gravimetric method)
5. Textural analysis of soil by Robinson's pipette method.
6. Determination of Soil colour using Munsell Chart.
7. Estimation of water holding capacity and hydraulic conductivity of soils.
8. Estimation of infiltration rate using double ring infiltrometer method.
9. Estimation of soil moisture using gypsum block, neutron probe, Tensiometer and pressure plate apparatus.
10. Soil compaction measurement with Penetrometer.
11. Determination of pore space of soil.
12. Determination of field capacity and permanent wilting point of soil.
13. Determination of soil water potential characteristic curves by tensiometer and pressure plate apparatus.
14. Aggregate size distribution analysis of soil.

15. Air capacity of soil by field method.
16. Estimation of pH and EC in soil.

17. Final Practical Examination

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.

CO4: Students learn to understand the role of microorganisms in promoting better soil health

CO 5: Students gain knowledge about various soil types present in India and how modern tools help in assessing soil conditions suitable for crop cultivation

CO-PO Mapping Matrix

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

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AGM 101 INTRODUCTORY MICROBIOLOGY (1+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 highlighten the role of microorganisms in soil fertility, food and industries.
- To enable better understanding of students about plant microbe interaction. Bioinoculants mass production.
- To give an exposure about industrial and food microbiology.

Theory

Unit I: History and scope of Microbiology

History and development-Contributions of Anton Van Leeuwenhoek, Louis Pasteur, Robert Koch, Beijerinck, Winogradsky and Waksman; Groups of microorganisms; Morphology of Bacteria- Bacterial size, shape and arrangement

Unit II: Microbiological Techniques

Microscopy – principles and types; principles and types of stain- simple, negative and Differential staining Sterilization and disinfection techniques; Principles and methods of sterilization – Physical methods – heat, filters and radiation; Chemical methods–Preservation of microbial cultures.

Unit III: Soil Microbiology

Distribution and importance of soil microorganisms in soil fertility – Factors affecting the activities of soil microorganisms – Rhizosphere microorganisms and their importance, R:S Ratio -microbial interactions in soil-Positive and negative interactions.

Unit IV: Bioinoculants

Bioinoculants-Types and importance of biofertilizers in Horticulture. Mass production of bacterial biofertilizer-VAM mass production- method of application and quality control of biofertilizers.

Unit V: Industrial and Food Microbiology

Fermentor – Design and characteristics – Upstream and Downstream process – Fermentation product process – Ethyl alcohol – Antibiotics- Penicillin – Importance of Food Microbiology, Types of microorganisms in food, Sources of contamination, Factors influencing the microbial growth in food. Current stream of thought

Lesson Plan

Theory Schedule

1. Contributions of Anton Van Leeuwenhoek, Louis Pasteur, Robert Koch, Beijerinck, Winogradsky and Waksman
2. Groups of microorganisms
3. Bacterial size, shape and arrangement and morphology
4. Microscopy – principles and types
5. Sterilization and disinfection techniques; Principles and methods of sterilization
Physical methods – heat, filters and radiation;
6. Chemical methods–Preservation of microbial cultures.
7. Distribution and importance of soil microorganisms in soil fertility
8. Factors affecting the activities of soil microorganisms
9. **Mid semester examination**
10. Rhizosphere microorganisms and their importance, R:S Ratio
11. Microbial interactions in soil-Positive and negative interactions
12. Bioinoculants-Types and importance of biofertilizers in Horticulture.
13. Mass production of bacterial biofertilizer-
14. VAM mass production- method of application and quality control of biofertilizers.
15. Fermentor – Design and characteristics – Upstream and Downstream process
16. Fermentation product process – Ethyl alcohol – Antibiotics- Penicillin
17. Importance and types of microorganisms in food, Sources of contamination, Factors influencing the microbial growth in food, current stream of though

Practical

1. Introduction to microbiology laboratory and its equipments
2. Principles of microscopy- Study of compound microscope
3. Methods of sterilization.
4. Preparation of culture media and agar slant
5. Buried slide technique
6. Enumeration of microbial population in soil by bacteria, fungi and actinomycetes in soil by standard plate technique
7. Purification of bacteria
8. Purification of fungi
9. Gram staining
10. Negative staining
11. Isolation of Rhizobium from legume root nodule.
12. Isolation of Azospirillum from soil.
13. Isolation of Phospobacteria from soil.
14. Mass production of bacterial biofertilizer and quality control
15. Wine making
16. Observation of microorganisms from spoiled vegetables and fruits.
17. Final Practical Examination

Course Outcomes

CO 1: The students would thoroughly understand about the role of microorganisms and their influence on the plant growth production and historical perspectives.

CO 2: Further, they would enrich on the various basic microbiological techniques.

CO 3: The students exposed to soil microbes and their interactions.

CO 4: The students would expose to the mass production of various biofertilizers.

CO 5: The students will gain knowledge on the role of microorganisms in food and industry.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	-	-	-	-
CO2	3	2	-	-	-	-
CO3	2	-	-	-	-	-
CO4	-	-	3	-	-	-
CO5	-	-	2	-	2	1

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PAT 101 FUNDAMENTALS OF PLANT PATHOLOGY (2+1)

Learning objectives

- To study the basic concepts of Plant Pathology and causes of plant diseases
- To study the classification of plant diseases and the host parasite relationship, Kochs postulates
- To know about pathogenesis, forecasting and diseases assessment
- To study the principles and methods of plant disease management
- To study the different groups of fungicides and their formulations and application

Theory

Unit I

Introduction to the science of phytopathology, its objectives, scope and historical background. Causes of plant diseases - Parasitic causes of plant diseases (fungi, bacteria, viruses, phytoplasma, protozoa, algae and flowering parasitic plants), their characteristics and classification. Non-parasitic causes of plant diseases.

Unit II

Classification of plant diseases, symptoms, signs, and related terminology. Study of disease symptoms and signs and host parasite relationship. Identification and isolation of plant pathogens. Koch's postulates.

Unit III

Pathogenesis - disease cycle - Pre-penetration, Penetration and Post penetration - Mode of infection and spread. Survival and dispersal of plant pathogens. Epidemiological Factors affecting disease development, forecasting and disease assessment.

Unit IV

Principles and methods of plant disease management. Exclusion, Eradication, Protection and Immunization - Protection of crops from air-borne, seed-borne, soil-borne and vector-borne plant diseases - Physical methods - soil solarization, Hot water treatment, Incineration - Integrated plant disease management.

Unit V

Chemical control of plant diseases - fungicides - Different group of fungicides and antibiotics in plant disease management - Fungicides classification based on chemical nature. Method of application- plant protection appliances. Safety measures/precautions while using fungicides. Commonly used fungicides, bactericides and nematicides.

Lesson Plan

Theory Schedule

1. Introduction to the science of phytopathology and its objectives
2. Scope and historical background.
3. Classification of plant diseases, symptoms, signs, and related terminology.
4. Causes of plant diseases - Biotic and abiotic factors

5. Significance of Plant diseases
6. Parasitic (biotic) causes of plant diseases (fungi, bacteria, viruses, phytoplasma, protozoa, algae and flowering parasitic plants)
7. Characteristics of biotic diseases and classification.
8. Non-parasitic (abiotic) causes of plant diseases.
9. Pathogenesis – disease cycle
10. Pre-penetration
11. Penetration
12. Post penetration
13. Mode of infection and Spread.
14. Survival of plant pathogens
15. Dispersal of plant pathogens.
16. Epidemiological Factors affecting disease development

17. Mid-semester Examination

18. Forecasting and disease assessment.
19. Principles and methods of plant disease management.
20. Exclusion
21. Eradication
22. Protection
23. Immunization
24. Protection of crops from air-borne, seed-borne, soil-borne and vector-borne plant diseases
25. Physical methods - soil solarization, Hot water treatment, Incineration
26. Integrated plant disease management.
27. Chemical control of plant diseases – fungicides
28. Different group of fungicides – Copper and Sulphur based
29. Different group of fungicides – Organo compounds in plant disease management
30. Systemic fungicides and new generation fungicides
31. Antibiotics in plant disease management
32. Method of application- plant protection appliances.
33. Safety measures/precautions while using fungicides.
34. Commonly used fungicides, bactericides and nematicides.

Practical Schedule

1. Plant pathology laboratory visit
2. Familiarizing with field equipments
3. Study of disease symptoms and signs
4. Host parasite relationship.
5. Koch's postulates
6. Identification and isolation of plant pathogens from the host
7. Inoculation of isolated cultures on the host
8. Reisolation and identification of plant pathogens
9. Reinoculation of isolated pathogen and confirmation of Kochs postulates
10. Field visit- physical methods
11. Preparation of fungicidal solutions
12. Preparation of fungicidal slurries
13. Preparation of fungicidal pastes

14. Method of fungicide applications
15. Special method of fungicide applications
16. Familiarity with plant protection appliances

17. Final practical examination

Course outcomes:

CO 1: Having knowledge about the basic concepts of Plant Pathology and causes of plant diseases

CO 2: Having knowledge about the classification of plant diseases and the host parasite relationship, Kochs postulates

CO 3: Being aware of the pathogenesis, forecasting and diseases assessment

CO 4: Having knowledge of the principles and methods of plant disease management

CO 5: Expertise in fungicides and their formulations and application

CO -PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	1	-
CO2	3	2	-	-	1	-
CO3	3	2	-	-	1	-
CO4	3	2	-	-	1	-
CO5	3	2	-	-	1	-

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EXT 101 FUNDAMENTALS OF EXTENSION EDUCATION (1+1)

Learning objectives

- To improve the knowledge level of the students on concepts, Principles of Extension Education, various extension teaching methods and information sources.
- To acquaint the students with Agricultural journalism, Innovation Decision Process and capacity building of various stake holders.
- To identify and understand various information sources for effective transfer of technology.
- To understand the scope and importance of agricultural journalism and state the sources of news and types.

- To gain knowledge on capacity building among the target groups.

Theory

Unit I: Extension Education

Meaning, definition, objectives, process, scope & principles of extension education -Extension programme planning: Meaning, Principles, Steps in programme planning development. Monitoring & evaluation of extension programmes: Monitoring - definition & concept, Evaluation- definition & types.

Unit II: Communication

Meaning, definition & elements of communication & their Characteristics. Concepts of Communication: Empathy, redundancy, fidelity, frame of reference, entropy. Barriers to Communication. Models of communication, Extension teaching methods: Definition, functions, classification according to use & form- individual. Group & mass contact methods.

Unit III: Diffusion and adoption of innovation

Definition & meaning of diffusion & adoption, adoption process: 5 stage & 7 stage models, Classification of adopter categories & their characteristics, Concepts of adoption, over adoption, rate of adoption. Innovation: meaning & attributes of innovation. Innovation decision process: Meaning, definition & stages

Unit IV: Transfer of technology

Concept & models with examples, Reforms in Agricultural Extension: ATMA, SREP. New trends in agricultural extension: Privatization of extension, meaning, factors influencing privatization of extension, merits & problems. Cyber extension meaning, features, Expert system in agriculture: Meaning, components, examples

Unit V: Capacity building of extension personnel and farmers

Training meaning, **types of training:** pre service, in-service, orientation, induction, refresher training. Training to farmers & farm women: time, duration & venue, short term, midterm & long term. FTC, KVK, DAATC: mandate & objectives. PRA: Meaning, techniques and importance in Agricultural Extension and current stream of thoughts

Practicals

Understanding university extension system and KVK centers of Agricultural University, - Group discussion and practicing brainstorming -Preparation and use of audio-visual aids, extension literature-Leaflets, folders - Preparation and Presentation of power point - Preparation of training schedule - Assess training needs - Understanding the problems being encountered by the villagers through PRA exercise - Organization and functioning of DRDA and other development departments at district level - NGOs in rural development - Understanding PRA techniques and their application in village development - Exposure to mass media centers - community radio and television studio for understanding the process of programme production - Planning and writing of scripts for radio print media and electronic media - Adoption of agricultural technologies.

Lesson Plan

Theory Schedule

1. Extension education: Meaning, definition, objectives, process, scope & principles
2. Extension programme planning: Meaning, Principles, Steps in programme planning.
3. Monitoring- definition & Concept, Evaluation- definition & types.
2. Communication: Meaning, definition & elements of communication & their Characteristics.
3. Concepts of Communication: empathy, redundancy, fidelity, frame of reference, entropy
4. barriers to Communication.

5. Models of communication.
6. Extension teaching methods: Definition, functions, classification according to use &
7. form- individual. Group & mass contact methods.
8. Diffusion and adoption of innovation: Definition & meaning of diffusion & adoption, adoption process: 5 stage model, 7 stage model.
- 9. Mid Semester Examination**
10. Classification of adopter categories & their characteristics, Concepts of adoption, over adoption, rate of adoption. Innovation: meaning, attributes of innovation.
11. Innovation decision process: Meaning, definition & stages
12. Transfer of technology: Concept & models with examples, Reforms in Agricultural Extension: ATMA, SREP.
13. New trends in agricultural extension: Privatization of extension, meaning, factors influencing privatization of extension, merits & problems.
14. Cyber extension: meaning, features, Expert system in agriculture: Meaning, components, examples.
15. Capacity building of extension personnel and farmers: training: meaning, types of training.
16. Training to farmers & farm women: FTC, KVK, DAATC
17. PRA: Meaning, techniques and importance in Agricultural Extension and current stream of thoughts

Practical Schedule

1. Visit to the KVK center of Agricultural University
2. Group discussion and practicing brainstorming
3. Preparation and use of audio-visual aids
4. Preparation of extension literature-Leaflets, folders
5. Preparation of power point slides
6. Presentation of power point
7. Visit to a village to conduct survey to assess training needs
8. Visit to a village to conduct resource inventory through PRA exercise
9. Visit to DRDA, to study the organizational setup and antipoverty programmes at district level
10. Visit to an NGO and learning from their experience in rural development.
11. Understanding PRA techniques and their application in village development planning.
12. Visit to community radio/television studio for understanding the process of programme production.
13. Planning and writing of scripts for radio.
14. Planning and writing of scripts for printmedia
15. Planning and writing of scripts for electronic media
16. Survey on adoption of agricultural technologies
- 17. Final Practical Examination**

Course Outcome

At the end of the course students will be able to

- CO 1:** Understand fundamentals of extension education.
CO 2: know the concepts related to communication
CO 3: Gain expertise to conduct PRA exercise

CO 4: Expose on Extension activities of different organizations.

CO 5: Gain knowledge about to TOT and capacity building

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	2	0	3	3
CO2	1	1	0	3	0	3
CO3	0	2	2	0	3	0
CO4	2	0	1	0	0	3
CO 5	0	0	-	0	0	3

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

Learning Objectives

- To impart basic language skills such as listening, speaking, reading and writing in order to communicate with speakers of English Language
- To develop the linguistic competence necessarily required in various life situations
- To improve English pronunciation and enhance proficiency in English

Theory

UNIT I Comprehension

Reading Comprehension –Synonyms –Antonyms--Verbal Ability, A list of Words often confused and misused

UNIT II Vocabulary

Vocabulary --Homonyms --Homophones

UNIT III Grammar

Functional Grammar--Tenses --Active voice and Passive voice--Degrees of Comparison --Types of Sentences--Direct and Indirect Speech --Agreement of Verb with Subject –Articles –Prepositions--Parts of Speech

UNIT IV Composition

Business Correspondence--Principles of Letter Writing--Structure and Layout of Letters --Quotations and Orders -Tenders--Job Application Letters --Social Correspondence –CV--Professional Writing--Precis Writing.

UNIT V Interview

The Screening Interview--The informational Interview --The Stress Interview--The Behavioural Interview--The Audition --Body Language and Interview

Lesson Plan

Theory Schedule

1. A Lesson: "The Sporting Spirit" --Answering the questions related to the text -- Comprehension pertaining to the Textual Grammar i.e., Fill in the blanks, Matching and vocabulary
2. Comprehension and answering the questions related to the Text
3. Synonyms, List of synonyms, Choose the correct synonyms, exercises - Practice and Implementation Antonyms, fill in the blanks, choose the correct Antonyms, exercises Practice and Implementation
4. Verbal Ability, A list of Words often confused and misused - Practice and Implementation
5. Comprehension pertaining to the Textual Grammar i.e., Fill in the blanks, Matching, Vocabulary and Reading Comprehension
6. Reading Comprehension and answering the Questions
7. Homonyms -- Homonyms are distinct words with quite different meanings --Use the following words in two ways, more words at a glance and exercises related to GRE & TOEFL
8. Homophones, A list of homophones, Fill in the blanks, Underline the correct word and exercises related to GRE & TOEFL
9. **Mid-Sem Examination**
10. A Lesson: "Spoken English and Broken English" by G.B. Shaw. Answering the questions related to the Text. Fill in the blanks, Matching, Vocabulary and Reading Comprehension
11. Functional Grammar, Tenses, Active voice and Passive voice, Degrees of Comparison and types of sentences
12. Direct and Indirect speech and Agreement of verb with subject
13. Functional Grammar, Articles, Prepositions, Parts of Speech and Agreement of Verb with Subject
14. Business Correspondence, Principles of Letter writing, Courtesy and Consideration, Directness and Conciseness, Avoid Verbosity and participial Endings, Clarity and Precision, Structure and layout of letters, Planning a letter, Quotations, Orders, Tenders, Sales letters, Claim and Adjustment Letters, Job application letters, Social correspondence Personal Correspondence and CV
15. The Style, Importance of Professional Writing, Choice of words and Phrases, Clichés, Jargons, Foreign words and phrases
16. Precis Writing, Summarizing, The essential features of a good précis, Important points while making a précis, Make a précis of the following paragraph and suggest suitable title. Figurative language
17. Interview, The Screening Interview, The informational Interview, The Directive Style, The Meandering Style, The Stress Interview, The Behavioural Interview, The Audition, The Tag-Team Interview, The Mealtime Interview, The Follow-up Interview, Fermi Interview, Preparing for the Interview, Body Language and Interview, Types of Interviews Questions. Idiomatic language

Practical Schedule

1. Effective Listening - Developing Listening Skills - Honing Listening skills

2. Listening to Short talks and Lectures from the cassettes of EFLUniversity
3. Spoken English, Vowels, consonants, monophthongs, diphthongs, triphthongs
4. Stress, intonation, phonetic transcription
5. Seminars, Conferences, preparation and demonstration
6. Oral Presentation by students, Articulation and delivery - Evaluation sheet for oral presentation
7. Communication skills - Verbal communication, Written Communication
8. Telephonic Conversation
9. Reading Skills, Skimming, Scanning, Extensive reading, Intensive reading examples
10. Meeting, purpose, procedure, participation, physical arrangements
11. Presentation of reports by using power point & L.C.D
12. Interviews - Mock interviews
13. Debate and Group discussion
14. Using a dictionary effectively
15. Vocabulary
16. Pronunciation Practice
17. **Final practical examination**

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TAM - 101*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;ik mwptpay; - gs;S ,yf;fpa';fs;/ VbuGgJ/ ,yf;fpaj;jpy; ntshz; bghwpapay; - njhl;ltpay; - tdtpay; kidapay; - NHypay; ntshz;ikg; gHbkhHpfs; - ,yf;fpak; fhl;Lk; thH;tpay; bewpKiwfs; - ,f;fhy ,yf;fpa';fspy; ntshz;ikr; rpe;jidfs; - gpiHapd;wp vGJk; Kiwfs; - ,yf;fpaj;jpy; bkd;jpwd;fs; - mwptpay; jkpH; tsh;r;rp epiyfs; fiyr;brhy;yhf;fk; - bkhHp bgah;g;ghsh; - Ml;rpj; jkpH; - cHth;fSf;fhd mwptpg;g[fis btspapLjy; - fl;Liur; RUf;fk; vGJy; - fzpdp cyfpy; jkpH;

bra;Kiwg; gapw;rpfs;

1. bjhy;fhg;gpak; fhl;Lk; Kjw;bghUs;/ fUg;bghUs; tHp ntshz; kug[fis mwpyj;
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;ik mwptpay;
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; gHbkhHpfs; - cHt[tpj mwptpay; - ehw;W eLjy; - vU ,Ljy; - ePh;g;ghrdk; - fis nkyhz;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. ,ilepiy; gUtj;njh;t[

10. gpiHapd;wp vGJk; Kiwfs; - vGj;Jg; gpiHfs; - brhw;gpiHfs; - brhw; gphpg;g[g;gpiH – thf;fpag;gpiH – bka;g;gJj; jpUj;jk;
11. ,yf;fpaj;jpy; bkd;jpwd;fs; - jiyikg;gz;g[- fhy nkyhz;ik
12. MSikg;gz;g[nkk;ghL – kdpj cwt[j;pwd;fs; tsh;j;jy;
13. mwptpay; jkpH; tsh;r;rp epiyfs;/ ntshz; E}y;fs;/ ntshz; ,jH;fs;
14. fiyr;brhy;yhf;fk; - ntshz; fiyr; brhw;fis cUthf;Fk; Kiw – jug;gLj;Jjy; - ,yf;fpa ntshz; fiyr;brhw;fs;/ tl;lhu ntshz;ik tHf;Fr; brhw;fs; - mfuhjpapay;
15. bkhHp bgah;g;g[- Kf;fpa tpjpf; - goepiyfs; - bkhHp bgah;ghshpd; ,d;wpaikahg; gz;g[fs; - ntshz; bra;jpfis bkhHp bgah;j;jy;
16. Ml;rpj; jkpH; - murhizfs; mYtyf; foj';fs; - cHth;fSf;fhd mwptpg;g[f;fis btspapLjy; - fl;Liur; RUf;fk; vGJjy;
17. fzpdp cyfpy; jkpH; - xU';F FwpaPL gapw;Wtpj;jy; - tiyg; g{f;fs; - tpf;fpgPoah – ntshz; bra;jpfisg; gjpntw;wk; bra;jy; - ntshz; bra;jpfis ,izajs tHp mwpjy;

nkw;ghh;it E}y;fs;

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- kPdhl;rp Re;juk;. kh. kw;Wk; V.,y.tprayl;Rkp jfty; bjhlh;gpy; jkpH; bkhHpg;gad;ghL/ nf.Mh;.v.Mg;brl; gphpz;lh;/ nfhit – 2002
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- jkpHhp; kug[r;bry;t';fs;/ cyfj; jkpHuha;r;rp epWtdk;/ brd;id
- re;jpunfud;/ ,uh/ bkhHpg;ghlk; - gilg;ghf;fj;jpwd; tsh;j;jy;
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- ghnte;jd;/ ,uh/ jkpHpy; mwptpay; ,jH;fs;/ rhKnty;/ @gp#; fpwpd; gjpg;gfk;/ nfhak;gJj;J}h;
- lhf;lh; ,uhjh bry;yg;gd;/ fiyr;brhy;yhf;fk;/ jkpH;g; gy;fiyf;fHfk;/ j";rht{h;

EXT 111* AGRICULTURAL HERITAGE 1(1+0)

Learning Objectives

To enable the student to

- Understand the importance of Agricultural heritage
- Know about the value of Indigenous knowledge in agriculture
- Familiarize the students about current scenario of Indian Agriculture

Learning Outcome

- The students have gained the basic knowledge about agricultural history of India.
- They have been familiarized with the indigenous knowledge and present scenario of Indian agriculture.

Theory

Unit I:

Agricultural heritage - Introduction, definition of agricultural heritage- Need and importance of Agricultural heritage- Historical facts- Relevance of heritage to present day Agriculture

Unit II

Development of human culture – stone age, bronze age and iron age periods; Ancient agricultural practices - Indus civilization, Vedic civilization- Agriculture and Kaudilya's Artha

sasthra- Agriculture in Sangam literature, Agriculture in Tamil dynasties Chera, Chola, Pandya and Pallavas

Unit III

Journey of Indian agriculture and its development from past to modern era- Development of agriculture in World and India- Green revolution in India - Role of International/National Institutions for Agricultural research

Unit IV

Indigenous Traditional Knowledge (ITK): Plant production and Plant protection through Indigenous traditional knowledge- Crop voyage in India - Branches of Agriculture- Agricultural resources available in India.

Unit V

Classifications of crops- Major crops of India and Tamil Nadu- National Agriculture setup in India- Current scenario of Indian agriculture- Indian Agricultural concerns and future prospects

Lesson Plan

Theory Schedule

1. Agricultural heritage; Definition, Indian agricultural heritage; Introduction
2. Need and importance of studying Agricultural heritage
3. Historical facts of agricultural heritage, relevance of heritage to present day Agriculture
4. Development of human culture – stone age, bronze age and iron age periods
5. Agriculture and allied activities in ancient India and Tamil Nadu- Indus civilization
6. Agriculture in Vedic civilization and Kautilya's Artha sastra
7. Agriculture in Sangam literature
8. Agriculture in Tamil dynasties Chera, Chola, Pandya and Pallavas
9. **Mid-semester Examination**
10. Journey of Indian agriculture and its development from past to modern era
11. Development of agriculture in World and India- Green revolution in India
12. Role of International/National Institutions for Agricultural research
13. Indigenous Traditional Knowledge (ITK): Plant production and Plant protection through Indigenous traditional knowledge
14. Crop voyage in India - Branches of Agriculture- Agricultural resources available in India
15. Classifications of crops- Major crops of India and Tamil Nadu
16. National Agriculture setup in India- Current scenario of Indian agriculture
17. Indian Agricultural concerns and future prospects

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NSS 111*/NCC 111* (0+1)

NSS 111 National service scheme*

The course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skilful in executing democratic leadership, developing skill in programme development to be able for self employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

All the activities related to the National Service Scheme course is distributed under four different courses viz., National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having one credit load. The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two year. Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

Theory

Semester I

Course Title: National Service Scheme I

Introduction and basic components of NSS:

Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health

NSS programmes and activities

Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/schemes of GOI, coordination with different agencies and maintenance of diary

Understanding youth

Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change

Community mobilisation

Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership **Social harmony and national integration** Indian history and culture, role of youth in nation building, conflict resolution and peacebuilding

Volunteerism and shramdan Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism **Citizenship, constitution and human rights** Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information

Family and society

Concept of family, community (PRIs and other community based organisations) and society

Semester II

Course Title: National Service Scheme II

Importance and role of youth leadership

Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership

Life competencies

Definition and importance of life competencies, problem-solving and decision-making, inter personal communication

Youth development programmes

Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led organisations

Health, hygiene and sanitation

Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health.

Youth health, lifestyle, HIV AIDS and first aid

Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid

Youth and yoga

History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

Semester III

Course Title: National Service Scheme III

Vocational skill development

To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list

Issues related environment

Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management

Disaster management

Introduction and classification of disaster, rehabilitation and management after disaster; role of NSS volunteers in disaster management.

Entrepreneurship development

Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role of financial and support service institution.

Formulation of production oriented project

Planning, implementation, management and impact assessment of project

Documentation and data reporting

Collection and analysis of data, documentation and dissemination of project reports

Semester IV

Course Title: National Service Scheme IV

Youth and crime

Sociological and psychological factors influencing youth crime, cyber crime, peer mentoring in preventing crime and awareness for juvenile justice

Civil/self defence

Civil defence services, aims and objectives of civil defence; needs and training of self defence

Resource mobilisation

Writing a project proposal of self fund units (SFUs) and its establishment

Additional life skills

Positive thinking, self confidence and esteem, setting life goals and working to achieve them, management of stress including time management.

Theory Schedule

1. Introduction and basic components of NSS: Orientation
2. NSS programmes and activities
3. Understanding youth
4. Community mobilisation
5. Social harmony and national integration
6. Volunteerism and shramdan
7. Citizenship, constitution and human rights
8. Family and society
9. Importance and role of youth leadership
10. Life competencies
11. Youth development programmes
12. Health, hygiene and sanitation
13. Youth health, lifestyle, HIV AIDS and first aid
14. Youth and yoga
15. Vocational skill development
16. Issues related environment
17. Disaster management
18. Entrepreneurship development
19. Formulation of production oriented project
20. Documentation and data reporting
21. Resource mobilization
22. Additional life skills
23. Activities directed by the Central and State Government

NCC 111 National Cadet Corps* (0+1)

Theory Schedule

Semester I: National Cadet Corps

1. Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
2. Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
3. Sizing, numbering, forming in three ranks, open and close order march and dressing.
4. Saluting at the halt, getting on parade, dismissing and falling out.
5. Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace
6. forward and to the rear.
7. Turning on the march and wheeling. Saluting on the march.
8. Marking time, forward march and halt.
9. Changing step, formation of squad and squad drill.
10. Command and control, organization, badges of rank, honours and awards

11. Nation Building- cultural heritage, religions, traditions and customs of India. National integration.

Semester II: National Cadet Corps

1. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen.
2. Leadership traits, types of leadership. Character/personality development.
3. Civil defense organization, types of emergencies, fire fighting, protection,
4. Maintenance of essential services, disaster management, aid during development projects.
5. Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
6. Structure and function of human body, diet and exercise, hygiene and sanitation.
7. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health.
8. Adventure activities
9. Basic principles of ecology, environmental conservation, pollution and its control.
10. Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self defense.

Semester III: National Cadet Corps

1. Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms.
2. Shoulder from the order and vice-versa, present from the order and vice-versa.
3. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice versa.
4. Guard mounting, guard of honour, Platoon/Coy Drill.
6. Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
7. Loading, cocking and unloading. The lying position and holding.
8. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
9. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG.
10. Introduction to map, scales and conventional signs. Topographical forms and technical terms.

Semester IV: National Cadet Corps

1. The grid system. Relief, contours and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
2. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map.
3. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
4. Field defenses obstacles, mines and mine lying. Bridging, waterman ship
5. Field water supplies, tracks and their construction.
6. Nuclear, Chemical and Biological Warfare (NCBW)
7. Judging distance. Description of ground and indication of landmarks.
8. Recognition and description of target. Observation and concealment. Field signals. Section formations.
9. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.

10. Types of communication, media, latest trends and developments.

PEY 111 Physical Education and Yoga Practices* 1(0+1)

Semester I: Physical Education and Yoga Practices

1. Teaching – Meaning, Scope and importance of Physical Education
2. Teaching – Definition, Type of Tournaments
3. Teaching – Physical Fitness and Health Education
4. Teaching of skills of Football/ Basket ball – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
5. Teaching of advance skills of Football/ Basket ball – involvement of all the skills in game situation with teaching of rules of the game
6. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
7. Teaching of skills of Ball Badminton/ Table Tennis – demonstration, practice of the skills, correction of skills, involvement in game situation
8. Mid Semester
9. Teaching of skills of Ball Badminton/ Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
10. Teaching of some of Asanas – demonstration, practice, correction and practice
11. Teaching of some of Asanas – demonstration, practice, correction and practice
12. Teaching of some of Asanas – demonstration, practice, correction and practice
13. Teaching of some more of Asanas – demonstration, practice, correction and practice
14. Teaching of some of Asanas – demonstration, practice, correction and practice
15. Teaching of some of Asanas – demonstration, practice, correction and practice
16. Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball).

Semester II: Physical Education and Yoga Practices

17. Teaching of different asanas – demonstration practice and correction.
18. Teaching of different asanas – demonstration practice and correction.
19. Teaching of different asanas – demonstration practice and correction.
20. Teaching of different asanas – demonstration practice and correction.
21. Teaching of weight training – demonstration practice and correction.
22. Teaching of circuit training – demonstration practice and correction.
23. Teaching of calisthenics – demonstration practice and correction
24. Mid Semester
25. Teaching of skills of Hockey – demonstration practice of the skills and correction.
26. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction.
27. Teaching of different track events – demonstration practice of the skills and correction.
28. Teaching of different track events – demonstration practice of the skills and correction.
29. Teaching of different track events – demonstration practice of the skills and correction with
30. competition among them.
31. Teaching of different field events – demonstration practice of the skills and correction.
32. Teaching of different field events – demonstration practice of the skills and correction.
33. Teaching of different field events – demonstration practice of the skills and correction with competition among them.

Note: 1) Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants) **2)** The games mentioned in the practical may be inter changed depending on the season and facilities.

MAT 101 ELEMENTARY MATHEMATICS** 2 (1+1)

Learning Objectives

To impart knowledge to the students on elementary mathematics topics required and useful in the study of agricultural courses. By the end of the course, the students will be able to

- Understand concepts of geometry of straight lines, circles.
- Understand concepts on calculus and matrices and their applications.

Theory

Unit I: Straight Lines (7 hours)

Distance formula, section formula – Equation of co- ordinate axes, Equation of lines parallel to axes - Problems on distance between the lines, Change of axes - Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line - Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines- Angles between two st. lines, Parallel lines, Perpendicular lines..

Circles - Introduction to Circle, Equation of circle with centre and radius, General equation of a circle, Equation of circle passing through three given points and tangent of the circle - Simple problems.

Unit II: Differential Calculus (7 hours)

Definition of function, limit and continuity - Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle - Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions - Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method - Differentiation of Inverse Trigonometric functions .

Unit III: Partial Differentiation (6 hours)

Partial differentiation, homogeneous functions - Examples and problems on partial differentiation- Euler's theorem and its application.

Unit IV: Integral Calculus (6 hours)

Integration of simple functions - Integration of Product of two functions, Integration by substitution method - Simple problems.

Unit V: Matrices and Determinants (6 hours)

Definition of Matrices, Addition, Subtraction and Determinants of Matrices - Multiplication, Transpose of matrices - Properties of determinants up to 3rd order and their Evaluation - Simple problems.

Lesson Plan

Theory Schedule

1. Straight lines: Distance formula, section formula (internal and external division).
2. Change of axes (only origin changed), Equation of co- ordinate axes, Equation of lines parallel to axes.
3. Problems on distance between the lines, Change of axes.
4. Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line.
5. Intercept form of equation of line, Normal form of equation of line.
6. General form of equation of line, Point of intersection of two straight lines.
7. Angles between two straight lines, Parallel lines, Perpendicular lines.
8. Problems on Angles between two straight lines, Parallel lines, Perpendicular line.
9. Introduction to - Circle, Equation of circle with centre and radius, General equation of a

- circle, Equation of circle passing through three given points and tangent of the circle.
10. Differential Calculus: Definition of function, limit and continuity.
 11. Problems on limits and continuity.
 12. Simple problems on continuity, Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle.
 13. Derivatives of sum, difference, product and quotient of two functions.
 14. Differentiation of functions of functions.
 15. Simple problems based on Derivatives of sum, difference, product and quotient of two functions.
 16. Simple problems based on Differentiation of functions of functions.
 17. Logarithmic differentiation, Differentiation by substitution method.
 18. Simple problems based on Logarithmic differentiation and differentiation by substitution method.
 19. Differentiation of Inverse Trigonometric functions.
 20. Simple problems based on Differentiation of Inverse Trigonometric functions.
 21. Partial differentiation, homogeneous functions.
 22. Examples and problems on partial differentiation.
 23. Euler's theorem and its application.
 24. Integral Calculus: Integration of simple functions.
 25. Integration of Product of two functions, Integration by substitution method.
 26. Problems on Integration of Product of two functions.
 27. Problems on Integration by substitution method.
 28. Matrices and Determinants: Definition of Matrices, Addition, Subtraction.
 29. Problems on Addition, Subtraction and Determinants of Matrices.
 30. Multiplication, Transpose of matrices.
 31. Problems on Multiplication, Transpose of matrices.
 32. Properties of determinants up to 3rd order and their evaluation.

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REMEDIAL COURSES

GPB 102: INTRODUCTORY BIOLOGY (1+1)

OBJECTIVES

To expose the students to the basic features of crop plants and its classification, botanical description, economic parts and economic importance of different horticultural and medicinal crops.

THEORY

Unit-I: Systems of classification and general morphological description

Introduction to the living world, diversity and Characteristics of life, Origin of life, Evolution and Eugenics. Bentham and Hooker's classification of plant kingdom - Nomenclature and its guidelines - Horticultural classification of crops; General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf; Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.

Unit-II: Botanical description and economic uses of Anacardiaceae, Rutaceae, Musaceae, Moraceae, Vitaceae, Caricaceae

List of horticultural crops, economic parts, chromosome number and family description of Anacardiaceae: Mango and Cashew Nut, Rutaceae: Acid lime, Sweet orange and Mandarin and Musaceae: Banana Moraceae: Bread fruit and Jack fruit Vitaceae: Grapes and Caricaceae: Papaya. Key botanical features of Mango, Cashew Nut, Acid lime, Sweet orange, Mandarin, Banana, Bread fruit, Grapes, Jack fruit and Papaya.

Unit-III: Botanical description and economic uses of Euphorbiaceae, Myrtaceae and Sapotaceae.

List of horticultural crops, economic parts, chromosome number and family description of Euphorbiaceae: Aonla, Cassava and Rubber Myrtaceae: Guava, Clove and Sapotaceae: Sapota. Brassicaceae: cabbage, cauliflower, radish, chenopodiaceae: Beet root and Amaranthaceae: Amaranthus. Key botanical features of Aonla, Cassava, Rubber, Guava, Clove, Sapota, cabbage, cauliflower, radish, Beet root, Amaranthus

Unit-IV: Botanical description and economic uses of Bromeliaceae, Punicaceae, Annonaceae, Rhamnaceae, Rosaceae, Convolvulaceae, Umbelliferae, Arecaceae.

List of horticultural crops, economic parts, chromosome number and family description of the following families and Key botanical features of the crops given against them: Bromeliaceae: Pineapple, Punicaceae: Pomegranate, Annonaceae: custard apple, Rhamnaceae: Ber and Rosaceae: apple, pear, plum, rose, Convolvulaceae: Sweet potato, Umbelliferae: Coriander and Carrot, Arecaceae: elephant foot yam, colocasia and Arecanut

Unit-V: Botanical description and economic uses of following Solanaceae, Malvaceae, Cucurbitaceae, Moringaceae, Fabaceae, Alliaceae, Piperaceae, Zingiberaceae and Orchidaceae

List of horticultural crops, economic parts, chromosome number and key botanical features of the crops and family description of the following families: Solanaceae: Tomato, Brinjal, Chilli, Potato, Malvaceae: Bhendi and Mesta, Cucurbitaceae: Pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber, Moringaceae: Moringa, Fabaceae: peas and

French beans and Alliaceae: onion and garlic. Piperaceae: pepper, betelvine , Zingiberaceae: Cardamom, Turmeric, Ginger, Orchidaceae: Vanilla, Dendrobium orchid.

PRACTICAL

Family features - observation and description of habit, morphology of root, stem, leaves, inflorescence, flowers, floral diagram, floral formula and economic parts of Anacardiaceae, Rutaceae, Musaceae, Moraceae, Vitaceae, Caricaceae, Euphorbiaceae, Myrtaceae, Sapotaceae, Bromeliaceae, Punicaceae, Annonaceae, Rhamnaceae, Rosaceae, Convolvulaceae, Umbelliferae, Arecaceae, Solanaceae, Malvaceae, Cucurbitaceae, Moringaceae, Fabaceae, Alliaceae, Piperaceae, Zingiberaceae and Orchidaceae. Cell, tissues & cell division. Internal structure of root, stem and leaf. Study of specimens and slides.

LESSON PLAN

THEORY

1. Introduction to the living world, diversity and Characteristics of life, Origin of life, Evolution and Eugenics.
2. Bentham and Hooker's classification of plant kingdom - Nomenclature and it guidelines - Horticultural classification of crops.
3. General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf.
4. Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.
5. List of horticultural crops, economic parts, chromosome number and family description of Anacardiaceae and Rutaceae. Key botanical features of Mango, Cashew Nut , Acid lime, Sweet orange, Mandarin.
6. List of horticultural crops, economic parts, chromosome number and family description of Musaceae, Moraceae, Vitaceae, Caricaceae. Key botanical features of Banana, Bread fruit, Jack fruit, Grapes and Papaya.
7. List of horticultural crops, economic parts, chromosome number and family description of Euphorbiaceae and Myrtaceae. Key botanical features of Aonla, Cassava, Rubber, Guava and Clove
8. List of horticultural crops, economic parts, chromosome number and family description of Sapotaceae, Brassicaceae. Key botanical features of Sapota, cabbage, cauliflower, radish.
9. List of horticultural crops, economic parts, chromosome number and family description of chenopodiaceae, Amaranthaceae. Key botanical features of Beet root, Amaranthus
10. Mid semester examination
11. List of horticultural crops, economic parts, chromosome number and family description of the following families Bromeliaceae, Punicaceae and Annonaceae. Key botanical features of the crops given against them Pineapple, Pomegranate, custard apple,

12. List of horticultural crops, economic parts, chromosome number and family description of the following families Rhamnaceae, Rosaceae and Convolvulaceae. Key botanical features of the crops given against them Ber, apple, pear, plum, rose, Sweet potato,
13. List of horticultural crops, economic parts, chromosome number and family description of the following families Umbelliferae, Arecaceae. Key botanical features of the crops given against them Coriander, Carrot, elephant foot yam, colocasia and Arecanut.
14. List of horticultural crops, economic parts, chromosome number and key botanical features of the crops and family description of the following families: Solanaceae: Tomato, Brinjal, Chilli, Potato, Malvaceae: Bhendi and Mesta,
15. List of horticultural crops, economic parts, chromosome number and key botanical features of the crops and family description of the following families: Cucurbitaceae: Pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber, Moringaceae: Moringa.
16. List of horticultural crops, economic parts, chromosome number and family description of the following families: Fabaceae, Alliaceae, Piperaceae. key botanical features of the crops peas, French beans, onion, garlic, pepper, betelvine.
17. List of horticultural crops, economic parts, chromosome number and family description of the following families: Zingiberaceae, Orchidaceae. key botanical features of the crops Cardamom, Turmeric, Ginger, Vanilla and Dendrobium orchid

COURSE OUTCOMES:

- CO 1:** The student will be able to characterize crops based on its anatomical characters such as root, shoot, leaf venation etc.
- CO 2:** Will be able to classify the plant species based on its economic importance
- CO 3:** The student will be able to identify the family to which a particular crop belongs to.
- CO 4:** Botanical features and economic importance of different horticultural crop plants belonging to 26 families will be exposed

CO-PO MAPPING MATRIX

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

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HOR 103 TROPICAL AND SUB -TROPICAL FRUITS (2+1)

Learning objectives

- To explore the fruits cultivated in tropical and sub-tropical zones.
- To provides knowledge on basic nursery management practices of tropical and subtropical fruit crops.
- To acquire knowledge on the cultivation aspects of tropical fruits.
- To acquire knowledge on the cultivation aspects of subtropical fruits.
- To acquaint advanced technologies in tropical and subtropical fruits cultivation.

Theory

Unit I: Scope, importance, classification and climate zones of tropical and subtropical fruit crops

Definition of horticulture - importance of horticulture - horticultural classification of fruits- climatic zones of horticultural crops - scope and importance of tropical and sub- tropical fruits cultivation - overview on global, national and regional level - area, production and export potential - horticultural zones of India and Tamil Nadu with emphasis on tropical and sub tropical fruits.

Unit II: Production technology I

Composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques- main field preparation - spacing - planting- planting density and cropping systems - after care - nutrients, water and weed management - training and pruning - special horticultural techniques- flowering- pollination and fruit set - use of plant growth regulators - physiological disorders and remedies -maturity indices and harvest -post harvest handling - ripening and storage - production constraints of mango, banana,grapes,citrus (Acid lime, lemon, sweet orange, mandarin orange).

Unit-III: Production technology II

Composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques- main field preparation - spacing - planting-

planting density and cropping systems - after care - 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 - ripening and storage - production constraints of papaya, sapota, guava, pomegranate, bael, ber and amla.

Unit IV: Production technology III

Composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques- main field preparation - spacing - planting- planting density and cropping systems - after care - 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 - ripening and storage - production constraints of annona, fig, pineapple, jackfruit, avocado, mangosteen, litchi and carambola.

Unit V: Production technology IV

Composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques- main field preparation - spacing - planting- planting density and cropping systems - after care - 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 - ripening and storage - production constraints of durian, rambutan, loquat and passion fruit.

Practical

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

Lesson Plan

Theory Schedule

1. Scope and importance of tropical and sub-tropical fruits cultivation - horticultural classification of fruits including genome classification - horticultural zones of India - if different fruit growing zones. Area, production and export potential of tropical and subtropical fruits.
2. Mango: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques- main field preparation - spacing - planting- planting density and cropping systems - after care - nutrients, water and weed management.
3. Training and pruning - special horticultural techniques- flowering- pollination and fruit set- use of plant growth regulators - alternate bearing / biennial bearing physiological disorders and remedies - harvesting - methods of harvesting - post harvest handling- export- value added products.
4. Banana: composition and uses - origin and distribution - species and cultivars - genomic classification and nomenclature - taxonomic classification: *Musa acuminata*, *Musa balbisiana*- major genomic groups - cultivars - hybrids.

5. Varieties- soil and climatic requirements - propagation techniques - main field preparation - Spacing - Planting- Planting density and cropping systems - After care - Nutrients, Water and Weed management.
6. Special horticultural practices- use of plant growth regulators - physiological Disorders - seediness and kokkan disease in banana - harvesting indices - harvesting - methods of harvesting - post harvest handling- export- value added products.
7. Grapes: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques- root stocks - main field preparation - spacing - planting- planting density and cropping systems - after care - nutrients, water and weed management.
8. Training and pruning - bud forecasting in grapes -special horticultural techniques - use of plant growth regulators - physiological disorders and remedies - harvesting - methods of harvesting - post harvest handling- export- value added products.
9. Citrus (Acid lime, lemon, sweet orange, mandarin orange): Composition and uses -origin and distribution - species and cultivars - varieties- soil and climatic requirements- propagation techniques - root stocks - bud wood certification - main field preparation- spacing - planting- planting density and cropping systems - after care - nutrients, water and weed management.
10. Training and pruning - use of plant growth regulators -physiological disorders and remedies - citrus decline and casual factors and their management - harvesting -methods of harvesting - post harvest handling- export- value added products.
11. Papaya: composition and uses - origin and distribution - species and cultivars -varieties- soil and climatic requirements - propagation techniques- sex expression and identification - main field preparation - spacing - planting- planting density and cropping systems - after care - nutrients, water and weed management.
12. Use of plant growth regulators - physiological disorders and remedies - harvesting - methods of harvesting - post harvest handling- sex expression and seed production in papaya.
13. Latex extraction and crude papain production, economics of production - export- value added products.
14. Sapota: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques- root stock- main field preparation - spacing - planting - after care - nutrients, water and weed management - training and pruning - use of plant growth regulators - harvesting -methods of harvesting - post harvest handling - export- value added products.
15. Guava: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques- main field preparation -spacing - planting- planting density (HDP) - after care - nutrients, water and weed management.
16. Training and pruning - bahar treatment - use of plant growth regulators - physiological disorders and remedies - harvesting - methods of harvesting - post harvest handling- export- value added products.
17. Mid semester examination
18. Pomegranate: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques - main field preparation - spacing - planting- after care - nutrients, water and weed management.

19. Training and pruning – bahar treatment - use of plant growth regulators -methods of harvesting - post harvest handling- export- value added products
20. Bael: composition and uses – origin and distribution – species and cultivars – varieties-soil and climatic requirements – propagation techniques – main field preparation –spacing – planting- after care – nutrients, water and weed management - training and pruning – use of plant growth regulators - harvesting - methods of harvesting – postharvest handling- value added products.
21. Ber: composition and uses – origin and distribution – species and cultivars – varieties-soil and climatic requirements – propagation techniques – main field preparation –spacing – planting- after care – nutrients, water and weed management - training and pruning – use of plant growth regulators - harvesting - methods of harvesting – postharvest handling- value added products.
22. Amla: composition and uses – origin and distribution – species and cultivars – varieties-soil and climatic requirements – propagation techniques – main field preparation – spacing – planting- after care – nutrients, water and weed management - training and pruning – use of plant growth regulators – harvesting - methods of harvesting – postharvest handling- value added products.
23. Annona: composition and uses – origin and distribution – species and cultivars – varieties-soil and climatic requirements – propagation techniques – main field preparation – spacing – planting- after care – nutrients, water and weed management - training and pruning – use of plant growth regulators – harvesting - methods of harvesting – postharvest handling- value added products.
24. Fig: composition and uses – origin and distribution – species and cultivars – varieties- soil and climatic requirements – propagation techniques – main field preparation – spacing – planting- after care – nutrients, water and weed management - training and pruning – use of plant growth regulators – harvesting - methods of harvesting – postharvest handling- value added products.
25. Pineapple: composition and uses – origin and distribution – species and cultivars – varieties-soil and climatic requirements – propagation techniques – main field preparation – spacing – planting- after care – nutrients, water and weed management - training and pruning – use of plant growth regulators – harvesting - methods of harvesting – postharvest handling- value added products.
26. Jack fruit: composition and uses – origin and distribution – species and cultivars – varieties- soil and climatic requirements – propagation techniques – main field preparation – spacing – planting- after care – nutrients, water and weed management - training and pruning – use of plant growth regulators – harvesting - methods of harvesting – postharvest handling- value added products.
27. Avocado: composition and uses – origin and distribution – species and cultivars – varieties-soil and climatic requirements – propagation techniques – main field preparation – spacing – planting- after care – nutrients, water and weed management - training and pruning – use of plant growth regulators – harvesting - methods of harvesting – postharvest handling- value added products.
28. Mangosteen: composition and uses – origin and distribution – species and cultivars – varieties- soil and climatic requirements – propagation techniques – main field preparation – spacing – planting- after care – nutrients, water and weed management - training and

- pruning - use of plant growth regulators - harvesting - methods of harvesting - postharvest handling- value added products.
29. Litchi: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques - main field preparation - spacing - planting- after care - nutrients, water and weed management - training and pruning - use of plant growth regulators - harvesting - methods of harvesting - postharvest handling- value added products.
 30. Carambola: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques - main field preparation - spacing - planting- after care - nutrients, water and weed management - training and pruning - use of plant growth regulators - harvesting - methods of harvesting - postharvest handling- value added products.
 31. Durian: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques - main field preparation - spacing - planting- after care - nutrients, water and weed management - training and pruning - use of plant growth regulators - harvesting - methods of harvesting - postharvest handling- value added products.
 32. Rambutan: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques - main field preparation - spacing - planting- after care - nutrients, water and weed management - training and pruning - use of plant growth regulators - harvesting - methods of harvesting - postharvest handling- value added products.
 33. Loquat: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques - main field preparation - spacing - planting- after care - nutrients, water and weed management - training and pruning - use of plant growth regulators - harvesting - methods of harvesting - postharvest handling- value added products.
 34. Passion: composition and uses - origin and distribution - species and cultivars - varieties- soil and climatic requirements - propagation techniques - main field preparation - spacing - planting- after care - nutrients, water and weed management - training and pruning - use of plant growth regulators - harvesting - methods of harvesting - postharvest handling- value added products.

Practical Schedule

1. Description and identification of varieties of mango, banana and grapes.
2. Description and identification of varieties of citrus, papaya, sapota.
3. Description and identification of varieties of guava, pineapple, pomegranate.
4. Description and identification of varieties of bael, ber, amla.
5. Description and identification of varieties of litchi, mangosteen.
6. Training and pruning of grapes.
7. Training and pruning of mango, guava and citrus.
8. Pre-treatment of banana suckers, de suckering in banana and study of sex forms in papaya
9. Use of plastics in fruit production viz., in propagation, mulching, irrigation, packaging, storage etc.
10. Visit to commercial orchards and diagnosis of maladies.
11. Manure and fertilizer application including bio fertilizers in different fruit crops.
12. Preparation and application of growth regulators in banana, grapes and mango.

13. Seed production in papaya, latex extraction and preparation of crude papain.
14. Production economics for major tropical and sub-tropical fruits.
15. Botanical description of ber, fig, jamun, pomegranate, carissa and phalsa.
16. Botanical description of wood apple, west Indian cherry, tamarind, aonla, bael and annona.

17. Final Practical Examination

Course Outcomes

CO 1 - The students will understand the cultivation aspects of tropical and sub-tropical fruit crops and its nursery management practices.

CO 2 - The students will understand the advances in plant propagation of tropical and sub-tropical fruits.

CO 3 - The students will gain skill on important cultivation techniques in tropical and sub-tropical fruits.

CO 4 - The students will learn and understand the current problems in tropical and sub-tropical fruits.

CO 5 - The students will get employment in orchards and post harvest industries.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	0	0	0	0
CO 2	3	0	1	0	2	0
CO 3	2	0	2	1	0	0
CO 4	1	2	0	0	2	3
CO 5	0	1	0	3	0	0

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HOR 104 TROPICAL AND SUBTROPICAL VEGETABLE CROPS (2 + 1)

Learning objectives

- To acquire knowledge on the cultivation aspects of tropical and subtropical vegetables.
- To explore the tropical and subtropical zones and to study more about tropical and subtropical vegetables.
- To provide knowledge on the special horticultural practices for cultivation of tropical and subtropical vegetables.
- To understand the current problems and their management in tropical and subtropical vegetables.
- To acquaint advanced technologies of tropical and subtropical vegetable crop cultivation.

Theory

Unit I: Scope and importance of tropical and subtropical vegetables

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

Unit II: Solanaceous and Malvaceous vegetable crops

Area and production - composition and uses - climate and soil requirements - season-varieties and hybrids - seed rate- nursery practices - preparation of field --planting system - spacing - sowing or transplanting - manuring and nutrient management - water and weed management - mulching- fertigation-special horticultural practices - nutrient deficiencies- physiological disorders - growth regulators - maturity indices- harvest -yield - postharvest handling and storage - marketing.

Crops: Tomato, brinjal, chilli, capsicum and bhendi

Unit III: Cucurbitaceous vegetable crops

Area and production - composition and uses - climate and soil requirements - season-varieties and hybrids - seed rate- preparation of field --planting system - spacing - direct sowing and raising in portray/polybag - sex expression - growth regulators - manuring and nutrient management - water and weed management - mulching- fertigation-special horticultural practices - nutrient deficiencies- physiological disorders - maturity indices- harvest -yield - postharvest handling and storage - processing gherkin - marketing.

Crops: Bitter gourd, snake gourd, ribbed gourd, bottle gourd, Ivy gourd, chow - chow, ash gourd, pumpkin, watermelon, musk melon, cucumber and gherkin

Unit IV: Legumes and greens

Area and production - composition and uses - climate and soil requirements - season-varieties- seed rate- preparation of field - planting system - spacing - sowing / planting - manuring and nutrient management - staking for climbing types - water and weed management - mulching- fertigation-nutrient deficiencies- physiological disorders - growth regulators - maturity indices- harvest -yield - postharvest handling and storage - marketing.

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

Unit V: Bulbous and Tuber crops

Area and production - composition and uses - climate and soil requirements – season-varieties and hybrids – seed rate- nursery practices - preparation of field – planting system – spacing – sowing or transplanting - manuring and nutrient management - water and weed management – mulching- fertigation-special horticultural practices - nutrient deficiencies- physiological disorders - growth regulators – maturity indices- harvest -yield – postharvest handling and storage – marketing.

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

Practical

Identification and description of tropical and subtropical vegetable crops - nursery practices - preparation of field and sowing /planting for direct sown/ transplanted vegetable crops – herbicide application - manures and fertilizer application, fertigation schedule – special horticultural practices –growth regulator application - identification of nutrient deficiencies and physiological disorders - harvest indices and maturity standards - post harvest handling and storage - marketing – working out the cost of cultivation - project preparation for commercial cultivation - visit to commercial vegetable growing areas, market and processing centre.

Lesson Plan

Theory Schedule

1. Scope and importance of vegetable crops. Area, production, global and national scenario, industrial importance, export potential of tropical and subtropical vegetable crops and institutions involved in vegetable crops research. Classification of vegetable crops.
2. Vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden and floating garden
3. Types of vegetable farming - rice fallow cultivation, river bed cultivation, rainfed cultivation and contract farming.
4. Organic vegetable production, GAP in vegetable production and export standards of vegetables.
5. Tomato - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, nursery practices, preparation of field, spacing, planting systems and transplanting.
6. Tomato - Manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, staking, physiological disorders, growth regulators, constraints in production, off season cultivation under protected structure, maturity indices harvest, yield, post harvest handling, storage and marketing.
7. Brinjal - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, nursery practices, reparation of field, spacing, planting systems and transplanting.
8. Brinjal - Manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.
9. Chilli - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, nursery practices, preparation of field, spacing, planting systems and transplanting.
10. Chilli - Manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, rainfed chilli

cultivation, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.

11. Capsicum - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, nursery practices, preparation of field, spacing, planting systems and transplanting manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, shadenet cultivation during summer, maturity indices harvest, yield, post harvest handling, storage and marketing.
12. Bhendi - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, sowing, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.
13. Bitter gourd and snake gourd- Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.
14. Ribbed gourd and bottle gourd - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.
15. Ivy gourd and chow-chow - Area and production, composition and uses, climate and soil requirements, season, varieties, propagation, preparation of field, spacing, planting systems, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield,-post harvest handling, storage and marketing.
16. Ash gourd and pumpkin - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices, harvest and yield, post harvest handling, storage and marketing.
17. **Mid semester examination**
18. Watermelon and musk melon - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices, harvest and yield, post harvest handling, storage and marketing.
19. Cucumber, long melon, snap melon and gherkin - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, seed rate, preparation of field, spacing, planting systems, sowing, sex expression, manuring and nutrient

- management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices, harvest and yield, post harvest handling, storage and marketing.
20. Cluster beans - Area and production, composition and uses, climate and soil requirements, season, varieties, seed rate, preparation of field, spacing, sowing, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.
 21. Vegetable cowpea - Area and production, composition and uses, climate and soil requirements, season, varieties, seed rate, preparation of field, spacing, sowing, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing
 22. Lab lab - Area and production, composition and uses, climate and soil requirements, season, varieties, seed rate, preparation of field, spacing, sowing, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.
 23. Broad bean, moringa bean and yam bean - Area and production, composition and uses, climate and soil requirements, season, varieties, seed rate, preparation of field, spacing, sowing, manuring and nutrient management, water and weed management, mulching, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.
 24. Amaranthus - Composition and uses, climate and soil requirements, season, varieties, seed rate, preparation of field, spacing, sowing, manuring and nutrient management, water and weed management, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.
 25. Basella, portulaca, roselle and sorrel - Composition and uses, climate and soil requirements, season, varieties, propagation, seed rate, preparation of field, spacing, sowing / planting, manuring and nutrient management, water and weed management, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.
 26. Moringa - Area and production, composition and uses, climate and soil requirements, season, perennial and annual moringa varieties, propagation, seed rate, preparation of field, spacing, sowing/planting, manuring and nutrient management, water and weed management, mulching, fertigation, nutrient deficiencies, physiological disorders, growth regulators, off season production, constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.
 27. Onion (Aggregatum and Common) - Area and production, composition and uses, climate and soil requirements, season, varieties and hybrids, specialities of seed propagated aggregatum onion, propagation methods, seed rate, nursery practices, sowing / transplanting- preparation of field, spacing, planting systems.
 28. Onion (Aggregatum and common) - Manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators,

constraints in production, maturity indices harvest, yield, post harvest handling, storage and marketing.

29. Cassava - Area and production, composition and uses, significance of HCN in tubers, climate and soil requirements, season, varieties, propagation, single bud cuttings, production of CMD free planting materials - true cassava seed production , nursery practices, preparation of field, spacing, planting systems.
30. Cassava -Manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, harvest, yield, post harvest handling, storage, marketing and starch estimation in tubers by relative density method and price fixation.
31. Sweet potato - Area and production, composition and uses, climate and soil requirements, season, varieties, propagation, preparation of field, spacing, planting systems, manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, -post harvest handling, storage and marketing.
32. Colocasia and Chinese potato (vegetable coleus) - Composition and uses, climate and soil requirements, season, varieties, propagation, preparation of field, spacing, planting systems, manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, -post harvest handling, storage and marketing.
33. Elephant foot yam - Area and production, composition and uses, climate and soil requirements, season, varieties, propagation, preparation of field, spacing, planting systems, manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, -post harvest handling, storage, effect of calcium oxalate in tubers on storage and cooking and marketing.
34. Edible Dioscorea, xanthosoma and arrow root - Area and production, composition and uses, climate and soil requirements, season, varieties, propagation, preparation of field, spacing, planting systems, staking and training vines, manuring and nutrient management, water and weed management, fertigation, nutrient deficiencies, physiological disorders, growth regulators, constraints in production, maturity indices harvest, yield, -post harvest handling, storage and marketing.

Practical Schedule

1. Planning and lay out of kitchen/ nutrition garden.
2. Preparation of nursery, containerized transplant production and sowing of seeds for solanaceous vegetable crops.
3. Preparation of field and sowing of direct sown vegetable crops.
4. Preparation of field, sowing of cucurbitaceous, perennial and leafy vegetable crops and tuber crops.
5. Identification and description of species and varieties of tomato, brinjal and chilli. Working out cost- benefit ratio.
6. Identification and description of species and varieties of bhendi, amaranth, cluster beans, vegetable cowpea and lab-lab. Working out cost- benefit ratio.
7. Identification and description of species and varieties of cucurbits, onion, moringa and chekkurmanis. Determination of sex ratio in cucurbits. Working out cost- benefit ratio.

8. Identification and description of cultivars and wild relatives of tuber crops. Working out cost -benefit ratio.
9. Study of rainfed cultivation practices in vegetable crops
10. Study of drip and fertigation, basal dressing, top dressing and foliar spray of fertilizers for vegetable crops.
11. Identification of weeds, preparation of herbicide spray fluids and their usage in the field. Working with the economics of weed management.
12. Preparation of growth regulator spray solution- their usage in tropical vegetable crops.
13. Identification of nutrient deficiencies, physiological disorders and corrective measures in vegetable crops.
14. Maturity indices, harvesting and post harvest management of tropical and subtropical vegetable crops.
15. Visit to commercial vegetable growing area / markets.
16. Project preparation for commercial cultivation of tropical vegetable crops.
17. **Final Practical Examination.**

Course Outcomes

CO 1 - The students will understand the cultivation aspects of tropical and sub-tropical vegetables crops and its nursery management practices.

CO 2 - The students will understand the advances in production aspects of tropical and sub-tropical vegetables.

CO 3 - The students will gain skill on post harvest handling in tropical and sub-tropical vegetables.

CO 4 - The students will learn and understand the current problems in tropical and sub-tropical vegetables.

CO 5 - The students will get employment in seed production and post harvest industries.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	2	0	0	0
CO 2	1	0	1	0	2	0
CO 3	2	0	2	1	0	0
CO 4	0	2	1	0	2	1
CO 5	0	1	1	3	0	0

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HOR 105 POTATO AND TUBER CROPS (1+1)

Learning Objectives

- To acquire knowledge on production technology of potato and tuber crops.
- To acquire knowledge on production technology of underutilized tuber crops.
- To acquaint knowledge on special techniques and post harvest handling.
- To explore cold storage and processing centers.
- To acquaint advanced technologies in horticulture.

Theory

Unit I: Introduction

Introduction and importance of potato and tuber crops in nutrition and national economy - area, production, export potential. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and Marketing.

Unit II: Production technology I

Potato, sweet potato and arrow root- origin, area, production, description of varieties and hybrids. Climate and soil requirement, season; seed rate; preparation of field; planting practices; spacing; water, nutrient and weed management; nutrient deficiencies. Use of chemicals and growth regulators; cropping systems. Harvesting practices yield; economic of cultivation. Postharvest handling and storage, marketing.

Unit III: Production technology II

Cassava, colocasia and xanthosoma - origin, area, production, description of varieties and hybrids. Climate and soil requirement, season; seed rate; preparation of field; planting practices; spacing; water, nutrient and weed management; nutrient deficiencies. Use of chemicals and growth regulators; cropping systems. Harvesting practices yield; economic of cultivation. Postharvest handling and storage, marketing.

Unit IV: Production technology III

Amorphophallus, dioscorea, Jerusalem artichoke- origin, area, production, description of varieties and hybrids. Climate and soil requirement, season; seed rate; preparation of field; planting practices; spacing; water, nutrient and weed management; nutrient deficiencies. Use of chemicals and growth regulators; cropping systems. Harvesting practices yield; economic of cultivation. Postharvest handling and storage, marketing.

Unit V: Production technology IV

Horseradish and other under exploited tuber crops - origin, area, production, description of varieties and hybrids. Climate and soil requirement, season; seed rate; preparation of field; planting practices; spacing; water, nutrient and weed management; nutrient deficiencies. Use of chemicals and growth regulators; cropping systems. Harvesting practices yield; economic of cultivation. Postharvest handling and storage, marketing.

Practical

Identification and description of varieties/hybrids; propagation methods, nursery management; preparation of field, sowing/transplanting. Top dressing of fertilizers and inter-

culture and use of herbicides and growth regulators; identification of nutrient deficiencies, physiological disorders; harvest indices and maturity standards, postharvest handling and storage, marketing. Seed collection, working out cost of cultivation and field visits to commercial farms.

Lesson Plan

Theory Schedule

1. Area, production, world scenario and export potential of potato and tuber crops.
2. Scope and importance - nutritional facts of potato and tuber crops.
3. Area, production and export potential, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, water, nutrient and weed management of potato.
4. Deficiencies and their management, Use of PGR'S and chemicals, special intercultural operations, cropping system, harvesting and yield. Post-harvest handling, field and seed standards and marketing of potato.
5. Area, production and export potential, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, water, nutrient and weed management of sweet potato.
6. Deficiencies and their management, Use of PGR'S and chemicals, special intercultural operations, cropping system, harvesting and yield. Post-harvest handling, field and seed standards and marketing of sweet potato.
7. Area, production and export potential, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, water, nutrient and weed management. Deficiencies and their management, use of PGR'S and chemicals, special intercultural operations, cropping system, harvesting and yield. Post-harvest handling, field and seed standards and marketing of arrow root.
8. Area, production and export potential, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, water, nutrient and weed management. Deficiencies and their management of cassava.
9. **Mid semester Examination.**
10. Use of PGR'S and chemicals, special intercultural operations, cropping system, Harvesting and yield. Post-harvest handling, field and seed standards and marketing of cassava
11. Area, production and export potential, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, water, nutrient and weed management. Deficiencies and their management, use of PGR'S and chemicals, special intercultural operations, cropping system, harvesting and yield. Post-harvest handling, field and seed standards and marketing of colocasia.
12. Area, production and export potential, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, water, nutrient and weed management. Deficiencies and their management, use of PGR'S and chemicals, special intercultural operations, cropping system, harvesting and yield. Post-harvest handling, field and seed standards and marketing of xanthosoma.
13. Area, production and export potential, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, water, nutrient and weed management. Deficiencies and their management, use of PGR'S and chemicals, special

intercultural operations, cropping system, harvesting and yield. Post-harvest handling, field and seed standards and marketing of amorphophallus.

14. Area, production and export potential, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, water, nutrient and weed management. Deficiencies and their management, use of PGR'S and chemicals, special intercultural operations, cropping system, harvesting and yield. Post-harvest handling, field and seed standards and marketing of dioscorea.
15. Area, production and export potential, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, water, nutrient and weed management. Deficiencies and their management, use of PGR'S and chemicals, special intercultural operations, cropping system, harvesting and yield. Post-harvest handling, field and seed standards and marketing of Jerusalem artichoke and horse radish.
16. Use of PGR'S and chemicals, special intercultural operations, cropping system, harvesting and yield. Post-harvest handling, field and seed standards and marketing of horseradish and other under exploited tuber crops.
17. Area, production and export potential, cultivation practices including soil and climate, season, seed rate, preparation of field planting, spacing, water, nutrient and weed management. Deficiencies and their management of under exploited tuber crops.

Practical

1. Identification and description of potato and tuber crops.
2. Soil water conservation, contour planting, crop geometry.
3. Study of various propagation methods in tuber crops.
4. Field preparation and planting of potato and sweet potato.
5. Field preparation and planting of amorphophallus, colocasia.
6. Field preparation and planting of cassava.
7. Field preparation and planting of aerial yam, lesser yam.
8. Use of herbicides, preparation of solution and its application in potato and tuber crops.
9. Major nutritional requirement for potato and tuber crops.
10. Micro nutritional requirement for potato and tuber crops.
11. Use of growth regulators, preparation of solution and application in potato and tuber crops.
12. Nutrient deficiencies in tuber crops.
13. Physiological disorders in potato, sweet potato and arrow root crops.
14. Physiological disorders in Cassava, colocasia and xanthosoma.
15. Physiological disorders in Amorphophallus, dioscorea, Jerusalem artichoke, horse radish and under exploited tuber crops.
16. Study of maturity indices and harvesting of various tuber crops.
17. **Final Practical examination.**

Course Outcomes

- CO 1** - The students will understand the cultivation aspects of potato and tuber crops and its nursery management.
- CO 2** - The students will understand the advances in plant propagation of potato and tuber crops.
- CO 3** - The students will gain skill on important cultivation techniques in potato and tuber crops.
- CO 4** - The students will learn and understand the current problems in tubers crops.

CO 5 - The students will get employment in potato and tuber crop research institutions.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	3	0	0	0
CO 2	2	0	0	2	0	0
CO 3	3	2	0	2	1	0
CO 4	0	0	0	3	2	0
CO 5	0	0	1	3	0	1

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HOR 106 GROWTH AND DEVELOPMENT OF HORTICULTURAL CROPS (1 + 1)

Learning Objectives

- To make them acquire knowledge on physiology of growth and development.
- To acquire knowledge on physiology of canopy management in growth and development.
- To provide knowledge on the role of essential nutrients in plant growth and development.
- To understand the role of plant growth regulators in the growth and development process of horticultural crops.
- To acquaint knowledge on the post harvest physiology of horticultural crops.

Theory

Unit I: Growth physiology

Growth and development - definitions, components, leaf area index (LAI) - optimum LAI in horticultural crops. Canopy development: Different stages of growth, growth curves, growth analysis in horticultural crops. Plant hormones - auxin, gibberellin, cytokinin, ethylene, ABA and retardants, basic functions, role in crop growth and development. New generation Plant Growth Regulators

Unit II: Physiology of propagation

Seed germination - Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and breaking methods in horticultural crops. Physiology of root formation in cuttings and layering and stock and scion relationship - PGR in propagation -

Unit III: Physiology of Canopy management

Pruning and training, physiological basis of training and pruning -, canopy management - PGR in canopy management - source and sink relationship - translocation of assimilates - partitioning of assimilates

Unit IV: Physiology of flowering

Flowering - physiology of flowering - Photoperiodism - long day, short day and day natural plants, Phytochrome - off-season flowering - PGRs in flowering - Factors affecting flowering, - vernalisation, factors affecting and its application in horticulture.

Unit V: Post-harvest physiology

Physiology of fruit growth and development, fruit setting, fruit thinning, fruit drop - factors affecting fruit set and development, Ripening - physiology of fruit ripening - climacteric and non climacteric fruits. Physiology of pre and post-harvest management of fruit vegetable and flower crops.

Practical

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

Lesson Plan

Theory Schedule

1. Growth and development - definitions, components, leaf area index (LAI) - optimum LAI in horticultural crops. Canopy development
2. Different stages of growth, growth curves, growth analysis in horticultural crops. Factors affecting growth.
3. Growth hormones: Auxins, gibberellins, Cytokinins - Basic functions - role in crop growth.
4. Growth hormones: Ethylene, Abscisic acid and Brassinosteroids- Basic functions - role in crop growth.
5. Growth inhibitors and retardants - New generation Plant Growth Regulators -physiological role in crop regulations.
6. Seed germination - Physiology of seed development and maturation
7. Dormancy of seeds and buds - factors causing dormancy of seeds - Artificial methods of breaking dormancy of seeds - Advantages of dormancy of seeds.
8. Physiology of root formation in cuttings and layering and stock and scion relationship - PGR in propagation
9. **Mid semester examination**
10. Pruning and training - Physiological basis of training and pruning - Canopy management - PGR in canopy management
11. Source - Sink relationship - translocation of assimilates - partitioning of assimilates
12. Flowering - Physiology of flowering - photoperiodism- Photoperiodic induction
13. Phytochrome - Off- season flowering - PGRs in flowering - Factors affecting flowering

14. Vernalization: Perception of cold stimulus- presence of floral hormone – mechanisms of vernalization- factors affecting – devernalization – practical utility
15. Physiology of fruit growth and development, fruit setting, fruit thinning, fruit drop - factors affecting fruit set and development
16. Abscission and senescence.
17. Physiology of pre and post-harvest management of fruit, vegetable and flower crops

Practical Schedule

1. Estimation of photosynthetic pigments.
2. Estimation of photosynthetic efficiency in horticulture crops.
3. Measurement of leaf area following various methods.
4. Growth analysis.
5. Identification of synthetic plant hormones and growth retardants
6. Preparation of hormonal solutions.
7. Assessment of hormonal influence on induction of rooting of cuttings.
8. Assessment of hormonal influence on control of flower and fruit drop.
9. Assessment of physiological changes during fruit ripening.
10. Estimation of ascorbic acid content in fruits.
11. Estimation of Lycopene content in fruit
12. Identification of physiological and nutritional disorders in horticultural crops.
13. Preparation of suitable formulations for the correction of physiological and nutritional disorders
14. Seed viability by tetrazolium test
15. Preparation of suitable hormonal formulations for breaking dormancy
16. Field visit

17. Final Practical Examination

Course Outcomes

CO 1 - Students will acquire basic knowledge on pattern of growth and development of horticultural crops and their management in relation to crop production,

CO 2 - Students will understand the basic concepts in physiology of growth and development

CO 3 - Students will gain skill on the role of growth regulators and their solution preparation in relation to production problems in horticultural crops.

CO 4 - Students will learn and understand the canopy management physiology for crop improvement in horticultural crops.

CO 5 - Students will gain knowledge on the post harvest physiology to reduce the problems in horticultural crops related to processing industries.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	0	0	0	0
CO 2	1	0	1	0	2	0
CO 3	2	1	2	2	0	0
CO 4	1	2	0	2	1	0
CO 5	1	0	3	3	1	1

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AGR 101 AGRO-METEOROLOGY AND CLIMATE CHANGE (1+1)

Learning Objectives

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

Theory

Unit -I: Introduction to Meteorology and Agrometeorology

Introduction to meteorology - branches, importance in crop production, scope of atmosphere - lower and upper- composition and its characters. Agro climatic zones of India and Tamilnadu

Unit -II: Solar radiation, light and temperature

Importance of solar radiation - sun and its thermal properties, different types of solar radiation and its effect on crop growth, lights and its influence on crop productivity, bandwidth, temperature, air and soil. Crop response to different conditions - factors affecting solar radiations, light and temperature.

Unit III: Atmospheric pressure and wind

Atmospheric pressure - variation in atmospheric pressure, causes of variation, pressure and wind system of the world, wind, daily and seasonal variation of wind speed, cyclone, anti cyclone. Effect of wind on crops - movement of air mountain and valley winds- land and sea breezes.

Unit -IV: Atmospheric humidity, precipitation and clouds

Atmospheric humidity-effect of humidity on crops- concept of saturation, vapour pressure and process of condensation, evaporation, evapotranspiration, PET, different forms of precipitation and condensation, cloud seeding (artificial rain making). Clouds- clouds formation, WMO classification and characteristics. Rainfall-importance of rainfall on crops, types of rain fall. Monsoon- definition, origin and

distribution of South West Monsoon and North West Monsoon, mechanism and importance in Indian agriculture.

Unit -V: Climate change and weather forecasting

Various types of weather hazards influencing crop growth - modification of micro climate, climatic normal, livestock, and crops. Global **warming**- impact of El-nina. Weather forecasting - principles and types. Current stream of thoughts.

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, automatic weather station, preparation of synoptic charts and crop weather calendars, mapping of agro climatic zones.

Lesson Plan

Theory Schedule

1. Introduction to meteorology - branches- definitions of meteorology, climatology and agricultural meteorology - scope and practical utility of agricultural meteorology.
2. Weather and climate- Factors affecting weather and climate-earth atmosphere- its composition, extent and structure
3. Atmospheric weather variable- agro climatic zones of India and Tamil Nadu
4. Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave and thermal, terrestrial, net radiation and albedo.
5. Physiological responses of different bands of incident radiation - function of light, factors affecting distribution of solar radiation within the plant canopy, heat units.
6. Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, cardinal temperature- importance of air temperature- energy balance of earth.
7. Low and high air temperature plant injury- soil temperature- importance of soil temperature.
8. Atmospheric pressure - variation in atmospheric pressure- causes of variation- pressure and wind system of the world

9. Mid-Semester Examination

10. Wind, daily and seasonal variation of wind speed, cyclone, anti cyclone, effect of wind on crops- movement of air and valley winds- land and seas breezes.
11. Atmospheric humidity, concept of saturation, vapor pressure, effect of humidity on crops., concept of saturation, vapour pressure and process of condensation- evaporation - Evapotranspiration-PET
12. Precipitation and condensation - definition- different forms of precipitation and condensation - cloud seeding (artificial rain making).
13. Clouds- clouds formation - WMO classification and characteristics.
14. Rainfall- importance of rainfall on crops- types of rain fall-monsoon definition - origin and distribution of South West Monsoon and North West Monsoon-mechanism and importance in Indian agriculture.
15. Weather hazards- drought , floods, frost, tropical cyclones , heat wave, cold wave, storms, hail storms, thunder storms, dust storms and tornadoes
16. Agricultural and weather relations, modifications of crop micro climate, climatic normal

for crop and livestock production.

17. Weather forecasting, types of weather forecast and their uses-climate change, climatic variability, El-Nino and La-Nina , global warming, causes of climate change and its impact on national and global agriculture and current stream of thoughts.

Practical Schedule

1. Visit to Annamalai University Agrometeorology observatory and understanding various types of agromet observatories.
2. Site selection & layout for observatory
3. Measurement of sunshine duration and light intensity
4. Measurement of maximum and minimum air temperature, its tabulation, trend and variation analysis
5. Measurement of soil temperature
6. Determination of vapor pressure, relative humidity and dew point temperature readings, hygrometric table.
7. Measurement of atmospheric pressure with various equipments.
8. Measurement of wind speed, direction and preparation of wind rose.
9. Measurement of rainfall and its tabulation
10. Rainfall analysis
11. Measurement of evaporation and evapotranspiration
12. Measurement of dew - dew gauge
13. Weather forecasting , types and its importance in agriculture
14. Use of synoptic chart and weather reports
15. Climatic variability and analysis of its impact on agriculture
16. Mapping of agro climatic zones of India and Tamil Nadu and its characterization.

17. Final practical examination

Course Outcomes

CO 1: To gain knowledge about role of weather elements in crop growth and how to record various weather elements

CO 2: To construct information about effect of solar radiation, temperature and relative humidity on crop production

CO 3: To comprehend knowledge with cyclones, El Nina and La Nina

CO 4: To create awareness on cloud types, precipitation, drought, flood and evapotranspiration.

CO 5: To formulate cropping pattern for different Agro climatic zones of India and Tamil Nadu, importance of weather forecasting.

CO-PO Mapping Matrix

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

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AGR 102 WEED AND WATER MANAGEMENT IN HORTICULTURAL CROPS (1+1)

Learning Objectives

- Able to understand about weed biology and ecology and its usefulness in weed management.
- Able to understand different methods of weed management including herbicides, their mode of action and selectivity and resistance for the effective weed control.
- The students will gain clear scientific knowledge on soil water plant relationship.
- The students will acquire knowledge on water requirement for various horticultural crops.
- The students will learn about various methods of irrigation and how to improve irrigation efficiency for horticultural crops.

Theory

Unit-I : 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, mechanical, chemical, biological methods - Integrated weed management.

Unit II : Herbicides and weed management

Herbicides - classification - formulation - methods of application - Introduction to adjuvants - Weed management in major vegetable, flower and fruit crops - lawns and plantation crops. Aquatic, parasitic and problematic weeds and their management.

Unit-III : Importance, sources of water 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-IV: 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-V: 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. Current stream of thoughts.

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 on irrigation Agronomy - Identification of wet, garden and dry land weeds - Agronomic method of weed management - Herbicides - Classification - Formulations - Calculations -Equipments - WCE - Economics - Problematic weeds - Weed survey.

Lesson Plan

Theory Schedule

1. Weeds - Definition, classification and characteristics, harmful and beneficial effect of weeds - weed seed dissemination - Seed dormancy.
2. Crop - weed competition and Allelopathy - Concept of weed prevention.
3. Principles and methods of weed management: Preventive, cultural, mechanical, chemical, biological and IWM.
4. Classification and characteristics of herbicides and herbicide formulations - Methods of herbicide application.
5. Adjuvants - Uses - Weed management in major vegetable, fruit and flower crops.
6. Weed management in lawns and plantation crops.
7. Aquatic, Problematic, parasitic weeds and their control.
8. Role of water for growth and development of crops - Need for scientific water management in India.
9. **Mid Semester Examination**
10. Water resources of India and Tamil Nadu - Irrigation systems of India and Tamil Nadu.
11. Soil - plant - water relationship - Soil water movement - Water movement along soil plant atmosphere system.
12. Soil moisture constants - saturation - field capacity - permanent wilting point- Available soil moisture - moisture equivalent - hygroscopic coefficient -determination - uses.
13. 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 of fruit and vegetable crops.
14. Scheduling of irrigation - different approaches - Climatological approach, empirical methods, crop co-efficient.
15. Methods of irrigation - surface (flooding, beds and channels, border strip, ridges and furrows, broad bed and furrows, surge irrigation) and sub - surface method.
16. Micro irrigation system (drip and sprinkler irrigation) - suitability, components, layout, operation, advantage and disadvantage.
17. Quality of irrigation water - Utilization of poor quality water for irrigation and current stream of thoughts.

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 on irrigation Agronomy.
9. Identification of wet land, garden land, dry 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 farmer's field.
17. **Final practical examination**

Course outcomes:

CO 1: To create knowledge on facts and information from different sources, pertaining to weed biology and management and be able to explain how they are interrelated; demonstrated through successful completion of assignments.

CO 2: To critically assess different weed management strategies

CO 3: To evaluate water requirement for various field crops.

CO 4: To gain skill development on layout of different methods of irrigation and ways to improve irrigation efficiency.

CO 5: To analyse the quality of water for irrigation and formulate different drainage methods.

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	-	2
CO2	3	2	-	-	-	
CO3	3	1	2	-	-	2
CO4	2	2	1	-	2	-
CO5	2	1	-	-	-	-

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GPB 102 PRINCIPLES OF GENETICS AND CYTOGENETICS 3(2+1)

Learning Objectives

- To inculcate knowledge on the fundamental concepts of inheritance and variation
- To make the students to understand the Structure of chromosomes and their functions
- To explore linkage and crossing over techniques for drawing gene maps
- To understand the sex determination process and inheritance of quantitative traits.
- To decipher the genetic code for the determination of protein product.

Theory

Unit I : Mendal's work and Non-Mendalian inheritance

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. Post mendalian concepts- Probability and Chi-square- Mendel's experiments and laws of inheritance. Allelic interactions - Dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance. Deviation from Mendelian inheritance - Non allelic interaction without modification in Mendelian ratio - Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio - i.) Dominant epistasis (12:3:1) ii.) Recessive epistasis (9:3:4) iii.) Duplicate and additive epistasis (9:6:1) iv.) Duplicate dominant epistasis (15:1) v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); 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 II: Study of chromosomes and chromosomal theory of inheritance

Structure and function of cell and cell organelles - Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram -Types of chromosomes based on position of centromere, based on structure and function: based on the role in sex determination, normal and special chromosomes - polytene, lampbrush, Other types of chromosomes - B, ring and isochromosomes. Cell division - mitosis, meiosis and their significance, cell cycle- Chromosomal theory of inheritance.

Unit III : Recombination Genetics and chromosomal abberations

Linkage - coupling and repulsion; Experiment on Bateson and Punnet - Chromosomal theory of linkage of Morgan - Complete and incomplete linkage, Linkage group. Crossing over - significance of crossing over; cytological proof for crossing over - Stern's experiment; Factors controlling crossing over. Strength of linkage and recombination; Two point and three point test cross. Double cross over, interference and coincidence; genetic map.

Chromosomal aberration: Variation in chromosome structure - deletion, duplication, inversion and translocation - genetic and cytological implications; Chromosomal aberration: Variation in

chromosome number – euploid, aneuploid, types of aneuploids and their origin; Uses of Dihaploids and Doubled haploids in Genetics-Nondisjunction - Klinefelter syndrome and Turner syndrome; Polyploid - auto and allopolyploids, their characters; evolution of wheat, Triticale, cotton, tobacco, Brassicas.

Unit IV: Sex chromosomes and extra chromosomal Inheritance

Sexual reproduction- Sporogenesis and Gametogenesis- Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination - different types –Genic balance theory of Bridges, 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.

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

Unit V: DNA-Models, Replication , Genetic code and Protein Synthesis

Nature of Genetic material- DNA as 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. 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; Gene function- Regulation of gene expression – operon model of Jacob and Monad; Gene concept- Cistron, muton and recon; Complementation test; exons, introns – split genes –Functional genomics, Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics.

Lesson Plan

Theory Schedule

1. Pre Mendelian concepts and Post Mendelian concepts of heredity
2. Mendelian principles of heredity. Law of segregation and Law of independent assortment
3. Exceptions to Mendel’s 1st law. Dominance relationships
4. Exceptions to Mendel’s 2nd law. (Law of incomplete dominance and interaction of factors)
5. Epistatic gene interactions (3 interactions with examples)
6. Epistatic gene interactions
7. Cell organelles
8. Chromosome –structure, types
9. Special chromosomes
10. Chromosomal theory of Inheritance
11. Cell division, cell cycle, mitosis
12. Meiosis
13. Probability and chi-square
14. Multiple alleles examples
15. Blood group genetics, pleiotropism and pseudo alleles
16. Sex determination mechanisms

17. Mid-Semester Examination

18. Sexual reproduction-sporogenesis and Gametogenesis
19. Sex determination mechanisms
20. Sex linkage, sex limited and sex influenced traits
21. Linkage – its estimation, two point test cross
22. Crossing over mechanisms ,Three point test cross, chromosome mapping
23. Structural changes in chromosomes Deletions, Duplications and inversions
24. Translocations, examples of all structural alternations
25. Mutations and classifications
26. Mutagenic agents, methods of inducing mutations ,CLB techniques
27. Qualitative and quantitative traits
28. Polygenes, continuous variations, multiple factor hypothesis
29. Cytoplasmic inheritance
30. Nature and structure of DNA, RNA
31. Replication of genetic material, DNA and RNA
32. Protein synthesis, transcription
33. Translational mechanisms of genetic material gene concept, gene structure
34. Gene function and regulation. Lac operon and top operator Genetic disorders

Practical Schedule

1. Study of microscope. Study of cell structure
2. Study of cell organelles
3. Study of cell organelles
4. Experiments on monohybrid
5. Experiments on Dihybrid
6. Experiments on trihybrid
7. Test cross, backcross, experiments on gene interactions (monohybrid)
8. Experiments on Study of cell gene interactions (Di hybrid)
9. Experiments on epistatic gene interactions
10. Experiments on probability
11. Experiments on chi-square test
12. Experiments on chi-square test –Gene interactions
13. Determination of linkage and cross over analysis through two point test cross data
14. Determination of linkage and cross over analysis through three point test cross data
15. Sex linked inheritance in *Drosophilla*
16. Study of models on DNA and RNA structure

17. Final practical examination

Course Outcomes

1. Students will understand the molecular structure of DNA and the central dogma of life.
2. Importance of studying Linkage and recombination mapping will be well understood by the students.
3. 3.Students will able to figure out the Fine structure of gene and gene mapping techniques.
4. The necessity of studying Gene regulation and function will be well elucidated
5. To explore the students in understanding various Genetic disorders and have a better idea on consanguineous mating

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3					
CO2		1	2			
CO3				2		
CO4					2	
CO5						3

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BIO 101 FUNDAMENTALS OF PLANT BIOCHEMISTRY AND BIOTECHNOLOGY (2+1)

Learning Objectives

- To impart knowledge on the fundamentals of biochemistry and biotechnology
- To understand the concepts of biochemistry and biotechnology
- To understand the biochemical reactions occurring in living cells
- To understand the differentiate between qualitative identification and quantitative estimations
- To understand the separation of biomolecules using various biochemical techniques
- To understand the basic techniques of biotechnology

Theory

UNIT I: Carbohydrates, lipids and proteins

Introduction - pH and Buffer - Phosphate and carbonate-bicarbonate buffer, Carbohydrate: Importance and classification. Structures of Monosaccharides, Structure of Disaccharides and Polysaccharides, Lipid: classification, Proteins: - amino acids - classification essential and non-essential amino acids, classification based on their hydrophobicity of R(side chain) groups.

UNIT II: Nucleic acids

Nucleic acids - structure of nitrogen bases - nucleosides and nucleotides - Adenosine triphosphate (ATP), Guanosine triphosphate (GTP), Cytidine triphosphate (CTP), Thymidine triphosphate (TTP) and Uridine triphosphate (UTP), Types of DNA -A, B & Z DNA. Types of RNA

UNIT III: Enzymes and metabolism

Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Glycolysis and Tricarboxylic Acid (TCA) cycle- metabolic energy generation in the above cycles. Oxidative phosphorylation and substrate level phosphorylation - electron transport chain in mitochondria

UNIT IV: Plant Biotechnology-I

Concepts and applications of plant biotechnology: Organ culture, embryo culture, cell

suspension culture, callus culture, anther culture and pollen culture and their applications, Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance, cryo-preservation.

UNIT V: Plant Biotechnology-II

Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and *Agrobacterium* mediated gene transfer methods, DNA fingerprinting. Biotechnology regulations

Lesson Plan

Theory Schedule

1. Introduction – pH and Buffer – Phosphate and carbonate-bicarbonate buffer
2. Carbohydrate: Classification. Structures of Monosaccharides, Structure of Disaccharides and Polysaccharides
3. Lipid: Classification
4. Proteins: – amino acids – classification essential and non essential amino acids – classification based on their hydrophobicity of R(side chain) groups.
5. Nucleic acids –Structure of nitrogen bases – nucleosides and nucleotides – Adenosine triphosphate (ATP), Guanosine triphosphate (GTP), Cytidine triphosphate (CTP), Thymidine triphosphate (TTP) and Uridine triphosphate (UTP)
6. Types of DNA -A, B & Z DNA. Types of RNA
7. Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes.
8. Glycolysis and Tricarboxylic Acid (TCA) cycle- metabolic energy generation in the above cycles
9. **Mid Semester Examination**
10. Oxidative phosphorylation and substrate level phosphorylation – electron transport chain in mitochondria
11. Concepts and applications of plant biotechnology: Organ culture, embryo culture, cell suspension culture.
12. Callus culture, anther culture and pollen culture and their applications
13. Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance
14. Cryo-preservation
15. Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and *Agrobacterium* mediated gene transfer methods,
16. DNA fingerprinting
17. Biotechnology regulation

Practical Schedule

1. Preparation of solution
2. Preparation of buffers and Ph
3. Qualitative tests of amino acids
4. Quantitative estimation of glucose
5. Quantitative estimation of proteins
6. Titration methods for estimation of amino acids
7. Titration methods for estimation of lipids
8. Effect of pH on enzyme activity
9. Effect of temperature on enzyme activity

10. Substrate concentration on enzyme activity
11. Separation of amino acids and by Paper chromatography
12. Agarose gel electrophoresis-demonstration
13. Sterilization techniques. Composition of various tissue culture media
14. Preparation of stock solutions for MS nutrient medium.
15. Demonstration on isolation of DNA
16. Demonstration of paper electrophoresis techniques
17. **Final practical examination**

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ENT 101 Fundamentals of Entomology (2+1)

Learning Objectives

- To study about the relative position of insects in animal kingdom
- To explore the external morphology of insects
- To observe the 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 I: 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 II: 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, Cetonidae, Buprestidae, Elateridae and Bostrychidae), Strepsiptera, Diptera (Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Pipunculidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae, Drosophilidae), Mecoptera, Siphonaptera, Trichoptera, Lepidoptera (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochlidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae, Metarbelidae and Hesperidae) and Hymenoptera (Tenthredinidae, Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Ichneumonidae, Braconidae, Platygasteridae, Bethyloidae, Evaniidae, Chalcididae, Encyrtidae, Eulophidae and Trichogrammatidae). Current stream of development in Morphology, Physiology and Taxonomy

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 – Paleoptera - Ephemeroptera and Odonata. Neoptera – Polyneoptera – Plecoptera, Dermaptera, Embioptera, Orthoptera, Phasmatodea, 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. Entomology- definition & Branches - Scope of Entomology - History of Entomology in India - Arthropoda - mention of insects in scripts - contributions of Fabricius, Caroleus Linnaeus, Rothney, L De Niceville, H.M Lefroy, T.B.Fletcher, T.V. Ramakrishna Ayyar, B.V.David, Ronald Ross, H.S. Pruthi, M.R.G.K. Nair and S.Pradhan; Locations and year of establishment of Zoological Survey of India (ZSI), Directorate of Plant Protection, Quarantine and Storage (DPPQS), Indian Institute of Natural Resins and Gums (IINRG), National Bureau of Agricultural Insect Resources (NBAIR), National Institute of Plant Health Management (NIPHM), National Centre for Integrated Pest Management (NCIPM) and Forest Research Institute (FRI).
2. Origin of insects - Position of insects in the animal kingdom. Classification and Characters of Phylum Arthropoda- different Classes of Arthropoda and comparison of characters of Class Insecta with Arachnida, Crustacea, Symphyla, Chilopoda, Diplopoda and Onychophora
3. Major points related to dominance of Insects in Animal kingdom
4. Morphology - Structure and functions of body wall - different layers, chemical composition, functions
5. Cuticular appendages - cuticular processes and cuticular invaginations - chaetotaxy - moulting - apolysis, ecdysis and sclerotization
6. Body segmentation - Structure of head - procephalon and gnathocephalon, types of head, sclerites and sutures of insect head; Thorax and abdomen segments and appendages, Epimorphic and anamorphic development in insects
7. Structure of typical insect antenna and its modifications
8. Mouth parts - biting and chewing type, sucking type-piercing and sucking, rasping and sucking, chewing and lapping, sponging and siphoning, mask and degenerate types with examples
9. Structure of a typical insect leg, wing and its modifications - Structure of a typical insect wing and its modifications, Wing venation and wing coupling
10. Structure of insect abdomen and its modifications - Abdominal appendages, Structure of male and female genitalia.
11. Metamorphosis- No metamorphosis, hemi- and holometamorphosis, intermediate and hyper metamorphosis and diapause - obligate and facultative diapause in insects.
12. Types of eggs, larvae and pupae
13. Insect behaviour - tropisms, biocommunication, rhythm, diapause, migration, defense and offence.
14. Structure and functions of Digestive system - alimentary canal - structure of foregut, midgut and hindgut - histology, functions, filter chamber and peritrophic membrane - process of digestion
15. Excretory system - structure, functions and modifications of malpighian tubules - structure and functions of other organs of excretion
16. Respiratory system - tracheal system - structure of spiracle and trachea - classification based on functional spiracles and other means of respiration
17. Circulatory system - open and closed types - organs of circulatory system - dorsal blood vessel (diaphragms, sinuses and accessory pulsatile organs) - process of circulation - properties and functions of haemolymph

18. Mid Semester Examination

19. Nervous system - neuron and its types (based on structure and function) -synapse, ganglia, central nervous system, sympathetic nervous system and peripheral nervous system
20. Reproductive system - structure of male and female reproductive systems - structure and types of ovarioles and structure of follicle, Types of reproduction in insects
21. Endocrine and Exocrine systems - their structure and functions
22. Sense organs - compound eyes - structure of ommatidium - ocelli - dorsalocelli and lateral ocelli - types of images and auditory organs (tympanum and Johnston's organ)
23. Taxonomy and systematics - importance - history - Binomial nomenclature -definitions of biotype, holotype, allotype and paratype - suffixes of tribes, subfamily, family and superfamily - law of priority - synonyms and homonyms -Species - subspecies - genus - family and order
24. Characters of Class Insecta - Ectognatha and entognatha- orders under each group with characters
25. 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 and their types
8. Demonstration of digestive system and male and female reproductive systems (grasshopper/cockroach)

9. Observation on distinguishing characters of Ephemeroptera and Odonata. Plecoptera, Dermaptera, Embioptera and Orthoptera (Acrididae, Tettiigonidae, Gryllidae and Gryllotalpidae)
10. Observation on distinguishing characters of Phasmatodea, 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 Hesperiiidae)
16. Observation on distinguishing characters of Hymenoptera (Families: Tenthredinidae, Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Ichneumonidae, Braconidae, Platygastriidae, Bethyidae, Evaniidae, Chalcididae, Encyrtidae, Eulophidae and Trichogrammatidae)
17. Orientation for final practical examination

Course Outcome:

CO1: Describe characters of Arthropoda and Insecta, and their relationship and reasons for insect dominance

CO2: Explain morphology of insects, its appendages, their modifications, growth and development (metamorphosis) and behaviour

CO3: Describe anatomy and physiology of various systems of insects

CO4: Identify different orders of insects based on their diagnostic characters up to family level

CO5: Demonstrate different collection and preservation techniques of insects

CO-PO Mapping Matrix:

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	0	0	1	0
CO2	1	2	0	0	1	0
CO3	3	3	0	0	1	0
CO4	2	3	0	0	1	0
CO5	3	3	0	0	1	0

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AEC- 101 ECONOMICS AND MARKETING (2+1)

Learning objectives

- To provide knowledge to students about basic concepts of economics
- To explain its relevance and importance in national income
- 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: Consumption

Nature and scope of economics, definition and concepts, divisions of economics, economic systems, approaches to the study of economics. Consumption – theory of consumer behaviour, laws of consumption, classification of goods. Wants – their characteristics and classification, utility and its measurement, cardinal and ordinal, law of diminishing marginal utility, law of equi - marginal utility, indifference curve and its properties, consumer equilibrium – consumer's surplus.

Unit II: Demand and Supply- Exchange

Theory of Demand, demand schedule and curve – Demand Function, Law of demand, Types of demand and Elasticity of Demand. Theory of Supply, supply schedule and curve – Supply Function, Law of supply, Types of supply and Elasticity of supply. – Market equilibrium – Engel's law of family expenditure.

Unit III: Production & Distribution

Theory of firm, factors of production – land and its characteristics, labour and division of labour, theories of population. Capital and its characteristics – classification and capital formation. Enterprises – forms of business organization – merits and demerits. Laws of return – law of

diminishing marginal return – cost concepts. Distribution: Theories of Rent, Wage, Interest and Profit

Unit IV: Marketing

Marketing- definition – Marketing Process – Need for marketing –Market- definition, Classification of markets- Role of marketing — Marketing functions -Marketing Agencies and institutions – Marketing of various commodities and channels – Price spread – Marketing Efficiency – Integration – Market Intelligence – Constraints in marketing of agricultural produce. Market Structure - Price determination under perfect competition .

Unit V: Price Policy

Agricultural Prices and Policy: Meaning and functions of prices; administered prices; Objectives of Price Policy and Price stabilization – Role of CACP – Concept of MSP, FRP(SMP) and SAP – Price Parity, Export of Horticultural Commodities and It's scope and importance - Export Institutions – APEDA, EXIM bank, AEZ - Export prices and procedures - Current Stream of Thought.

Practicals

Basic concepts in economics - Law of Diminishing Marginal Utility - Law of Equi -Marginal Utility - Indifference Curve Analysis - Demand and Supply- Equilibrium Analysis Consumer's and Producer's surplus - Elasticity of Demand and Supply - Short and Long run Equilibrium in Perfect Market - National Income Measurement Approaches - Demographic and Socio-economic Indicators - Preparation of Market survey schedule - Visit to a farm to collect information on marketing practices of agricultural commodities and marketing problems. - Computation of marketable and marketed surplus of important commodities. - Visit to a local market / weekly *shandy* / farmers' market to study various marketing Functions performed by different agencies. - Identification of marketing channels for selected commodity.-. Types and importance of agencies involved in agricultural marketing; marketing channels for different farm products. - Marketing costs, margins; price spread estimation for major agricultural and allied agricultural products and marketing efficiency

Lesson plan

Theory Schedule

1. Nature and scope of economics, definition and concepts, divisions of economics, economic systems, approaches to the study of economics.
2. Consumption – theory of consumer behaviour, laws of consumption, classification of goods.
3. Wants – their characteristics and classification, utility and its measurement, cardinal and ordinal
4. Law of diminishing marginal utility, law of equi-marginal utility
5. Indifference curve and its properties, consumer equilibrium – consumer's surplus.
6. Theory of Demand, demand schedule and curve – Demand Function, Law of demand, Types of demand and Elasticity of Demand.
7. Theory of Supply, supply schedule and curve – Supply Function, Law of supply, Types of supply and Elasticity of supply.
8. Market equilibrium –Engel's law of family expenditure
9. Theory of firm, factors of production – land and its characteristics,
10. Labour and division of labour, theories of population.

11. Capital and its characteristics – classification and capital formation.
12. Enterprises – forms of business organization – merits and demerits.
13. Laws of return – law of diminishing marginal return
14. Cost concepts.
15. Distribution - Theories of rent and wage,
16. Theories of interest and profit.
- 17. Mid Semester Examination**
18. Marketing- definition – Marketing Process – Need for marketing
19. Classification of markets
20. Role of marketing — Marketing functions
21. Marketing Agencies and institutions – CWC, SWC, FCI
22. AGMARK, HACCP. FSSAI
23. Marketing of various commodities and channels – Price spread - Marketing Efficiency
24. Integration – Market Intelligence – Constraints in marketing of agricultural produce.
25. SCP
26. Price determination under perfect competition
27. Agricultural Prices and Policy: Meaning and functions of price; administered prices;
28. Objectives of Price Policy and Price Stabilization –
29. Role of CACP
30. Concept of MSP, FRP (SMP) and SAP – Price Parity
31. Export of Horticultural Commodities and It's scope and importance
32. Export Institutions – APEDA, EXIM bank, AEZ
33. Export prices and procedures

34. Current Stream of thought.

Practical Schedule

1. Basic concepts in economics
2. Law of Diminishing Marginal Utility
3. Law of Equi -Marginal Utility
4. Indifference Curve Analysis
5. Demand and Supply- Equilibrium Analysis
6. Consumer's and Producer's surplus
7. Elasticity of Demand and Supply
8. Short and Long run Equilibrium in Perfect Market
9. National Income Measurement Approaches
10. Demographic and Socio-economic Indicators
11. Preparation of Market survey schedule
12. Visit to a farm to collect information on marketing practices of agricultural commodities and marketing problems.
13. Computation of marketable and marketed surplus of important commodities.
14. Visit to a local market / weekly *shandy* / farmers' market to study various marketing Functions performed by different agencies.
15. Identification of marketing channels for selected commodity.-. Types and importance of agencies involved in agricultural marketing; marketing channels for different farm products.
16. Marketing costs, margins; price spread estimation for major agricultural and allied agricultural products and marketing efficiency.

17. Practical Examination

Course Outcome

CO1: Understand the important concepts on micro and Macro Economics.

CO2: To know the principles of economics, concepts like GDP, GNP, Inflation.

CO3: To understand the marketing channels of different commodities.

CO 4: To gain the practical knowledge of prices spread and its implications.

CO 5: To Know the Price policy and its concepts

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	-
CO2	2	-	-	-	2	-
CO3	-	2	3	-	-	-
CO4	-	2	-	-	-	-
CO5	-	-	-	2	-	-

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HOR 201 TEMPERATE FRUIT CROPS (1+1)

Learning Objectives

- To provide knowledge on basic nursery management practices of temperate fruit crops.
- To explore the temperate zones to study more about temperate fruits.
- To make them acquire knowledge on the cultivation aspects of temperate fruits.
- To provide knowledge on production problem of temperate fruit crops.

- To acquaint advanced technologies in temperate fruit crops.

Theory

Unit I: Temperate horticulture and classification

Definition of temperate fruit crops- Temperate horticulture - Temperate fruits- Climatic conditions of temperate zone- scope and importance of temperate fruits cultivation - Classification- An overview on global, national economy - area, production and export potential - Horticultural zones of India and Tamil Nadu with emphasis on temperate fruits.

Unit II: Production technology I

Scope, importance, classification, area and production of temperate fruits - composition and uses - origin and distribution - species and varieties - soil and climate with reference to chilling requirement for flowering, warm winter varieties - propagation - rootstocks - main field preparation - spacing, planting density and cropping systems. HDP and meadow orchards - planting and after care - nutrients, water and weed management - training and pruning - canopy management - incompatibility - pollinizers - flowering and pollination use of plant growth regulators - physiological disorders and remedies - maturity indices and harvest - post harvest handling and storage - production constraints of Apple, pear, peach, plum, Cherry.

Unit III: Production technology II

Composition and uses - origin and distribution - species and cultivars - varieties - soil and climatic requirements - propagation techniques - rootstock influence - main field preparation - spacing - planting density - planting and after care - 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 - postharvest handling - ripening and storage of strawberry, apricot, persimmon, kiwi, almond

Unit IV: Production technology III

Composition and uses - origin and distribution - species and cultivars - varieties - soil and climatic requirements - propagation techniques - rootstock influence - main field preparation - spacing - planting density - planting and after care - 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 - postharvest handling - ripening and storage of Walnut, Queen's land nut, pecan nut, pistachio nut, hazel nut and chest nut.

Unit V: Production problems

Re-planting problems - rejuvenation and special production problems - control of preharvest fruit drop - plant protection measures in temperate fruit crops.

Practical

Nursery management practices for temperate fruit crops- Planting systems and root stock characteristics - Training and pruning practices followed in temperate fruit crops- Description and identification of varieties of apple, pear, peach, plum, cherry, strawberry, apricot, persimmon, kiwi, almond, walnut, queen's land nut, pecan nut, pistachio nut, hazel nut and chest nut- Use of growth regulators- Nutrient management- Physiological disorders- Physiological disorders- Visit to private temperate fruit orchards

Lesson Plan

Theory Schedule

1. Temperate fruits and its classification- Area, production, productivity of temperate fruits -

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

11. Kiwi: Introduction – origin and distribution – composition and uses- species and varieties - soil and climate requirements - propagation - rootstocks- main field preparation - spacing, planting density and cropping systems. planting and after care - nutrients, water and weed management - training and pruning – canopy management- incompatibility - pollinizers - use of plant growth regulators, physiological disorders and remedies, maturity indices and harvest - post harvest handling and storage.
12. Persimmon: Introduction – origin and distribution – composition and uses- species and varieties - soil and climate requirements - propagation - rootstocks- main field preparation- spacing, planting density and cropping systems. planting and after care - nutrients, water and weed management - training and pruning – canopy management- incompatibility -pollinizers - use of plant growth regulators, physiological disorders and remedies, maturity indices and harvest - post harvest handling and storage.
13. Almond: Origin and distribution - Composition and uses - Area and production - Varieties- Climate and soil requirements - Root stocks -Propagation- Planting methods-Training and Pruning- Manures and fertilizers - After care - Flowering - Pollination and fruit set - Use of growth regulators in flowering - Maturity indices - Harvesting(Mechanical)- Post-harvest handling - Storage - Physiological disorders - Kernel use - Shelling yield- Grades of kernels for the international trade.
14. Walnut: Introduction – origin and distribution – composition and uses- species and varieties - soil and climate requirements - propagation - rootstocks- main field preparation- spacing, planting density and cropping systems. planting and after care - nutrients, water and weed management - training and pruning – canopy management- incompatibility -pollinizers - use of plant growth regulators, physiological disorders and remedies, maturity indices and harvest - post harvest handling and storage.
15. Queens land nut (Macadamia nut) and pecan nut: Introduction – origin and distribution – composition and uses- species and varieties - soil and climate requirements – propagation- rootstocks- main field preparation - spacing, planting density and cropping systems. planting and after care - nutrients, water and weed management - training and pruning –canopy management- incompatibility - pollinizers - use of plant growth regulators, physiological disorders and remedies, maturity indices and harvest - post harvest handling and storage.
16. Pistachio nut, Hazel nut and Chest nut: Introduction – origin and distribution –composition and uses- species and varieties - soil and climate requirements – propagation- rootstocks- main field preparation - spacing, planting density and cropping systems. planting and after care - nutrients, water and weed management - training and pruning –canopy management- incompatibility - pollinizers - use of plant growth regulators, physiological disorders and remedies, maturity indices and harvest - post harvest handling and storage.
17. Re-planting problems - Rejuvenation and special production problems - control of pre-harvest fruit drop - Important insect pests and diseases – Plant protection measures in temperate fruit crops.

Practical Schedule

1. Nursery management practices for temperate fruit crops
2. Planting systems and root stock characteristics of temperate fruit crops
3. Training and pruning practices followed in temperate fruit crops
4. Description and identification of varieties of apple
5. Description and identification of varieties of pear and peach

2. Description and identification of varieties of plum and cherries
3. Description and identification of varieties of strawberry
4. Description and identification of varieties of apricot and almond
5. Description and identification of varieties of kiwi and persimmon
6. Description and identification of varieties of walnut, pistachio nut and pecan nut
7. Description and identification of varieties of hazel nut, chest nut and queens land nut
8. Use of growth regulators in growth and development of temperate fruit crops
9. Nutrient management in temperate fruit crops
10. Physiological disorders in temperate fruit crops
11. Plant protection and its control measures in temperate fruit crops
12. Visit to private temperate fruit orchards

13. Final Practical examination

Course Outcomes

CO 1 - The students will understand the cultivation aspects of temperate fruit crops and its nursery management practices.

CO 2 - The students will understand the advances in plant propagation and nursery management practices of temperate fruit crops.

CO 3 - The students will gain skill on important cultivation techniques in temperate fruits.

CO 4 - The students will learn and understand the current problems in temperate fruit crops.

CO 5 - The students will get employment in temperate orchards.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	0	0	0	0
CO 2	3	0	1	0	2	0
CO 3	2	0	2	1	0	0
CO 4	1	2	0	0	2	3
CO 5	0	1	0	3	0	0

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HOR 202 TEMPERATE VEGETABLE CROPS (1+1)

Learning Objectives

- To acquire knowledge on production technology of temperate vegetables.
- To acquire knowledge on nutrient management of temperate vegetable crops.
- To acquaint knowledge on special techniques and post-harvest handling.
- To explore cold storage and processing centers.
- To acquaint advanced technologies in production of temperate vegetable crops..

Theory

Unit I: Scope, importance and varietal wealth of temperate vegetable crops

Introduction and importance of temperate vegetable in nutrition and national economy - area, production, export potential. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and marketing.

Unit II: Production technology I

Production technology for cabbage, cauliflower, brussel sprout, sprouting broccoli. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and marketing of cabbage, cauliflower, brussel sprout, sprouting broccoli.

Unit III: Production technology II

Production technology for chinese cabbage, chow-chow, spinach, lettuce and palak. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and marketing of chinese cabbage, chow-chow, spinach, lettuce and palak.

Unit IV: Production technology III

Production technology for peas, french beans, globe artichoke, rhubarb, asparagus and vegetable kale. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and Marketing of peas, french beans, globe artichoke, rhubarb, asparagus and vegetable kale.

Unit V: Production technology IV

Production technology for carrot, beetroot, turnip, knol-khol, garlic and leek. Description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and Marketing of carrot, beetroot, turnip, knol-khol, garlic and leek.

Practical

Identification and description of varieties/hybrids; propagation methods, nursery management; preparation of field, sowing/transplanting. Top dressing of fertilizers and interculture and use of herbicides and growth regulators; identification of nutrient deficiencies, physiological disorders; harvest indices and maturity standards, postharvest handling and storage, marketing. Seed collection, working out cost of cultivation and field visits to commercial farms.

Lesson Plan

Theory Schedule

1. Area, production, world scenario, industrial importance, export potential of temperate vegetable crops.
2. Cabbage: Composition and uses - area and production- climate and soil requirements - season-warm winter types- varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems -planting - water and weed management Nutrient requirement-fertigation, nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping system - constraints in production - harvest - yield.

3. Cauliflower: Composition and uses - area and production- climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - plantingsystems - planting - water and weed management Nutrient requirement - fertigation, nutrientdeficiencies - physiological disorders - use of chemicals and growth regulators - croppingsystems - constraints in production - harvest - yield
4. Brussels sprouts and Sprouting broccoli - Composition and uses - area and production climateand soil requirements - season -warm winter types- varieties and hybrids -seed rate - nurserypractices - containerized transplant production and transplanting- preparation of field -spacing - planting systems - planting - water and weed management Nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - use of chemicals and growthregulators - cropping systems - constraints in production - harvest - yield.
5. Chinese cabbage: Composition and uses- area and production- climate and soil requirements -season -warm winter types- varieties and hybrids -seed rate - nursery practices -containerized transplant production and transplanting- preparation of field - spacing - plantingsystems - planting - water and weed management - nutrient requirement - fertigationnutrientdeficiencies - physiological disorders - use of chemicals and growth regulators -cropping system - constraints in production - harvest - yield
6. Chow chow: Composition and uses- origin and distribution- area and production- climate andsoil requirements - season - varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - plantingsystems - planting - water and weed management - Nutrient requirement - fertigationnutrientdeficiencies -physiological disorders - use of chemical and growth regulators -cropping system - constraints in production - harvest - yield - seed production
7. **Mid Semester Examination**
8. Spinach, lettuce and palak : Composition and uses - area and production- climate and soilrequirements - season -warm winter types- varieties and hybrids -seed rate - nurserypractices - transplanting- preparation of field - spacing - planting systems - planting - waterand weed management - nutrient requirement - fertigation- nutrient deficiencies -physiological disorders - use of chemicals and growth regulators - cropping systems -constraints in production - harvest - yield.
9. Carrot and beetroot: Composition and uses-area and production- climate and soil requirements -season -warm winter types- varieties and hybrids -seed rate - preparation of field - spacing -planting systems - planting - water and weed management - nutrient requirement -fertigation - nutrient deficiencies - physiological disorders - use of chemicals and growthregulators - cropping systems - constraints in production - harvest - yield
10. Turnip and knolkhol: Composition and uses- area and production- climate and soilrequirements - season -warm winter types- varieties and hybrids -seed rate - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation- nutrient deficiencies - physiological disorders - use of chemical and growthregulators - cropping system - constraints in production - harvest - yield.
11. Garlic and leek: Composition and uses- origin and distribution- area and production- climateand soil requirements - season - varieties and hybrids -seed rate - nursery practices -containerized transplant production and transplanting- preparation of field - spacing - plantingsystems - planting - water and weed management - Nutrient requirement -

- fertigation nutrient deficiencies - physiological disorders - use of chemical and growth regulators - cropping system - constraints in production - harvest - yield - seed production
12. Peas, french beans and broad beans: Composition and uses - area and production- climate and soil requirements - season - warm winter types- varieties and hybrids -seed rate - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation, nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield.
 13. Globe artichoke - composition and uses - area and production- climate and soil requirements - season - warm winter types- varieties and hybrids -seed rate - nursery practices - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation- nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield
 14. Rhubarb and asparagus - composition and uses - area and production- climate and soil requirements - season - warm winter types- varieties and hybrids - seed rate -nursery practices - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation- nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield
 15. Vegetable kale - composition and uses - area and production- climate and soil requirements - season - warm winter types- varieties and hybrids - seed rate -nursery practices - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation- nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield

Practical Schedule

1. Identification and description of various temperate vegetable crops.
2. Nursery preparation and sowing for transplanted temperate vegetables
3. Soil water conservation, contour planting and crop geometry
4. Use of herbicides, preparation of solution and its application in temperate vegetables.
5. Major nutritional requirement for cabbage, cauliflower, knol-khol.
6. Major nutritional requirement for sprouting broccoli, brussel's sprout, lettuce and palak.
7. Major nutritional requirement for chinese cabbage, spinach, garlic, onion and leek.
8. Major nutritional requirement for turnip and beet root.
9. Micro nutritional requirement for cabbage, cauliflower and knol-khol.
10. Micro nutritional requirement for sprouting broccoli, brussel's sprout, lettuce and palak.
11. Micro nutritional requirement for chinese cabbage, spinach, garlic, onion and leek.
12. Micro nutritional requirement for turnip and beet root.
13. Use of growth regulators, preparation of solution and application in temperate vegetables.
14. Identification of physiological disorders in temperate vegetables.
15. Identification of nutritional disorders in temperate vegetables.
16. Maturity indices and harvesting of temperate vegetables.
17. Final Practical examination.

Course Outcomes

CO 1 The students will understand the cultivation aspects of temperate vegetables.

- CO 2 The students will understand the nursery management practices of temperate vegetables
 CO 3 The students will understand the advances in plant propagation of temperate vegetables.
 CO 4 The students will learn and understand the current problems in temperate vegetables.
 CO 5 The students will get employment in temperate vegetables research institutions.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	3	0	0	0
CO 2	2	0	0	2	0	0
CO 3	3	2	0	2	1	0
CO 4	0	0	0	3	2	0
CO 5	0	0	1	3	0	1

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HOR 203 ORNAMENTAL HORTICULTURE (1+1)

Learning Objectives

- To impart basic knowledge on importance of ornamental plants and flowers.
- To acquaint knowledge on garden adornments.
- To learn about cultivation aspects for ornamental plants.
- To enable better understanding on special types of gardens and horticultural crafts.
- To acquaint advanced technologies in ornamental horticulture.

Theory

Unit I: Scope and Importance of Ornamental Horticulture

History - definitions - scope of ornamental horticulture - aesthetic values - floriculture industry - Importance - area and production - industrial importance of ornamental plants and flowers.

Unit II: Cultivation aspects of ornamental plants

Importance - classification - design values and general cultivation aspects for ornamental plants *viz.*, annuals - biennials - herbaceous perennials - grasses and bulbous ornamentals - shrubs - climbers - trees - indoor plants - palms and cycads - ferns and selaginellas - cacti and succulents.

Unit III: Garden components and special types of gardens

Importance - design and establishment of garden features/components *viz.*, hedge - edge - borders - flower beds - bridges - paths - drives - fences - garden walls - gates - carpet bed -

arbour – Patio – decking - retaining walls - shade garden - sunken garden - roof garden -terrace garden - pebble garden – rockery – pools – waterfalls – fountains - bog garden -avenue planting and children garden.

Unit IV: Garden adornments

Importance of garden adornments *viz.*, floral clock - bird bath – statutes – sculptures – lanterns - water basins - garden benches *etc.*, lawn types - establishment and maintenance.

Unit : Flower arrangement and bonsai making

Importance of flower arrangement -ikebana – techniques – types - suitable flowers and cut foliage - uses of vertical garden - bottle garden – terrariums -art of making bonsai - culture of bonsai and maintenance.

Practical

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

Lesson Plan

Theory Schedule

1. History, development, scope and importance of landscape gardening.
2. Aesthetic values, floriculture industry and its importance, industrial importance of ornamental plants and flowers.
3. Importance, classification, design values and general cultivation aspects for ornamental plants *viz.*, annuals, biennials and herbaceous perennials.
4. Importance, classification, design values and general cultivation aspects for ornamental plants *viz.*,grasses and bulbous ornamentals.
5. Importance, classification, design values and general cultivation aspects for ornamental plants *viz.*,trees, shrubs, climbers.
6. Importance, classification, design values and general cultivation aspects for ornamental plants *viz.*, indoor plants.
7. Importance, classification, design values and general cultivation aspects for ornamental plants *viz.*, palms and cycads, ferns and selaginellas.
8. Importance, classification, design values and general cultivation aspects for ornamental plants *viz.*, cacti and succulents.
9. **Mid semester examination**
10. Importance, design and establishment of garden features/components *viz.*, hedge, edge, borders, flower beds, bridges, paths, drives, fences, garden walls, gates, carpet bed, arbour, patio, decking, retaining walls, shade garden, sunken garden, roof garden.
11. Importance, design and establishment of garden features/components *viz.*, terrace garden, pebble garden, rockery, pools, waterfalls, fountains, bog garden, avenue planting and children garden.
12. Importance of garden adornments *viz.*, floral clock, bird bath, statutes, sculptures, lanterns, water basins, garden benches *etc.*
13. Lawn types, establishment and maintenance.

14. Importance of flower arrangement, Ikebana, techniques, types, suitable flowers and cut foliage.
15. Uses of vertical garden, bottle garden, terrariums.
16. Art of making bonsai.
17. Culture of bonsai and maintenance.

Practical Schedule

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

Course Outcomes

CO 1 - The students will understand scope and importance of ornamental horticulture and floriculture industry, industrial importance of ornamental plants and flowers.

CO 2 - The students will gain knowledge on importance, classification, design values and general cultivation aspects of ornamental plants.

CO 3 - The students can understand importance, design and establishment of garden features/components and special type of gardens.

CO 4 - The students will learn about importance, establishment and maintenance of garden adornments.

CO 5 - The students can develop knowledge about flower arrangement and bonsai making and maintenance

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	2	3	3	3	2
CO 2	2	3	3	3	3	2
CO 3	2	3	3	3	3	2
CO 4	2	3	3	3	3	2
CO 5	2	3	3	3	3	2

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HOR 204 DRYLAND AND SILVI HORTICULTURE (2+1)

Learning Objectives

- To learn the special techniques followed in dryland horticulture and importance of social forests.
- To provide knowledge in the soil erosion and watershed management.
- To learn the fruit crops suitable for drylands.
- 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: Dryland horticulture

Introduction and definition -dry climates and their classification-problems of crop production in dry lands - existing pattern of land use in low rainfall areas-rainfall patterns in dry regions-drought - occurrence, types and management strategies for drought.

Unit II: Soil erosion and watershed management

Soil erosion - types, factors affecting erosion, agronomic and soil conservation measures. Fertilizer use in dry land horticultural crops - inorganic, organic and bio- fertilizers. Efficient cropping systems, normal and contingency crop planning under aberrant weather conditions. Evapotranspiration - measures to reduce evaporation and transpiration- Watershed management - objectives and approaches, steps in watershed planning- land use capability and classification. soil and water conservation measures in watershed areas- water harvesting and lifesaving irrigation-problems and prospects under watersheds- dry land horticultural crops based alternate land use systems.

Unit III: Dry land fruit crops

Composition and uses - origin and distribution - climate and soil requirements - varieties - spacing and planting patterns - cropping systems - management of nutrients, water, weeds - special horticultural practices - use of plant growth regulators - harvest and yield-production constraints - post harvest handling of the following crops:

Aonla, ber, pomegranate, date palm, fig, phalsa, custard apple, jamun, bael, wood apple, west indian cherry, carissa and manila tamarind.

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 lands and afforestation

Silviculture of important agroforestry species viz., cashew, tamarind, punga, 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.

Practical

Study of rainfall patterns- Contour bunding/trenching- micro catchments- soil erosion and its control- Study of evapotranspiration- mulches and micro irrigation systems-- Special techniques of planting and aftercare in dry lands- Study of morphological and anatomical features of drought tolerant fruit crops-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.

Lesson Plan

Theory Schedule

1. Dry land horticulture - introduction and definition. Dry climates and their classification.
2. Problems of crop production in dry lands. Rainfall patterns in dry regions.
3. Drought - definition, types occurrence of drought and management strategies for drought.
4. Soil erosion - types, factors affecting erosion, agronomic and soil conservation measures.
5. Fertilizer use in dry land horticultural crops, inorganic, organic and biofertilizers.
6. Efficient cropping systems, normal and contingency crop planning under aberrant weather conditions. Evapo transpiration - measures to reduce evaporation and transpiration.
7. Watershed management - objectives and approaches, steps in watershed planning, land use capability and classification. Soil and water conservation measures in watershed areas.
8. Water harvesting and lifesaving irrigation. Dry land horticultural crops based alternateland use systems.
9. Aonla - composition and uses - origin and distribution - climate and soil requirements - varieties -spacing and planting patterns - cropping systems - management of nutrients, water, weeds - special horticultural practices - use of plant growth regulators - harvest and yield-production constraints - post harvest handling.
10. Ber - composition and uses - origin and distribution - climate and soil requirements - varieties -spacing and planting patterns - cropping systems - management of nutrients, water, weeds - special horticultural practices - use of plant growth regulators - harvest and yield-production constraints - post harvest handling.
11. Pomegranate and Carissa - composition and uses - origin and distribution - climate and soil requirements - varieties -spacing and planting patterns - cropping systems - management of nutrients, water, weeds - special horticultural practices - use of plant growth regulators-harvest and yield-production constraints - post harvest handling.
12. Custard apple and fig - composition and uses - origin and distribution - climate and soil requirements - varieties -spacing and planting patterns - cropping systems - management of nutrients, water, weeds - special horticultural practices - use of plant growth regulator harvest and yield-production constraints - post harvest handling.

13. Date palm and phalsa - composition and uses - origin and distribution - climate and soil requirements - varieties - spacing and planting patterns - cropping systems - management of nutrients, water, weeds - special horticultural practices - use of plant growth regulators - harvest and yield-production constraints - post harvest handling.
14. Jamun and wood apple - composition and uses - origin and distribution - climate and soil requirements - varieties - spacing and planting patterns - cropping systems - management of nutrients, water, weeds - special horticultural practices - use of plant growth regulators - harvest and yield-production constraints - post harvest handling.
15. Bael and west Indian cherry - composition and uses - origin and distribution - climate and soil requirements - varieties - spacing and planting patterns - cropping systems - management of nutrients, water, weeds - special horticultural practices - use of plant growth regulators - harvest and yield-production constraints - post harvest handling.
16. Manila tamarind - composition and uses - origin and distribution - climate and soil requirements - varieties - spacing and planting patterns - cropping systems - management of nutrients, water, weeds - special horticultural practices - use of plant growth regulators - harvest and yield-production constraints - post harvest handling.
- 17. Mid semester examination**
18. Role of forests - 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 - Hortisilviculture - silvipasture - Hortisilvipasture - 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. Preparation of seed bed, fertilizer application and sowing.
2. Analysis of rainfall data, temperature and evaporation and its interpretation.
3. Study of dry farming implements.
4. Study of agronomic measures of soil and moisture conservation and erosion problems in field.

5. Preparation of contingent crop planning for aberrant weather conditions.
6. Collection of biometric data on crop and its interpretation.
7. Study of varieties and propagation techniques for dryland fruit crops.
8. Assessment of maturity standards, harvesting and postharvest handling for dry land fruit crops.
9. Project preparation for commercial cultivation of dryland fruit crops.
10. Identification and description of agroforestry tree species and fuel, fodder and green
11. manure trees in the locality.
12. Production of presprouted seeds in agroforestry tree species by different seed treatment methods and nursery practices 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 casurina, eucalyptus, neem, tamarind, observing, spacing, height, girth and calculating tree volume using the formula.
15. Visit to agroforestry systems in farmers holding and recording the spacing and assessing the growth and yield.
16. Visit to watershed areas and dry land fruit crop fields, social forestry plantation and identification of tree species- recording spacement and purpose.
17. **Final Practical examination**

Course Outcomes

CO 1 - The students will be able to grasp the importance of dryland horticulture.

CO 2 - The students will become skillful in practicing cultivation practices of dry land fruit crops

CO 3 - The students will understand the importance of growing trees as livelihood for the village communities and establishing of tree nurseries.

CO 4 - The students will gain knowledge in the management of tree species and afforestation.

CO 5 - The students will gain skill on arboriculture and agro forestry management.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	3	2	1	1	0
CO 2	3	2	3	2	2	0
CO 3	2	3	2	1	1	0
CO 4	1	3	1	3	1	0
CO 5	1	2	1	3	2	0

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HOR 205 BREEDING OF VEGETABLES, TUBER AND SPICE CROPS (2+1)

Learning Objectives

- To provide knowledge on the basics of plant breeding.
- To highlight the principles of plant breeding
- To acquaint knowledge on the breeding strategies of vegetable, tuber and spice crops.
- To acquire knowledge on the achievements made in the improvement of vegetable, tuber and spice crops.
- To provide knowledge on hybridization techniques and various breeding methods of vegetable, tuber and spice crops.

Theory

Unit I: Breeding of self and often cross pollinated vegetable crops

Centres of origin, plant bio-diversity and its conservation, relatives and forms of vegetable crops. Mode of reproduction, Pollination mechanism and Self-incompatibility and male sterility, its classification and application in vegetable crop improvement. History, Principles, importance - floral biology - objectives - methods of breeding - achievements - Breeding for insect resistance, breeding for disease resistance, breeding for abiotic resistance, Genetic basis of adoptability and stability. Self / often cross pollinated vegetable crops : Tomato, brinjal, chilli and Capsicum, bhendi, Lab lab, vegetable cowpea, peas, french bean, cluster beans and amaranthus.

Unit II: Breeding of cross pollinated vegetable crops

Origin, distribution of species, wild relatives and forms of vegetable crops. Plant genetic resources, their conservation and utilization in crop improvement. Self-incompatibility and male sterility, its classification and application in vegetable crop improvement. Breeding for insect resistance, breeding for disease resistance, breeding for abiotic resistance, Genetic basis of adoptability and stability. Principles - floral biology - objectives - methods of breeding - achievements- Crops: Bitter gourd, bottle gourd, ribbed gourd, snake gourd, pumpkin, ash gourd, water melon, musk melon, cucumber, Tinda, cabbage, cauliflower, radish, beetroot, carrot, onion, moringa.

Unit III: Breeding of asexually propagated vegetable crops

Origin -distribution of species, wild relatives and forms of vegetable crops. -Principles of breeding - objectives - methods of breeding - clonal selection, polyploidy breeding, mutation breeding and achievements . Plant genetic resources, their conservation and utilization in crop improvement. Breeding for insect resistance, breeding for disease resistance, breeding for abiotic resistance, Genetic basis of adoptability and stability. -Crops: Cassava, Potato, sweet potato, Dioscorea, major Yam, Ivy gourd, Chowchow, Coccinia.

Unit IV: Breeding of spice crops (ginger, turmeric and seed spices)

Origin, distribution of species, wild relatives and forms of spices. Principles of breeding - floral biology - objectives - methods of breeding and achievements. Plant genetic resources, their conservation and utilization in crop improvement. Breeding for insect resistance, breeding for

disease resistance, breeding for abiotic resistance, male sterility and incompatibility and their utilization in development of hybrids. Genetic basis of adoptability and stability. Crops: Ginger, turmeric, cardamom, coriander, fennel, fenugreek (Seed spices and leafy spices).

Unit V: Breeding of black pepper and tree spices

Origin, distribution of species, wild relatives and forms of vegetable crops. Plant genetic resources, their conservation and utilization in crop improvement. History, Importance, Principles of breeding - floral biology - objectives - methods of breeding and Achievements. Breeding for insect resistance, breeding for disease resistance, breeding for abiotic resistance, male sterility and incompatibility and their utilization in development of hybrids. Genetic basis of adoptability and stability. Crops: Black pepper, nutmeg, cinnamon, tamarind (Tree spices) and Current Stream of thought.

Practical

Floral biology and pollination mechanism in self and cross pollinated vegetables, tuber crops and spices. Working out phenotypic and genotypic heritability, genetic advance. GCA, SCA, combining ability, heterosis, heterobeltosis, standard heterosis, GxE interactions (stability analysis) Preparation and uses of chemical and physical mutagens. Polyploidy breeding and chromosomal studies. Techniques of F1 hybrid seed production. Maintenance of breeding records.

Lesson Plan

Theory Schedule

1. History, principles and importance of breeding of self, cross-pollinated vegetable and vegetative propagated crops.
2. Plant genetic resources - germplasm - different types of plant genetic resources - gene pool - types of gene pools - genetic erosion. Centre's of origin and diversity for vegetable and tuber crops.
3. Breeding for insect resistance - types of insect resistance, nature and genetics, sources of resistance - methods of breeding, screening techniques - advantages and problems in breeding for insect resistance and achievements for vegetable and tuber crops.
4. Breeding for disease resistance - vertical and horizontal resistance - mechanism of disease resistance, genetics and sources of resistance- Methods of breeding and testing for disease resistance- Problems in breeding for disease resistance and advantages for vegetable and tuber crops.
5. Breeding for drought resistance - drought resistance, genetics, sources of resistance, breeding methods, difficulties in breeding for vegetable and tuber crops.
6. Male sterility and incompatibility and their utilization in development of hybrids and Breeding for Quality Improvement in vegetable and tuber crops.
7. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in tomato and brinjal.
8. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Chilli & Capsicum.
9. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Bhendi and amaranthus.
10. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Lab lab and vegetable cowpea.

11. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in peas, french bean and, cluster beans.
12. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Cucurbits -Cucumbers, Ashgourd , Pumpkin, Bittergourd and Snakegourd.
13. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Ribbedgourd and Bottlegourd, Watermelon, Muskmelon and Tinda.
14. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in onion and moringa.
15. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Cabbage and Cauliflower.
16. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in carrot, radish and beetroot.
- 17. Mid semester examination**
18. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Coccinea and Chow chow.
19. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Dioscorea.
20. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Tuber crops - Cassava.
21. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Tuber crops- Sweet potato.
22. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Tuber crops - Potato.
23. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in major Yam, Ivy gourd
24. History, principles and importance of breeding of spice crops.
25. Origin and distribution of species, wild relatives and forms. Breeding objectives and procedures / methods for development of hybrids / varieties in Cardamom.
26. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Spice crops - Ginger.
27. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Turmeric.
28. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in seed spices and leaf Spices.
29. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in Black pepper.
30. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in tree spices.
31. Origin and distribution of species, wild relatives and forms, Breeding objectives and procedures / methods for development of hybrids / varieties in minor spices.
32. Breeding for Quality Improvement in spice crops.

33. Achievements made in biotic and abiotic stress resistance in spicecrops.
34. Male sterility and incompatibility and their utilization in development of hybrids in spice crops.

Practical Schedule

1. Floral biology, selfing, emasculation and crossing technique in Tomato.
2. Floral biology, selfing, emasculation and crossing technique in Brinjal.
3. Floral biology, selfing, emasculation and crossing technique in Bhendi.
4. Floral biology, selfing, emasculation and crossing technique in Chilli.
5. Floral biology, selfing, emasculation and crossing technique in Cucurbits (Bitter gourd, bottle gourd, ribbed gourd).
6. Floral biology, selfing, emasculation and crossing technique in Cucurbits (snake gourd, pumpkin, ash gourd).
7. Floral biology, selfing, emasculation and crossing technique in Cucurbits (water melon, musk melon, cucumber).
8. Floral biology, selfing, emasculation and crossing technique in beans.
9. Floral biology selfing, emasculation and crossing technique in Turmeric & Ginger.
10. Floral biology, selfing, emasculation and crossing technique in seed spices.
11. Breeding objectives, Floral biology, selfing, emasculation and crossing technique in tree spices.
12. Calculation of Heterosis, Heterobeltiosis and Standard Heterosis.
13. Calculation of variability, inbreeding depression.
14. Calculation of General combining ability, Specific combining ability, variances and effects.
15. Stability analysis.
16. Techniques of F1 hybrid seed production and maintenance of breeding records.
17. Final Practical examination

Course Outcomes

- CO 1 - The students will be able to get knowledge on the basics of plant breeding.
- CO 2 - The students will be able to get knowledge on the principles of plant breeding
- CO 3 - The student will be able to understand the breeding strategies and outcome of vegetable, tuber and spice crops.
- CO 4 - The students will gain skill in hybridization techniques.
- CO 5 - The students acquaint knowledge on the achievements made in the improvement of vegetable, tuber and spice crops.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	2	2	1	0
CO 2	3	0	2	2	1	0
CO 3	3	0	2	2	1	0
CO 4	3	0	2	2	1	0
CO 5	3	0	2	2	1	0

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GPB 201 PRINCIPLES 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 horticultural crops
- To impart knowledge on breeding methods of self, cross and clonally propagated horticultural crops
- To impart knowledge on application of various genetic principles in horticultural crop improvement
- To familiarize recent strides in molecular markers.

Theory

Unit I: Reproductive systems in plant breeding

Plant Breeding – definition, concept, Nature, Aims & Objectives and Role. Major Achievements and future Prospects of Plant Breeding. History and Development of Plant Breeding – Genetics in relation to Plant Breeding – Modes of reproduction – Asexual reproduction (Vegetative reproduction and apomixes) and sexual reproduction – their classification and significance in plant breeding – Modes of pollination – classification of crop species on the basis of mode of pollination – self pollination – Mechanisms promoting self and cross pollination. Self incompatibility – classification – utilization in crop improvement. Male sterility – different types – genetic, cytoplasmic and cytoplasmic genetic male sterility – inheritance and maintenance – Utilization of male sterile lines in hybrid seed production – their limitations, advantages and disadvantages.

Unit II: Breeding methods of self pollinated crops

Genetic consequences of self pollination, cross pollination and often cross pollinated crops - Plant introduction – Types, history, purpose, procedure, merits and demerits – plant introduction agencies in India – NBPGR and its activities – germplasm collections, genetic erosion, gene sanctuaries – centers of origin / diversity. Biometrical genetics – definition, qualitative and quantitative characters, role of environment on quantitative characters – biometrical techniques used in plant breeding – Selection – natural and artificial selection – basic principles of selection – selection intensity – selection differential – heritability – genetic

advance. Johannsen's pure line theory and its concepts and significance - progeny test. Genetic basis and breeding methods in self pollinated crops - Mass selection - procedure by mass selection - merits, demerits and achievements. Genetic basis of pure line selection - general procedure for evolving a variety by pure line selection - merits, demerits and achievements - comparison between mass and pure line selection - Hybridization - types of hybridization - pre-requisites of hybridization - procedure / steps involved in hybridization. - Pedigree, bulk method - procedure - merits, demerits and achievements - comparison between pedigree and bulk method - single seed descent method. Back cross method - applications, procedure for transfer of single dominant gene, recessive gene - merits, demerits and achievements, comparison between pedigree and back cross methods - Multiline variety - definition, characteristics, development of multiline varieties and achievements.

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

Population genetics - concepts, Hardy Weinberg law, factors affecting equilibrium frequencies in random mating populations. Heterosis breeding and Inbreeding depression - Composites and Synthetics - steps in development of synthetics and composites Population improvement - selection without progeny testing - selection with progeny testing - progeny selection - merits and demerits of progeny selection - line breeding - achievements - Recurrent selection - different types - detailed procedure of simple recurrent selection and brief description of other recurrent selection methods - conclusion of the efficiency of different selection schemes. Methods of breeding for vegetatively propagated crops - clone - characteristics of asexually propagated crops - characteristics of clones - importance of a clone - sources of clonal selection - procedure - advantages and disadvantages - problems in breeding asexually propagated crops - genetic variation within a clone - clonal degeneration - achievements - comparison among clones, purelines and inbreds.

Unit IV: Special breeding methods

Wide hybridization - history - objectives - barriers to the production of distant hybrids - techniques for production of distant hybrids - applications of wide hybridization in crop improvement - sterility in distant hybrids - Polyploidy breeding - classification - applications in crop improvement and limitations. Mutation breeding - spontaneous and induced mutations - characteristic features of mutations - procedure of mutation breeding - applications - advantages, limitations and achievements. Breeding for resistance to biotic stresses - disease resistance - mechanisms of disease resistance in plants - Insect resistance - mechanism of insect resistance in plants - nature of insect resistance - genetics of insect resistance - horizontal and vertical - genetics of resistance - sources of insect resistance - breeding methods for insect resistance - problems in breeding for insect resistance - achievements. Breeding for resistance to abiotic stresses - drought resistance - mechanisms of drought resistance - features associated with drought resistance - sources - breeding methods - limitations - achievements ; breeding for resistance to water logging - effects of water logging mechanism of tolerance - ideotype for flooded areas - breeding methods - breeding for salt tolerance - response of plants to salinity - symptoms - mechanisms - breeding methods - problems - achievements; cold tolerance - chilling resistance - effects of chilling stress of plants - mechanism - sources - selection criteria - freezing resistance - effects of freezing - mechanism of freezing resistance - genetic resources for freezing tolerance - selection criteria - problems in breeding for freezing tolerance.

Unit V: Molecular Markers and Plant Breeders rights

Molecular markers – Definition – Brief description of different types of molecular markers, RFLP, AFLP, RAPD and SSR markers – Importance, procedure and applications. DNA finger printing – procedure, application – QTL mapping and MAS and its applications in crop improvement. Pre breeding – Definition, Concept, need, methods and factors affecting pre breeding. Participatory Plant Breeding – Concept Relevance, activities and goals of PPB, kinds of PPB, perspectives and prospects, advantages, disadvantages and limitations. Intellectual Property Rights (IRP) and Patents – Types, protection of IPR, trade secret, copy rights, Plant Variety Protection and Geographical Indications, Plant Breeders' Rights – Benefits and disadvantages. Protection of Plant Varieties and Farmers' Rights Act – Introduction, types of varieties, NDUS, salient features, National Gene Fund, Award and Recognitions.

Practical

Plant Breeder's kit for hybridization, study of germplasm of various crops. Study of megasporogenesis and Microsporogenesis, fertilization and life cycle of an angiospermic plant. – Study of floral structure of self pollinated crops – floral biology, anthesis, pollination, selfing and crossing techniques in bhendi – Study of floral structure of cross pollinated crops – Floral biology, anthesis, pollination, selfing and crossing techniques in cucurbits – Floral biology, anthesis, pollination, selfing and crossing techniques in vegetable crops – brinjal, tomato, chillies – Types of male sterility – genetic, Cytoplasmic and cytoplasmic Genetic male sterility, transfer of male sterile cytoplasm and restorer gene to a normal strain. – types of self incompatibility, gametophytic and sporophytic incompatibility. – Terminology in backcross method, transfer of a dominant gene and recessive gene for disease rust resistance through the backcross methods in self pollinated crops. – Handling of segregating populations – Pedigree, bulk and Single seed decent methods. – consequences of inbreeding on genetic structure of resulting populations – Types of recurrent selection, simple RS, RS for GCA & SCA and reciprocal recurrent selection. – Field layout of experiments – Designs used in plant breeding experiments – analysis of Randomized Block Design (RBD) – field trails – maintenance of records and registers. – Basic statistics, commonly used in plant breeding – Mean, range, variance, Phenotypic coefficient of Variation (PCV), Genotypic Coefficient of Variation (GCV), Heritability and Genetic advance. – Estimation of Heterosis, Heterobeltiosis and Standard heterosis – Prediction of performance of double cross hybrids. – Estimation of general combining ability, specific combining ability, variances and effects. – Visit to RARS / Local / ICAR stations to acquaint about the mode of pollination in a given crop and extent of natural out crossing. – Visit to RARS / Local / ICAR Institute to acquaint about the handling of segregating generations – Pedigree, bulk and back cross methods – Preliminary Yield Trail, Advanced Varietal Trail and other methods.

Lesson Plan

Theory Schedule

1. Plant Breeding – definition, concept, Nature, Aims & Objectives and Role. Major Achievements and future Prospects of Plant Breeding.
2. History and Development of Plant Breeding – Scientific contributions of eminent scientists – landmarks in Plant Breeding.
3. Genetics in relation to Plant Breeding – Modes of reproduction – Asexual reproduction (Vegetative reproduction and apomixes) and sexual reproduction – their classification and significance in plant breeding – Modes of pollination – classification of crop species on the

- basis of mode of pollination – self pollination – Mechanisms promoting self and cross pollination.
4. Self incompatibility – classification – heteromorphic, homomorphic, gametophytic and sporophytic systems of incompatibility – mechanisms of self incompatibility – Relevance of self incompatibility – methods of overcome self incompatibility – advantages and disadvantages – utilization in crop improvement.
 5. Male sterility – different types – genetic, cytoplasmic and cytoplasmic genetic male sterility – inheritance and maintenance – Utilization of male sterile lines in hybrid seed production – their limitations, advantages and disadvantages.
 6. Genetic consequences of self pollination, cross pollination and often cross pollinated crops. Cultivar options – method of plant breeding – classification of plant breeding methods – methods of breeding for self pollinated, cross pollinated and asexually propagated species – brief account of breeding methods.
 7. Plant introduction – Types, history, purpose, procedure, merits and demerits – plant introduction agencies in India – NBPGR and its activities – germplasm collections, genetic erosion, gene sanctuaries – centers of origin / diversity.
 8. Biometrical genetics – definition, qualitative and quantitative characters, role of environment on quantitative characters – biometrical techniques used in plant breeding – components of genetic variation – additive, dominance and epistatic variance – differences between additive and dominance variance.
 9. Selection – natural and artificial selection – basic principles of selection – basic characteristics and requirements of selection – selection intensity – selection differential – heritability – genetic advance.
 10. Genetic basis and breeding methods in self pollinated crops – Mass selection – procedure for evolving a variety by mass selection – modification of mass selection – merits, demerits and achievements.
 11. Genetic basis of pure line selection – general procedure for evolving a variety by pure line selection – merits, demerits and achievements – comparison between mass and pure line selection – Johannsen's pure line theory and its concepts and significance – origin of variation in pure lines – characters of pure lines – progeny test.
 12. Hybridization – aims and objectives – types of hybridization – pre-requisites of hybridization – procedure / steps involved in hybridization.
 13. Handling of segregating generation – pedigree method – procedure – modifications of pedigree method – merits, demerits and achievements.
 14. Handling of segregating generations - - bulk method – procedure – merits, demerits and achievements of bulk methods – comparison between pedigree and bulk methods bulk method – procedure – merits, demerits and achievements of bulk method – comparison between pedigree and bulk method – single seed descent method.
 15. Back cross method – requirements and applications, procedure for transfer of single dominant gene, recessive gene – transfer of two or more characters.
 16. Back cross method – merits, demerits and achievements, comparison between pedigree and back cross methods – Multiline variety – definition, characteristics, development of multiline varieties and achievements.
 17. **Mid Semester Examination**
 18. Population genetics – concepts, Hardy Weinberg law, factors affecting equilibrium frequencies in random mating populations.

19. Heterosis - heterosis and hybrid vigour, luxuriance, brief history in self and cross pollinated crops, types, manifestations of heterosis, genetic basis - dominance, over dominance and epistasis hypotheses.
20. Heterosis - comparison between dominance and over dominance hypothesis - physiological bases of heterosis - commercial utilization of heterosis in different crops.
21. Inbreeding depression - brief history, effects of inbreeding depression, degrees of inbreeding depression - procedure for development of inbred lines and their evaluation Composites and Synthetics - production procedures, merits and demerits, achievements, factors determining the performance of synthetics, comparison between synthetics and composites.
22. Population improvement - selection without progeny testing - selection with progeny testing - progeny selection - merits and demerits of progeny selection - line breeding - achievements - Recurrent selection - different types - detailed procedure of simple recurrent selection and brief description of other recurrent selection methods - conclusion of the efficiency of different selection schemes.
23. Methods of breeding for vegetatively propagated crops - clone - characteristics of asexually propagated crops - characteristics of clones - importance of a clone - sources of clonal selection - procedure - advantages and disadvantages - problems in breeding asexually propagated crops - genetic variation within a clone - clonal degeneration - achievements - comparison among clones, purelines and inbreds.
24. Wide hybridization - history - objectives - barriers to the production of distant hybrids - techniques for production of distant hybrids - applications of wide hybridization in crop improvement - sterility in distant hybrids - cytogenetic, genetic and cytoplasmic bases of sterility - limitations and achievements.
25. Polyploidy - autopolyploids - origin and production - morphological and cytological features of autopolyploids - applications of autopolyploidy in crop improvement - limitations of autopolyploidy - segregating in autotetraploids - allopolyploidy - morphological and cytological features of allopolyploids - applications of allopolyploidy in crop improvement - limitations of allopolyploidy.
26. Mutation breeding - spontaneous and induced mutations - characteristic features of mutations - procedure of mutation breeding - applications - advantages, limitations and achievements.
27. Breeding for resistance to biotic stresses - disease resistance - mechanisms of disease resistance in plants (disease escape, tolerance, resistance, immunity and hypersensitivity) - causes of disease resistance - genetic basis of disease resistance - sources of disease resistance - breeding methods for disease resistance - achievements - Insect resistance - mechanism of insect resistance in plants (non preference, antibiosis, tolerance and avoidance) - nature of insect resistance - genetics of insect resistance - horizontal and vertical - genetics of resistance - sources of insect resistance - breeding methods for insect resistance - problems in breeding for insect resistance - achievements.
28. Breeding for resistance to abiotic stresses - drought resistance - mechanisms of drought resistance (drought escape, avoidance, tolerance, and resistance) - features associated with drought resistance - sources - breeding methods - limitations - achievements ; breeding for resistance to water logging - effects of water logging mechanism of tolerance - ideotype for flooded areas - breeding methods - breeding for salt tolerance - response of plants to salinity - symptoms - mechanisms - breeding methods - problems - achievements; cold

tolerance – chilling resistance – effects of chilling stress of plants – mechanism – sources – selection criteria – freezing resistance – effects of freezing – mechanism of freezing resistance – genetic resources for freezing tolerance – selection criteria – problems in breeding for freezing tolerance.

29. Molecular markers – Definition – Brief description of different types of molecular markers, RFLP, AFLP, RAPD and SSR markers – Importance, procedure and applications.
30. DNA finger printing – procedure, application – QTL mapping and MAS and its applications in crop improvement.
31. Pre breeding – Definition, Concept, need, methods and factors affecting pre breeding. Participatory Plant Breeding – Concept Relevance, activities and goals of PPB, kinds of PPB, perspectives and prospects, advantages, disadvantages and limitations.
32. Intellectual Property Rights (IRP) and Patents – Types, protection of IPR, trade secret, copy rights,
33. Plant Variety Protection and Geographical Indications.
34. Plant Breeders' Rights – Benefits and disadvantages.

Practical Schedule

1. Plant Breeder's kit for hybridization, study of germplasm of various crops.
2. Study of megasporogenesis and Microsporogenesis, fertilization and life cycle of an angiospermic plant.
3. Study of floral structure of self pollinated crops – floral biology, anthesis, pollination, selfing and crossing techniques in bhendi.
4. Study of floral structure of cross pollinated crops - Floral biology, anthesis, pollination, selfing and crossing techniques in cucurbits.
5. Floral biology, anthesis, pollination, selfing and crossing techniques in vegetable crops – brinjal, tomato, chillies.
6. Types of male sterility – genetic, Cytoplasmic and cytoplasmic Genetic male sterility, transfer of male sterile cytoplasm and restorer gene to a normal strain.
7. Types of self incompatibility, gametophytic and sporophytic incompatibility.
8. Terminology in backcross method, transfer of a dominant gene and recessive gene for disease rust resistance through the backcross methods in self pollinated crops.
9. Handling of segregating populations – Pedigree, bulk and Single seed decent methods.
10. Consequences of inbreeding on genetic structure of resulting populations – Types of recurrent selection, simple RS, RS for GCA & SCA and reciprocal recurrent selection.
11. Field layout of experiments – Designs used in plant breeding experiments – analysis of Randomized Block Design (RBD) – field trails – maintenance of records and registers.
12. Basic statistics, commonly used in plant breeding – Mean, range, variance, Phenotypic coefficient of Variation (PCV), Genotypic Coefficient of Variation (GCV), Heritability and Genetic advance.
13. Estimation of Heterosis, Heterobeltiosis and Standard heterosis – Prediction of performance of double cross hybrids.
14. Estimation of general combining ability, specific combining ability, variances and effects.
15. Visit to RARS / Local / ICAR stations to acquaint about the mode of pollination in a given crop and extent of natural out crossing.
16. Visit to RARS / Local / ICAR Institute to acquaint about the handling of segregating generations – Pedigree, bulk and back cross methods – Preliminary Yield Trail, Advanced Varietal Trail and other methods.

17. Final Practical examination

Course Outcomes

CO 1: The student will have the gist of the various self and cross pollinated crops.

CO 2: Will be able to develop expertise in the various crossing and emasculation techniques in various crops

CO 3: Students will develop the capacity to carry out independent plant breeding experiments

CO 4: The students will be able to multiply and modify the vegetatively propagated crops.

CO 5: The students will be able to develop in the various biotic and abiotic resistance source in various crops.

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5
CO1	3	-	-	3	-
CO2	3	-	-	3	2
CO3	-	-	-	2	2
CO4	-	-	-	2	2
CO5	-	3	-	-	2

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SOL 201 SOIL FERTILITY AND NUTRIENT MANAGEMENT (1+1)

Learning Objectives

- To gain knowledge about on plant nutrients and basic principles of soil fertility.
- To impart knowledge on soil fertility evaluation,
- To learn about different types and uses of commercial fertilizers for crop production
- To familiarize the importance of organic manures for sustainable agriculture.
- To gain the knowledge about problem soils and their reclamation as well as analytical knowledge on soil available nutrients.

Theory

Unit I- Soil fertility and Plant nutrition

Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements- functions, deficiency systems, Plant nutrient toxicity symptoms and remedies measures.

Unit II - Fertilizers and Manures

Fertilizers-Definition -classification -Manufacturing process of nitrogen, phosphorus, potassium, secondary and micronutrient. Manures -definition- classification - effect on soils and plants. Fertilizer control order.

Unit III- Nutrient transformation

Fate of applied major, secondary and micronutrients in soils and its effect on soil properties

Unit IV- Problem soils and Soil organic matter

Acid, calcareous and salt affected soils - characteristics and management. Soil organic matter, Role of microorganisms in organic matter- decomposition - humus formation. Importance of C: N ratio and pH in plant nutrition, soil buffering capacity.

Unit V- Soil fertility evaluation and Fertilizer use efficiency

Soil fertility evaluation and methods, critical limits of plant nutrient elements and hunger signs. Luxury consumption, nutrient interactions. Soil test crop response and targeted yield concept. Integrated plant nutrient management. Methods of fertilizer application - Bio fertilizer - Fertilizer use efficiency and management- Effect of potential toxic elements in soil productivity. Current stream of thoughts

Lesson Plan

Theory Schedule

1. Nutrient elements - essential nutrients- criteria of essentiality - beneficial and functional nutrients- major, secondary and
2. Micronutrients-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. Fertilizers - Definition, classification of N, P and K fertilizers. N fertilizers- Urea, ammonium sulphate, ammonium nitrate, CAN properties and their reactions in soil- Manufacture of urea and ammonium sulphate
5. P fertilizers- Rock phosphate, bone meal, basic slag, single super phosphate, diammonium phosphate, triple super phosphate, properties and their reactions in soil- manufacturing of SSP and DAP
6. K fertilizers- MOP and SOP- properties and reactions in soil- syntheses of MOP and SOP
7. Complex fertilizers- definition, manufacture of ammonium phosphate, nitro phosphate and N,P,K complexes - Mixed fertilizers-definition, preparation and compatibility- Fertilizer Control Order
8. Organic manures- Definition, and difference between manures and fertilizers-classification of manures with suitable examples- importance of manures in soil fertility management.
9. **Mid Semester Examination**
10. Composting techniques- Aerobic and anaerobic (Bangalore and Coimbatore method) enriched FYM and vermicompost. Composting of organic waste-sugarcane trash and coir waste

11. Nutrients transformations in soil- ionic forms of plant nutrients- sources, forms, mobility, transformation, fixation, losses and availability of major nutrients in soil.
12. Sources, forms, mobility, transformation, fixation, losses and availability of secondary and micronutrients in soil.
13. Problem soils- definition- classification-acid, salt affected soils (saline, alkali/sodic and saline alkali/sodic)-field diagnosis-characteristics-formation and reclamation measures of acid soil-lime requirement and saline, sodic and saline sodic-gypsum requirement a calcareous soil.
14. Humus formation- importance of C:N ratio and pH in plant nutrition, soil buffering capacity. Role of SOM in sustaining soil health
15. Techniques/ methods of soil fertility evaluation - Inductive, deductive, 'A' value technique, crop logging, critical level, Luxury consumption, hidden hunger, DRIS, indicator plants and agronomic approach. Methods of fertilizer application.
16. Bio-fertilizers - definition - classification with suitable examples- importance of importance of manures in soil fertility management.
17. Nutrient management concepts - INM, STCR, IPNS, SSNM and RTNM. Nutrient use efficiency of N, P, K and micronutrients and their enhancement techniques.

Practical Schedule

1. Estimation of available nitrogen in soils
2. Estimation of available phosphorus in soils
3. Estimation of Potassium and calcium and magnesium in soils
4. Estimation of available sulfur and micronutrient in soil
5. Estimation of soil organic carbon
6. Determination of boron and chlorine content in soils
7. Estimation of gypsum requirement in sodic soil
8. Estimation of lime requirement in acid soils
9. Sampling of organic manure and fertilizer for chemical analysis
10. Physical properties of organic manure and fertilizers.
11. Estimation of Total nitrogen in urea and farmyard manure.
12. Estimation of ammonical nitrogen and nitrate nitrogen in ammonical fertilizer.
13. Estimation of water soluble P_2O_5 , Ca and S in SSP, Lime and Gypsum.
14. Estimation of Potassium in MOP/SOP and
15. Estimation of Zinc in zinc sulphate.
16. Visiting of fertilizer testing laboratory.
17. **Final Practical examination**

Course Outcomes

- CO1: Knowledge on essential nutrients, soil fertility, nutrient transformations in soil.
- CO2: Manures, fertilizers and soil fertility management through various approaches.
- CO3: Decisions making on nutrient dose, choice of fertilizers and method of application etc. practiced in crop production.
- CO4: Nutrient management concepts and Nutrient use efficiencies of major and micronutrients and enhancement techniques.
- CO5: Soil health - Quality indices and their management - Organic farming and Precision Farming - Long term effect of fertilization on soil

CO-PO Mapping Matrix

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

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PAT 201 DISEASES OF VEGETABLE ORNAMENTAL AND SPICES CROPS (2+1)

Learning Objectives

- To acquire knowledge on symptoms, etiology, disease cycle and management practices of important diseases of solanaceous and cucurbits crops.
- To acquire knowledge on symptoms, etiology, disease cycle and management practices of important diseases of crucifers and leafy vegetables crops.
- To acquire knowledge on symptoms, etiology, disease cycle and management practices of important diseases of tuber and bulb crops.
- To acquire knowledge on symptoms, etiology, disease cycle and management practices of important diseases of ornamental crops.
- To acquire knowledge on symptoms, etiology, disease cycle and management practices of important diseases of spices crops.

Theory

Unit I

Nature, prevalence, factors affecting, disease development of Brinjal, tomato, bhindi, peas, beans, cucumber, watermelon, muskmelon, pumpkin, gourds, squash, moringa and their management.

Unit II

Nature, prevalence, factors affecting, disease development of cabbage, cauliflower, Knol khol, brussel sprout, radish, mustard, beet root, turnip, carrot, lettuce, broccoli, spinach and amaranthus.

Unit III

Nature, prevalence, factors affecting, disease development of potato, sweet potato, cassava, elephant foot yam, white yam, colocasia, onion, garlic and post-harvest diseases of vegetables and their management.

Unit IV

Nature, prevalence, factors affecting, disease development of spices such as Jasmine, rose, crossandra, chrysanthemum, tuberose, carnation, gladiolus, nerium marigold, gerebera, anthurium and geranium

Unit V

Symptoms, epidemiology and management of diseases of different spice crops such as chilli, black pepper, cardamom, clove, cinnamon, nutmeg, cumin, coriander, turmeric, ginger, fennel, fenugreek, tamarind, saffron and their management.

Lesson Plan

Theory Schedule

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

1. Brinjal
2. Tomato
3. Bhendi
4. Peas, Beans
5. Cucumber
6. Watermelon and Muskmelon
7. Pumpkin, gourds, squash and moringa
8. Cabbage and cauliflower
9. Knol Khol, brusel sprout and radish
10. Mustard, Turnip and Beet root
11. Lettuce, Spinach and Broccoli
12. Amaranthus and Carrot
13. Potato
14. Sweet Potato
15. Elephant foot yam, white yam
16. Colocasia and Cassava
- 17. Mid semester Examination**
18. Onion and garlic
19. Post-harvest diseases of vegetable crops and their management
20. Jasmine and rose.
21. Chrysanthemum, tuberose
22. Carnation and gladiolus
23. Nerium marigold and gerebera
24. Anthurium and geranium
25. Chilli
26. Black pepper
27. Cardamom
28. Clove and cinnamon,
29. Nutmeg
30. Cumin and coriander,
31. Turmeric

32. Ginger
33. Fennel and Fenugreek
34. Tamarind and saffron

Practical Schedule

Study of diseases symptoms and host parasite relationship and disease management in:

1. Brinjal, tomato and bhendi
2. Peas and beans
3. Cucumber, watermelon, muskmelon, pumpkin, gourds, squash and moringa
4. Cabbage, cauliflower, knol khol, brussel sprout, radish and mustard
5. Beet root, turnip, carrot, lettuce, broccoli, spinach and amaranthus.
6. Potato, sweet potato, cassava, elephant foot yam, white yam and colocasia.
7. Onion and garlic
8. Post-harvest diseases of vegetables and their management.
9. Jasmine, rose, crossandra and chrysanthemum
10. Tuberose, carnation, gladiolus and nerium
11. Marigold, gerebera, anthurium and geranium
12. Field visit
13. Chilli, Black pepper and cardamom
14. Clove, cinnamon, nutmeg, cumin and coriander
15. Turmeric and ginger
16. Fennel, fenugreek, tamarind, saffron

17. Final practical examination

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

Course Outcomes

- CO 1: Acquainted with etiology, epidemiology, identifying and managing diseases of vegetables, ornamental and spices crops
- CO 2: Acquainted with etiology, epidemiology, identifying and managing diseases of cruciferous and leafy vegetable crops
- CO 3: Acquainted with the symptoms, etiology, disease cycle and management practices of important diseases of tuber and bulb crops.
- CO 4: Acquired knowledge of the symptoms, etiology, disease cycle and management practices of important diseases of ornamental crops.
- CO 5: Acquired knowledge of the symptoms, etiology, disease cycle and management practices of important diseases of spices crops.

CO - PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	-	-	1	-
CO2	2	3	-	-	1	-
CO3	2	3	-	-	1	-
CO4	2	3	-	-	1	-
CO5	2	3	-	-	1	-

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AEG 201 FARM MACHINERY, POWER AND RENEWABLE ENERGY 2(1+1)

Learning Objectives

- To impart knowledge to the students on the significance, use and maintenance of farm power and improved farm equipment through various media including demonstrations.
- 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, 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, windmill, bio gas plants and production of bio diesel and ethanol from agricultural produce.

Theory

Unit I: Farm power sources, Mechanical Machinery and Tractors

Status of farm power in India-farm mechanization for enhancing productivity - sources of farm power - advantages and disadvantages-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 II: Tillage and Tillage Machinery, Sowing, Planting, Intercultural Equipment

Farm 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 III: 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 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.

Lesson Plan

Theory Schedule

1. Status of farm power in India - farm mechanization for enhancing productivity - sources of farm power – advantages and disadvantages.
2. Internal combustion (IC) engines – working principle – four stroke and two stroke cycle engines – difference between the two types- components of IC engine - Working principle of IC engines using diesel and petrol as fuels.
3. Familiarization with various systems of tractor – Power Transmission from engine to rear wheels – role of different units in speed reduction and transmission of power.
4. Tractors – classification – factors to be considered while purchasing a tractor. Cost analysis of owning and operating tractor and implements
5. Tillage – primary and secondary tillage- mould board plough- constructional features - components of MB plough and their functions – limitations of MB plough - Standard disc plough- constructional features and operational adjustments - determination of theoretical and effective field capacities, field efficiency- numerical problems on drawbar power and field capacity in Metric and SI units.
6. Secondary tillage implements – harrows – different types – classification of disc harrows, cultivators – rigid tine and spring tine types- Methods of sowing-sowing implements-seed drills and planters-seed metering mechanism – calibration of seed drill and numerical problems on the subject.
7. Tractor - mounted equipment for land management – bund former, ridger and terraces blade - Equipment for manual and power harvesting- sickle and harvester combines - methods of harvesting fruits crops in hill areas.
8. Introduction – renewable energy sources – classification – advantages and disadvantages
9. **Mid-Semester Examination**
10. Biomass – importance of biomass – classification of energy production – principles of combustion – pyrolysis and gasification - Biogas – principles of biogas production –

advantages and disadvantages – utilization

11. Biogas plants – classification – types of biogas plants – constructional details of biogas plants -Types of gasifiers – producer gas and its utilization - Briquettes – briquetting machinery – types and uses of briquettes – shredders
12. Solar energy – application of solar energy – methods of heat transfer – conduction, convection and radiation
13. Solar appliances – flat plate collectors – focusing plate collectors – solar air heater – solar cookers – solar water heating systems - Solar grain dryers – solar refrigeration system – solar ponds
14. Solar photovoltaic system – solar lantern – solar streetlights – solar fencing – solar water pumping system
15. Wind energy – constructional details of windmills – applications of windmills advantages – disadvantages – wind mills – types
16. Bio fuels – characteristics of various bio fuels – different parameters and calorific values- Bio diesel production – applications – extraction from *Jatropha*
17. Ethanol from agricultural produce (sugar cane and corn)

Practical Schedule

1. Study of various components of IC engine and study of two stroke and four stroke cycle engines.
2. Familiarization with primary tillage implements – MB plough – to study MB plough in operation.
3. Familiarization with primary tillage implements – disc plough – to study disc plough in operation and Familiarization with secondary tillage implements study of harrows and cultivators
4. Familiarization with sowing implements - study of seed-cum-fertilizer drill- calibration of seed drill.
5. Constructional details of KVIC and Janata type biogas plants
6. Constructional details of Dheen Bandu type biogas plants
7. Constructional details of different types of gasifiers
8. To study the briquettes preparation from biomass
9. To study the efficiency of solar cooker
10. To study the performance of a solar still
11. To study the performance of a solar dryers
12. To study the working of solar photovoltaic pumping system
13. To study the performance evaluation of domestic solar water heater
14. To Study the performance evaluation of solar street light
15. To study the performance of different types of wind mills
16. To study the processing of bio diesel production from *Jatropha*

17. Final Practical Examination

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AGM 201 FUNDAMENTALS OF FOOD TECHNOLOGY (1+1)

Learning Objectives

- To make the students to know food principles underlying food and Energy.
- To impart knowledge on cereals, pulser, Lipids and oils.
- To have knowledge Vegetables, enzymatic browning and sources of pigments.
- To learn the composition and spoil of meat, fish and poultry
- To impart knowledge on milk composition, spoilage, pasteurization and fermented Foods.

Theory

Unit 1: Food properties and functions

Food and its function, physico-chemical properties of foods, food preparation techniques nutrition, relation of nutrition to good health. characteristic of well and malnourished population, energy, definition, determination of energy requirements, food energy, total energy needs of the body.

Unit 2: Cereals, pulses and lipids

Rice - structure and composition, parboiling of rice- advantages and disadvantages, wheat structure and composition types (hard, soft/strong, weak) Malting pulses-structure and composition of toxic constituents on pulses lipids classification types of fatty acids-saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids.

Unit 3: Fruits and vegetables

Fruits and vegetables composition classification enzymatic browning spoilage. Names and sources of pigments, dietary fibre.

Unit 4: Meat, Fish and Poultry

Meat-composition of red and white meat, marbling, post-mortem changes in meat-Rigor mortis, tenderization and aging of meat. Fish - classification fresh water and marine) composition, spoilage-microbiological and physiological and biochemical - Poultry structure of hen's composition and nutritive value, characteristics and fresh egg, deterioration of egg quality.

Unit 5: Milk and its processing techniques

Milk - definition, chemical composition sits constituents, processing of Milk, pasteurization, homogenization for overview of types of market milk and milk produced.

Lesson Plan

Theory Schedule

1. Food and its function, Physio-chemical properties of foods.
2. Food preparation techniques and their nutrition.
3. Energy-definition, determination of energy requirements, food energy, total energy needs of the body.
4. Rice - structure and composition, preboiling of rice-advantages and disadvantages.
5. Wheat - structure and composition, toxic constituents in pulses.

6. Pulses - structure and composition, toxic constituents in pulses.
7. Lipids-classification types of fatty acids.
8. Refining of oils, types, bleaching steam deodorization and rancidity.
- 9. Mid semester examination**
10. Fruits - composition, classification enzymatic browning, spoilage.
11. Vegetables - composition, classification, spoilage.
12. Names and sources of pigments, dietary fibre.
13. Meat - definition of carcass, composition of red and white meat, Marbling.
14. Post – Mortem changes in meat-rigor mortis tenderization and aging of meat.
15. Fish - classification, composition, spoilage.
16. Poultry-structure of hen’s egg, composition and nutritive value, spoilage, characteristics of fresh egg, deterioration of egg quality.
17. Milk-definition composition spoilage processing overview of types of Market milk and milk products.

Practical Schedule

1. Introduction to microbiological laboratory and its equipment’s
2. Microbiological examination of fruits.
3. Microbiological examination of vegetables.
4. Microbiological examination of cereals.
5. Microbiological examination of pulses.
6. Microbiological spoilage of meat.
7. Microbiological spoilage of sea foods
8. Microbiological spoilage of egg.
9. Isolation of lactic acid bacteria from curd.
10. Mehtylene blue reduction test.
11. Resazurin test.
12. Isolation of mycotoxigenic fungi from food grains.
13. Quantitative analysis of milk by standard plate count method.
14. Isolation and enumeration of yeast from rice batter.
15. Production of fermented foods – sauerkraut.
16. Production of fermented foods – flavoured yoghurt.
17. **Final Practical examination.**

Course Outcomes

CO 1 : The students will gain knowledge on food and energy

CO 2 : The students would expose to the nutritive value of cereals, pulses and gain knowledge on lipids and oils.

CO 3 : The students would thoroughly understand the nutritive value and spoilage of meat, fish and poultry.

CO 4 : The students exposed to microbes on fruits and vegetables.

CO 5 : To have a knowledge on value added fermented foods and spoilage of milk

CO - PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	-	2	-	-	-
CO 2	-	1	-	-	-
CO 3	-	2	-	-	-
CO 4	-	2	-	-	-

CO 5	-	-	-	-	3
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1. HOR 206 SPICES AND CONDIMENTS (2+1)

Learning Objectives

- To make them acquire knowledge on the cultivation aspects of spices and condiments.
- To provide knowledge on basic nursery management practices of spices and condiments.
- To provide knowledge on production technology of spices and condiments.
- To acquaint knowledge on post-harvest operations such as grading, packing and value addition.
- To make them acquire knowledge on the Role of spices board and Institutes for improvement of spices and condiments.

Theory

Unit I: Importance and classification of spices and condiments

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- Different classifications based on economic importance, cultivation methods, family, longevity of spice plants, type of the spice, origin and flavour, plant part used, active principle.

Unit II: Production technology of major Spices

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 pepper, cardamom, turmeric and ginger.

Unit III: Production technology of tree spices

Clove, Nutmeg, Cinnamon, All spice, Curry leaf and Tamarind.

Unit-IV: Production technology of condiments, herbal and other spices

Coriander, fenugreek, fennel, cumin Dill, Celery, Bishop weed, Rosemary, Thyme, Vanilla, Saffron, garlic and Asafoetida.

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

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

Practical

Description and identification of spices and condiments - nursery management practices- planting - training and pruning - manures and fertilizer application - harvesting and processing, grading and packing -study of value added products - visit to fields and processing industries.

Lesson Plan

Theory Schedule

1. Introduction, history of spices, definition of spices and condiments, important spice crop of India (List of the crops with Common name, Botanical name and family), importance, role of spices in human nutrition, industry, exports and imports of spices in improving the national economy.
2. Classification of Spices - Different classifications based on economic importance, cultivation methods, family, longevity of spice plants, type of the spice, origin and flavour, plant part used, active principle.
3. Institutes working on spices and condiments, role of organizations for improvement of spices and condiments like IISR, ICAR, DCASD and Spices Board.
4. Black Pepper - origin and distribution, area and production, uses, botany, types of shoots, varieties, soil and climate, propagation with seed, vegetative method - cuttings, layering, rapid multiplication method, bush pepper, intercrop and mixed crop.
5. Black Pepper - Establishment of pepper garden, planting of standard plants, planting of the vines, shade and shade regulation, training and pruning of pepper vines. Role of growth regulators, nutritional management, irrigation, weed control, maturity indices, harvesting, post harvest technology, despiking, blanching, black pepper, white pepper, drying and curing various forms of black pepper. Packing, storage and value added products.
6. Cardamom - origin and distribution, area and production, uses, botany, varieties, small and large cardamom, types of cardamom like, Malabar, Mysore and Vazukka, soil and climate, selection of site, propagation, seed and vegetative method like suckers.
7. Cardamom - planting, mulching, weeding, trashing, shade regulation, earthing up, nutrient and irrigation management, role of growth regulators, inter cropping and mixed cropping, harvesting indices, yield and post harvest technology - bleached cardamom.
8. Ginger - origin and distribution, area and production, importance, uses, botany, varieties, soil and climate, propagation, selection of land and preparation, planting season, seed rate, spacing, methods - bed system and ridge and furrow system, seasons, earthing up, mulching, systems of cultivation like rotations and mixed cropping.
9. Ginger - irrigation, nutrient management, harvesting and curing, green ginger, dry ginger - bleached and unbleached ginger, preserved ginger. Storage, grades of ginger, value added products like soft drink ginger candy, murabba, pickles, ginger wine, preservation of seed rhizome.
10. Turmeric - origin and distribution, area and production, importance, uses, botany, species, varieties, soil and climate, propagation, selection of mother rhizome, selection of land and preparation. Methods of cultivation like bed system, ridge and furrow system planting - seasons, seed rate, spacing, mulching, earthing up.

11. Turmeric- irrigation, nutrient management, weeding, shade provision, cropping systems like inter cropping, rotations, role of growth regulators, harvesting and processing (curing, polishing, colouring), packing and storage, grades of turmeric, value added products like turmeric powder, oil and oleoresin, preservation of seed rhizome.
12. Clove - origin and distribution, area and production, importance, uses, botany, varieties, soil and climate, propagation by seed - selection of mother cloves, nursery management, planting, staking, weeding, manuring, irrigation, pruning, mixed cropping system, harvesting, curing and processing, grading, packing and storage, value added products like clove bud oil, clove stem oil, clove leaf oil, clove root oil, oil of mother clove.
13. Nutmeg - origin and distribution, area and production, importance, uses, botany, varieties, soils and climate, propagation, seed and vegetative method, nursery techniques, planting, cropping system like mixed cropping, manuring, weeding, intercultural, sex problem, top working, harvesting, post harvest technology, grading, packing and value added products.
14. Cinnamon - importance, origin and distribution, area and production, uses, species of cinnamomum, difference between cinnamon bark and cassia bark, varieties, soil and climate, propagation - seed, cuttings, layers, nursery management, planting, weeding, manuring, irrigation, coppicing, harvesting, post harvest technology - cutting and peeling, preparation of quills, drying, grading - quills, quillings, featherings, chips, packing, storage and value added products.
15. All Spice - introduction, area and production, uses, botany, varieties, soil and climate, propagation like seed and vegetative method - budding, approach grafting, planting, weeding, manuring, harvesting, post harvest technology like drying and curing and value added products like berry oil, leaf oil, oleoresin.
16. Curry Leaf - introduction, area and production, uses, botany, varieties, soil and climate, propagation like seed, planting, weeding, pruning, manuring, harvesting and post harvest technology.
17. **Mid semester examination**
18. Tamarind - introduction, area and production, uses, botany, varieties, soil and climate, propagation like seed and vegetative method - softwood grafting and air layering, planting, weeding, training and pruning, manuring, harvesting, post harvest technology and value added products.
19. Coriander - importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting, threshing and value added products.
20. Fenugreek - importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, harvesting and threshing, value added products.
21. Fennel - importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, seed treatment and sowing, nutritional management, thinning, irrigation, hoeing, weeding, earthing up, harvesting, threshing and value added products.
22. Cumin - importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, sowing, nutritional

- management, thinning, irrigation, hoeing, and weeding, harvesting, threshing and value added products.
23. Dill - importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, sowing, nutritional management, thinning, weeding, irrigation, harvesting, and value added products.
 24. Celery - importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, sowing, nutritional management, blanching, thinning, weeding, earthing up, irrigation, harvesting and value added products.
 25. Bishops weed (Ajwain) - importance, origin and distribution, area and production, uses, botany, varieties, soil and climate, field preparation, seasons, seed rate, spacing, sowing, nutritional management, weeding, earthing up, irrigation, harvesting and value added products.
 26. Rosemary - Importance and uses, origin, distribution, botany, varieties, soil, climate, land preparation, propagation, transplanting, spacing, manures and fertilizers, irrigation, interculture, harvesting, yield.
 27. Thyme - Importance and uses, origin, distribution, botany, varieties, soil, climate, land preparation, propagation, transplanting, spacing, manures and fertilizers, irrigation, interculture, harvesting and yield.
 28. Vanilla - importance, area and production, uses, botany (labellum, rostellum), varieties, constraints of production, propagation by cuttings, soil and climate, land preparation, planting, staking, training, manuring, flowering and pollination-hand pollination, harvesting, curing and processing and types of vanilla like Mexican, Bourbon and Indonesian vanilla, value added products like vanilla pods, vanilla essence, vanillasugar, vanilla oleoresins, grading, packing and storage.
 29. Saffron - importance, area and production, uses, botany, varieties, propagation, soil and climate, land preparation, planting, weeding, manuring, picking, drying, grading, packing and storage.
 30. Asafoetida - introduction, area and production, uses, botany, varieties, soil and climate, propagation, preparation of land and planting, manuring, irrigation and weeding, tapping, processing, packing, storage and value added products.
 31. Garlic - introduction, area and production, uses, botany, varieties, soil and climate, propagation, preparation of land and planting, manuring, irrigation and weeding, tapping, processing, packing, storage and value added products.
 32. Pepper Export Promotion Council.
 33. Role of organizations/commodity boards for improvement of spices.
 34. Role of organizations/commodity boards for improvement of condiments.

Practical Schedule

1. Identification of Spices and Condiments.
2. Seed treatment, sowing, layout and planting methods in spices and condiments.
3. Raising of spice crops.
4. Raising of condiments.
5. Propagation methods and role of growth regulators in pepper and cardamom.
6. Propagation methods and role of growth regulators in turmeric, zinger and condiments.
7. Identification of pepper, cardamom, turmeric and ginger varieties.
8. Identification of coriander, fennel, fenugreek and cumin varieties.

9. Important operations followed in spices like manuring, use of weedicides and earthing up operations.
10. Training and pruning in spices and condiments.
11. Maturity standards and harvesting of spices and condiments.
12. Curing, processing and grading of spices and condiments.
13. Methods of extraction of essential oils and oleoresins in spices and condiments.
14. Visits to commercial spice gardens.
15. Visit to plantations and processing units.
16. Visit to essential oil extraction units.
17. **Final Practical examination.**

Course Outcome

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

CO 2 - Students can demonstrate important production techniques and diagnose problems in cultivation of spices and condiments.

CO 3 - Students can demonstrate curing, processing and grading of spices and condiments.

CO 4 - Students can demonstrate methods of extraction of essential oils and oleoresins in spices and condiments.

CO 5 - The students will be able to acquire knowledge on Role of organizations/commodity boards for improvement of spices and condiments.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	1	1	1	1	0
CO 2	2	2	2	2	1	0
CO 3	1	2	1	1	2	0
CO 4	2	3	3	3	3	0
CO 5	2	2	1	1	1	0

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HOR 207 PRINCIPLES OF LANDSCAPE ARCHITECTURE (1+1)

Learning Objectives

- To educate the students on history and style of gardening.
- To enable better understanding of landscape features and establishment of various gardens.
- To develop knowledge about landscape gardening principles
- To learn the usage of software for landscaping.
- To acquaint advanced technologies of landscape architecture.

Theory

Unit I: History and style of gardening

Historical importance of Indian gardens - gardens of ancient world - definitions - famous gardens of India and abroad - formal - informal - free style and wild gardens - basic themes of gardens *viz.* circular - rectangular and diagonal themes.

Unit II: Garden designing and principles of landscape design

Steps in preparation of garden design -use of Auto CAD and Archi CAD in designing gardens - factors affecting landscape design *viz.* initial approach - view - human choice - simplicity - topography *etc.*, - principles of landscape gardens *viz.* axis - rhythm - balance - time and light - space -texture - form - mass effect - focal point- mobility -emphasis - unity and harmony *etc.*

Unit III: Elements of landscape design and planning of urban garden

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

Unit IV: Gardening for different situations

Development of institutional gardens - planning and planting of avenues - beautifying schools - railway lines - railway stations - factories - bus stands - airports - corporate buildings - dams - hydroelectric stations - riverbanks - playgrounds - gardens for places of religious importance *viz.*, - temples - churches - mosques - tombs *etc.*,

Unit V: Importance and features of various gardens

Importance, features and establishment of - English garden - Japanese gardens- Mughalgardens - French and Persian garden - Italian gardens - Hindu gardens and Buddhist gardens- xeriscaping - definition - principles and practice.

Practical

Study of garden equipment. Study of graphic language, Use of drawing equipment, graphic symbols and notations in landscaping designing, study and designing of different styles of gardens, Study and designing of gardens based on different themes, designing gardens using Auto-cad/ Archi-cad, designing gardens for home, traffic islands, schools and colleges, public buildings, factories, railway stations, airports, temples, churches, playgrounds, corporate buildings/ malls. Designing and planting of avenues for state and National highways, Design and establishment of Japanese, English and Mughal gardens. Visit to public, institutional and botanical gardens.

Lesson Plan

Theory Schedule

1. Historical importance of Indian gardens, gardens of ancient world, definitions, famous gardens of India and abroad.
2. History and special features of formal, informal, free style and wild gardens, basic themes of gardens *viz.* circular, rectangular and diagonal themes.

3. Steps in preparation of garden design.
4. Use of Auto CAD and Archi CAD in designing gardens.
5. Factors affecting landscape design viz. initial approach, view, human choice, simplicity, topography.
6. Principles of landscape gardens viz. axis, rhythm, balance, time and light, space, texture, form, mass effect, focal point, mobility, emphasis, unity and harmony.
7. Elements of landscape gardens viz. tangible and intangible elements.
8. Bio-aesthetic planning, definition, objectives.
- 9. Mid semester examination**
10. Planning and designing of home gardens, colonies, country planning, urban landscape.
11. Development of institutional gardens, planning and planting of avenues, beautifying schools, railway lines, railway stations, factories, bus stands, airports corporate buildings, dams, hydroelectric stations, riverbanks, playgrounds.
12. Gardens for places of religious importance viz. temples, churches, mosques and tombs.
13. Importance, features and establishment of English garden and Japanese gardens
14. Importance, features and establishment of Mughalgardens and French gardens.
15. Importance, features and establishment of Persian garden and Italian gardens.
16. Importance, features and establishment of Hindu gardens and Buddhist gardens,
17. Xeriscaping, definition, principles and practice.

Practical

1. Study of garden equipment, graphic language and use of drawing equipment.
2. Study of graphic symbols and notations used in landscape designing.
3. Plant materials for landscaping and their identification i.e., annuals, herbaceous perennials, trees, shrubs, climbers, bulbous plants, cacti and succulents, aquatic plants, ground covers i.e., grasses, bamboos etc.,
4. Study of various features of an ornamental garden with suitable plants and identification of plants for each feature.
5. Study and designing of different styles of gardens, Study and designing of gardens based on different themes.
6. Designing gardens using Auto-cad/ Archi-cad.
7. Study of designing gardens for home, traffic islands, schools and colleges, public buildings and factories.
8. Study of designing gardens railway stations, airports, temples, churches, playgrounds and corporate buildings/ malls.
9. Designing and planting of avenues for state and national highways.
10. Study of designing and establishment of Japanese, English and Mughal gardens.
11. Study of special type of gardens (terrace garden and rock garden)
12. Study of special type of gardens (sunken garden and bog or marsh garden)
13. Identification and description of indoor plants, interior plant-scaping
14. Study of climatic factors (light, temperature, humidity, fresh air and watering) on successful culture of indoor plants.
15. Visit to public gardens, temples and national highway gardens.
16. Visit to botanical gardens.
17. Final **practical examination**

Course Outcomes

CO 1 - At the end of this course, the students can understand historical importance of Indian gardens, different styles of garden, famous gardens of India and abroad.

CO 2 - The students will gain skill on preparation of garden design using Auto CAD and Archi CAD and they accrued knowledge on principles of landscape design.

CO 3 - The students can gain knowledge of elements of landscape design, bio-aesthetic planning, planning and designing of home gardens, colonies, country planning and urban garden.

CO 4 - The students will learn about planning and establishment of gardening for different situations.

CO 5 - The students can understand about importance and features of English garden, Japanese gardens, Mughal gardens, French garden, Persian garden, Italian gardens, Hindu gardens and Buddhist gardens and principles and practice of xeriscaping

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	0	1	1	2	2	0
CO 2	0	1	2	3	3	2
CO 3	0	1	2	3	3	2
CO 4	1	2	3	3	3	3
CO 5	1	2	2	3	3	2

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HOR 208 BREEDING OF FRUIT AND PLANTATION CROPS (2+1)

Learning Objectives

- To provide knowledge on the history and basics of plant breeding.
- To highlight the importance of plant breeding
- To acquaint knowledge on the breeding objectives and strategies of fruit and plantation crops
- To acquire knowledge on the achievements made in the improvement of fruit and plantation crops

- To gain skills in hybridization techniques and various breeding methods of fruit and plantation crops.

Theory

Unit I: Historical perspectives, approaches and challenges in improvement of fruit crops

Fruit breeding - History, Basics, importance in fruit production, distribution, domestication and adaptation of commercially important fruits, variability for economic traits, breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement - policy manipulations - *in vitro* breeding tools- Historical perspectives, approaches and challenges in improvement of fruit crops; Centers of origin and diversity of major fruit crops. Breeding methods and achievements in Mango, Banana, Lime, Oranges and Lemon.

Unit II: Breeding of fruit crops

Breeding objectives, methods and achievements in Grapes, Guava, Sapota, custard apple, Papaya, Aonla, Pomegranate, Pineapple.

Unit III: Breeding of Arid zone, temperate fruit & nut crops

Breeding objectives, methods and achievements in Ber, Jamun, Litchi, Apple, Plum, Peach, Pear, Strawberry, Apricot, Walnut, Pistachio nut.

Unit IV: Historical perspectives, approaches and challenges in improvement of plantation crops

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

Unit V: Breeding of plantation crops

Breeding objectives, methods and achievements in Coconut, Arecanut, Oilpalm and Rubber and current stream of thought.

Practical

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

Lesson Plan

Theory Schedule

1. Origin, importance, historical perspectives, approaches and challenges in improvement of fruit crops.
2. Pure line selection, mass selection, pedigree selection, back cross breeding procedures in fruit crops.
3. Breeding methods -- clonal selection for varieties and hybrids fruit crops.
4. Application of mutation, mutagens and achievements, *in vitro* breeding tools and achievements in fruit crops.
5. Breeding objectives, breeding methods and achievements in Mango.
6. Breeding objectives, breeding methods achievements in Banana.
7. Breeding objectives, breeding methods and achievements in Oranges.
8. Breeding objectives, breeding methods and achievements in lime.
9. Breeding objectives, breeding methods and achievements lemon.
10. Breeding objectives, methods of breeding and achievements in Guava.

11. Breeding objectives, methods of breeding and achievements in Sapota.
12. Breeding objectives, methods of breeding and achievements in Papaya.
13. Breeding objectives, methods of breeding and achievements in Grapes.
14. Breeding objectives, methods of breeding and achievements in Pineapple.
15. Breeding objectives, methods of breeding and achievements in Pomegranate.
16. Breeding objectives, methods of breeding and achievements in Aonla and custard apple.
17. **Mid semester examination**
18. Breeding objectives, methods of breeding and achievements in Ber.
19. Breeding objectives, methods of breeding and achievements in Jamun.
20. Breeding objectives, methods of breeding and achievements in Litchi.
21. Breeding objectives, methods of breeding and achievements in Apple.
22. Breeding objectives, methods of breeding and achievements in Peach.
23. Breeding objectives, methods of breeding and achievements in Pear and Plum.
24. Breeding objectives, methods of breeding and achievements in Strawberry and Apricot.
25. Breeding objectives, methods of breeding and achievements in Walnut and Pistachio nut.
26. Origin, importance, historical perspectives, approaches and challenges in improvement of plantation crops.
27. Breeding objectives, methods of breeding and achievements in Tea.
28. Breeding objectives, methods of breeding and achievements in Coffee.
29. Breeding objectives, methods of breeding and achievements in Cashew.
30. Breeding objectives, methods of breeding and achievements in CoCoa.
31. Breeding objectives, methods of breeding and achievements in Arecanut.
32. Breeding objectives, methods of breeding and achievements in coconut.
33. Breeding objectives, methods of breeding and achievements in oil palm & rubber.
34. In vitro breeding tools and achievements in plantation crops.

Practical Schedule

1. Floral biology, selfing and crossing technique in Mango & Banana.
2. Floral biology, selfing and crossing technique in Grapes & Citrus.
3. Floral biology selfing and crossing technique in Papaya & Pineapple.
4. Floral biology, selfing and crossing technique in Sapota and Apple.
5. Floral biology, selfing and crossing technique in Custard apple, Aonla and Ber.
6. Floral biology, selfing and crossing technique in Litchi, Pomegranate and Jamun.
7. Floral biology, selfing and crossing technique in Apple and Plum.
8. Floral biology, selfing and crossing technique in Pear and Peach.
9. Floral biology, selfing and crossing technique in Apricot and Strawberry.
10. Floral biology, selfing and crossing technique in coconut, arecanut.
11. Floral biology, selfing and crossing technique in coffee , tea and rubber.
12. Floral biology, selfing and crossing technique in cashew and cococa.
13. Hybrid seed germination; raising and evaluation of segregating populations.
14. Working out variability, heritability and Genetic advance.
15. Working out different types of heterosis.
16. Preparation and use of physical and chemical mutagens.
17. **Final Practical examination**

Course Outcomes

- CO 1** - The students will be able to get knowledge on the history and basics of plant breeding.
- CO 2** - The students will be able to get knowledge on the importance of plant breeding.

CO 3 - The student will be able to understand the breeding objectives, strategies and outcome of fruit and plantation crops.

CO 4 - The students will gain skill in hybridization techniques.

CO 5 - The students acquaint knowledge on the achievements made in the improvement of fruit and plantation crop.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	2	2	1	0
CO 2	3	0	2	2	1	0
CO 3	3	0	2	2	1	0
CO 4	3	0	2	2	1	0
CO 5	3	0	2	2	1	0

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HOR 209 ORCHARD AND ESTATE MANAGEMENT (1+1)

Learning Objectives

- This course aims to impart the importance of orchard and estate to students.
- To impart basic knowledge in the various management practices of orchard.
- To acquire knowledge on rejuvenation of orchards and resource utilization.
- To impart knowledge on crop model and crop regulation in relation to cropping systems.
- To acquaint advanced technologies in orchard and estate management.

Theory

Unit I: Orchard management

Orchard and estate management-importance and objectives- cultivation methods and their merits and demerits.

Unit II: Mulching and cropping systems

Clean cultivation- sod culture - Sod mulch- herbicides - inorganic and organic mulches- Tropical, subtropical and temperate horticultural systems- competitive and complimentary effect of root and shoot systems.

Unit III: Irrigation and soil management

Biological efficiency of cropping systems in horticulture- systems of irrigation-Soilmanagement in relation to nutrient and water uptake and their effect on soil environment,moisture, organisms and soil properties.

Unit IV Unfruitfulness, rejuvenation of orchards and resource utilisation

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

Unit V Crop model and crop regulation

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

Practical

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

Lesson Plan

Theory Schedule

1. Definition of orchard - Objectives of orchard management - Importance of orchardmanagement - merits and demerits - Methods of soil management.
2. Planning - Layout of orchard- Planting methods - Vertical Row planting- Alternate rowplanting- Planting distance- Planting season.
3. Clean cultivation -Sod culture - Characteristics of ideal sod - Methods of growing - Typesof sod culture - Sod pasture method - Sod mulch method -Temporary sod - Merits and Demerits.
4. Weed management in orchard - Cultural (mechanical) methods - Biological methods - Chemical methods - Guidelines for using herbicides in orchard - Herbicides used for weed control.
5. Mulching in orchard - Definition of mulch and mulching - Objectives of mulching -Types ofmulches - Organic mulches - Garden compost - Peat - Leaves and leaf mould - Straw andHay - Saw dust and Wood chopping - Husk - Flax - Hop waste -Pine needles - News paperand Card board - Inorganic mulches - Plastic mulch -Clear and black plastic mulch - Coloured plastic mulches - Dust mulches - Gravel - Stones - Sand - Merits and Demeritsof Mulching.
6. Cropping Systems - Tropical and subtropical Horticultural Systems - Mono cropping - Multiple cropping - Inter cropping - Factors determining choice of inter crop - Mixedcropping - Ratoon cropping - Multi storey or Multitier cropping -Temperate HorticulturalSystems - Medium High density planting - Optimum high density planting viz., - Taturatrellis - Pyramid system Cordon system - Curtain system - Hedge row system - Ultra HighDensity planting viz., Meadow orchard - Mechanized system - Intensive system.
7. Plant Interaction - Types of Interactions in cropping systems - Competitive interaction - above ground and below ground - Complimentary Interactions- Annidation in space andtimeAllelopathy and its effects.
8. Soil Management in relation to soil organisms - Ploughing and tillage - Continuouscultivation - crop rotation - Irrigation - Liming - Gypsum - Fertilizers and manures- Oilcakes - Soil Aggregation.

9. Mid semester examination

10. Soil management in relation to Nutrient uptake - Soil physical conditions - Soil Fertility - Soil reaction - Climatic factors - Crop factors - Soil management in relation to wateruptake- Soil water - Factors influencing infiltration - Soil properties -Tillage - Intercultivation - Soil management on soil environment - Soil temperature and plant growth.
11. Systems of Irrigation - Surface systems - Flooding - Check or bed method - Furrowmethod - Border method - Basin method - Ring method - Drip (surface) method - Pitchermethod - Pipe method - Soil sloping method - Merits and Demerits. Sub surface systems -Straight trench method - Cross trench method - Circular trench method - Perforatedpipeline method - Trench drip method - Buried drip method - Merits and Demerits OverHead System - Sprinkler system of irrigation - Different types and mechanism- Merits andDemerits.
12. Integrated Nutrient Management (INM) - Concept - Need for INM - Components of INM -- Mineral fertilizer - Organic sources - Biological sources - Merits of INM -Method ofapplication of fertilizers in orchards - Surface application - Trench application - Foliarapplication - Fertigation and integrated pest management.
13. Rejuvenation of old orchard, top working, and frame working - Utilization of resourcesconstraints in existing systems.
14. Pollination and fruit set problems -Self and Cross pollination - Definitions of fruit setting - Fruit fullness - Fertility - Self fertility - Self sterile - Cross unfruitful - Pollinator - Polliniser- Causes of unfruitfulness - Internal factors- External factors.
15. Climate aberration and mitigation measures of horticultural crops - Crop regulations inrelation to cropping systems - Crop regulation in pine apple - fig - Aonla
16. Bahartreatment - Citrus - Guava - Pomegranate.
17. Crop models in horticulture crops and canopy management in Mango - Apple - Plum - Pear - Peach - Guava.

Practical Schedule

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

Course Outcomes

CO 1 - The students will be able to understand importance of orchard and estate.

CO 2 - Students can demonstrate advanced management practices in orchard.

CO 3 - The students will gain knowledge on crop model and crop regulation in relation to cropping systems.

CO 4 - Students can demonstrate irrigation and soil management practices.

CO 5 - Students can demonstrate rejuvenation of old orchard.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	2	1	2	1	0
CO 2	3	1	1	1	2	0
CO 3	2	1	2	1	1	0
CO 4	1	3	3	3	2	0
CO 5	1	1	2	2	3	0

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AGR 201 INTRODUCTION TO MAJOR FIELD CROPS (1+1)

Learning Objectives

- To impart updated technology and skills in performing different operations in raising major field crops.
- By the end of the course, the students will be, Able to know the statistics of different crops at different levels and also learn constraints for low production in India and Tamil Nadu
- To understand the effect of climate, soil and varieties, Able to understand the concepts of integrated weed control, integrated nutrient management and conjunctive use of water.
- To know cropping systems in India and state, post-harvest operations in different crops.
- To learn about seed production, Farm Mechanization and resource conservation technology.

Theory

Classification and distribution of field crops, origin, economic importance, soil and climatic requirements, varieties, cultural practices multiple cropping, mixed cropping, intercropping,

relay and alley cropping for major cereals, millets, pulses, oil seeds, fibre crops, sugar crops, fodder and green manure crops and yield.

Unit I: Agronomy of cereals and millets

Cereals- Rice, wheat, maize. Millets- sorghum, pearl millet, finger millet and minor millets.

Unit II: Agronomy of pulses and oilseeds

Pulses- Blackgram, greengram, redgram, bengalgram. Oilseeds- groundnut, gingelly, sunflower, rapeseed and mustard

Unit III: Agronomy of fibre and sugar crops

Fibre crops- Cotton, jute. Sugar crops;- sugarcane, sugar beet and sweet sorghum.

Unit IV: Agronomy of fodder crops

Fodder sorghum, fodder maize, cowpea, horse gram, cluster bean, stylosanthes, lucerne, elephant grass and Napier. Post-harvest management practices and by products utilization of forage crops.

Unit V: Agronomy of green manure crops

Daincha, sunnhemp, sesbania, kolingi, glyricidia, subabul, pungam, poovarasu and neem. Insitu incorporation of green manures and green leaf manures. Current stream of thoughts.

Practical

Identification of crops and crop varieties – nursery preparation, main field preparation for field crops – seed treatment techniques. Sowing and manuring – seeding implements – Estimation of plant population – study of growth and yield attributes, sowing. Harvesting and yield estimation of field crops – cost of cultivation. Practical training of farm operations in raising fodder crops, Hay and silage making.

Lesson Plan

Theory Schedule

1. Introduction – importance of cereals, millets, pulses and oilseeds.
2. Introduction – importance of fibre crops, sugar crops, fodder and green manure crops.
3. Area, production and productivity of major cereals, millets, pulses, oilseeds, fibre crops, sugar crops of India and Tamil Nadu.
4. Rice, wheat, maize- origin – geographic distribution – economic importance – varieties – soil and climatic requirement, cultural practices and yield.
5. Sorghum, pearl millet, finger millet and minor millets- origin – geographic distribution – economic importance – varieties – soil and climatic requirement, cultural practices and yield.
6. Blackgram, greengram, redgram, bengalgram- origin – geographic distribution – economic importance – varieties – soil and climatic requirement, cultural practices and yield.
7. Groundnut, gingelly, sunflower, rapeseed and mustard – origin- geographic distribution – economic importance – varieties – soil and climatic requirement, cultural practices and yield.
8. Cotton, jute - origin- geographic distribution – economic importance – varieties – soil and climatic requirement, cultural practices and yield.
9. **Mid semester examination**
10. Sugarcane, sugar beet and sweet sorghum -origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
11. Definitions and concept of multiple cropping, mixed cropping, intercropping, relay and alley cropping of major field crops

12. Fodder sorghum, fodder maize, cowpea, horse gram, cluster bean- origin- geographic distribution - economic importance - varieties - soil and climatic requirement, cultural practices and yield.
13. Stylosanthes, lucerne, elephant grass and napier. - origin- geographic distribution - economic importance - varieties - soil and climatic requirement, cultural practices and yield.
14. Post-harvest management practices and by products utilization of forage crops.
15. Daincha, sunnhemp, sesbania, wild indigo- origin- geographic distribution - economic importance - varieties - soil and climatic requirement and cultural practices
16. Glyricidia, subabul, pungam, poovarasu and neem - origin- geographic distribution - economic importance- soil and climatic requirement and cultural practices
17. Insitu incorporation of green manures and green leaf manures and current stream of thoughts.

Practical Schedule

1. Identification of cereals, millets, pulses, oilseeds, fibre crops, sugar crops and forage crops in the crop cafeteria.
2. Practicing various types of nursery and main field preparation for the rice crop.
3. Nursery and main field preparation for important millets and red gram.
4. Nursery preparation and methods of planting for sugarcane
5. Acquiring skill in different seed treatment techniques for major field crops.
6. Field preparation and sowing of major field crops.
7. Estimation of plant population and seed rate requirement for major field crops.
8. Working out fertilizer requirement and fertilizer management for major field crops.
9. Observations on growth and yield parameters of major field crops.
10. After cultivation practices for major field crops.
11. Working out cost of cultivation for major crops.
12. Estimation of yield components and yield of major field crops.
13. Identification of green manures and green leaf manures and practicing incorporation methods.
14. Silage and hay making - quality and preservation of fodder.
15. Visit to farmer's field.
16. Visit to research stations to study the cultivation techniques of major field crops.
17. **Final Practical examination.**

Course outcomes:

CO 1: To understand the importance of food grain requirement and cultivation of major cereal and Pulse crops.

CO 2: To gain knowledge about importance of oil seeds, sugar crops and its cultivation practices.

CO 3: To gain knowledge about importance of fibre crops and its cultivation practices.

CO 4: To construct idea regarding knowledge on growing of legume and perennial fodders and its preservation

CO 5: To create awareness about role of green manures in soil fertility.

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	2
CO2	2	-	-	-	-	2

CO3	2	2	2	-	-	2
CO4	2	2	2	-	2	2
CO5	2	-	-	-	2	-

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AGR 202 INTRODUCTORY AGROFORESTRY 2(1+1)

Learning Objectives

- To acquire knowledge on the basic aspect of Forestry.
- To conceptualize the importance of forests and Agro forestry system.
- To impart knowledge on Agroforestry systems as an essential eco-friendly mechanism in productivity of agro-ecosystems.
- To learn about artificial regeneration and manmade forestry
- To learn about techniques of tree planting and its management.

Theory

Unit I: Forest and its importance

Forest- definitions of basic terms. Role and functions of forests. Forest classification- Social forestry, farm forestry, agro forestry, community forestry, industrial forestry and urban forestry, forest Influences. Status of Indian forests and role in India farming systems.

Unit II: Forest regeneration

Forest regeneration- objectives- natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers. Artificial regeneration-Man made plantations. Factors determining regeneration. Nursery technique. Forest plantation. Tending operations - weeding, cleaning, thinning - mechanical, ordinary, crown and advance thinning.

Unit III: Forest mensuration

Forest mensuration- objectives, diameter measurement, instruments used in diameter measurement. Non instrumental methods of height measurement - shadow and single pole method. Instrumental methods of height measurement - geometric and trigonometric principles. Instruments used in height measurement. Measurement of tree diameter, tree height, age and growth rate and tree stand.

Unit IV: Agroforestry

Agroforestry- concept, definitions, importance, benefits, limitations. Criteria of selection of trees in Agroforestry. Planning for agroforestry – constraints, diagnosis and design methodology, selection of tree crop species for agro-forestry. Agroforestry system, subsystem and practice: agri-silviculture, silvipastoral, horti-silviculture, horti-silvipastoral, shifting cultivation, taungya, home gardens, alley cropping, intercropping, wind breaks and shelterbelts.

Unit V: Silviculture

Silviculture- definition, objectives. Plant classification – Crown, stem, roots locality, Plant succession- Cultivation practices for importance trees. Silviculture practices for important fast growing tree species of the region. TBO's, MPTS and NFTS- Ailanthus, Neem, Pungam, Prosopis, Casuarina, Silk cotton, Bamboo and Acacias and Current stream of thoughts.

Practical

Identification of trees-Seeds and seedlings of important agroforestry species-Seed treatments - Forest nursery-types-Layout-bed preparation-Nursery technology of important tree species- Forest mensuration- Visit and study of different agroforestry systems- Biomass estimation in Energy plantations- Economics- Forest plantations and their management- Visit to forest training college- Visits of nearby forest based industries.

Lesson Plan

Theory Schedule

1. Introduction- Introduction to Indian forest, target area, productivity - Definitions of basic terms related to forestry – Role, functions and scope of forestry.
2. Classification of forest- Social forestry, Community forestry, Extension forestry, Farm forestry, Industrial forestry and urban forestry.
3. Status of Indian forests and role in India farming systems. .
4. National Forest Policies including Agro forestry policies.
5. Forest regeneration- Natural and Artificial Regeneration methods- seed and vegetative parts.
6. Artificial regeneration- man made plantations -coppicing, pollarding, root suckers choice between natural, essential preliminary considerations.
7. Nursery management practices in forestry.
8. Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning.
9. **Mid – semester examination.**
10. Forest mensuration- Objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method- Instrumental methods of height measurement.
11. Geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees.
12. Agroforestry-concept - definitions, importance, benefits, limitations -criteria of selection of trees in Agroforestry
13. Planning for agroforestry – constraints, diagnosis and design methodology.
14. Selection of tree crop species for agroforestry
15. Agroforestry system, subsystem and practice: agri-silviculture, silvipastoral, horti-silviculture, horti-silvipastoral, shifting cultivation, taungya, home gardens, alley cropping, intercropping, wind breaks and shelterbelts.

16. Silviculture- definition- objectives- cultivation practices for important trees TBO's, MPTS and NPTS.
17. Silvicultural practices for Ailanthus, Neem, Pungam, Prosopis, Casuarina, Silk cotton, Bamboo and Acacias and Current stream of thoughts.

Practical Schedule

1. Identification of tree species suitable for Timber, Fuel wood and Fodder
2. Identification of tree species suitable for Roadside plantation, Field bunds, Windbreaks and for Wastelands
3. Identification of Minor forest tree species, trees for Beautification purpose and Nitrogen fixing tree species and other species suitable for Agroforestry
4. Identification of seeds of important tree species
5. Collection, Extraction and Storage of tree seeds
6. Collection, Extraction and Storage of tree seeds
7. Application of Pre-sowing Seed Treatment to tree seeds
8. Nursery, types, importance of nursery and criteria for nursery site selection.
9. Nursery methods for important silviculture tree species - Mother bed - raised bed and sunken bed
10. Biomass estimation in Energy plantations.
11. Cost of cultivation of Commercial trees.
12. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees
13. Height measurement of standing trees by Shadow method, Single pole method and Hypsometer.
14. Volume measurement of logs using various formulae.
15. Forest plantations and their management.
16. Visits of nearby forest based industries.
17. **Final Practical examination.**

Course outcomes:

- CO 1: Students can learn about the basic aspects of Forestry.
- CO 2: Students can understand the importance of forests and Agro forestry system.
- CO 3: Students acquire knowledge about the minor forest products.
- CO 4: Students can learn about the aging of tree species.
- CO 5: Students learn about techniques of tree planting and its management.

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	3	2	1
CO2	2	2	3	-	3	-
CO3	2	3	3	-	2	2
CO4	2	1	3	-	1	2
CO5	3	3	2	3	2	2

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SAC 202 SOIL, WATER AND PLANT ANALYSIS 2(1+1)

Learning Objectives

- To develop basic understanding regarding soil testing in the students.
- To introduce them with macro and micro nutrients for soil. .
- To interpret chemical results for soil fertility management.
- Understand soil chemical processes of each plant nutrient.
- Choose analytical methods and maintain laboratory quality control.

Theory

Unit I: Analysis techniques

Methods of soil and plant sampling and processing for analysis. Leaf analysis standards, index tissue, interpretation of leaf analysis values Rapid tissue tests for soil and plant. Chemical and mineral composition of horticultural crops

Unit II: Soil air movement

Characterization of hydraulic mobility - diffusion and mass flow. Renewal of gases in soil and their abundance. Methods of estimation of oxygen diffusion rate and redox potential.

Unit III: Soil constraints

Saline, alkali, acid, waterlogged and sandy soils, their appraisal and management. Soil micro-organisms and their importance.

Unit IV: Radiotracer techniques

Use of radio tracer techniques in soil fertility evaluation, Radio tracer technology application in plant nutrient studies

Unit V: Appraisal of irrigation water and Pollution

Quality of irrigation water, Management of poor quality. Current stream of thoughts

Lesson Plan

Theory Schedule

1. Soil sampling, importance, methods of sampling and processing of soil samples.
2. Chemical and mineral composition of important horticultural crops
3. Soil air and its composition. Gaseous exchange and measurement of ODR
4. Plant sampling, importance, methods of sampling and processing of plant samples.
5. Leaf analysis, standards and index tissues of different crops and interpretation of leaf analytical values.
6. Principles and measurement of pH, EC and redox potential

7. Principle and operation of spectrophotometer and Flame photometer
 8. **Mid-semester examination**
 9. Principle and operation of Atomic Absorption Spectrophotometer
 10. Genesis, characterization and management of saline, sodic soils and acid soils
 11. Soil physical constrains, excessive and slow permeable soils, surface crusting and sub surface hard pan and their management.
 12. Genesis, characterization and management of water logged soils. Soil microorganisms and their importance
 13. Use of radio tracer techniques in soil fertility evaluation.
 14. Radio tracer technology application in plant nutrient studies
 15. Quality of irrigation waters, criteria and parameters used for judgement
 16. Classifications of irrigation water and management of poor quality irrigation waters.
- Current stream of thoughts

Practical Schedule

1. Introduction to analytical chemistry-Preparation of standard solution of different concentration and types of titration
2. Collection and preparation of soil, water and plant samples for analysis.
3. Determination of pH and electrical conductivity in soils
4. Estimation of Total nitrogen in plant
5. Estimation of Total phosphorus in plants
6. Estimation of Total potassium in plants
7. Estimation of secondary nutrients (Ca, Mg and S) in plants
8. Estimation of Total micronutrients in plants
9. Determination of pH and EC in irrigation water samples,
10. Determination of Carbonates and bicarbonates in irrigation water
11. Determination of Calcium and Magnesium in irrigation water.
12. Determination of Sodium, Potassium in irrigation water
13. Determination of Chlorine and Boron in irrigation water.
14. Interpretation of irrigation water quality indices
15. Determination of CEC in soil
16. Determination of sodium adsorption ratio and exchangeable sodium percentage of soils.
17. **Final Practical examination**

Course Outcomes

CO1: Students will distinguish the main characteristics for describing soils and plants, and conduct basic soil and plant analyses

CO2: Students will apply their knowledge to interpret measurements in terms of agricultural applications

CO3: Students will appreciate the diversity and interdependence of soils and plants

CO4: Students will understand that soil and plant characteristics are dynamic and unique to a particular sample at a given time

CO5: Students will understand the importance of radiotracer technique in soil and plant analysis, besides in soil fertility evaluation

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	-	-	-	1
CO2	1	1	1	1	1	-

CO3	1	2	-	1	1	-
CO4	1	1	-	1	1	-
CO5	1	1	1	-	-	1

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ENT 202 INSECT PESTS OF FRUITS, PLANTATIONS, MEDICINAL AND AROMATIC CROPS (2+1)

Learning Objectives

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

Theory

Bioecology, distribution, pest surveillance, symptoms of injury, host range, and integrated management strategies for Insects, Mites and Nematode pests of the following crops:

Unit I: 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 II: Pests of temperate fruit Crops

Apple, Pear, Peach, Plum, Strawberry, Kiwi, Sweet and Sour cherry, Apricot, Raspberry, Persimmon and Currants

Unit III: Pests of Plantation Crops

Coconut, Arecanut, oil palm, Tea, Coffee, Cashew, Cocoa, Cinchona, Rubber

Unit IV: Pests of Medicinal and Aromatic Plants

Phyllanthus, Aswagantha, Vasaka, Senna, Periwinkle, Ocimum, Mint, Lemon grass, Citronella, Vetiver, Betel vine, Senna, Neem, Belladonna, Pyrethrum, Costus, Crotalaria, Datura, Dioscorea, Mint, Opium, *Solanum khasianum*, Ageratum, Allium, Centella, Crocus, Curcuma,

Mentha, Myristica, Nigella, Plumbago, Rosmarinus

Unit V: Pests of Storage materials and Insecticide residue

Insect pests on stored fruits, plantation, medicinal and aromatic crops and their processed products. Insecticide residue - problems in fruit, plantation, medicinal and aromatic crops, maximum residue limits (MRLs).

Practical

Identification of symptoms of damage and life stages of important Insects, Mites and Nematode pests of different horticultural crops: fruits, plantations, medicinal and aromatic crops, storage materials.

Lesson Plan

Theory Schedule

1. Pests of Mango
2. Pests of Citrus
3. Pests of Banana
4. Pests of Guava
5. Pests of Grapevine and Ber
6. Pests of Sapota
7. Pests of Papaya and Avocado
8. Pests of Mangosteen, durian
9. Pests of Fig and Hill banana
10. Pests of Pomegranate
11. Pests of Aonla and Pine apple
12. Pests of Custard apple, Wood apple and Jamun
13. Pests of Jack
14. Pests of Bread fruit, Passion fruit and Litchi
15. Pests of Apple
16. Pests of Pear, Peach, Plum
- 17. Mid Semester Examination**
18. Pests of Strawberry and Kiwi
19. Pests of Sweet and Sour cherry and Apricot
20. Pests of Raspberry, Persimmon and Currants.
21. Pests of Coconut
22. Pests of Arecanut and Oil Palm
23. Pests of Tea
24. Pests of Coffee
25. Pests of Cashew
26. Pests of Cocoa, Cinchona and Rubber
27. Pests of Gloriosa, Coleus and Phyllanthus, Aswagantha, Vasaka and Senna
28. Pests of Periwinkle, Ocimum, Mint, Opium, *Solanum*, *Ageratum*, *Allium*,
29. Pests of Centella, Crocus, Curcuma, Mentha, Myristica, Nigella, Plumbago, Rosmarinus
30. Pests of Stored fruits and plantation products
31. Pests of Stored medicinal and aromatic plants
32. Pests of Processed products of fruits and plantation, medicinal and aromatic plants.
33. Insecticide residue problems in fruit, plantation, medicinal and aromatic crops
34. Maximum residue limits (MRLs)

Practical Schedule

1. Identification of Pests of Mango, Citrus
2. Identification of Pests of Guava and Banana
3. Identification of Pests of Grapevine, Ber, Sapota and Papaya
4. Identification of Pests of Avocado, Mangosteen, Durian, fig, Hill banana
5. Identification of Pests of Pomegranate, Aonla, Pine apple, Custard apple and Wood apple
6. Identification of Pests of Jamun, Jack, Bread fruit, Passion fruit
7. Identification of Pests of Litchi, Apple, Pear, Peach, Plum and Strawberry
8. Identification of Pests of Kiwi, Sweet and Sour cherry, Apricot, Raspberry, Persimmon and Currants
9. Identification of Pests of Coconut, Arecanut and Palmyrah
10. Identification of Pests of Tea, Coffee
11. Identification of Pests of Cashew, Cocoa and Rubber
12. Identification of Pests of Gloriosa, Coleus, Phyllanthus, Aswagantha, Vasaka, Senna, Periwinkle, Ocimum, Mint, Lemon grass, Citronella and Vetiver
13. Identification of Pests of Betel vine, Senna, Neem, Belladonna, Pyrethrum, Costus, Crotalaria, Datura, Dioscorea, Mint, Opium,
14. Identification of Pests of *Solanum khasianum*, Ageratum, Allium, Centella, Crocus, Curcuma, Mentha, Myristica, Nigella, Plumbago, Rosmarinus
15. Identification of Pests of stored fruits, plantation
16. Identification of Pests of medicinal and aromatic crops and their processed products.
17. **Final practical examination.**

Assignment:

- Collection and submission of at least 30 insect pests of fruits, plantations, medicinal and aromatic crops
- Rearing of at least 20 insect pests of fruits, plantations, medicinal and aromatic crops

Course Outcomes

CO1: Define bionomics, symptoms of damage and integrated management strategies for pests of tropical fruit crops

CO2: Discuss bionomics, symptoms of damage and integrated management strategies for pests of temperate fruit crops

CO3: Explain bionomics, symptoms of damage and integrated management strategies for pests of Plantation Crops

CO4: Define bionomics, symptoms of damage and integrated management strategies for pests of medicinal and aromatic plants

CO5: Discuss bionomics, symptoms of damage and integrated management strategies for pests of Stored fruits, plantation, medicinal and aromatic crops

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	2	3	3
CO 2	3	3	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	3	3	3	2	3	3
CO 5	3	3	3	2	3	3

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PAT 202 NEMATODE PESTS OF HORTICULTURAL CROPS AND THEIR MANAGEMENT 2(1+1)

Learning Objectives

- To learn about the elements, history and economic importance of nematodes in crops,
- To acquire knowledge of the morphology, taxonomy, classification of nematodes.
- To study the symptomatology and control of important plant parasitic nematodes of fruit crops
- To learn the symptomatology and control of nematodes of vegetables, tuber, ornamental, spice and plantation crops
- To acquaint with the role of nematodes in plant disease complex and their integrated management.

Theory

Unit I

History and development of nematology - definition, economic importance

Unit II

General characters of plant parasitic nematodes, their morphology, taxonomy, classification.

Unit III

Nematode biology, symptomatology and control of important plant parasitic nematodes of fruits (tropical, sub-tropical and temperate)

Unit IV

Symptomatology and control of important plant parasitic nematodes of vegetables, tuber, ornamental, spice and plantation crops

Unit V

Role of nematodes in plant disease complex. Integrated nematode management.

Lesson Plan

Theory Schedule

1. History of nematology
2. Development of nematology

3. Definition and economic importance of nematology
4. General characters of plant parasitic nematodes
5. Morphology nematodes
6. Taxonomy nematodes
7. Classification nematodes
8. Biology of nematode
- 9. Mid semester examination**
10. Symptoms and management of important plant parasitic nematodes of tropical fruits
11. Symptoms and management of important plant parasitic nematodes of sub tropical fruits
12. Symptoms and management of plant parasitic nematodes of temperate fruits
13. Symptoms and management of plant parasitic nematodes of vegetables and tuber crops
14. Symptoms and management of plant parasitic nematodes of ornamental, spice and plantation crops
15. Role of nematodes in plant disease complex
16. Integrated nematode management
17. Integrated nematode management

Practical Schedule

1. Common symptoms of nematodes infection in plants
2. Sampling methods of nematodes
3. Sampling methods of nematodes
4. Extraction of nematodes from soil
5. Field visit
6. Extraction of nematodes from plant parts
7. Preparation of temporary nematode mounts
8. Preparation of permanent nematode mounts
9. Preparation of permanent nematode mounts
10. Role of nematodes in plant disease complex
11. Nematicides and their uses
12. Nematicides and their uses
13. Field visit
14. Examination of different life stages important plant parasitic nematodes
15. Examination of different life stages important plant parasitic nematodes
16. Principles and practices of nematode management
17. Record certification

Course Outcomes

CO1: Acquainted with the history and economic importance of nematology

CO2: Having updated knowledge in general characters and classification of nematodes

CO3: Having expertise in symptomatology and control of nematodes of fruit crops

CO4: Having expertise in symptomatology and control of nematodes of vegetables, tuber, ornamental, spice and plantation crops

CO5: Acquainted with the role of nematodes in plant disease complex and their integrated management

CO - PO Mapping Matrix

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

CO3	2	3	-	-	1	-
CO4	2	3	-	-	1	-
CO5	2	3	-	-	1	-

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AGM 202 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT (2+1)

Learning Objectives

1. Students will develop knowledge about the environment and ecology.
2. Students will develop positive attitude of Concern for the surrounding.
3. Student will acquire potential role on the microorganisms employed in Bioremediation.
4. Students will acquire technology about solid waste management
5. Students will aware about current scenario of disaster Management.

Theory

Unit I: Ecology- Ecosystem Components

Ecology - Ecosystem - components - Biosphere - Lithosphere - Hydrosphere- Atmosphere - Terrestrial Biomes - Energy flow - Food chain - Food web - Ecological - Pyramids. Adaptation - Structural - Physiological - Colonization - Succession - Climax community.

Unit II: Natural Resource and Biodiversity

Natural resources - Forest - Minerals - Energy Resources - Renewable - Non-renewable - Sustainable Management and Conservations - Biodiversity - Importance - Hot spots - Threats - in situ - Ex situ - Conservation Biosphere Reserve - National parks and wild life Sanctuaries - Botanical garden.

Unit III: Pollution Management

Sources and types of Pollution - Impact and control Measures of soil, Water and air Pollution - Noise Pollution - Radioactive pollution - Heavy metal pollution. Types of Waste - Characteristics and Environmental impact - Solid waste Management techniques - Physical, Chemical and biological methods - Standards for waste water disposal.

Unit IV: Global Treaties Environmental Laws

Global treaties – Conventions – National and state level organization – Tamil Nadu Pollution control Board (TNPCB) – Central Pollution Control Board (CPCB) – Environmental impact Assessment (EIA) Environmental laws and Acts -- Role of Information technology on Environment.

Unit V: Disaster Management

Natural Disasters – Meaning and nature of natural disasters, their types & effects, flood, drought, cyclone, earth quakes, land slide and Volcanic eruption , Climate change – Global Warming Sea level rise , Ozone depletion, Man - made disasters – Nuclear disasters, Chemical disasters, biological disasters, building fire , Coal fire , Forest fire , Oil fire - Management (Mgt) effect to migrate natural International Strategies for disaster at National & Global levels, International strategies for disaster reduction Armed forces in disasters response, police and other organisation. Current stream of thoughts

Practical

Environmental sample 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 wastes water irrigation – Biogas production from Wastes – Suspended particulate Matter (SPM) assessment in the ambient air – Field Visit to sewage Water treatment Plant and Pollution Control Boards- Isolation of microorganisms from Tsunami affected soil -Assessment of microorganisms in industrial air Zone - Sample collection and preservation from contaminated sites

Lesson Plan

Theory Schedule

1. Ecology- Environment- Ecosystem and its components
2. Terrestrial biomes
3. Lithosphere- Hydrosphere-Atmosphere
4. Energy flow-Food chain- Food web and Ecological pyramids
5. Adaptation- Structural- Physiological
6. Succession- Climax Community
7. Natural and Energy resource, Forest minerals
8. Energy resources- Renewable and Non-renewable
9. Sustainable management and conservation of natural resource
10. Biodiversity types, Nation and global status, importance
11. Hot spots and Threats
12. Conservation of Biodiversity -in situ and ex-situ – Biosphere Reserves- National parks wildlife sanctuaries, botanical gardens.
13. Environmental pollution- types, sources and management
14. Soil pollution- sources, effects fate of soil pollutants management, water pollution- sources and types of waste water.
15. Waste water impact on ecosystem – Eutrophication. Air pollution sources, effects and control measures.
16. Noise pollution- sources, effects and control measures. Radioactive, heavy metal pollution.
17. **Mid-semester Examination**

18. Types of waste, solid waste management technique- physical methods, chemical methods and biological methods.
19. Composting and vermicomposting, waste water treatment methods. Physical, chemical and biological methods.
20. Assessment of microorganisms in industrial air Zone.
21. Sample collection and preservation from contaminated sites.
22. Visit to water treatment plant.
23. Global treaties and convention for Environmental protection
24. National & state level organizations CPCB, TNPSB, etc.
25. Environmental impact assessment stage and monitoring.
26. Environmental Laws and Acts
27. Role of information technology on Environment.
28. Natural Disasters – Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat & Cold Waves.
29. Climatic change: global warming, sea level rise, ozone depletion.
30. Man- made Disasters: Nuclear disasters, chemical disasters, biological disasters building fire, coal fire, forest fire, oil fire.
31. Disaster management: Concept, Effect to migrate natural disaster at national & global levels.
32. International strategy for disaster reduction.
33. National disaster management frame work.
34. Armed forces in disaster response police and other organizations.

Practical Schedule

1. Estimation of microbial communities in Irrigation and Polluted water samples.
2. Estimation of Oligotrophic bacteria.
3. Characterisation of waste water.
4. Estimation of dissolved oxygen in water (DO).
5. Estimation of biological oxygen demand (BOD).
6. Estimation of chemical oxygen demand (COD).
7. Detection of *E.coli* in water samples.
8. Assessment of microorganisms in air.
9. Impact of air pollution on phyllosphere microflora.
10. Solid waste management- Decomposition of cellulose.
11. Solid waste management- Vermicomposting.
12. Biogas production from organic waste.
13. Isolation of microorganisms from Tsunami affected soil.
14. Assessment of microorganisms in industrial air zone.
15. Sample collection and preservation from contaminated sites.
16. Visit to water treatment plant.

17. Final Practical Examination

Course Outcomes

- CO 1: The students gained basic understanding different ecosystem concepts, Biomes energy flow, food web and interaction.
- CO2: The students gained knowledge on the natural resource like renewable and non-renewable, Biodiversity concept and conservation etc.

CO3: The students would expose knowledge on management of different types of pollutions types of waste and management of solid waste their impact on environment and agriculture.

CO4: The students would be exposed to the laws and acts in forest with respect to environment.

CO5: The students gained knowledge about Disaster management,

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5
CO1	2	1	1	-	1
CO2	2	2	1	2	3
CO3	1	2	3	2	2
CO4	-	2	2	1	2
CO5	2	1	2	1	2

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HOR 301 COMMERCIAL FLORICULTURE 3(2+1)

Learning Objectives

- To acquaint knowledge on importance of floriculture industry.
- To impart basic knowledge on principles of growing commercial flowers.
- To understand about production technology of cut flowers and loose flowers.
- To learn about production technology of foliage and flowering fillers.
- To acquaint advanced technologies in commercial floriculture.

Theory

Unit I: Importance of Commercial Floriculture

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 - Protected structures - controlled environmental conditions such as - glass house, plastic house etc.,- soil sterilization - factors influencing protected cultivation of cut flower production.

Unit II: Production technology of rose, chrysanthemum, tuberose and China aster

Soil and climate - botany - species and varieties - propagation - principles and practices - planting systems and methods - inter cultivation - pinching, training and pruning practices -

nutrient and water management - role of growth regulators- harvest and yield of rose, chrysanthemum, tuberose and China aster.

Unit III: Production technology of jasmine, marigold and crossandra

Soil and climate - botany - species and varieties - propagation - principles and practices - planting systems and methods - inter cultivation - pinching, training and pruning practices- nutrient and water management - role of growth regulators- harvest and yield of jasmine, marigold and crossandra.

Unit IV: Production technology of orchid, carnation, anthurium and gerbera gladiolus, dahlia and bird of paradise

Soil and climate - botany - species and varieties - propagation - principles and practices - planting systems and methods - inter cultivation - pinching, training and pruning practices - nutrient and water management - role of growth regulators- harvest and yield of orchid, carnation, anthurium, gerbera, gladiolus, dahlia and bird of paradise.

Unit V: Production technology of foliage, flowering fillers and bulbous

Production techniques of flowering fillers and foliage filler materials-production techniques for bulbous -postharvest technology of cut flowers in respect of commercial flower crops - dehydration technique for drying of flowers.

Practical

Identification of commercially important floricultural crops - rose, jasmine, tuberose, crossandra, chrysanthemum, marigold, cut rose, carnation, gerbera, gladiolus, orchids and anthurium .Propagation practices in chrysanthemum, sowing of seeds and raising of seedlings of annuals. Propagation by cutting, layering, budding and grafting. Training and pruning of roses. Use of chemicals and other compounds for prolonging the vase life of cut flowers. Drying and preservation of flowers. Flower arrangement practices.

Lesson Plan

Theory Schedule

1. Scope and importance of commercial floriculture in India - area and production - export statistics
2. Industrial importance - floriculture industry in India and Tamil Nadu - institutions and developmental agencies involved in promotion of floriculture - TANFLORA, NHM, NHB, APEDA.
3. Cropping systems in flower crops- flower forcing - protected structures - controlled environmental conditions such as - glass house, plastic house etc.,
4. Soil sterilization - factors influencing protected cultivation of cut flower production.
5. Rose- importance and uses - origin and history - soil and climate - botany - species and varieties - propagation - principles and practices - planting systems and methods - inter cultivation - pinching, training and pruning practices.
6. Rose - nutrient and water management - role of growth regulators- harvest and yield.
7. Cut rose - protected cultivation - media -propagation - principles and practices - planting systems and methods - inter cultivation - pinching, training and pruning practices - nutrient and water management - role of growth regulators -Physiological disorders - harvest and yield - post harvest management.
8. Chrysanthemum - importance and uses - origin and history - area and production - botany - classification - soil - climate - species and varieties - propagation - season and planting - nutrition and irrigation - management practices

9. Chrysanthemum - role of growth regulators - pinching and disbudding - harvest and yield - Post harvest management.
10. Cut chrysanthemum - protected cultivation - soil sterilization - factors influencing protected cultivation - species and varieties - propagation - planting systems - pinching, disbudding, training and pruning practices - nutrient and water management - role of growth regulators - harvest and yield - post harvest management.
11. Tuberose - importance and uses - origin and history - distribution - area and production - botany - soil - climate - species and varieties - propagation - season and planting - nutrition and irrigation soil climate - management practices - nematode management - role of growth regulators - harvest and storage of corms - yield - post harvest management.
12. China aster - importance and uses - origin and history - distribution - area and production - botany soil - climate - species and varieties - propagation - season and planting - nutrition and irrigation - management practices - role of growth regulators - harvest and yield.
13. Jasmine - importance and uses - origin and history- soil and climate - botany - species and varieties - propagation - principles and practices - planting systems and methods.
14. Jasmine- inter cultivation - pinching, training and pruning practices- - nutrient and water management - role of growth regulators - concrete extraction - harvest and yield.
15. Marigold - importance and uses - origin and history - area and production - botany - species and varieties - propagation - season and planting - nutrition and irrigation - management practices - role of growth regulators - pinching and disbudding - harvest and yield.
16. Crossandra- Importance and uses - origin and history - distribution - area and production - botany - species and varieties - propagation - season and planting - nutrition and irrigation - management practices - role of growth regulators - nematode management - harvest and yield.
- 17. Mid semester examination**
18. Orchid - protected cultivation - factors influencing protected cultivation - media - species and varieties - flower structure - propagation - planting systems -- nutrient and water management - role of growth regulators - harvest and yield- post harvest management.
19. Carnation - protected cultivation - soil sterilization - factors influencing protected cultivation - species and varieties - propagation - planting systems - pinching, disbudding, training (Netting) and pruning practices
20. Carnation - nutrient and water management - physiological disorders - role of growth regulators - harvest and yield - post harvest management.
21. Anthurium - protected cultivation - factors influencing protected cultivation - media- species and varieties - propagation - planting systems - leaf pruning - nutrient and water management - role of growth regulators - harvest and yield - post harvest management.
22. Gerbera - importance and uses - origin and history - distribution - area and production - botany soil - climate - species and varieties - propagation - season and planting - nutrition and irrigation - management practices - physiological disorders - role of growth regulators- harvest and yield.
23. Gladiolus - importance and uses - origin and distribution - area and production - botany and varieties - propagation- season and planting - nutrition and irrigation - management practices - role of growth regulators - harvest and storage of corms - yield.

24. Dahlia - Importance and uses - origin and history - distribution - area and production - botany soil - climate - species and varieties - propagation - season and planting - nutrition and irrigation - management practices - role of growth regulators - harvest and yield.
25. Bird of paradise - importance and uses - origin and history - distribution - area and production - botany and varieties - media and climate - methods of propagation- nutrient management- - irrigation -- harvesting and yield - post harvest management - harvest and yield.
26. Flowering fillers- limonium and gypsophila importance and uses - origin and distribution - botany and varieties - propagation - planting.
27. Limonium and gypsophila - inter culture - harvesting and yield - post harvest management.
28. Foliage fillers - ivy and asparagus- importance and uses - origin and distribution - botany and varieties - propagation - planting.
29. Foliage and flowering fillers - inter culture - harvesting and yield - post harvest management.
30. Bulbous- importance and uses - origin and distribution - botany and varieties - propagation - planting.
31. Bulbous- inter culture - harvesting and yield - post harvest management.
32. Drying techniques of flowers.
33. Principles of dry flower arrangement.
34. Export potential of dry flowers.

Practical Schedule

1. Rose - identification and description of species, varieties - propagation and planting - pruning management.
2. Cut rose - identification and description of species, varieties - media - planting- training - pruning and other important intercultural practices.
3. Jasminum sp. - identification and description of species, varieties - propagation and planting - pruning management.
4. Tuberose and crossandra - identification, description of species, varieties, propagation and planting.
5. Chrysanthemum and - identification and description of species, varieties - propagation and planting.
6. Cut chrysanthemum- identification and description of species, varieties - media - planting - plant propagation - pinching and disbudding.
7. Marigold and China aster - identification, description of species, varieties, nursery raising and planting.
8. Visit to flower market and flower growing areas to get expertise in loose flowers and cut flowers.
9. Carnation - identification and description of species, varieties - media - planting - netting in carnation.
10. Gerbera - identification and description of species, varieties - media - planting - netting in carnation.
11. Gladiolus - identification and description of species, varieties - media - planting - plant propagation - pinching and disbudding in chrysanthemum.
12. Anthurium and orchids - identification and description of species, varieties - media preparation - planting.

13. Sowing and raising of annuals.
14. Use of chemicals and other compounds for prolonging the vase life of cut flowers.
15. Practice in drying and preservation of flowers.
16. Practicing flower arrangement
17. **Final practical examination**

Course Outcomes

CO 1 - The students will understand commercial floriculture industry and its importance.

CO 2 - The students will gain knowledge on loose flower.

CO 3 - The student will be able to practice production technology of cut flowers.

CO 4 -The students will understand the production technology of foliage, flowering fillers and bulbous plant.

CO 5 - The student will become eligible to manage a commercial floriculture unit.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	2	2	2	2	1
CO 2	3	2	2	2	2	0
CO 3	3	2	2	2	2	0
CO 4	3	2	2	2	2	0
CO 5	2	2	3	3	3	1

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HOR 302 PRECISION FARMING AND PROTECTED CULTIVATION 3(2+1)

Learning Objectives

- To acquaint basic concepts of precision horticulture
- To acquired knowledge on different precision farming techniques for horticultural crops
- To provide knowledge on basics in protected cultivation
- To provide better understanding on technologies of protected cultivation

- To acquaint technologies in precision and protected cultivation for vegetable and flower crops.

Theory

Unit I: Concepts in precision farming

Precision farming -definition, components and steps - laser leveling, mechanized direct seed sowing; seedling and sapling transplanting - mapping of soils and plant attributes - site specific input application, weed management, insect pests and disease management - yield mapping in horticultural crops.

Unit II: Precision farming techniques for horticultural crops

Precision farming techniques -protray seedlings - field preparation - raised bed formation -row planting - drip irrigation - mulching- fertigation system - training systems - growth regulators - plant protection - harvesting - grading and packing system for mango, banana, guava, tomato, chilli, bitter gourd, turmeric and marigold.

Unit III: Basics in protected cultivation

Green house technology -scope and importance - types of greenhouses - plant response to greenhouse environment - planning and design of greenhouses, design criteria of greenhouse for cooling and heating purposes. green house equipment - materials of construction for traditional and low cost greenhouses - problems / constraints of greenhouse cultivation and future strategies.

Unit IV: Technologies in greenhouse cultivation

Irrigation systems used in greenhouses - carbon dioxide enrichment - light management - Growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT) / hydroponics - typical applications, passive solar green house, hot air greenhouse heating systems, green house drying. cost estimation and economic analysis.

Unit V: Protected cultivation technology for vegetable and flower crops

Hi-tech protected cultivation techniques - soil sterilization - growing media preparation - bed formation - special horticultural practices - drip and fertigation -mulching- plant growth regulators - harvest and yield - storage - postharvest management for Tomato, capsicum, cucumber, dutch rose, chrysanthemum, carnation, gerbera, anthurium, orchids.

Practical

Study of different types of greenhouses based on shape, construction and cladding materials - Calculation of air rate exchange in an active summer cooling and winter cooling system - Estimation of drying rate of agricultural products inside greenhouse - Testing of soil and water to study its suitability for growing crops in greenhouses - The study of fertigation requirements for greenhouses crops and estimation of E.C. in the fertigation solution - The study of various growing media used in raising of greenhouse crops and their preparation and pasteurization / sterilization - Visit to commercial greenhouses - Economics of protected cultivation.

Lesson Plan

Theory Schedule

1. Precision farming - definition, components and steps.
2. Laser leveling, mechanized direct seed sowing, seedling and sapling transplanting of horticultural crops.
3. Soil mapping and plant attributes.
4. Site specific nutrient management (SSNM) system.
5. Weed management in precision farming.

6. Insect pests and disease management in precision farming.
7. Yield mapping in horticultural crops.
8. Design, layout and installation of drip and fertigation in precision farming.
9. Precision farming techniques for mango.
10. Precision farming techniques for banana.
11. Precision farming techniques for guava.
12. Precision farming techniques for tomato and chilli.
13. Precision farming techniques for bitter gourd.
14. Precision farming techniques for turmeric and marigold.
15. Scope, importance and constraints of protected cultivation.
16. Types of greenhouses.
17. **Mid semester examination**
18. Plant response to greenhouse environment.
19. Planning, design and materials of construction for traditional and low cost green house.
20. Design criteria of greenhouse for cooling and heating purposes.
21. Irrigation systems used in green house.
22. Carbon di oxide enrichment in green house.
23. Light management in green house.
24. Growing media - different types, soil culture, pasteurization of media, drainage, flooding and leaching.
25. Hydroponics /Nutrient film techniques.
26. Passive solar green house, hot air greenhouse heating systems, green house drying.
27. Protected cultivation techniques for tomato.
28. Protected cultivation techniques for capsicum.
29. Protected cultivation techniques for cucumber.
30. Protected cultivation techniques for Dutch roses.
31. Protected cultivation techniques for chrysanthemum.
32. Protected cultivation techniques for gerbera and carnation.
33. Protected cultivation techniques for anthurium and orchids.
34. Integrated pest and disease management for vegetable and flower crops in protected cultivation.

Practical Schedule

1. Geographic information system and its application in precision farming.
2. Global positioning system and its application in precision farming.
3. Study of different types of greenhouses based on shape, construction and cladding materials.
4. Study of cooling systems in green house.
5. Calculation of air rate exchange in active summer and winter cooling system.
6. Study of heating systems in green house.
7. Study of various growing media used in raising of greenhouse crops and their preparation and pasteurization / sterilization.
8. Estimation of drying rate of agricultural products inside green house.
9. Testing of soil and water to study the suitability for growing crops.
10. Study the fertigation requirements for green house crops and estimation of EC in the fertigation solution.

11. Study of special cultural practices for production of vegetable crops under protected cultivation.
12. Study of special cultural practices for flower crops under protected cultivation.
13. Economics of protected cultivation of important vegetable crops.
14. Economics of protected cultivation of important flower crops.
15. Visit to commercial greenhouse.
16. Visit to GIS lab.
17. **Final Practical examination**

Course Outcomes

CO 1 - The student will gain knowledge on basic concepts of precision Horticulture

CO 2 - The student will acquire skill on different precision farming techniques for horticultural crops

CO 3 - The student will acquire knowledge on basics in protected cultivation

CO 4 - The students will gain skills on protected cultivation of vegetable crops

CO 5 - The students will acquire knowledge on protected cultivation of flower crops

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	1	1	3	2	1
CO 2	3	2	2	3	2	0
CO 3	3	1	1	3	2	1
CO 4	3	2	1	3	2	1
CO 5	3	2	2	3	2	0

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HOR 303 POST HARVEST MANAGEMENT OF HORTICULTURAL CROPS (2+1)

Learning Objectives

- To highlight the importance of Post harvest technology.
- To provide knowledge on the principles of Post harvest technology.
- To impart knowledge on post harvest packaging and export of horticultural produces.

- To acquired knowledge on different systems/ methods of storage.
- To gain knowledge on Post Harvest practices of horticultural crops.

Theory

Unit I: Importance of post harvest handling and maturity indices

Importance & scope of post-harvest management of horticultural crops in India-Structure of fruits, vegetables and cut flowers related to physiological changes after harvest. Maturity indices-harvesting- sorting and grading of fruit, vegetables, cut flowers, plantation crops, spices, medicinal and aromatic plants.

Unit II: Factors influencing shelf life and fruit ripening

Pre-harvest factors affecting quality-Factors responsible for deterioration of horticultural produce- Quality parameters and specification-Physiological and bio-chemical changes during ripening-Hastening and delaying ripening process.

Unit III: Pre harvest and post harvest treatments

Pre and Post harvest treatments of Horticultural crop *viz.* pre harvest sprays- curing- degreening- pre cooling- waxing- fumigation- irradiations- HWT-VHT, etc.

Unit IV: Packaging methods

Packaging methods (vacuum packaging, poly shrink packaging, grape guard packing)- types of packages and recent advances in packaging- Types of containers and cushioning materials- Export specification.

Unit V: Storage and transport

Different systems/methods of storage including cold storage- CA & MA storage- low cost cooling structures, etc. Cold chain management- Management of storage pest, diseases and disorders-Transportation of fresh horticultural produce to local and distant market and current stream of thoughts.

Practical

Identification of various equipment for the post-harvest management of horticultural Crops-Practice in judging the maturity of various horticultural produce- determination of physiological loss in weight and quality- Sorting and grading of horticultural produce- Postharvest treatments of horticultural crops- physical and chemical methods. Identification of various packaging materials and packaging studies in fruits, vegetables plantation crops,spicesand cut flowers by using different packaging materials- methods of storage- post-harvest disorders in horticultural produce. Identification of storage pests and diseases in horticultural crops- Visit to markets, pack houses and cold storage units.

Lesson Plan

Theory Schedule

1. Importance and current scenario of post harvest management of perishables in India.
2. Different methods of judging maturity in horticultural crops.
3. Maturity indices for major fruit and vegetable crops.
4. Maturity indices for flower crops and plantation and spices, medicinal and aromatic crops.
5. Harvesting methods / techniques in horticultural crops.
6. Major causes of post harvest losses of perishables.
7. Pre-harvest factors affecting post harvest life and quality of horticultural crops.
8. Sorting and grading of horticultural crops.
9. Ripening, climacteric and non climacteric ripening of fruits.
10. Ethylene biosynthesis and its role in fruit ripening.

11. Physiological and biochemical changes associated with ripening.
12. Ripening management in fruits.
13. Pre harvest treatments for enhancing post harvest life of fruits and vegetables.
14. Pre cooling methods for perishables.
15. Pre storage treatments for major fruits.
16. Pre storage treatments for major vegetables.
17. **Mid semester examinations**
18. Post harvest handling of fruits and vegetables.
19. Post harvest handling of commercial flowers and Plantation crops.
20. Post harvest handling of medicinal and aromatic plants.
21. Export specification for horticultural produce.
22. Traditional and modern packaging methods for perishables.
23. Types of containers and cushioning materials.
24. MAP, vacuum packaging, film wrapping and shrink wrapping.
25. Edible packaging and nano packaging.
26. Cold chain management.
27. On farm and low cost storage of fruits and vegetables.
28. Cold storage of perishables - the need and the status of cold chain in India.
29. Techniques of refrigerated storage.
30. Modified and controlled atmospheric storage of fruits and vegetables.
31. Physiological disorders associated with storage.
32. Post harvest pest management.
33. Post Harvest diseases and their management.
34. Transport of perishables to local and distant market.

Practical Schedule

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

17. Final Practical examination

Course Outcomes

CO 1 - The students will be able to understand the post harvest technology, handling methods, Packaging and storage methods.

CO 2 - The students will be able to identify the maturity indices of various horticultural crops.

CO 3 - The students will gain skill in doing post harvest operations pertaining to Horticultural crops.

CO 4 - The students will be able to understand factors influencing shelf life and ripening management of fruit crops.

CO 5 - The students will gain skills to operate post harvest practices of horticultural crops in industries.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	0	0	1	1	1	1
CO 2	0	0	1	1	1	1
CO 3	0	0	1	1	1	1
CO 4	0	0	1	1	1	1
CO 5	0	0	3	3	1	1

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HOR - 304 BREEDING AND SEED PRODUCTION OF FLOWER AND ORNAMENTAL PLANTS (2+1)

Learning Objectives

- To make them gain comprehensive knowledge about the breeding methodologies and problems in breeding flower crops.
- To provide knowledge on principles, concepts and special breeding techniques of flower crops and ornamental plants.
- To understand the current problems in breeding of commercial flowers and ornamental plants.
- To impart skill in hybrid flower seed production in commercial flowers and ornamental plants.

- To gain knowledge on the seed extraction and preservation methods.

Theory

Unit I: Introduction and methods of breeding of flower and ornamentals

History of improvements of ornamental plants, Centre of origin of flower crops and ornamental crops, objectives and techniques in ornamental plant breeding. Breeding for disease resistance. Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility, production of open pollinated seed. Harvesting, seed production, seed processing and storage of seeds, seed certification. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of following ornamental and flower crops.

Unit II: Breeding and seed production I

Jasmine, Rose, Chrysanthemum, Tuberose, Gerbera and Gaillardia.

Unit III: Breeding and seed production II

Petunia, Dahlia, Hibiscus - Bougainvillea - Zinnia - Cosmos.

Unit IV: Breeding and seed production III

Dianthus - Marigold and Geranium - Antirrhinum and China aster - Orchids.

Unit V: Breeding and seed production IV

Gladiolus - Heliconia - Anthurium - Carnation - Dahlia.

Practical

Study of floral biology and pollination in important species and cultivars. Techniques of inducing polyploidy and mutation. Production of pure and hybrid seeds. Harvesting, conditioning and testing of seeds. Practice in seed production methods.

Lesson Plan

Theory Schedule

1. History and development of hybrids, different breeding methods for self & cross pollinated crops. Important concepts of breeding of ornamental crops.
2. Breeding for disease resistance in flower and ornamental crops.
3. Role of heterosis in F1 hybrids development and use of male sterility.
4. Breeding objectives, breeding methods and achievements in rose.
5. Breeding objectives, breeding methods and achievements in jasmine.
6. Breeding objectives, breeding methods and achievements in Chrysanthemum and tuberose.
7. Breeding objectives, breeding methods and achievements in Gerbera and Gladiolus.
8. Breeding objectives, breeding methods and achievements in Dahlia and Heliconia.
9. Breeding objectives, breeding methods and achievements in Dahlia and Gaillardia and
1. Petunia.
10. Breeding objectives, breeding methods and achievements in Dahlia and Hibiscus.
11. Breeding objectives, breeding methods and achievements in Bougainvillea.
12. Breeding objectives, breeding methods and achievements in Zinnia.
13. Breeding objectives, breeding methods and achievements in Cosmos.
14. Breeding objectives, breeding methods and achievements in Dianthus.
15. Breeding objectives, breeding methods and achievements in Marigold and Geranium.
16. Breeding objectives, breeding methods and achievements in Antirrhinum and China aster.
17. **Mid semester examination**
18. Breeding objectives, breeding methods and achievements in Orchids.
19. Breeding objectives, breeding methods and achievements in Carnation.

20. Introduction to Commercial Flower Seed Production – Flower Seeds and Flower Seed Industry.
21. Scope and Importance of Commercial Floriculture and Seed Production techniques of ornamental plants.
22. Factors considered for efficient seed programme in Ornamental seed production methods of seed production in marigold and Zinnia.
23. Methods of Seed production techniques in marigold, zinnia and Chrysanthemum (including processing, storage and seed certification).
24. Methods of Seed production techniques in Dahlia, Petunia and Balsam (including processing, storage and seed certification).
25. Methods of Seed production techniques in Cockscomb, Cosmos and Hollyhock (including processing, storage and seed certification).
26. Methods of Seed production techniques in Gaillardia and Gomphrena (including processing, storage and seed certification).
27. Methods of seed / vegetative plant production technique in rose and jasmine (including processing, storage and seed certification).
28. Methods of Seed / vegetative plant production technique in hibiscus and Bougainvillea (including processing, storage and seed certification).
29. Methods of Seed / vegetative plant production techniques in Orchids (including processing, storage and seed certification).
30. Methods of Seed / vegetative plant production technique in Gerbera and Anthurium (including processing, storage and seed certification).
31. Methods of Seed / vegetative plant production technique in Gladiolus and Carnation (including processing, storage and seed certification).
32. Classification of Seeds based on longevity.
33. Seed storage and Storage conditions for some flower crops.
34. Conserving the Germplasm of Herbaceous Ornamental Plants.

Practical Schedule

1. Selfing, emasculation and crossing techniques in ornamentals.
2. Introduction, selection, hybridization - technique for improvement of ornamental plants.
3. Mutation and Polyploidy breeding - technique for improvement of ornamental plants.
4. Biotechnological breeding - technique for improvement of ornamental plants.
5. Floral biology, selfing, emasculation and crossing technique in Rose, Jasmine, Marigold and Anthurium.
6. Floral biology, selfing, emasculation and crossing technique in Gladiolus and Orchids.
7. Floral biology, selfing, emasculation and crossing technique in Gaillardia and Gerbera.
8. Floral biology, selfing, emasculation and crossing technique in Zinnia, Ageratum, Alyssum, Aster and Calendula.
9. Seed collection in ornamental plants (annuals, perennials and tree crops).
10. Methods of seed extraction in ornamental plants.
11. Identification of seed and seed structure of ornamental plants.
12. Seed germination and viability testing in ornamental plants.
13. Seed Dormancy & Methods of breaking of seed dormancy in ornamental plants.
14. Seed germination, test evaluation and seed enhancement techniques (Seed Priming, Pregermination, Pelleting and Coating) in ornamental plants.
15. Study of seed storage, seed package and packaging materials in ornamental plants.

16. Visit to ornamental seed production plots and Commercial flower seed production industries.

17. Final Practical examination.

Course Outcomes

CO 1 - The students will understand the principles , methods and basic concepts in breeding of commercial flowers and ornamental plants.

CO 2 - The students will understand the advances in special breeding techniques of commercial flowers and ornamental plants.

CO 3 - The students will gain skill on hybrid seed production in commercial flowers and ornamental plants.

CO 4 - The students will learn and understand the current problems in hybrid seed production and their extraction methods .

CO 5 - The students will get employment in seed production industries.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	1	2	0	2	0
CO 2	1	2	0	1	0	2
CO 3	2	1	2	3	0	0
CO 4	0	0	2	1	0	1
CO 5	0	0	1	3	1	2

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HOR 305 CROP PRODUCTION-VEGETABLE CROPS (0+1)

Learning Objectives

- To give hands on experience to the students on transplants preparation.
- To acquire knowledge on nutrient management on crop production aspects.
- To give hands on experience to the students on crop protection aspects.
- To give hands on experience to the students on assess maturity, harvesting, processing and post harvest technology.

- To give hands on experience to the students to workout cost economics of production.

Practical

Practical training and experience in vegetable production in one transplanted crop (tomato or brinjal or chillies) and one direct sown crop (bhendi or amaranthus or radish or aggregatum onion)- seed treatment- raising nursery- sowing seeds- field preparation- transplanting, manuring, irrigation, fertigation, weed control, after culture- growth regulators- plant protection- maturity indices and harvesting - maintenance of cultivation sheet-working out cost benefit ratio

Lesson Plan

Practical Schedule

1. Practice in raising nursery for transplanted vegetables.
2. Seed treatment, sowing, application of FYM its incorporation.
3. Field preparation-ploughing formation of irrigation channels.
4. Formation of raised and flat beds, ridges and furrows.
5. Application of basal dressing of fertilizers.
6. Practices in transplanting and direct sowing of vegetables.
7. Practice in weeding and herbicide application.
8. Practice in scheduling of irrigation and fertigation.
9. **Mid Semester Examination**
10. Practice in gap filling operation.
11. Practice in top dressing and earthing up operation.
12. Practice in PGR preparation and application.
13. Practice in pesticide, fungicide applications and other intercultural operation.
14. Assessing maturity index and harvesting.
15. Practice in seed extraction processing, cleaning and packaging.
16. Cost economics of production.
17. **Final practical examination.**

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HOR 305 CROP PRODUCTION- FLOWER CROPS (0+1)

Learning Objectives

- To give hands on experience to the students on transplants preparation.
- To acquire knowledge on nutrient management on crop production aspects.
- To give hands on experience to the students on crop protection aspects.

- To give hands on experience to the students on assess maturity, harvesting and post harvest technology.
- To give hands on experience to the students to workout cost economics of production.

Practical

Practical training and experience in vegetable production in one transplanted crop (tuberose or marigold or chrysanthemum or any other annual flower crops)- seed treatment- raising nursery- sowing seeds- field preparation- transplanting, manuring, irrigation, fertigation, weed control, after culture- growth regulators- plant protection- maturity indices and harvesting - maintenance of cultivation sheet-working out cost benefit ratio

Lesson Plan

Practical Schedule

1. Practice in raising nursery for transplants.
2. Seed treatment, sowing, application of FYM and its incorporation.
3. Field preparation-ploughing formation of irrigation channels.
4. Formation of raised and flat beds, ridges and furrows.
5. Application of basal dressing of fertilizers.
6. Practices in transplanting of flower crops.
7. Practice in weeding and herbicide application.
8. Practice in scheduling of irrigation and fertigation.
9. **Mid Semester Examination**
10. Practice in gap filling operation.
11. Practice in top dressing and earthing up operation.
12. Practice in PGR preparation and application.
13. Practice in pesticide, fungicide applications and other intercultural operation.
14. Assessing maturity index and harvesting.
15. Practice in seed extraction processing, cleaning and packaging.
16. Cost economics of production.
17. **Final practical examination.**

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ENT 301 INSECT PESTS OF VEGETABLES, ORNAMENTALS AND SPICES CROPS (2+1)

Learning Objectives

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

Theory

Bioecology, distribution, pest surveillance, symptoms of injury, host range, and integrated management strategies for Insects, Mites and Nematode pests of following crops

Unit I: Pests of Vegetables - I

Brinjal, Bhendi, Tomato, Crucifers, Cucurbits

Unit II: Pests of Vegetables - II

Chow-chow, Carrot, Beet root, Radish, Turnip, Beans, Palak, Chillies, Onion, Garlic, Moringa, Amaranthus

Unit III: Pests of Tuber Crops

Potato, Sweet potato, Tapioca, Yam and Colocasia

Unit IV: Pests of Spice Crops

Ginger, Turmeric, Cardamom, Pepper, Fennel, Cumin, Fenugreek, Clove, Nutmeg, Cinnamon, Coriander, Curry leaf, Asafoetida, Vanilla, Betelvine and Tamarind

Unit V: Pests of Ornamental crops

Rose, Jasmine, Crossandra, Chrysanthemum, Tuberoses, Cut flowers, Gloriosa, Lawn

Insect pests of processed vegetables, spices and ornamental crops, Insecticidal residue problems in vegetables, spices and ornamental crops, tolerance limits etc.

Practical

Identification of symptoms of damage and life stages of important Insects, Mites and Nematode pests of different vegetables, tubers, spices, flower crops and lawn

Lesson Plan

Theory Schedule

1. Pests of Brinjal
2. Pests of Bhendi
3. Pests of Tomato
4. Pests of Crucifers
5. Pests of Cucurbits
6. Pests of Chow Chow, Carrot and Beet root
7. Pests of Radish&Turnip
8. Pests of Beans and Palak
9. Pests of Chillies
10. Pests of Onion and Garlic
11. Pests of Moringa
12. Pests of Amaranthus
13. Pests of Potato
14. Pests of Sweet potato
15. Pests of Tapioca, Yam and Colocasia.
16. Pests of Ginger
17. **Mid Semester Examination**
18. Pests of Turmeric
19. Pests of Cardamom
20. Pests of Pepper and Fennel
21. Pests of Cumin, Fenugreek
22. Pests of Clove, Nutmeg and Cinnamon
23. Pests of Coriander, Curry leaf and Asafoetida

24. Pests of Vanilla, Betelvine
25. Pests of Tamarind
26. Pests of Rose
27. Pests of Jasmine and Crossandra
28. Pests of Chrysanthemum, Tuberose and Cut flowers
29. Pests of Lawn
30. Pests of processed vegetables and spices
31. Pests of processed ornamental plants
32. Insecticidal residue problems in vegetables and spices
33. Insecticidal residue problems in ornamental crops
34. Tolerance limits of insecticides

Practical Schedule

1. Identification of Pests of Brinjal
2. Identification of Pests of Bhendi and Tomato
3. Identification of Pests of Crucifers
4. Identification of Pests of Cucurbits
5. Identification of Pests of Chow chow, Carrot, Beet root, Radish, Turnip, Beans and Palak
6. Identification of Pests of Chillies, Onion, Garlic
7. Identification of Pests of Moringa and Amaranthus
8. Identification of Pests of Potato
9. Identification of Sweet potato, Tapioca, Yam and Colocasia
10. Identification of Pests of Cardamom, Pepper
11. Identification of Pests of Ginger, Turmeric, Fennel, Cumin and Fenugreek
12. Identification of Pests of Clove, Nutmeg, Cinnamon, Coriander, Curry leaf, Asafoetida, Vanilla, Betelvine and Tamarind
13. Identification of Pests of Rose, Jasmine
14. Identification of Pests of Crossandra, Chrysanthemum, Tuberose and Cut flowers
15. Identification of Pests of Lawn
16. Identification of Pests of Stored and processed vegetables, ornamentals and spices
17. **Final practical examination**

Assignment:

- Collection and submission of at least 30 insect pests of vegetables, ornamentals and spices crops
- Rearing of at least 20 insect pests of vegetables, ornamentals and spices crops

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

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	2	3	3
CO 2	3	3	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	3	3	3	2	3	3
CO 5	3	3	3	2	3	3

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PAT 301 DISEASES OF FRUITS, PLANTATION, MEDICINAL AND AROMATIC CROPS (2+1)

Learning Objectives

- To acquire knowledge on symptoms, etiology, disease cycle and management practices of important diseases of fruit crops.
- To acquire knowledge on symptoms, etiology, disease cycle and management practices of important diseases of temperate fruit crops.
- To acquire knowledge on symptoms, etiology, disease cycle and management practices of important diseases of plantation crops.
- To acquire knowledge on symptoms, etiology, disease cycle and management practices of important diseases of medicinal crops.
- To acquire knowledge on symptoms, etiology, disease cycle and management practices of important diseases of aromatic crops.

Theory

Unit I

Nature, prevalence, factors affecting, disease development of banana, mango, jack, grapes, citrus, guava, sapota, papaya, pomegranate, pineapple and their management.

Unit II

Nature, prevalence, factors affecting, disease development of apple, pear, peach, plum, apricot, cherry, ber, walnut, almond, strawberry, fig, custard apple, avocado, litchi and their management. Post-harvest diseases of fruits and their management

Unit III

Nature, prevalence, factors affecting, disease development of tea, coffee, rubber, arecanut, cocoa, coconut, cashew, oil palm and their management.

Unit IV

Nature, prevalence, factors affecting, disease development of amla, betel vine senna, neem, hemp, belladonna, pyrethrum, camphor, costus, croton, datura, dioscorea, opium, *Solanum khasianum*, Tephrosia, palmarosa and their management

Unit V

Nature, prevalence, factors affecting, disease development of mint, vetiver, dhavana, geranium, lemongrass, patchouli and their management.

Lesson Plan

Theory Schedule

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

1. Banana
2. Mango
3. Jack and grapes
4. Citrus
5. Guava
6. Papaya
7. Pomegranate
8. Pineapple
9. Apple
10. Pear, peach and plum
11. Apricot, cherry and ber
12. Walnut
13. Almond and strawberry
14. Fig and custard apple
15. Avocado and litchi
16. Post-harvest diseases of fruits
17. **Mid Semester Examination**
18. Tea and coffee
19. Rubber
20. Arecanut
21. Cocoa
22. Coconut
23. Cashew and oilpalm
24. Amla, betel vine
25. Senna, neem,
26. Hemp and belladonna
27. Pyrethrum and camphor
28. Costus and croton,
29. Datura and dioscorea

30. Opium and *Solanum khasianum*
31. Tephrosia and palmarosa
32. Mint and Vettiver
33. Dhavana and geranium
34. Lemangrass and patchouli

Practical Schedule

Study of diseases symptoms and host parasite relationship and disease management in:

1. Banana and mango
2. Jack, citrus and grapes
3. Guava, papaya, pomegranate and pineapple
4. Apple, pear, peach and plum,
5. Apricot, cherry, ber, walnut and almond
6. Strawberry, fig, custard apple, avocado and litchi
7. Tea and coffee
8. Arecanut, cocoa
9. Coconut, cashew and date palm
10. Amla, betel vine senna and neem,
11. Hemp, belladonna and pyrethrum,
12. Camphor, costus and crotalaria
13. Datura, dioscorea and opium,
14. *Solanum khasianum*, tephrosiav and palmaros
15. Mint, vetiver and Dhavana
16. Geranium, Lemangrass and patchouli
17. **Final practical examination**

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

Course Outcomes

CO 1: To acquire the knowledge about new emerging diseases of fruits, plantation medicinal and aromatic crops

CO 2: To acquire the knowledge on of various epidemiological factors involving for emerging of new diseases

CO 3: Having expertise in identifying and managing diseases in fruits crops

CO 4: Having expertise in identifying and managing diseases in plantation crops

CO 5: Having expertise in identifying and managing diseases in medicinal and Aromatic crops

CO - PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	-	-	1	-
CO2	2	3	-	-	1	-
CO3	2	3	-	-	1	-
CO4	2	3	-	-	1	-
CO5	2	3	-	-	1	-

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EXT 301 COMMUNICATION SKILLS & PERSONALITY DEVELOPMENT (1+1)

Learning Objectives

- To improve the knowledge level of the students on various communication skills
- To improve listening skills and develop presentation skills
- To gain knowledge on personality development and team building
- To enhance skill on various group techniques
- To facilitate the student on effective management of time and stress.

Theory

Unit I: Communication skills

Communication: Meaning & process of communication. Forms of communication: verbal & non-verbal -meaning. Communication skills: Meaning, hard & soft skills - over view, Verbal & non- verbal communication: Verbal: oral & written skills Non- verbal communication skills: Concept, meaning, forms & functions, importance of non- verbal communication in communication.

Unit II: Listening & Presentation skills

Listening skill- meaning, concept, types of listening, barriers in listening & Note Taking, Oral presentation skills: impromptu presentation & extempore presentation, Effective Public Speaking.

Unit III: Group discussion & Techniques

Group discussion: Procedure, principles, purpose, advantages & disadvantages, Small group discussion techniques: Panel. Symposium, buzz session, syndicate, conference, seminars, workshop, debate and lecture. Writing of technical articles , field diary & lab record, indexing, footnote & bibliographic procedures

Unit IV: Personality development & Team Building

Personality development : Meaning, definition & overview of personality traits, Questioning skills Attitude: Meaning, functions of attitude, developing positive attitude, Team building: working in team

Unit V: Time & Stress Management

Time management: Importance & role in personality development & time management Techniques, Conflict management: Meaning. Concept, causes of conflict & managing conflicts Stress management : Meaning, definition, management of stress and current stream of

thoughts.

Practical

Simulation exercise to acquire various communication skills, Practical exercises - Group discussion, Panel discussion, Debate, Exercise on writing of technical articles, Identification of personality types analysis of attitude & student feedback, Management games, Simulation exercise - time management, conflict management & Stress management. Creativity, acquisition of interview skills.

Lesson Plan

Theory Schedule

1. Communication: Meaning & process of communication. Forms of communication: verbal & non-verbal -meaning.
2. Communication skills: Meaning, hard & soft skills – over view
3. Verbal & non- verbal communication: Verbal: oral & written skills Non- verbal communication skills: Concept, meaning, forms & functions, importance of non- verbal communication in communication
4. Listening skill- meaning, concept, types of listening, barriers in listening & Note Taking
5. Oral presentation skills: impromptu presentation & extempore presentation
6. Effective Public Speaking
7. Group discussion: Procedure, principles, purpose, advantages & disadvantages
8. Small group discussion techniques: Panel, Symposium, buzz session, syndicate, conference, seminars, workshop, debate and lecture
9. **Mid Semester Examination**
10. Writing of technical articles , field diary & lab record, indexing, footnote & bibliographic procedures
11. Personality development : Meaning, definition & overview of personality traits
12. Questioning skills
13. Attitude: Meaning, functions of attitude, developing positive attitude
14. Team building: working in team
15. Time management: Importance & role in personality development & time management Techniques
16. Conflict management: Meaning. Concept, causes of conflict & managing conflicts
17. Stress management : Meaning, definition, management of stress and current stream of thoughts

Practical Schedule

1. Simulation exercise for non- verbal communication & students feedback
2. Listening & note taking & student feedback
3. Exercise on reading & comprehension & students feedback
4. Group discussion – Practical exercises
5. Panel discussion – Practical exercises
6. Debate – Practical exercises
7. Exercise on writing of technical articles & students feedback
8. Identification of personality types- role play & psychological tests & students feedback
9. Identification of personality types- role play & psychological tests & students feedback
10. Attitude-Role play- analysis of attitude & student feedback
11. Working in learners- management games
12. Simulation exercise on time management

13. Simulation exercise on conflict management
14. Interview Skills – Mock interviews
15. Simulation exercise on creativity
16. Simulation exercise on physical and mental stress.
17. **Final Practical Examination**

Course Outcomes

At the end of the course students will be able to

CO 1: Organize and conduct of various group techniques

CO 2: Students will be able to acquire various personality traits

CO 3: Develop hard and soft skills

CO 4: Gain knowledge on conflict management

CO 5: Acquire skill on public speaking

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	3	0	0	3
CO2	0	1	3	1	1	3
CO3	1	1	3	1	0	3
CO4	0	0	3	0	1	3
CO 5	1	1	3	0	0	3

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COM 301 Information and Communication Technology (1+1)

Learning Objectives

- Give students an in-depth understanding of why computers are essential components in business, education and society.
- Introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet, networking and mobile computing.
- Provide hands-on use of Microsoft Office applications Word, Excel, Access and PowerPoint. Completion of the assignments will result in MS Office applications knowledge and skills.
- To get familiar with basics of the Internet Programming.

Theory

Unit I: Computer Fundamentals:

Introduction to Computers - Computer Hardware and Software, Advantages computer - Components of Computers and its functions - Overview of Input devices and output device - word and character representation.

Unit II: Programming Languages:

Programming Languages: Introduction to different computer programming languages - Machine Language, Assembly Languages, High-level language, advantage and disadvantage - Algorithm and flowcharts.

Unit III: Operating system & Networking

Introduction to OS, OS concept, Introduction to Windows and Linux - Local area Network (LAN), Wide Area Network (WAN) - Internet - World Wide Web (WWW) - HTML and IP.

Unit IV: Microsoft Office Applications

MSWORD: Creating, Editing, formatting a document and saving a document - Features of File, Edit and Format menus. Microsoft Excel: Entering a formula in a cell, Built-in functions, Import and export data - Charts - Create Bar and Pie charts - PIVOT table. MS POWER POINT: Data Presentation, Audio video presentations.

Unit V: Communication Model

Berlo's Communication model - Barriers communication -barriers communications model-feedback of barriers.

Lecture Schedule

1. Introduction to Computers, Anatomy of Computers.
2. Hard ware and software.
3. Input and Output devices, Units of memory, Memory concepts
4. Programming language
5. Operating System, Types of operating system.
6. Booting sequence of operating system, DOS, Windows, Unix.
7. Algorithm and Flow chart.
8. LAN, WAN, MAN.
9. **Mid Semester Examination**
10. World wide web.
11. MS Office word, Creating, Editing, Formatting a document and Saving a document.
12. MS Excel Worksheet manipulation: insert, delete, move, copy and hide worksheet
13. Cell manipulation: copy, edit and format cell data - Charts
14. Data Presentation, Data presentation, interpretation and graph creation.,
15. MS Power point presentations.
16. Berlo's communication model.
17. Barriers communications.

Practicals Schedule

1. Study of Computer Components and accessories-Booting and Shut down
2. Introduction of different operating systems such as windows ,Linux
3. Practicing DOS Commands
4. Number System conversion: Decimal, Binary, Octal, Hexa Decimal, Binary addition and subtraction.
5. Algorithm and flow chart.
6. MSWORD - creating, editing and presenting a scientific Document.
7. MSWORD- Use of options from Tool Bar, Format, Insert, ,Mail-Merge

8. MSEXCEL-Creating a spreadsheet, Aligning rows and columns, writing expressions
9. MSEXCEL - Entering formula expression through the formula tool bar and use of in built statistical, mathematical functions.
10. MS Power Point – creating, editing and presenting a scientific Document.
11. Introduction to word wide web and its components
12. HTML –creation of scientific website,.
13. Creating and operating E-mail account.
14. Creating audio and video equipment’s.
15. Planning of posters and charts
16. Preparing and presenting of posters and charts.
17. Organization of audio and visual programming.

Course Outcomes

At the end of the course students will be able to

CO 1: Describe the usage of computers and why computers in society.

CO 2: Analyse common business problems using appropriate

CO 3: Learn categories of programs.

CO 4: system software and applications.

CO 5: Information Technology applications and systems.

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	3	0	0	3
CO2	0	1	3	1	1	3
CO3	1	1	3	1	0	3
CO4	0	0	3	0	1	3
CO 5	1	1	3	0	0	3

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HOR 306 PLANTATION CROPS (2+1)

Learning Objectives

- To provide prominent knowledge on the scope, importance and employment potential of plantation crops.
- To provide adequate knowledge on production technology of plantation crops.
- To highlight the advancement and developments in the production of plantation crops.
- To provide knowledge on technology involved in processing of medicinal and aromatic crops.
- To facilitate understanding on the industrial importance and organic production of plantation crops.

Theory

Unit I: Scope and importance of plantation crops

Status, scope and importance of plantation crops – area and production - National and State scenario - export and import – Role in national economy – Role of commodity board and other organizations – Industrial importance and byproduct utilization – GAP – Organic production - IPR issues.

Unit II: Commercial production of beverage crops

Origin and distribution –area and production- composition and uses – soil and climate – varieties – propagation- seed and vegetative propagation and planting systems - methods – irrigation and nutrient management - weed control – training - pruning - mulching - shade regulation –application of growth regulators – soil management – liming - Special horticultural practices – handling –harvest and yield - post harvest handling - processing – value addition and storage.

Crops: Coffee, Tea and Cocoa.

Unit III: Commercial production of cash crops

Origin and distribution –area and production- composition and uses – soil and climate – varieties – propagation- seed and vegetative propagation and planting systems - methods –gap filling - irrigation and nutrient management - weed control – training - pruning - mulching - cover cropping - shade regulation –application of growth regulators - Special horticultural practices – top working – HDP in cashew - handling –harvest and yield - post harvest handling - processing – value addition and storage.

Crops: Rubber and Cashew.

Unit IV: Commercial production of major palms

Origin and distribution –area and production- composition and uses – soil and climate – varieties – propagation- nursery management - planting systems and methods – multi-tier cropping systems - gap filling – irrigation, nutrient and micronutrient management - weed control – soil & water conservation measures - mulching - intercropping - application of growth regulators – harvest and yield - post harvest handling - processing – value addition and storage.

Crops: Coconut and Arecanut

Unit V: Commercial production of other palms

Origin and distribution –area and production- composition and uses – soil and climate – varieties – propagation- seed and vegetative propagation - planting systems and methods –gap filling - irrigation and nutrient management - weed control – training - pruning - mulching - application of growth regulators –harvest and yield - post harvest handling - processing – value addition and storage.

Crops: Oil palm and Palmyrah

Practical

Description and identification of varieties - mother palm and seed nut selection - nursery management - vegetative propagation - micro propagation - planting - manuring - nutritional disorders - training and pruning - top working - harvesting - processing - working out the economics and project preparation for coconut, cashew and rubber - visit to Plantation farm, commodity boards and processing units.

Crops: Coconut, Arecanut, Cashew, Rubber, Oil palm, Palmyrah, Coffee, Tea, Cocoa

Lesson Plan

Theory Schedule

1. History and development - scope and importance-state, national and global scenario of plantation crops.
2. Area and production of plantation crops - export and import potentials - role in national and state economy - institutions and commodity boards involved in research and development of plantation crops.
- 3., 4. & 5. Coffee - importance - origin and distribution - area and production-composition and uses - soil and climate - varieties - propagation- planting systems and methods - gap filling - irrigation and nutrient management - weed control - training - pruning - mulching - cover cropping - shade regulation -application of growth regulators - soil management - liming - special horticultural practices - flowering and rainfall pattern - soil moisture regulation - handling -harvest and yield - processing - value addition and storage.
- 6.,7. & 8. Tea - importance - origin and distribution - area and production-composition and uses - soil and climate - varieties - propagation - planting systems and methods - gap filling - irrigation and nutrient management - weed control - training - pruning - mulching - shade regulation - application of growth regulators - soil management - liming - special horticultural practices - tipping - top working- handling -harvest and yield - processing - value addition and storage.
- 9.,10. &11. Cocoa - Origin and distribution -area and production- composition and uses - soil and climate - varieties - propagation- seed and vegetative propagation - planting systems and methods -gap filling - irrigation and nutrient management - weed control - training - shade regulation, pruning different type of shoots in cocoa in improve productivity - mulching -application of growth regulators -harvest and yield - post harvest handling - processing - value addition and storage , shade regulation, pruning different type of shoots in cocoa in improve productivity.
- 12.,13 &14. Rubber - origin and distribution - area and production- composition and uses - soil and climate - varieties - propagation- seed and vegetative propagation - planting systems and methods - multi-tier cropping systems - gap filling - irrigation and nutrient management - weed control - training - pruning - mulching - cover cropping - intercropping - shade regulation - application of

growth regulators - soil management - harvest and yield - processing - value addition and storage.

15.&16. Cashew - origin and distribution - area and production- composition and uses - soil and climate - varieties - propagation- seed and vegetative propagation - planting systems and methods - gap filling - irrigation and nutrient management - weed control - training - pruning - mulching - intercropping - application of growth regulators - Special horticultural practices - top working - high density planting - harvest and yield - processing - grading -international standards of kernels - value addition and storage.

17. Mid-semester Examination

18.,19.&20. Coconut - importance - origin and distribution - area and production- composition and uses - soil and climate - varieties - propagation- planting systems and methods - multi-tier cropping systems - gap filling - irrigation and nutrient management - weed control - mulching - cover cropping - intercropping - soil & water conservation measures - nutrient deficiency - root feeding - harvest and yield - post harvest handling - value addition and storage

21.,22.&23. Arecanut - importance - origin and distribution - area and production- composition and uses - soil and climate - varieties - propagation- planting systems and methods - multi-tier cropping systems - gap filling - irrigation and nutrient management - weed control - mulching - intercropping- harvest and yield - processing - value addition and storage.

24.&25. Oil palm -importance - origin and distribution - area and production- composition and uses - soil and climate - varieties - propagation- planting systems and methods - multi-tier cropping systems - gap filling - irrigation and nutrient management - weed control - intercropping - harvest and yield - processing - value addition and storage

26.&27. Palmyrah - importance - origin and distribution - area and production- composition and uses - soil and climate - varieties - propagation- planting systems and methods - gap filling - irrigation and nutrient management - weed control - special cultural practices - tapping -harvest and yield - post harvest handling - value addition and storage.

28. GAP in plantation crops.

29.&30. Organic production of plantation crops.

31.&32. Industrial importance and byproduct utilization of plantation crops.

33. Role of commodity boards in plantation crops

34. IPR issues in plantation crops.

Practical Schedule

1. Coffee - study of varieties - nursery management- training and pruning - harvesting and processing in coffee.
2. Tea - Mother plant selection - preparation of cuttings and rooting of tea under specialized structure.
3. Tea - training, centering, pruning, tipping, harvesting - processing.

4. Cocoa – varieties – training & pruning – harvesting – processing.
5. Visit to Coffee board and Coffee Plantation / Tea board and Tea Plantation.
6. Cashew - raising nursery and practicing grafting techniques – HDP – top working.
7. Rubber – varieties – tapping of latex – processing of rubber.
8. Visit to Rubber plantation and processing unit.
9. Description and identification of Coconut and Arecanut varieties.
10. Coconut - mother palm and seed nut selection - preparation of nursery - sowing of seed nuts and nursery management.
11. Coconut – practice in manuring - study of nutritional disorders and correction - root feeding of coconut tonic.
12. Arecanut - mother palm and seed nut selection - preparation of nursery - sowing of seed nuts and nursery management.
13. Visit to Coconut byproduct industries.
14. Working out cost economics of Coconut, Cashew, Rubber.
15. Oil palm – vegetative and micro propagation – pollination – harvest – processing.
16. Palmyrah – nursery management – harvesting – processing.

17. Final Practical examination

Course Outcomes

CO 1 - Students will understand scope, importance, status, research of plantation crops.

CO 2 - The students can demonstrate propagation and nursery management of plantation crops.

CO 3 - Students will be able to understand the cultivation aspects, advances and developments in production of plantation crops.

CO 4 - The students will gain knowledge on harvesting techniques and processing of plantation crops.

CO 5 - The student will become eligible to get employment in managing plantation crops production units.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	3	0	0	0
CO 2	2	0	0	2	0	0
CO 3	3	2	0	2	1	0
CO 4	0	0	0	3	2	0
CO 5	0	0	1	3	0	1

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HOR - 307 MEDICINAL AND AROMATIC CROPS 3(2+1)

Learning Objectives

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

Theory

Unit I: Introduction to medicinal crops

History-importance - Scope- opportunities and constraints - area and production - imports and exports - classification of medicinal plants - GAP,GMP guidelines, institutions for promotion of medicinal plants- extraction techniques- Marketing.

Unit II: Production technology of medicinal crops I

Uses - soil and climate - varieties - propagation - nursery practices -planting and after care - nutrient management- irrigation - harvest - post harvest management storage techniques- Chemical composition. **Crops:** withania, senna, periwinkle, glory lily, ashwagandha, medicinal coleus, aloe, long pepper, isabgol, medicinal solanum.

Unit III: Production technology of medicinal crops II

Uses - soil and climate - varieties - propagation - nursery practices -planting and after care - nutrient management- irrigation - harvest - post harvest management storage techniques - Chemical composition. **Crops:** medicinal dioscorea, rauwolfia, sweet flag, belladonna, cinchona and gloriosa pyrethrum, centella, insulin (costus), indian long pepper and noni.

Unit IV: Introduction to aromatic crops

History-importance - Scope- opportunities and constraints - exports and imports -Origin, distribution- area and production-distillation. Uses - soil and climate - varieties - propagation - nursery practices - planting and after care - nutrient management- irrigation - harvest - post harvest management -storage techniques-Chemical composition. **Crops:** ocimum, davana, mentha, lemon grass, citronella, palmarosa, vetiver, sweetflag.

Unit V: Production technology of aromatic crops

Uses - soil and climate - varieties - propagation - nursery practices - planting and after care- nutrient management- irrigation - harvest - post harvest management-storage techniques- Chemical composition. **Crops:** geranium, patchouli, lavender, bursera, musk.

Practical

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

Lesson Plan

Theory Schedule

1. Withania - Importance and uses, origin and distribution, botany, chemical constituents, varieties, soil, climate, propagation, season, spacing, planting, thinning, pruning, trailing and lowering, manures and fertilizers, irrigation, weed control, harvesting and processing.
2. Periwinkle - Importance and uses, origin and distribution, botany, types, chemical constituents and varieties, soil, climate, propagation, spacing, planting, manures and fertilizers, irrigation, weed control, interculture, mulching, harvesting and processing.
3. Rauvolfia - Importance and uses, origin and distribution, botany, varieties, chemical constituents, soil, climate, propagation, spacing, planting, manuring, irrigation, weeding, harvesting and root yield.
4. Dioscorea - Importance and uses, origin and distribution, botany, species, chemical constituent's varieties, soil, climate requirements of various species, propagation, field preparation, spacing, planting, staking, manures and fertilizers, irrigation, interculture and intercropping, harvesting, yield and marketing.
5. Isabgol - Importance and uses, origin, distribution area, production, description of plant, chemical constituents, varieties, soil, climate, propagation, seed rate, season, planting, manures and fertilizers, artificial pollination, irrigation, trimming, harvesting and yield.
6. Cinchona and Gloriosa - Importance and uses, origin and distribution, description of plant, chemical constituents, varieties, soil and climate, land preparation, propagation, spacing, fertilizer application, irrigation, intercultivation, harvesting and yield.
7. Pyrethrum - Importance and uses, origin and distribution, botany, types and chemical constituents, varieties, soil, climate, season, land preparation, propagation, planting, and fertilizers, irrigation, harvesting, drying, extraction and storage.
8. Belladonna - Importance and uses, origin and distribution, botany, types and chemical constituents, varieties, soil, climate, season, land preparation, propagation, planting, and fertilizers, irrigation, harvesting, drying, extraction and storage.
9. Senna - Importance and uses, origin and distribution, botany, chemical constituents, varieties, soil, climate, land preparation, propagation, sowing, manures and fertilizers, crop rotation and intercropping, irrigation, weeding and interculture, harvesting, drying, storage and yield.
10. Coleus - Importance and uses, origin and distribution, botany, chemical constituents, varieties, soil and climate, propagation, spacing, planting, manures and fertilizers, irrigation, weeding, harvesting and yield of tubers.
11. Aswagandha - Importance and uses, origin and distribution, description of plant, chemical constituents, varieties, soil, climate, propagation, manures, fertilizers and intercultivation. - Harvesting, crop duration, method of harvesting, drying, grading and yield.

12. Aloe - Importance and uses, origin and distribution, description of plant, species, chemical constituents, varieties, soil, climate, land preparation, propagation, crop duration, spacing and planting, manuring, irrigation, inter cultivation, harvesting and yield.
13. Centella - Importance and uses, origin and distribution, description of plant, species, chemical constituents, varieties, soil, climate, propagation, manures and fertilizers, irrigation, interculture, harvesting and yield.
14. Insulin plant - Importance and uses, distribution, botany, chemical constituents, varieties, soil, climate land preparation, propagation, spacing, manures and fertilizers, irrigation, weeding, harvesting and yield.
15. Noni - Importance and uses, distribution, botany, chemical constituents, varieties, soil, climate, season, propagation techniques.
16. land preparation, nursery raising and transplanting, spacing, planting, manures and fertilizers, irrigation, weeding, harvesting and yield of noni.
- 17. Mid semester examination**
18. Indian long pepper - Importance and uses, distribution, botany, chemical constituents, varieties, soil, climate, season, propagation, spacing, planting, manures and fertilizers, irrigation, weeding, harvesting and yield.
19. Aromatic plants - History, importance and uses - industrial and cosmetic values, area and production, future prospects, opportunities and constraints in the cultivation of aromatic plants.
20. Aromatic plants - Extraction methods for essential oil crops - distillation methodology - Water and steam distillation.
21. Aromatic plants - Distillation process, enfleurage or cold fat extraction, Maceration or Hot fat extraction, Solvent extraction, Expression, Supercritical Fluid Extraction (SCFE), storage of essential oils, Technical terms used in the trade.
22. Lemongrass - Importance and uses, origin, distribution, area and production, botany, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, interculture, harvesting and extraction of oil yield.
23. Citronella - Importance and uses, origin, distribution, area and production, botany, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, interculture, harvesting and extraction of oil yield.
24. Vetiver - Importance and uses, origin, distribution, botany, varieties, soil, climate, land preparation, propagation, planting, manures and fertilizers, weeding, irrigation, interculture, harvesting and yield.
25. Palmarosa - Importance and uses, origin, distribution, botany, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, interculture, harvesting and extraction of oil yield.
26. Lavender - Importance and uses, origin, distribution, botany, species, varieties, soil, climate, land preparation, propagation, spacing, planting, manures and fertilizers, irrigation, pruning, harvesting and postharvest handling.
27. Geranium - Importance and uses, origin, distribution, botany, varieties, soil, climate, propagation, spacing, planting and after care, manures and fertilizers, harvesting and yield.
28. Patchouli - Importance and uses, botany, varieties, soil, climate, propagation, planting, interculture, manures and fertilizers, irrigation, inter cropping, harvesting and extraction of oil yield.

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

Practical Schedule

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

Course Outcome

CO 1- Students will understand scope, importance, status, research of medicinal and aromatic crops.

CO 2- The students can demonstrate propagation and nursery management of medicinal and aromatic crops.

CO 3- Students will be able to understand the cultivation aspects, advances and developments in production of medicinal and aromatic crops.

CO 4- The students will gain knowledge on harvesting techniques and processing of medicinal and aromatic crops.

CO 5- The student will become eligible to get employment in managing medicinal and aromatic seed production units.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	3	0	0	0
CO 2	2	0	0	2	0	0
CO 3	3	2	0	2	1	0
CO 4	0	0	0	3	2	0
CO 5	0	0	1	3	0	1

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HOR 308 PROCESSING OF HORTICULTURAL CROPS (1+2)

Learning Objectives

- To highlight the importance of value addition of horticultural produces
- To Provide knowledge on the principles and methods of processing and preservation of horticultural crops
- To acquire knowledge on quality control and safety of processed products
- To gain knowledge in various ancient and novel methods of preservation
- To impart knowledge on post harvest and value addition practices in processing industries.

Theory

Unit I: Scope of fruit and vegetables preservation

Importance and scope of fruit and vegetable preservation industry in India – Food pipe line, losses in post harvest operations, unit operations in food processing, principles and guidelines for location of units and setting up of processing units – canning and dehydration industries.

Unit II: Principles and methods of food preservation

Principles and methods of preservation of fruits and vegetables. Preservation by thermal treatments: mild heat, pasteurization and sterilization, canning and bottling of fruits and vegetables. Preservation by chemical preservatives-Methods for preparation of unfermented beverages viz. juices, RTS, nectar, squashes, syrups, cordials and fermented beverages, storage system of fruit and vegetable products.

Unit III: Value addition of fruits

Traditional and novel methods of food preservation and its importance -Preservation by sugar: Jam, jelly and marmalade, preserves, candies, crystallized fruits and toffees etc. Preservation with salt, spices, oil and vinegar: pickling, chutneys, sauces and tomato products.

Unit IV: Preservation by freezing & Dehydration

Freezing preservation – frozen orange slices and peas. Freeze drying of horticultural crops. Individual Quick Freezing, Drying& dehydration of fruits & vegetables- Minimal processing of fruits and vegetables.

Unit V: Processing of plantation crops and food laws

Processing of Plantation crops. Spoilage in processed foods, quality control and safety of processed products. Govt. policy on import and export of processed products. Food laws. Fruit and Vegetable processing industry costs, contribution and Break even analysis-and by- product utilization from processing industry and Current Stream of thought.

Practical

Market survey of fruit and vegetable based processed products -Equipment used in food processing units. Physico-chemical analysis of fruits and vegetables. Canning of fruits and vegetables, preparation of juice, squash, RTS, cordial,nectar, syrup,fermented beverages – wine and vinegar,jam, jelly, marmalade, candies, preserves,crystallized fruits and toffees, chutneys, sauces(hot and sweet),pickles. Dehydration of fruits and vegetables –tomato products, refrigeration and freezing-Fruit juice & vegetable powder-Minimal processing of fruits and vegetables, potato products.Cut out analyses of fruit and vegetable based processed foods. Processing of plantation cropsProcessing of dehydrated spice products.Spoilage in processed foods. Visit to processing units. Quality control of processed products (physico-chemical and sensory analysis).

Lesson Plan

Theory Schedule

1. Importance and scope of fruit and vegetable in world agriculture and preservation industry.in India.
2. Food pipe line loss of fruit and vegetables from farm to fork - losses in post harvest operations.
3. Unit operations in fruit and vegetable processing industry.
4. Principles and guidelines for setting up of fruit and vegetable processing units.
5. Storage system of Fruit and Vegetable products.
6. Principles and methods of preservation by heat – bottling of fruits and vegetables.
7. Methods of preparation of beverages – fermented beverages – wine and vinegar. Non fermented beverages – RTS, nectar, squashes, syrups and cordials.

8. Traditional and Novel Methods of food preservation and its importance. Preservation by using sugar – Jam, jelly and marmalade, preserves, candies, crystallized fruits and toffees etc.
9. Mid semester examination
10. Preservation with salt and vinegar – chutney and sauces – tomato and mushroom sauce.
11. Freeze preservation – Individual quick Freezing, Frozen peas.
12. Minimal processing of fruits and vegetables.
13. Spoilage in processed foods.
14. Processing of coffee, tea, cocoa and chocolate manufacture process.
15. Government policy on import and export of processed fruits and vegetables – APEDA.
16. Quality control and safety of processed products – Food laws -Food safety and Standards Authority of India (FSSAI), Food Safety and Standards Act (2006) and Hazard Analysis Critical Control Point (HACCP).
17. Fruit and Vegetable processing industry costs, contribution and Break even analysis and by-product utilization from processing industry.

Practical Schedule

1. Market survey of fruit and vegetable based processed products.
2. Introduction to equipment used in food processing units.
3. Physico-chemical analysis of fruits and vegetables.
4. Preparation of preparation of squash and RTS.
5. Preparation of Cordial , syrup and nectar.
6. Bottling of fruits and vegetables.
7. Preparation of hot and sweet chutneys.
8. Preparations of Sauces and Ketchup (tomato, green chilli, mushroom & soya).
9. Preparation of tomato products viz., puree, paste & cocktail.
10. Preparation of pickles(Lime, Mango, Amla, onion).
11. Preparation of fermented pickles- Sauerkraut.
12. Preparation of candy and Preserves.
13. Preparation of crystallized fruits and toffees.
14. Preparation of jam.
15. Preparation of jelly.
16. Preparation of marmalade.
17. Preparation of frozen products viz., peas, orange slices.
18. Minimal Processing of fruits & vegetables.
19. Preparation of Potato products (Chips & starch).
20. Preparation of dehydrated products from fruits & Vegetables.
21. Osmotic dehydration of fruits and vegetables.
22. Preparation of fruit juice and pulp powder(Banana, papaya, orange).
23. Preparation of vegetable and leaf powder (moringa , onion).
24. Processing of plantation crops viz., chocolate bars and hot chocolate.
25. Processing of palmyrah based products.
26. Processing of dehydrated spice products.
27. Canning of fruits and vegetables.
28. Preparation of fermented beverages – wine.
29. Preparation of vinegar.
30. Quality control of processed products (physico-chemical and sensory analysis).

31. Microbial Spoilage in processed foods.
32. Cut out analyses of fruit and vegetable based processed foods.
33. Visit to processing units.

34. Final Practical examination

Course Outcomes

CO 1 - The students will be able to understand the importance and principles of processing and preservation of horticultural crops

CO 2 - The students will gain skill in doing processing and preservation of horticultural produces.

CO 3 - The students will be able to understand quality control and safety of processed products

CO 4 - The students will be able to gain skills in various ancient and novel methods of preservation

CO 5 - The students will gain skills to operate value addition practices in industries

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	0	0	1	1	1	1
CO 2	0	0	1	1	1	1
CO 3	0	0	1	1	1	1
CO 4	0	0	1	1	1	1
CO 5	0	0	3	3	1	1

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AGR 301 ORGANIC FARMING (1+1)

Learning Objectives

- To conceptualize the principles and practices of organic farming for sustainable crop production.

- Aims at incurring knowledge on importance of organic farming in present world scenario and its impact on environment and soil health.
- Students will gain knowledge about low cost organic inputs for sustainable agriculture.
- To gain knowledge on the organic residue recycling.
- Understand the concepts of organic certification and quality products to improve the economic conditions of the farmer.

Theory

Unit I: Importance of organic farming

Organic farming: Introduction – Principles, concept and its scope in India - History of organic farming and relevance in present context – pre requisites for Organic farming - Initiatives taken by government (Central/State), NGO's and other organizations for promotion of organic agriculture - Organic ecosystem and their concepts.

Unit II: Organic sources

Organic production requirements - organic manures – organic waste recycling-methods compost – Compost making - Vermicomposting – Insitu and exsitu manuring - Soil and crop management - inter cropping, crop rotation, green manures, cover crops, mulching - bio fertilizers .

Unit III: Biological methods of Crop protection

Indigenous- role of livestock – cow in organic farming – Panchagavya – Dasagavya – Amirthakaraisal – preparation – properties – general effects on crops – Biofertilizers - Organic crop protection methods - Integrated diseases and pest management – use of bio control agents, biopesticides pheromones, trap crops, bird perches.

Unit IV: Bio-intensive nutrient management

Bio-intensive nutrient management – application of Effective micro organism (EM) technology – phosphate rich organic manure (PROM). Weed management in organic farming - Organic rice production – economic evaluation - benefits – organic enterprises.

Unit V: Organic certification and marketing

Organic certification – NPOP guidelines - Certification agencies in India – crop production standards - Quality considerations - labeling and accreditation process - marketing and export opportunities – APEDA.

Practical

Raising of vegetable crops organically through nutrient, diseases and pest management – experiencing organic farming practices – hands on experience on bio composting, vermicomposting, ITK based biological preparations, bio-inoculants - quality analysis of inputs and products - Grading, packaging, post-harvest management – visit to organic farms, market outlets and organic certification centers

Lesson Plan

Theory Schedule

1. Organic farming; definition – prospects- principles and concepts - History and genesis of organic farming in World and India: Present status in World, India and Tamil Nadu.
2. Pre-requisites and basic steps for organic farming; conversation to organic farming – planning and processes in practices - Integration of animal components. Green revolution-definition-impacts- Natural resources and its management.

3. Initiatives taken by government (Central/State), NGO's and other organizations for promotion of organic agriculture - Organic ecosystem and their concepts.
4. Sources of organic manures - plant, animal and microbial origin - on-farm resources; FYM, green manures, crop residues, poultry manure, sheep and goat manures, biogas slurry and vermicompost.
5. Off-farm resources; coir pith, pressmud, oilcakes, flyash, bio compost, minerals, bone meal, bio fertilizers, traditional preparations.
6. Organic waste recycling methods and techniques - composting, vermicomposting, *in situ* composting - system approach.
7. Soil and crop management in organic farming ;Inter cropping and companion planting, crop rotation , green manures and cover crops, mulching.
8. Indigenous practices of organic farming - role of livestock - cow in organic farming -
9. **Mid-Semester Examination**
10. Panchagavya - Dasagavya - Amirthakaraisal - preparation - properties - general effects on crops.
11. Bio-intensive nutrient management - application of Effective micro organism (EM) technology.
12. Phosphate rich organic manure (PROM).
13. Organic crop protection methods.- Weed management in organic farming.
14. Organic rice production -Economic evaluation - benefits - organic enterprises.
15. Organic certification - NPOP guidelines - Certification agencies in India.
16. Crop production standards - Quality considerations.
17. Labeling and accreditation process - marketing and export opportunities - APEDA

Practical Schedule

1. Resource inventory of organic farm- Soil sampling and analysis for organic carbon and pesticide residues / contaminants.
2. Raising of vegetable crops organically through nutrient, diseases and pest management.
3. Incorporation of green manure
4. Seed treatment techniques for vegetable crops
5. Preparation of Panchagavya, Dasagavya and amirdhakaraisal
6. Preparation of vermicompost
7. Quantification of nutrients from organic sources and application of manures and bio-fertilizers.
8. Organic crop production and weed management.
9. Exposure visit to bio-pesticide and pheromone manufacturing units.
10. Organic crop production and pest management.
11. Exposure visit to bio-control agent (*Pseudomonas*, *Trichoderma* etc.,) production units
12. Organic crop production and diseases management.
13. Exposure on macro quality analysis of crop produces in laboratories
14. Hands on training on grading, packaging and post-harvest management.
15. Exposure visit to organic market out lets.
16. Exposure visit to organic certification agencies / Directorate of Organic Certification, Tamil Nadu.

17. Final Practical Examination

Course Outcomes

CO 1: To acquire knowledge on concepts of organic agriculture.

CO 2: To gain the information about the impact of organic farming and indigenous practices on environment.

CO 3: To understand the procedure followed for organic certification as per NPOP guidelines namely production standards, labelling and accreditation.

CO 4: To equip students with organic control methods of pests and diseases using bio inoculants and bio-agents.

CO 5: To gain knowledge on preparation of organic nutrient solutions and marketing

CO- PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	2	2	3	3	2
CO2	2	3	3	2	3
CO3	3	2	2	3	2
CO4	3	3	3	3	3
CO5	2	-	2	2	-

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GPB 301 SEED PRODUCTION OF VEGETABLES, TUBER AND SPICES (2+1)

Learning Objectives

- To make the students understand the importance of quality seed
- Principles involved in quality seed production
- Techniques involved in quality seed production of varieties and hybrids in horticultural crops and make them seed entrepreneurs
- To understand the seed post harvest technology of horticultural crops
- Knowledge about seed certification and legislation.

Theory

Unit I: Importance of quality seed

Seed - structure and texture - monocot - dicot seeds and their importance - Characteristics of good quality seeds - classes of seed - generation system of seed production - multiplication

ratio – seed replacement rate (SRR) –seed renewal period (SRP) – varietal deterioration – causes – maintenance.

Unit II: Principles and Techniques of seed production in horticultural crops

Methods and tools of seed production in variety and hybrid – Seed production – importance – Principles –factors influencing seed production – variety and hybrid seed production – Seed production in tomato, brinjal, chillies, bhendi – pumpkin, ash gourd, bitter gourd, ribbed gourd, snake gourd and bottle gourd – onion – amaranthus – cabbage, cauliflower – carrot, beetroot – marigold, petunia –ashwagandha, periwinkle – spices –coriander and fenugreek – cocoa, coffee and coconut.

Unit III: Post-harvest Technology

Physiological maturation – pre-harvest sanitation spray – pre and post-harvest techniques – extraction methods – processing – seed treatment – packing – Dormancy – types – causes – treatment- storage – types – factors influencing storage.

Unit IV: Seed certification and seed legislation

Seed certification – phases – general and specific seed crop standards for horticultural crops – field standards – seed standards – field inspection – Grow Out Test –The Seeds Act and Rules –Release and Notification of varieties of horticultural Crops – State Seed Sub – Committee – Central Seed Certification Board, State Seed Certification Agency – Central Seed Testing Laboratory cum Referral Laboratory and Notified Seed Testing Laboratories – Seed Inspector – duties and responsibilities – offences and penalties – Seeds (Control) Order, 1983 and labelling standards – New Policy on seed development, 1988 –PPV and FR act, 2001 – salient features of Seed Bill 2004.

Unit V: Seed testing

Seed testing – importance – seed lot – assignment of lot number – seed sample – sampling methods – purity analysis – moisture estimation – germination tests – viability test – seed vigour tests – seed health test.

Practical

Seed structure – seed production planning – practicing emasculation and dusting techniques (tomato/brinjal/okra) – practicing different seed extraction methods – supplementary pollination in horticultural crops – seed sampling, mixing and dividing – analysis of physical purity – moisture estimation – conducting of germination tests – seedling evaluation and quick viability test –seed vigour test – seed health test – seed blending.

Lesson Plan

Theory Schedule

1. Seed – definition – importance –characteristics of good quality seed– seed production and crop production
2. Classes of seed – generation system – seed multiplication ratio – seed replacement rate – seed renewal period.
3. Varietal deterioration – causes – maintenance of genetic purity during seed production.
4. Principles and factors influencing seed production
5. Methods and tools of seed production in variety and hybrid
6. Seed production in tomato and brinjal
7. Seed production in bhendi and chillies
8. Seed production in pumpkin, ash gourd and bitter gourd.
9. Seed production in ribbed gourd, snake gourd and bottle gourd
10. Seed production in onion and amaranthus

11. Seed production in cabbage and cauliflower
12. Seed production in carrot and beetroot.
13. Seed production in marigold and petunia.
14. Seed production in ashwagantha and periwinkle.
15. Seed production in coriander and fenugreek
16. Seed handling techniques in cocoa, coffee and coconut.
17. **Mid Semester Examination**
18. Physiological maturation – pre-harvest sanitation spray – pre- and post-harvest techniques.
19. Seed extraction methods.
20. Processing – seed treatment – packing.
21. Dormancy – types – causes – treatment
22. Storage –types-factors influencing seed storage
23. Seed certification – phases – general and specific standards
24. Field Standard – seed standards – field inspection – Grow Out Test
25. The Seeds Act and Rules –Committee on crop standards.
26. Release and Notification of varieties of horticultural Crops
27. Central Seed Certification Board, State Seed Certification Agency – Central Seed Testing Laboratory cum Referral Laboratory and Notified Seed Testing Lab
28. Seed Inspector – duties and responsibilities – offences and penalties
29. Seeds (Control) Order, 1983 – Labelling standards – New Policy on seed development, 1988.
30. PPV and FRA, 2001 and salient features of Seed Bill 2004.
31. Seed testing – importance – seed lot – assignment of lot number – seed sample – sampling methods
32. Purity analysis – moisture estimation
33. Germination tests – viability test
34. Seed vigour tests – seed health test

Practical Schedule

1. Seed structure in horticultural crops
2. Seed production planning
3. Seed extraction techniques.
4. Practicing emasulation and dusting techniques (tomato/brinjal/okra)
6. Supplementary pollination in horticultural crops.
7. Seed sampling, mixing and dividing the submitted sample.
8. Analysis of physical purity
9. Estimation of seed moisture
10. Conducting of germination tests
11. Seedling evaluation
12. Quick viability test
13. Seed health test
14. Grow out test
15. Vigour test
16. Seed blending.
17. **Final practical examination**

Course Outcomes

CO 1: Acquire knowledge on Seed quality characteristics, significance and Genetic and agronomic principles of seed production

CO 2: Understand the Seed production techniques of Horticultural crops

CO3: Acquire knowledge on Post harvest seed handling techniques in seed production

CO4: Understand the concept of Seed Legislation and certification procedures

CO 5: Acquire knowledge on Seed quality testing, Storage and Marketing

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	-	-	-	-
CO2	-	-	-	3	-	-
CO3	-	-	-	2	-	-
CO4	-	-	-	1	-	-
CO5	-	-	-	1	-	-

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ENT 302 APICULTURE, SERICULTURE AND LAC CULTURE 3(2+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 describe helpful insects and their services, injurious insects and their impacts
- To study the basic morphology, biology and extraction techniques of important plant parasitic nematodes.

Theory

Unit I: Apiculture

Economic classification of insects. Importance and history of apiculture, species of bees, morphology, anatomy-structural adaptations. Colony organization and life history - bee castes, duties, social behaviour, bee pasturage, bee foraging, communication, swarming. Apiary - selection of site, bee-keeping equipment, seasonal management and Artificial queen rearing. Enemies and diseases of bees, bee pollination, bee products and their uses, bee poisoning and Scope of beekeeping in India.

Unit II: Sericulture

Importance and history of sericulture, organizations involved in sericulture, silkworm types - mulberry silkworms and non - mulberry silkworms -eri, tasar and muga silkworms. voltinism - multivoltine - bivoltine -hybrid-double hybrids - morphology and biology of mulberry silkworm - structure and function of silk glands.

Unit III: Moriculture

Moriculture - mulberry varieties - methods of propagation -nursery and main field preparation - planting methods - Pruning and harvesting -preservation of leaves - pests and diseases of mulberry and their management.

Unit IV: Mulberry silk

Rearing house - room and bed disinfectants -grainage- Chawki rearing - Rearing of late age worms. Mounting - mountages - harvesting of cocoons. Pests and diseases of mulberry silkworm and their management - Steps in Post cocoon technology - stifling to weaving. Uses of silk.

Unit V: Lac Culture

Lac culture - Importance and history. Lac insect - species, morphology, biology and secretion of lac. Host plants of lac insect - maintenance of host plants. Inoculation of Lac insect and yield. Enemies of lac insect. Lac processing - Seed lac- Button lac - Shellac. Lac products - Uses of lac.

Practical

Acquaintance with honey bee species, structural adaptation, castes, Bee -keeping equipment, bee forage plants, enemies of bees and Handling of bee colonies and Artificial queen rearing. Acquaintance with silkworm types, life stages of mulberry silkworm, Mulberry varieties, Rearing appliances for silkworm, Enemies of 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, lac products.

Assignment: Each student has to submit an assignment on bee keeping/sericulture/Lac culture

Lesson Plan

Theory Schedule

Economic classification of insects. Importance and history of apiculture

1. Beekeeping as an industry, Scope of beekeeping in India
2. Species of bees - Little bee, Dammar bee, Indian honey bee, European bee and Rock bee
3. Morphology, anatomy of bees
4. Structural adaptations of bees
5. Bee biology- Colony organization and life history
6. Bee castes
7. Duties - social behaviour
8. Bee pasturage and bee foraging
9. Communication and swarming
10. Apiary - selection of site, bee - keeping equipment
11. Apiary - seasonal management
12. Artificial queen rearing
13. Bee enemies and diseases of bees
14. Bee pollination, bee products and their uses
15. History of sericulture - silk road - Organizations in sericulture industry
16. Types of silkworm - Non - mulberry, Eri, Tasar and Muga silkworms

17. **Mid Semester Examination**

18. Voltinism - multivoltine, bivoltine, bivoltine hybrids, double hybrids
19. Morphology and biology of mulberry silkworm
20. Structure and function of silk glands
21. Mulberry cultivation - soil type - mulberry varieties - Methods of propagation -Nursery preparation - Main field preparation - Methods of planting - Nutritional requirements - Water management
22. Pruning methods - Methods of harvesting - preservation of leaves - Pests of mulberry plants
23. Mulberry silk worm rearing - rearing house, room and bed disinfectants, grainage
24. Chawki rearing - feeding, cleaning and spacing
25. Rearing of late age worms - feeding, cleaning, spacing
26. Mounting - mountages - harvesting of cocoons. Pests and diseases of mulberry silkworm and their management. Steps in Post cocoon technology - stifling to weaving
27. Uses of silk. Pests and diseases of silkworm - symptoms - management practices
28. Importance and history of Lac culture, Species of Lac insect
29. Morphology, biology and secretion of lac
30. Host plants of lac insect - maintenance of host plants, Inoculation of Lac insect and Yield
31. Enemies of lac insect
32. Lac processing - Seed lac - Button lac - Shellac
33. Lac products - Uses of lac

Practical Schedule

1. Acquaintance with honey bee species
2. Castes of bees
3. Structural adaptation
4. Acquaintance with Bee - keeping equipments
5. Bee forage plants
6. Studies on seasonal management of bees
7. Identification of enemies of honey bees
8. Identification of Silkworm types - mulberry, Eri, Tasar and Muga silkworms
9. Acquaintance with life stages of mulberry silkworm
10. Acquaintance with Mulberry varieties
11. Preparation of mulberry cuttings
12. Identification of rearing appliances for mulberry silkworm
13. Acquaintance with methods of disinfection
14. Handling of silkworm in Chawki rearing
15. Late age rearing
16. Identification of lac insects and lac products
17. **Final practical examination**

Course Outcomes

CO1: Discuss bee morphology, biology, behaviour and describe apiary selection, bee pasturage and management of bee colony (Apiculture)

CO2: Explain silkworm types, voltinism, biology and define mulberry cultivation, rearing techniques of silkworms and cocoon harvesting and processing of silk (Sericulture).

CO3: Describe biology, strains and cultivation of lac and depict minor productive insects and their uses

CO4: Compare and contrast predators and parasitoids, express other helpful insects, their uses. Discuss insects injurious to humans, farm animals and other house hold insects and their menace

CO5: Explain basic morphology and anatomy of nematodes and describe biology of major plant parasitic nematodes

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	2	2	2
CO2	2	2	3	3	3	3
CO3	2	3	2	2	3	3
CO4	2	3	3	3	2	2
CO5	2	3	3	3	3	2

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AEC- 301 HORTI-BUSINESS MANAGEMENT (2+0)

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 agri business and managing the business
- To provide knowledge to the students on project selection, formulation, financial feasibility analysis, monitoring and evaluation techniques with reference to agricultural sector.
- To understand the types of inventories, inventory costs and managing the inventories

Theory

Unit I: Management Principles I- Planning, Organizing and Staffing

Management introduction – definition, functions- Planning – meaning, steps and methods of planning, types of plan, characteristics of effective plans. Organizations – forms of business

organizations, organizational principles, division of labour. Unity of command, scalar pattern, job design, span of control responsibility, power authority and accountability, staffing – Personnel management - recruitment and selection, training, appraisal and remuneration.

Unit III: Management Principles II – Directing & Controlling

Direction – guiding, leading, motivating, supervising, coordination – meaning, types and methods of controlling – evaluation, control systems and devices. Budgeting as a tool for planning and control. Record keeping as a tool of control. Controlling production in terms of quantity and quality.

Unit III: Production Management

Farm management - definition, nature, characteristics and scope. Farm management principles and decision making, production function, technical relationships, cost concepts, curves and functions – factors, product, relationship – factors relationship, product relationship, optimum conditions, principles of opportunity cost-equi-marginal returns and comparative advantages, time value of money, economic of scale, returns to scale, cost of cultivation and production, break even analysis, decision making under risk and uncertainty.

Unit IV: Operations and Material management

Functional areas of management -Operations management – physical facilities, implementing the plan, scheduling the work, Materials management – types of inventories, inventory costs, managing the inventories, economic order quantity (EOQ) – Reorder point.

Unit V: Marketing and Financial Management

Marketing management – definitions, planning the marketing programmes, marketing mix - four P's - Market segmentation -Market Promotion Strategies. Financial management – financial statements and ratios, capital budgeting. Project management – project preparation and evaluation measures.

Lesson plan

Theory Schedule

1. Management introduction – definition, functions
2. Planning – meaning, steps and methods of planning, types of plan
3. Characteristics of effective plans
4. Organizations – forms of business organizations
5. Organizational principles, division of labour
6. Unity of command
7. Scalar pattern
8. Job design
9. Span of control responsibility, power authority and accountability
10. Staffing – Personnel management - recruitment and selection
11. Training, appraisal and remuneration
12. Direction – guiding, leading, motivating, supervising, coordination – meaning
13. Types and methods of controlling – evaluation, control systems and devices
14. Budgeting as a tool for planning and control

15. Record keeping as a tool of control
16. Controlling production in terms of quantity and quality
- 17. Mid- Semester Examination**
18. Farm management - definition, nature, characteristics and scope
19. Farm management principles and decision making, production function, technical relationships
20. Cost concepts, curves and functions
21. Factors – Product relationship – Factors – Factor relationship
22. Product - Product relationship, optimum conditions, principles of opportunity cost
23. Equi-marginal returns and comparative advantages, time value of money, economic of scale, returns to scale
24. Cost of cultivation and production, break even analysis
25. Decision making under risk and uncertainty
26. Functional areas of management
27. Operations management – physical facilities, implementing the plan, scheduling the work,
28. Materials management – types of inventories, inventory costs, managing the inventories
29. Economic order quantity (EOQ) – Reorder point.
30. Marketing management – definitions, planning the marketing programmes,
31. Marketing mix - four P's - Market segmentation - Market Promotion Strategies.
32. Financial management – financial statements and ratios,
33. Capital budgeting.
34. Project management – project preparation evaluation measures.

CourseOutcome

CO1: Understand nature and scope of financial management in horticulture business.

CO2: Identify the tools for credit, repayment and down payments.

CO 3: Do the appraisal of projects by measurement of costs benefits and sensitivity analysis.

CO4: To understand the EOQ, types of inventories, inventory costs, managing the inventories

CO 5: To know the methods of capital budgeting techniques

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	3	-	-	-
CO2	-	3	-	-	-	-
CO3	2	2	-	3	-	2
CO4	-					
CO5	3	-		-	-	

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AEC-302 ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS MANAGEMENT (1+1)

Learning objectives

- To understand the importance of Entrepreneurship in agriculture
- To understand the various agri- business incubator
- To know the Government policies on Small and Medium Enterprise
- To understand the role of venture capital in agriculture
- To equip the organizational and managerial skills

Theory

Unit I: Entrepreneurship Basic Concepts

Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; Creativity-Innovation and Entrepreneurship - Globalization and the emerging business / entrepreneurial environment - Entrepreneurial Culture.

Unit II: Entrepreneurship Development

Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Planning - Importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Entrepreneurship Development Process - Institutions for Entrepreneurial Development - Generation, incubation and commercialization of ideas and innovations.

Unit III: Government Policy

Entrepreneurship - Current scenario - Types of organization- Role Of Entrepreneurship In Economic Development - Backward and Forward Linkages: Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) Role of SSI sector - Marketing management-Export Import Policy

Unit IV: Supply chain Management

Supply Chain Management- concept, meaning, nature and scope-Venture capital. Contract farming and joint ventures, public-private partnerships. Supply chain management and total quality management. Overview of horticultural inputs industry. Characteristics of Indian horticultural processing and export industry. Social Responsibility of Business.

Unit V: Entrepreneurship and Project preparation

Women entrepreneurship Development -Entrepreneurship Development in rural areas - Entrepreneurship in Agriculture - Entrepreneurship in Service Sector- Ownership Structures - Intrapreneurship- Dealership, Networking Franchising - Project Identification Project Cycle - Project Report Preparation - Basic guidelines, Project Appraisal and Evaluation -- Bank norms – Insurance – SWOT analysis – Crisis management, - **Current Stream of thought.**

Practicals

Visit to Small and Medium Enterprises (SMEs) -Conducting market survey to access the demand for product – Preparation of questionnaire and Schedule -Assessment of Demand and Supply in potential areas of growth-Project appraisal techniques - NPV, BCR and IRR- Sensitivity analysis - Economic Feasibility of Projects - Financial management-Visit to commercial banks - Financial feasibility-Net Work techniques - PERT/ CPM-Business communication -Visit to Agri clinic and agri- business centres-Functions of the Small Industries Service Institutes (SISI) -Visit to Small Industries Development Bank of India (SIDBI)-Small Industries Development Corporation(SIDCO)-Identification of Problems of Startups (SSI)-Functions of SIDO & DIC-Functions of NIESBUD, NAYE -Role of EDII & IDBI-Visit to Horticultural export firms

Lesson plan

Theory Schedule

1. Concept of entrepreneurship, entrepreneurial and managerial characteristics, managing an enterprise, motivation and entrepreneurship development
2. Creativity-Innovation and Entrepreneurship, Globalization and the emerging business / entrepreneurial environment, Entrepreneurial Culture

3. Entrepreneurship Development, Assessing overall business environment in the Indian economy
4. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs
5. Planning - Importance of planning, monitoring, evaluation and follow up, managing competition, entrepreneurship development programs, SWOT analysis
6. Entrepreneurship Development Process
7. Institutions for Entrepreneurial Development Generation, incubation and commercialization of ideas and innovations.
8. Entrepreneurship - Current scenario - Types of organization- Role Of Entrepreneurship In Economic Development
9. **Mid semester Examinations**
10. Backward and Forward Linkages: Government schemes and incentives for promotion of entrepreneurship
11. Government policy on Small and Medium Enterprises (SMEs) Role of SSI sector - Marketing management - Export, Import Policy
12. Venture capital, Contract farming and joint ventures, public-private partnerships. Supply chain management and total quality management
13. Overview of horti inputs industry, Characteristics of Indian horticultural processing and export industry, Social Responsibility of Business
14. Women entrepreneurship Development, Entrepreneurship Development in rural areas, Entrepreneurship in Agriculture, Entrepreneurship in Service Sector
15. Ownership Structures, Intrapreneurship, Dealership, Networking Franchising
16. Project Identification Project Cycle, Project Report Preparation, Basic guidelines, Project Appraisal and Evaluation, Bank norms, Insurance, SWOT analysis , Crisis management
17. **Current Stream of thought**

Practical schedule

1. Visit to Small and Medium Enterprises (SMEs)
2. Conducting market survey to access the demand for product – Preparation of questionnaire and Schedule
3. Assessment of Demand and Supply in potential areas of growth
4. Project appraisal techniques - NPV, BCR and IRR
5. Sensitivity analysis - Economic Feasibility of Projects - Financial management
6. Visit to commercial banks - Financial feasibility
7. Net Work techniques - PERT/ CPM
8. Business communication
9. Visit to Agri clinic and agri- business centres
10. Functions of the Small Industries Service Institutes (SISI)

11. Visit to Small Industries Development Bank of India (SIDBI)
12. Small Industries Development Corporation(SIDCO)
13. Identification of Problems of Startups (SSI)
14. Functions of SIDO & DIC
15. Functions of NIESBUD, NAYE
16. Role of EDII & IDBI
17. Visit to Horticultural export firms

Course Outcome

CO 1: To understand the emerging business / entrepreneurial environment.

CO2: To know the Entrepreneurship Development Process

CO 3: Role of Entrepreneurship in Economic Development

CO 4: To identify the Supply chain and total quality management in horti products

CO 5: To gain knowledge on Project Report preparation in horti products.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	3	-	-	-
CO2	3		-	2	-	-
CO3	-	2	-		-	2
CO4	-			2		
CO5	3	3		-	-	

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3. Mario Raposo, D. Smallbone, K. Balaton, L. Hortoványi, 2011. Entrepreneurship, Growth and Economic Development, Edward Elgar Publishing,
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3.<http://jnkvv.org/PDF/02032022164711Entrepreneurship%20Development%20and%20Business%20Commination.pdf>

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STA 301 STATISTICS METHODS (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: Diagrams and graphs

Introduction to Statistics, Definition, Advantages & Limitations, Quantitative and Qualitative data- Discrete and Continuous Variables. Diagrammatic representations Bar

Graphs- Pie Graphs - Graphical Representation - Frequency histogram, Frequency polygon, frequency curve and ogives.

Unit II: Measures of Central Tendency and Dispersion

Measures of Central Tendency: Definition, Different Measures, Characteristics of a Satisfactory Average. Definition and Calculation of Arithmetic Mean, Median and Mode - Merits and Demerits. Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation

Unit III: Probability Distribution and Bivariate Analysis

Introduction to Probability – Events, Sample Space, Definition of Probability, Addition and Multiplication Theorem (without proof). Binomial Distribution, Poisson Distribution. Normal Distribution (Concepts only)

Introduction to Correlation: Definition, Scatter Diagram, Types of correlation, Properties - Karl Pearson's correlation coefficient. Regression - definition - fitting of two simple linear regression equation - properties of regression coefficient. Chi-square test

Unit IV: Tests of Significance

Definitions of Statistical Population, Sample, Random Sampling, Parameter, Statistic. Sampling distribution, Standard error - Test of Significance, Null Hypotheses, Types of Errors, Level of Significance and Degrees of freedom, Steps involved in Testing of a Hypotheses. Large sample tests: Test of single and difference of proportions - Test of single and difference of means.

Small sample tests: students t test for one and two samples. Paired T test and test for correlation coefficient. Chi-square test for attributes, F test for equality of variances.

Unit V: Design of Experiments

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). **Current Streams of thought.**

Lesson Plan

Theory Schedule

1. Introduction to Statistics, Definition, Advantages & Limitations, Applications in

Agriculture, Data -Types of data - Quantitative and Qualitative Variables- Discrete and Continuous Variables

2. Simple bar diagram, Multiple Bar, percentage bar and Pie diagram—Histograms, Frequency polygon, frequency curve
3. Definition, Different Measures, Characteristics of a Satisfactory Average
.Definition and Calculation of Arithmetic Mean, Median and Mode for Ungrouped data
4. Arithmetic Mean, Median and Mode for Grouped data. Merits and Demerits of AM, Median and Mode
5. Standard Deviation, Variance and Coefficient of Variation
6. Introduction to Probability—Events, Sample Space, Definition of Probability, Addition and Multiplication Theorem (without proof)
7. Binomial Distribution, Poisson Distribution. Normal Distribution
8. Correlation: Definition, Scatter Diagram, Types of correlation, Karl Pearson's correlation coefficient
9. **Mid Semester Examination**
10. Regression: Definition, Fitting of two lines Y on X and X on Y, Properties, inter relation between correlation and Regression
11. Definitions of Population, Sample, Random Sampling, Parameter, Statistic. Sampling distribution, Standard Error, Null Hypotheses, alternate Hypotheses, Types of Errors, Level of Significance and Degrees of freedom, Steps involved in Testing of a Hypotheses
12. Large sample tests - Test of single and difference of proportions - Test of single and difference of means, Null Hypotheses, Test Statistic Table values and Inference (Conclusion about Null Hypotheses)
13. Small sample tests: students t test for one and two samples. Paired T test and test for correlation coefficient
14. Chi-square test in 2x2 and $r \times c$ Contingency table. F-test for Two Population variances and properties Assumptions
15. Analysis of Variance (ANOVA) - assumptions - one way and two way classifications.
16. Basic principles of experimental designs - Completely Randomized Design (CRD)
17. Randomized Block Design (RBD) - Latin Square Design (LSD)

Practical Schedule

1. Simple bar diagram. Multiple bar diagram, percentage bar diagram and pie diagram
2. Frequency histogram, Frequency polygon, frequency curve and ogives
3. Calculation of Arithmetic Mean, Median and Mode for ungrouped data
4. Calculation of Arithmetic Mean, Median and Mode for grouped data
5. Computation of Standard Deviation, Variance and Coefficient of Variation for ungrouped data
6. Computation of Standard Deviation, Variance and Coefficient of Variation for grouped data
7. Computation of Karl Pearson's correlation coefficient
8. Computation of regression equations
9. Solving problems for long sample test for single proportion and difference of proportions
10. Large sample test - test for single mean and difference between two means
11. Small samples test - one sample t-test, two sample t test and paired t test

12. Chi-square test for 2x2 contingency table and r xc contingency table
13. F test for two population variances
14. Analysis of Completely Randomised Design (CRD)
15. Analysis of Randomised Block Design (RBD)
16. Analysis of Latin Square Design (LSD)
17. **Final Practical Examination**

Course Outcomes

CO 1: The students will understand fundamental concept of statistical applications in biology.

CO 2: The students will understand application of statistical concepts.

CO 3: The students will acquire theoretical concept of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.

CO 4: The students will get to know about Practical exposure to concept of descriptive statistics, testing of hypothesis, correlation and regression.

CO 5: The students will get to know about Practical exposure to basic design of experiments.

CO-PO Mapping Matrix

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

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2. www.statsoft.com
3. http://www.iasri.res.in/ebook/EB_SMAR/index.htm
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5. <http://davidmlane.com/hyperstat/>

VII & VIII Semesters

Student READY (Rural and Entrepreneurship Awareness Development Yojana) to assure employability and to develop entrepreneurs

This will be undertaken by the students during the seventh and eighth semesters. Student READY shall be run for full year by making two groups and rotating activities of the final year in two groups. To get the eligibility for registering for the Student READY programme, the students should have completed all the courses successfully up to sixth semester. No student should be allowed to take up the Student READY programme with backlog/repeat courses.

The students will be required to have registered for the three components listed below. The minimum attendance required for this programme is 85%. Any student in the event of recording shortage of attendance has to re-register the EL when offered next by paying the assigned fee.

1. Experiential Learning (EL)/Hands on Training (HOT) - 20 credits (24 weeks)
2. Rural Horticulture Work Experience (RHWE) 10 credits (10 weeks)
3. In Plant Training/Industrial attachment - 10 credits (10 weeks)

The Experiential Learning (EL)/Hands on Training (HOT)

Experiential Learning/Hands on Training (HOT) helps the student to develop competence, capability, capacity building, acquiring skills, expertise, and confidence to start their own enterprise and turn job creators instead of job seekers. EL provides the students an excellent opportunity to develop analytical and entrepreneurial skills, and knowledge through meaningful hands on experience, confidence in their ability to design and execute project work.

The main objectives of EL are:

- To promote professional skills and knowledge through meaningful hands on experience
- To build confidence and to work in project mode
- To acquire enterprise management capabilities

The Experiential Learning Programme (ELP) shall be run for full year by making two groups and rotating activities of the final year in two groups.

The students will register for any of two modules, listed below, of 0+10 credit hours each. A separate certificate should be issued to the students after successful completion of ELP. Allotment of ELP amongst students to different modules should be done strictly on the basis of merit at the end of sixth semester.

ELHOR 401	Commercial Horticulture	Horticulture	0+10
ELHOR 402	Floriculture and Landscape gardening	Horticulture	0+10
ELHOR 403	Processing of fruits and vegetables for value addition	Horticulture	0+10
ELHOR 404	Protected cultivation of high value horticultural crops	Horticulture	0+10
ELHOR 405	Organic vegetable production	Horticulture	0+10
ELAGR 401	Horticultural Waste Management	Agronomy	0+10
ELGPB 401	Seed Production and Technology	Genetics and Plant Breeding	0+10
ELGPB 402	Hybrid seed production technologies	Genetics and Plant Breeding	0+10
ELAGM 401	Production Technology for Bioagents and Biofertilizer	Agricultural Microbiology	0+10
ELPAT 401	Mushroom Cultivation Technology	Plant Pathology	0+10
ELSAC 401	Soil, Plant, Water and Seed Testing	Soil Science and Agricultural Chemistry	0+10
ELENT 401	Commercial Apiculture	Entomology	0+10

ELENT 402	Commercial Production of Entomophages & Biopesticides	Entomology	0+10
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Periodical evaluation of the above course will be done by the course teacher during different stages of work. Final evaluation of the above course will be done by the teacher in charge and another staff member appointed as examiner by the Head of the Department. The final examination will be conducted by the University before the commencement of regular final semester examinations.

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
	Total	100

Rural Horticultural Work Experience (RHWE) and Industrial Attachment (IA) (Village/ Industrial Attachment Training Programme)

It shall be undertaken by the students during the seventh/eighth semesters for a total duration of 20 weeks with a weightage of 0+20 credit hours in two parts. The Rural Horticultural Work Experience (RHWE) helps the students primarily to understand the rural situations, status of agricultural technologies adopted by the farmers to prioritize the farmers problems and to develop skills & attitude of working with farm families for overall development in rural area. The timings for RHWE can be flexible for specific regions to coincide with the main cropping season.

It will consist of general orientation and on-campus training by different faculties followed by village attachment/Unit attachment in University/College/KVK/Estates or a Research Station. The students would be attached with the horti-industries to get an experience of the industrial environment and working. Due weightage in terms of credit hours will be given depending upon the duration of stay of students in villages/horti-industries. At the end of RHWE/IA, the students will be given one week for project report preparation, presentation and evaluation. The students would be required to record their observations in field and horti-industries on daily basis and will prepare their project report based on these observations.

RHWE & IA - Rural Horticultural Work Experience and Industrial Attachment

Activities	Department	No. of weeks	Credit Hours
General orientation & On campus training by different faculties	Agricultural Extension	1	9
Village attachment		8	

Unit attachment in Univ./College. KVK/ Estates/Research Station /Financial Inst.	Agricultural Economics	5	9
Agri clinic/Horti business center		4	
Horti-Industrial Attachment			
Project Report Preparation, Presentation and Evaluation	Agricultural Extension & Agricultural Economics	2	2
Total weeks for RHWE & AIA		20	20
EXT 411 Educational Tour II	Agricultural Extension		1(0+1)

Industrial Attachment: The students would be attached with the Horticulture based industries for a period of 3 weeks to get an experience of the industrial environment and working.

RHWE Component-I

Village Attachment Training Programme

Sl. No.	Activity	Duration
1.	Orientation and Survey of Village	1 week
2.	Agronomical Interventions	1 week
3.	Plant Protection Interventions	1 week
4.	Soil Improvement Interventions (Soil sampling and testing)	1 week
5.	Fruit and Vegetable production interventions	1 week
6.	Floriculture and Landscape interventions	1 week
7.	Food Processing and Storage interventions	1 week
8.	Extension and Transfer of Technology activities	1 week

RHWE Component -II

Horti-Industrial Attachment

- Students shall be placed in Horti-and Cottage industries and Commodities Boards for 03 weeks.
- Industries include Seed/Nursery production, landscape, Pesticides-insecticides, Post harvest-processing value addition, Agri-finance institutions, etc.

Activities and Tasks during Horti-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry
- Study of various processing units and hands-on training under supervision of industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students

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	
Final examination		
Commendable activities	10	By the Examiners
Detailed project report presentation and Record	30	
<i>Viva Voce</i>	20	
Total	100	