



**ANNAMALAI UNIVERSITY  
FACULTY OF AGRICULTURE**



**DEGREE OF BACHELOR OF SCIENCE IN HORTICULTURE  
WITH EFFECT FROM 2012 – 2013  
System of Education: Formal Education with Semester System**

**Regulations**

- Candidates for admission to the degree of **Bachelor of Science in Horticulture B.Sc.(Hort.)** – shall be required to have passed the Higher Secondary Course (10+2) or any other examination recognized as equivalent there to and fulfilling the following requirements

**A. Eligible Subjects of Study in the Qualifying Examination**

**HSC/ Equivalent- Academic Stream**

- Mathematics / Botany / Biology as first subject.
- Physics as second subject.
- Chemistry as third subject.
- One elective as fourth subject\*

Subjects of study are grouped below

Subject 1	Subject 2	Subject 3	Subject 4 (elective subject)*
Biology	Physics	Chemistry	Computer Science/ Micro biology/Biotechnology/ Biochemistry/Nursing/ Nutritional Dietetics
Botany	Physics	Chemistry	Zoology
Mathematics	Physics	Chemistry	Biology/Computer Science/ Statistics/Biochemistry/ Home science

\*Incase of failure to qualify with the first three subjects, his marks in the subject listed as fourth will be considered for calculating eligible minimum qualifying aggregate marks. The aggregate marks will be computed using the following formula

$$\frac{\% (\text{Sub 1}) + \% (\text{Sub 2}) + \% (\text{Sub 3})}{3} \times 2 = \boxed{\phantom{00}}$$

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**(or)**

$$\frac{\% (\text{Sub 1}) + \% (\text{Sub 2}) + \% (\text{Sub 3}) + \% (\text{Sub 4})}{4} \times 2 = \boxed{\phantom{00}}$$

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**B. HSC/ Equivalent**

Biology with three vocational subjects.

**C. Eligible Minimum Qualifying Marks**

**C1.** Open Competition (OC): *50 % aggregate in the qualifying subjects as mentioned above.*

**C2.** Backward Class (BC), Backward Class Christians (BCC) and Backward Class Muslims (BCM): *45 % aggregate in the qualifying subjects as mentioned above.*

**C3.** Most Backward Class (MBC) / De notified Community (DNC): *40 % aggregate in the qualifying subjects as mentioned above.*

**C4.** Scheduled Caste (SC)/ Scheduled Tribe (ST): *A pass in qualifying examination with above qualifying subjects.*

**D. Number of Attempts to Pass**

The maximum number of attempts to pass the qualifying examination for admission to all the courses are as follows

Sl. No.	Community	Maximum Number of Attempts
1	Scheduled Caste / Scheduled Tribe	Three
2	All others Communities	Two

### **E. Award of B.Sc.(Hort.) Degree**

The candidates should have undergone successfully the prescribed course of study in the University. They shall further be required to have completed and passed 165 course credits and shall have earned an overall grade point average (OGPA) of 5.50 out of 10 for all courses completed in B.Sc. (Hort.) degree programme. In addition to the above, students shall in the judgment of the Faculty, possess good conduct and character.

2. The syllabi for the courses shall be prescribed from time to time by the Academic Council on the recommendations of the Board of Studies.
3. The B.Sc.(Hort.) degree course shall be of four academic years. Each academic year shall comprise two semesters as shown below.

I Year	B.Sc.(Hort.)	-	Semester I and II
II Year	B.Sc.( Hort.)	-	Semester III and IV
III Year	B.Sc.(Hort.)	-	Semester V and VI
IV Year	B.Sc.(Hort.)	-	Semester VII and VIII

4. **SEMESTER DURATION:** A Semester consists of 110 working days including semester examination days.

### **5. DEFINITIONS**

- 5.1. "Course" is a teaching unit of a discipline to be covered within a semester as detailed in the curricula and syllabi issued by the University.
- 5.2. A "Credit" in theory means 60 minutes of class room lecture plus two hours of library or homework, and a "Credit" in practical means two hours of laboratory or three hours of field work per week.
- 5.3. "Curriculum" is a group of courses and other specified requirements for the fulfillment of the degree programme.
- 5.4. "Credit load" of a student during a semester is the total number of credits of all the courses he/she registers during that particular semester.
- 5.5. "Grade Point" means the total marks in percentage divided by 10 and rounded to two decimals.
- 5.6. "Credit Point" means the grade point multiplied by credit.
- 5.7. "Overall Grade Point Average" (OGPA) means the total credit points of the courses completed by the student divided by total credit hours of the course and rounded to two decimals. The OGPA shall be the basis to determine the student's merit and to decide whether or not a student meets the academic requirements for getting the degree.
- 5.8. "Transcript Card" is a consolidated report of grades secured by the student issued by the University.
- 5.9. a) The result of evaluation of a course shall be indicated by grade points ranging from 0 to 10. Grade point is the total marks in percentage divided by 10. The minimum grade point to be secured for the successful completion of a course will be 5.00; Less than 5.00 will be treated as 'F' grade and the grade point will be 0 for calculating the GPA/OGPA.

b) The following symbols shall be used in the grade sheets.

E	-	Incomplete (due to attendance deficiency)
F	-	Failed
RR	-	Re registration
SE	-	Supplementary Examination
IE	-	Improvement Examination
EE	-	Incomplete for reasons other than attendance

### **6. EXAMINATIONS**

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

**6.1. Course with both theory and practical**

	<b>Marks</b>
i) Mid Semester Examination	20
ii) Practicals, records, term papers and other assignments including field trips, if any, (Written = 25, Record = 5 Specimen collection = 5 and Viva-Voce = 5)	40
iii) Final Theory Examination	<u>40</u>
<b>Total</b>	<b><u>100</u></b>

**6.2. Course with only Theory / Practical\***

	<b>Marks</b>
i) Mid Semester Examination	40
ii) Final Semester Examination	60
<b>Total</b>	<b><u>100</u></b>

\* Except Five courses: NSS / NCC, EXP 411, EXP 421, RHWEP 412, and RHWEP 422 the distribution of marks of these courses are furnished in Regulations 6.4 to 6.6.

6.3. A student should secure a minimum of 50 per cent of marks in the aggregate and 45 per cent of marks in theory and practical separately to successfully complete a course. The candidate who does not satisfy the above criteria shall be awarded 'F' grade.

**6.4. NSS / NCC (0+1)**

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

**NSS**

Each student enrolled in NSS should serve in four semesters (I, II, III and IV). He / She should also attend at least one special camp not exceeding 10 days duration. Marks will be awarded as follows.

	<b>Marks</b>
NSS Regular Programme	60
NSS Special camp not exceeding 10 days duration	<u>40</u>
<b>Total</b>	<b><u>100</u></b>

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

**NCC**

Each student enrolled in NCC should attend 10 parades per semester. Marks will be awarded at the rate of two marks per parade (2 x 40 = 80). The final semester examination will be for 20 marks. There will be no supplementary examination for the final NCC examination.

6.5. Course on Rural Horticultural Work Experience (RHWEP) *Viz.*, **RHE-412 Village stay programme, RHE-422 Placement in Industries** will be offered in the VII & VIII Semesters respectively. The students will be evaluated by the teachers in charge of the group and the evaluation procedure as follows:

**a. RHE-412 Village stay programme**

1. Daily record (Observation note book)	- 20	}	By the teacher in-charge
2. Skills learned	- 20		
3. Commendable Activities	- 10	}	By the examiners
4. Village stay programme record	- 30		
5. Viva-voce	- 20		
<b>Total</b>	<u>100</u>		

**b. RHE-422 Attachment to Horticultural Industries**

**i) Visit to NGO/Agri clinics/Input Industry / Agricultural Finance Institutions**

• Daily Record	- 20
• Project Report	- 20
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Total	40
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**ii) Horticultural Industrial Tie-Up**

• Daily observation note book	- 20
• CD preparation/Project report	- 20
• Viva-voce	- 20
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Total	60
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**6.6. Experiential learning courses:** EXP 411 and EXP 421 will be offered in the VII and VIII semesters. Periodical evaluation of the above course will be done by the course teacher during the different stages of work. Final evaluation of the above course will be done by the course teachers and the Head of the Department. The final semester examination will be conducted by the University before the commencement of regular final semester examinations. The distribution of marks will be 40 for periodical evaluation and 60 for final examination. The evaluation will comprise of skills learnt, proficiency in project execution, project report and viva-voce

Evaluation	Marks	
1. Daily Record (Observation note book)	20	} By the teacher in-charge
2. Skills learned	20	
3. Proficiency in project execution	10	} By the Examiners
4. Project Report	30	
5. Viva-Voce	20	
<b>Total</b>	<u>100</u>	

**7. MID-SEMESTER EXAMINATION (MSE)**

- 7.1. The appearance of the candidate for the mid-semester examinations is compulsory. If a student does not appear for MSE he/she is not eligible to appear for the final examinations. 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 two weeks before the schedule of MSE on payment of fee prescribed by the University. They will be conducted by the Dean, Faculty of Agriculture. The answer scripts will be shown to the student after valuation, retained for 10 days 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.
- 7.2. The MSE marks will not be shown separately in the grade sheet but will be combined with the respective final theory and practical marks. MSE marks awarded in a course will be added to the supplementary examinations also.
- 7.3. The MSE marks will be furnished to the Dean, Faculty of Agriculture through HOD's 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 H.D. himself is the course teacher, one senior member of the department concerned shall be nominated by the Dean.
- 7.4. The MSE of theory will be one hour duration for 20 marks which will be apportioned as shown below.

	Marks
i) Objective questions @ 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 three	5
iv) Essay type @ 5 marks for 1 question out of two	5
<b>Total</b>	<u>20</u>

- 7.5. If the student is not able to write the MSE due to his or her deputation by the University or due to other genuine reasons as judged by the Dean in consultation with Head of the Department and course teacher, he/she may be permitted to take up a make-up test of the particular examination. Such tests should be completed ordinarily within 15 working days after the respective MSE.

## **8. FINAL EXAMINATIONS**

- 8.1. The final theory and practical examinations will be of three hours duration each.
- 8.2. Theory examinations will be conducted after practical examinations.
- 8.3. The question papers for the final theory examinations will be set by the external examiners.
- 8.4. Central valuation of answer books will be done by examiners on the advice of the Chairman, Board of Examiners.
- 8.5. Practical Examination  
Practical examinations will be conducted in the practical classes itself towards the end. 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.
- 8.6. Two examiners appointed by the University, of whom one will be the course teacher concerned and one teacher nominated by HOD will conduct the practical examination.

## **9. SUPPLEMENTARY EXAMINATION**

- 9.1. A student who has failed in a course (subject) or awarded EE can take up supplementary 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.
- 9.2. A candidate with OGPA of less than 5.50 shall be allowed to appear for the examination of the courses completed earlier in which he/she had obtained GPA of 6.00 or less.
- 9.3. Students with arrear subjects can reappear for the same at the time of regular semester examination only.
- 9.4. A continuing candidate cannot appear for more than six subjects in the supplementary examination at a time. The candidate who has completed the tenure of four years in the B.Sc. (Hort.) Degree Programme cannot appear for more than 16 subjects in the supplementary examination at a time.
- 9.5. a. There will be no supplementary examination for the courses viz., EXP 411, EXP 421, RHWEP 412, and RHWEP 422. Those who fail in the above subject shall have to repeat the course in the subsequent year/ years.  
b. The supplementary *viva-voce* examination for these courses will be arranged as decided by the Dean for those who would have completed the course requirements but were unable to take up *viva-voce* due to medical or other compelling circumstances.
- 9.6. The candidates for the supplementary examinations will submit their applications through the Dean, Faculty of Agriculture who will scrutinize the applications to ensure compliance of regulation 9.2 and 9.4. The attested copy of all grade sheets pertaining to the supplementary examinations should be enclosed along with the applications.

## **10. ATTENDANCE REQUIREMENT**

- 10.1. One hundred per cent class attendance is expected from each student. A student who fails to secure 75 per cent of attendance prescribed for a course (subject) of study, separately in theory and practical shall not be permitted to appear for both theory and practical examinations in that course (subject) and shall be given 'E' (incomplete) and will be required to repeat the course (subject).
- 10.2. 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. Such information should be forwarded to the course teacher within three working days.
- 10.3. However, condonation of attendance deficiency may be considered by the Vice-Chancellor only in case of genuine reasons including indoor hospitalization with evidence in the form of Hospitalization certificate and Discharge summary recommended by the Dean, Faculty. The Vice-Chancellor may decide whether or not a condonation fee is required, based on the reason for condonation fee.

## 11. EVALUATION

### 11.1. Final Grade Point Average

Based on the total credits offered, the final grade point average shall be calculated and given. The various courses taken by a student along with credits and the grades obtained shall be shown on his/her transcript.

11.2. At the end of each semester, the student will be given the grade card of the grades obtained along with the cumulative average of grades up to that semester by the University.

### 11.3 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	: $140.50 + 156.00 = 296.50$
vii. Overall Grade Point Average	: $(296.50/40) = 7.412$
viii. Corrected to two decimals	: $7.41 / 10.00$

11.3. The student should complete the requirements for getting B.Sc. (Hort.) degree, namely, OGPA of 5.5 out of 10.00 for all courses within a period of eight years from the date of his/her admission. If the candidate does not complete the requirements within the above said period he/she should seek readmission.

## 12. TUITION FEES AND SCHOLARSHIPS

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

- In case of new admission, the fees for the semester are payable in advance failing which they will not be admitted.
- In other cases, the fees are payable within seven working days from the commencement of the semester.
- In the case of default, a fine as per the University rules will be collected.
- 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.
- 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.
- 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.
- 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.

## 13. TRANSITORY REGULATIONS

Separate time table of course work under old semester system will be arranged by the H.D. 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 2012 – 2013.

The candidates under old semester system will, however, complete all the examinations within a period of eight academic years from the year of admission.

**B.Sc. Horticulture**  
**SEMESTER-WISE DISTRIBUTION OF COURSES (2012)**

**SEMESTER-I**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	HOR 111	Fundamentals of Horticulture	2	1	3
02.	HOR 112	Plant Propagation and Nursery Management	1	1	2
03.	AGR 113	Introductory Meteorology	1	1	2
04.	SAC 114	General biochemistry	2	1	3
05.	GPB 115	Crop Physiology	2	1	3
06.	ENT 116	Fundamentals of Entomology	2	1	3
07.	TAM 117	Tamil/ Development Education	0	1	1
08.	NSS/NCC 101*	NSS /NCC	0	1	1
<b>Total</b>			<b>10</b>	<b>8</b>	<b>18</b>

**Note:** \* The Courses on NSS/NCC has to be offered for four semesters I, II, III & IV

**SEMESTER-II**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	HOR 121	Growth and Development of Horticultural Crops	1	1	2
02.	AGR 122	Introduction to Major Field Crops	2	1	3
03.	PAT 123	Principles of Plant Pathology	2	1	3
04.	AGM 124	Introductory Micro Biology	2	1	3
05.	SAC 125	Fundamentals of Soil Science	1	1	2
06.	AEX 126	Fundamentals of Extension Education	1	1	2
07.	AHS 127	Live stock and poultry production	2	1	3
08.	COM 128	Introduction to Computer and Application	1	1	2
09.	AEG 129	Farm Power and Machinery	1	1	2
<b>Total</b>			<b>15</b>	<b>7</b>	<b>22</b>

**SEMESTER-III**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	HOR 211	Production Technology of Tropical and Arid Zone Fruits	2	1	3
02.	HOR 212	Production Technology of Tropical Vegetables	2	1	3
03.	HOR 213	Production Technology of Plantation Crops, Spices and Condiments	2	1	3
04.	HOR 214	Bio-technology of Horticultural crops	1	1	2
05.	AGR 215	Water Management in Horticultural Crops	1	1	2
06.	ENT 216	Beneficial Insects and Nematode Pests	2	1	3
07.	SAC 217	Soil and Plant Analysis	1	1	2
08.	GPB 218	Genetics and Cytogenetics	2	1	3
09.	AEC 219	Introductory Economics	1	1	2
<b>Total</b>			<b>14</b>	<b>9</b>	<b>23</b>

**SEMESTER- IV**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	HOR 220	Production Technology of Medicinal and Aromatic Crops	1	1	2
02.	HOR 221	Ornamental and Landscape Gardening	2	1	3
03.	HOR 222	Protected and Precision Horticulture	1	1	2
04.	HOR 223	Crop production in Vegetable Crops (or) Crop Production in Flower Crops	0	1	1
05.	ENT 224	Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops and their management	1	1	2
06.	PAT 225	Mushroom Culture	0	1	1
07.	AEX 226	Extension Methodologies for Transfer of	1	1	2

		Horticultural Technologies			
08.	GPB 227	Principles and Methods of Plant Breeding	2	1	3
09.	AEG 228	Fundamentals of Soil and Water conservation Engineering	2	1	3
10.	STA 229	Statistics	1	1	2
<b>Total</b>			<b>11</b>	<b>10</b>	<b>21</b>

#### SEMESTER- V

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	HOR 311	Breeding of Horticultural Crops	2	1	3
02.	HOR 312	Commercial Floriculture	1	1	2
03.	HOR 313	Organic Horticulture	1	1	2
04.	HOR 314	Urban and Environmental Horticulture	1	1	2
05.	PAT 315	Diseases of Fruit, Plantation and Medicinal and Aromatic Crops	2	1	3
06.	AGM 316	Environmental Science	1	1	2
07.	AEC 317	Fundamentals of Horti-Business Management	1	1	2
08.	AEX 318	Entrepreneurship Development	1	1	2
09.	ENG 319	Comprehension and Communication Skills in English	1	1	2
<b>Total</b>			<b>11</b>	<b>9</b>	<b>20</b>

#### SEMESTER- VI

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	HOR 321	Production technology of sub tropical and temperate Fruit and nut crops	2	1	3
02.	HOR 322	Production Technology of Temperate and Subtropical Vegetables	2	1	3
03.	HOR 323	Processing and Post harvest Management of Horticultural Crops	1	1	2
04.	AGR 324	Weed Management in Horticultural Crops	1	1	2
05.	ENT 325	Insect Pests of Vegetable, Ornamental and Spice Crops and their management	1	1	2
06.	PAT 326	Diseases of Vegetable, Ornamental and Spice Crops	2	1	3
07.	SAC 327	Soil Fertility and Nutrient Management	1	1	2
08.	AEC 328	Production Economics and Orchard Management	1	1	2
09.	GPB 329	Seed Production of Horticultural Crops	1	1	2
<b>Total</b>			<b>12</b>	<b>9</b>	<b>21</b>

#### SEMESTER- VII

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	EXP 411*	<b>Experiential learning (Professional Package)</b> Protected Cultivation of High Value Horticultural Crops Nursery Production and Management	5	10	15
02.	RHE 412	RHWEP –Village Stay Programme	0	5	5
<b>Total</b>			<b>5</b>	<b>15</b>	<b>20</b>

\* Choose any one course

#### SEMESTER- VIII

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	EXP 421*	<b>Experiential learning (Professional Package)</b> Post Harvest Technology and Value-Addition Floriculture And Landscape Gardening	5	10	15
02.	RHE 422	Attachment to Horticultural Industries	0	5	5
<b>Total</b>			<b>5</b>	<b>15</b>	<b>20</b>

\* Choose any one course



**B.Sc. Horticulture**  
**DISCIPLINE-WISE DISTRIBUTION OF COURSES (2012)**

**I. HORTICULTURE**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	HOR 111	Fundamentals of Horticulture	2	1	3
02.	HOR 112	Plant Propagation and Nursery Management	1	1	2
03.	HOR 121	Growth and Development of Horticultural Crops	1	1	2
04.	HOR 211	Production Technology of Tropical and Arid Zone Fruits	2	1	3
05.	HOR 212	Production Technology of Tropical Vegetables	2	1	3
06.	HOR 213	Production Technology of Plantation Crops, Spices and Condiments	2	1	3
07.	HOR 214	Bio-technology of Horticultural crops	1	1	2
08.	HOR 220	Production Technology of Medicinal and Aromatic Crops	1	1	2
09.	HOR 221	Ornamental and Landscape Gardening	2	1	3
10.	HOR 222	Protected and Precision Horticulture	1	1	2
11.	HOR 223	Crop production in Vegetable Crops (or) Crop Production in Flower Crops	0	1	1
12.	HOR 311	Breeding of Horticultural Crops	2	1	3
13.	HOR 312	Commercial Floriculture	1	1	2
14.	HOR 313	Organic Horticulture	1	1	2
15.	HOR 314	Urban and Environmental Horticulture	1	1	2
16.	HOR 321	Production technology of sub tropical and temperate Fruit and nut crops	2	1	3
17.	HOR 322	Production Technology of Temperate and Subtropical Vegetables	2	1	3
18.	HOR 323	Processing and Post harvest Management of Horticultural Crops	1	1	2
<b>Total</b>			<b>25</b>	<b>18</b>	<b>43</b>

**II. AGRONOMY**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	AGR 113	Introductory Meteorology	1	1	2
02.	AGR 122	Introduction to Major Field Crops	2	1	3
03.	AGR 215	Water Management in Horticultural Crops	1	1	2
04.	AGR324	Weed Management in Horticultural Crops	1	1	2
<b>Total</b>			<b>5</b>	<b>4</b>	<b>9</b>

**III. ENTOMOLOGY**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	ENT 116	Fundamentals of Entomology	2	1	3
02.	ENT 216	Beneficial Insects and Nematode Pests	2	1	3
03.	ENT 224	Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops and their management	1	1	2
04.	ENT 325	Insect Pests of Vegetable, Ornamental and Spice Crops and their management	1	1	2
<b>Total</b>			<b>6</b>	<b>4</b>	<b>10</b>

**IV. PLANT PATHOLOGY**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	PAT 123	Principles of Plant Pathology	2	1	3
02.	PAT 225	Mushroom Culture	0	1	1
03.	PAT 315	Diseases of Fruit, Plantation and Medicinal and Aromatic Crops	2	1	3
04.	PAT 326	Diseases of Vegetable, Ornamental and Spice Crops	2	1	3
<b>Total</b>			<b>6</b>	<b>4</b>	<b>10</b>

**V. MICRO BIOLOGY**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	AGM 124	Introductory Micro Biology	2	1	3
02.	AGM 316	Environmental Science	1	1	2
<b>Total</b>			<b>3</b>	<b>2</b>	<b>5</b>

**VI. SOIL SCIENCE AND AGRICULTURAL CHEMISTRY**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	SAC 114	General Bio-chemistry	2	1	3
02.	SAC 125	Fundamentals of Soil Science	1	1	2
03.	SAC 217	Soil and Plant Analysis	1	1	2
04.	SAC 327	Soil Fertility and Nutrient Management	1	1	2
<b>Total</b>			<b>5</b>	<b>4</b>	<b>9</b>

**VI.GENETICS & PLANT BREEDING**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	GPB 115	Crop Physiology	2	1	3
02.	GPB 218	Genetics and Cytogenetics	2	1	3
03.	GPB 227	Principles and Methods of Plant Breeding	2	1	3
04.	GPB 329	Seed Production of Horticultural Crops	1	1	2
<b>Total</b>			<b>7</b>	<b>4</b>	<b>11</b>

**VIII. AGRICULTURAL ECONOMICS**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	AEC 219	Introductory Economics	2	0	2
02.	AEC 317	Fundamentals of Horti-Business Management	1	1	2
03.	AEC 328	Production Economics and Orchard Management	1	1	2
<b>Total</b>			<b>3</b>	<b>3</b>	<b>06</b>

**IX. AGRICULTURAL EXTENSION**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	AEX 126	Fundamentals of Extension Education	1	1	2
02.	AEX 226	Extension Methodologies for Transfer of Horticultural Technologies	1	1	2
03.	AEX 318	Entrepreneurship Development	1	1	2
<b>Total</b>			<b>3</b>	<b>3</b>	<b>06</b>

**X. ANIMAL HUSBANDARY**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	AHS 127	Live stock and poultry production	2	1	2
<b>Total</b>			<b>2</b>	<b>1</b>	<b>2</b>

**XI. COURSES OFFERED BY OTHER DEPARTMENTS**

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
<b>COMPUTER SCIENCE &amp; ENGINEERING</b>					
01.	COM 128	Introduction to Computer and Application	1	1	2
02.	AEG 129	Farm Power and Machinery	1	1	2
03.	AEG 228	Fundamentals of Soil and Water conservation Engineering	2	1	3
<b>STATISTICS</b>					
04.	STA 229	Statistics	1	1	2

TAMIL/ EDUCATION					
05.	TAM 117	Tamil/ Development Education	0	1	1
ENGLISH					
06.	ENG 319	Comprehension and Communication Skills in English	1	1	2
<b>Total</b>			<b>6</b>	<b>6</b>	<b>12</b>

## XII. NSS/NCC

S.No.	Course No.	Title	Credits		
			Theory	Practical	Total
01.	NSS/NCC 101	NSS /NCC	0	1	1

## XIII. Experiential Learning:

Experiential learning is introduced in final year B.Sc. (Hort.). Four areas have been detailed as a model with different activities for learning and evaluation. For this purpose the students would be required to prepare a work plan in the area selected with an end-to-end approach i.e. from purchasing the input to producing a product and marketing. It would also have components of project development, monitoring and accounting. Students at the end of completion of project will submit report for evaluation. For this programme an advisor will guide students and the Committee appointed by the Dean of the College should do the evaluation of the project. The evaluation will comprise of skills learnt, proficiency in project execution, project report and viva-voce.

### Hands on Training/ Experiential Learning Models

Final year B.Sc. (Hort.) students to select any two areas of the following *ie.* One each at VII and VIII semesters, to undergo specialized training

1. EXP 411\* -Protected cultivation of high value crops
2. EXP 411\*-Post harvest technology and value addition
3. EXP 421\*Nursery production and management
4. EXP 421\*Floriculture and landscape gardening

S.No.	Activity	Credits	Duration in Weeks
1	Experiential learning (Professional Package)	5+10	14
2	Experiential learning (Professional Package)	5+10	14
3	RHWEP & Attachment to Horticultural Industries	0+10	6
<b>Total</b>		<b>10+30</b>	

\* Choose any one course in a semester

**Professional Packages:** 14 weeks duration

## XIV. RHWEP courses:

### RHE-412 Village stay programme and RHE-422 Placement in Industries

Village stay programme & Placement in industries will be conducted in VII and VIII semesters respectively. The duration will be of three weeks each. The students will be evaluated by the teachers in charge of the group.

### EXP 411\*

#### I. Protected Cultivation of High Value Horticultural Crops

1. Visit to commercial poly-houses, Project preparation and planning. Specialized lectures by commercial export house
2. Study of designs of green- house structures for cultivation of crops
3. Land preparation and soil treatment
4. Planting and production:
  - i. Cultural management including soil/media management in poly houses
  - ii. Fertigation and irrigation management
  - iii. Integrated Pest Management
  - iv. Harvesting and post harvest management; certification and distribution
  - v. Cost of production
5. Visit to export houses; Market intelligence; Marketing of produce; cost analysis; Institutional management
6. Report writing and viva-voce

**EXP 411\*****II Nursery Production and Management**

1. Project preparation
2. Nursery registration, methodology and certification
3. Establishment and management of plant propagating structures
4. Establishment of progeny blocks, identification of mother plants and maintenance of bud wood bank
5. Procurement of inputs (pots, polythene, FYM etc.)
6. Techniques and environ management for large scale production
7. Packaging and selling of plant material
8. Working out economics

**EXP 421 \*****III Post Harvest Technology and Value-Addition**

1. Design and project formulation
2. Design and layout of pilot plant, cold store, grading – packing line, cool chain
3. Pre harvest practices to extend shelf life
4. Quality standards of fruits and vegetables for processing
5. Procurement of raw material, inventory control
6. Post harvest handling; grading; packaging; cool chain transportation and storage of fresh Produce
7. Processing (juice/pulp extraction, concentration, product preparation; dehydration; waste Management; In-plant quality control)
8. Packaging (bottling, corking, sealing, labeling, aseptic packaging, storage)
9. Quality laboratory exercises, quality assurance, analytical tools, hygiene, machinery Maintenance, HACCP, International standards, FPO Licence, PFA standards, codex Laws
10. Sales promotion, certification, distribution and marketing, banking, finance and Institutional management
11. Work experience in food processing plant

**EXP 421 \*****IV Floriculture and Landscape Gardening**

1. Preparation of project report, soil and water analysis, preparation of land and layout.
2. Production and Management of commercial flowers
3. Harvesting and post harvest handling of produce
4. Marketing of produce
5. Cost Analysis
6. Institutional Management
7. Visit to Flower growing areas and Export House
8. Attachment with private landscape agencies
9. Planning and designing, site analysis, selection and use of plant material for landscaping
10. Formal and informal garden, features, styles, principles and elements of landscaping
11. Preparation of landscape plans of home gardens, farm complexes, public parks, institutions, high ways, dams and avenues.
12. Making of lawns, use of software in landscape,
13. Making of bouquets, button hole, wreath, veni and gazaras, car and marriage palaces
14. Dry flowers Technology (identification of suitable species, drying, packaging and forwarding techniques)

\* Choose any one course in a semester

**SEMESTER – WISE CREDIT DISTRIBUTION**

S. No.	Semester	Credits		
		Theory	Practical	Total
1	SEMESTER-I	10	8	18
2	SEMESTER-II	15	7	22
3	SEMESTER-III	14	9	23
4	SEMESTER-IV	11	10	21
5	SEMESTER-V	11	9	20
6	SEMESTER-VI	12	9	21
7	SEMESTER-VII	5	15	20
8	SEMESTER-VIII	5	15	20
	<b>Total</b>	<b>82</b>	<b>83</b>	<b>165</b>

**SEMESTER-I**  
**HOR 111: FUNDAMENTALS OF HORTICULTURE (2+1)**

**OBJECTIVE**

This is a basic course, which outlines the importance of horticulture and its scope global scenario on the export and import of horticultural crops and their products besides the high nutritive potential of fruits and vegetables. Orchard is an important component in horticulture for the cultivation of horticultural crops and hence greater emphasis is given in Orchard planning and layout. Due to perennial nature of fruit trees, the need for maintaining of framework will be emphasized with teaching of appropriate training and pruning methods to enhance productivity. Protected cultivation i.e., production in green houses and shade houses is an upcoming field in horticulture for the year round production of fruits, vegetables and flowers by which we can increase our export potential. Hence, this course will clearly impart the basic knowledge in horticulture and serve as a platform over which advanced technologies of Horticulture can be built up.

**THEORY**

**Unit I – Scope and Importance of Horticulture**

Scope and importance of horticultural crops – Divisions of Horticulture – Area and production – Export and import - global scenario – Classification of horticultural crops – nutritive –value – Horticultural zones of India and Tamil Nadu – Special features of horticulture crops grown in India.

**Unit II –Establishment of Orchard and Production techniques**

Establishment of Orchard – principles, planning and layout – different planting systems – Nursery techniques - Factors limiting Horticultural crop production – Manures and manuring – weed management – irrigation methods.

**Unit III –Cropping System**

Cropping systems – intercropping, multi-tier cropping – cover cropping – planting methods- Mulching- Organic Horticulture- principles, scope and advantages.

**Unit IV – Bearing Habits, Floral Physiology and Crop regulation**

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

**Unit V – Protected cultivation and Post harvest technology**

Basics of Protected cultivation – Green house components – Structure for environmental control -Hydroponics – Media and methods – Advantages –Post harvest technology- importance and causes for post harvest losses- maturity indices- harvesting methods and post harvest handling- processing, value addition, storage and marketing of horticultural produce.

**PRACTICAL**

Different features of Orchard – Planning and layout of orchard - Tools and implements – Different planting systems — Nursery beds – Training and pruning of fruit crops – Preparation of fertilizer mixtures and field application – Use of growth regulators – assessment of bearing habits – Weed management – Irrigation systems — Structures for protected cultivation – Judging the maturity indices of horticulture crops -Harvesting methods and post harvest handling -Visit to Green houses and processing units.

**LECTURE SCHEDULE**

1. Scope, importance and nutritive value of horticultural crops
2. Divisions of horticulture
3. Area and production of horticultural crops.
4. Export and import of horticulture crops and their products – global scenario
5. Classification of horticulture crops – different climate zones of India and Tamil Nadu in relation to horticulture crops.
6. Special features of horticulture crops grown in India.
7. Principles, planning and layout of Orchard.
8. Different planting systems
9. Nursery techniques for horticulture crops

10. Soil and climate in relation to horticulture crop production and other factors limiting horticulture crop production.
11. Fertility management in Orchards
12. Weed management and methods of weed control.
13. Methods of irrigation in relation to horticultural crops.
14. Study of cropping systems.
15. Study of multi-tier, inter cropping and cover crops- planting methods.
16. Mulching – Role of mulching – Types of mulches for horticultural crop production.
17. Mid-Semester Examination.
18. Organic horticulture – Principles, scope and advantages.
19. Detailed study on bearing habits of horticulture crops.
20. Study of flowering, pollination and fruit set in horticulture crops.
21. Unfruitfulness – causes and prevention in horticulture crops.
22. Fruit drop - causes and prevention in horticulture crops.
23. Principles and methods of training in horticulture crops.
24. Principles and methods of pruning in horticulture crops.
25. Rejuvenation of old orchards and role of growth regulators in horticultural crops.
26. Principles and practices of protected cultivation.
27. Study of different types of media and protected structures for propagation.
28. Study of green house components and environmental control for crop production.
29. Study of hydroponics – deep water culture, flood and drain system, Nutrient Film Technique (NFT) and aeroponics.
30. Post harvest technology- importance and causes for post harvest losses
31. Maturity indices-climacteric and non climacteric fruits
32. Harvesting methods and post harvest handling
33. Processing and value addition.
34. Storage and marketing of horticultural produce.

### **PRACTICAL SCHEDULE**

1. Study of different features of Orchard.
2. Planning and layout and planting fruit trees
3. Identification of tools and implements.
4. Preparation of nursery beds and sowing vegetable seeds and transplanting of vegetable crops.
5. Practicing training of fruit trees
6. Practicing pruning of fruit trees
7. Identification of growth regulators and preparation and application.
8. Preparation of fertilizer mixture and field application
9. Practicing weeding including chemical weed control
10. Layout of different irrigation systems and irrigation methods
11. Study of bearing habits of horticultural crops
12. Study of different structures for protected cultivation.
13. Study of different media for protected cultivation
14. Practicing in judging the maturity indices of fruits and vegetables.
15. Study of harvesting methods and post harvest handling
16. Study of different storage methods
17. Visit to Green houses and processing units.

### **REFERENCE BOOKS**

1. Chadha, K.L. 2002. Hand book of Horticulture, ICAR, New Delhi.
2. Kumar, N. 1990. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.
3. Prasad, S. and U. Kumar. 1999. Principles of Horticulture. Agro. Botanica, Bikaner, New Delhi.
4. Christopher, E.P. 2009. Introductory Horticulture, Biotech books, New Delhi.
5. Prasad, S. and U. Kumar. 2010. Green House management for Horticulture crops. Agrobios(India)
6. Salokhe V.M. and A.K. Sharma. 2006. Green house technology and applications, Agrotech Publishing Academy, Udaipur.
7. Schilletter , J.C. and H.W. Richey. 2005. Text Book of General Horticulture, Biotech books, New Delhi.

## **HOR 112: PLANT PROPAGATION AND NURSERY MANAGEMENT (1+1)**

### **OBJECTIVES**

Plant propagation is one of the fundamental agricultural operations which involves multiplication and perpetuation of seeds and planting material to achieve uniform stand of crops with high yield potential. This course deals with different methods of plant propagation and strategies for nursery management of various fruit crops. Knowledge of tools and implements is essential to carry out all scientific horticultural operations and also nursery management practices.

The above themes are discussed elaborately in this course and the basic knowledge gained will be useful for the career development of students in commercial nursery business.

### **THEORY**

#### **Unit- I: Methods of propagation**

Scope and importance - Propagation- overview-sexual methods of propagation-advantages and disadvantages of seed and vegetative propagation.

#### **Unit - II: principles and methods of seed propagation**

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

#### **Unit - III: Propagation Structures**

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

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

Methods and techniques of cuttings, layering, grafting and budding – factors influencing rooting of cuttings, layering, budding, grafting – stock scion relationship- root stock influences – bud wood selection – bud wood certification techniques.

#### **Unit – V: Propagation through specialized organs**

Propagation through specialized organs – tuber, bulb, corm, bulbils rhizome, runner, offshoot, crown, slip, sucker and micro propagation.

### **PRACTICAL**

Potting medium - liquid manures – tools implements and containers for propagation of nursery beds – propagation structures – potting – repotting – mist chambers and pit nursery – raising of rootstocks and scion preparation – different techniques and practices of cutting, layering, grafting and budding – use of specialized organs – rejuvenation – project preparation for commercial nurseries - visit to private nurseries and tissue culture laboratory – working out economics.

### **LECTURE SCHEDULE**

1. Scope and importance of plant propagation, study of sexual and asexual methods of propagation.
2. Advantages and disadvantages of seed and vegetative propagation.
3. Seed dormancy – Internal and external factors .
4. Study about nursery techniques, prostrate culture, monoembryony and polyembryony.
5. Study of propagation structures mistchambers, cold frames, hot beds, phytotron, humidifiers.
6. Construction of green houses and glass houses controlling system.
7. Study about pit nursery techniques and important tools and implements
8. Use of growth regulators in seed and vegetative propagation.
9. Mid Semester Examination
10. Types of cuttings and techniques of preparation.
11. Study about types of layering and techniques of preparation.
12. Grafting and budding methods and techniques of preparation.
13. Study of stock scion relationship
14. Influence of root stock on scion bud wood selection and certification
15. Study about propagation by specialized plant parts – bulbs and tubers.
16. Study about propagation by specialized plant parts – Runners, suckers and other organs
17. Study about micro propagation techniques including Tissue culture.

## **PRACTICAL SCHEDULE**

1. Preparation of nursery beds, seed treatment and sowing
2. Identification of various tool and implements
3. Practices in potting, repotting and liquid manures.
4. Preparation of pot mixture and study of various containers
5. Study of special structures for propagation viz., Mist chamber, coldframes, hot beds, poly house, shade net house,
6. Raising of rootstocks and scions preparation.
7. Mist propagation techniques.
8. Practice in propagation by cuttings
9. Practice in propagation by layering
10. Practicing budding methods
11. Practicing grafting methods
12. Use of growth regulators in propagation
13. Practices in separation and description of plant parts used for propagation.
14. Rejuvenation, top working and bridge grafting.
15. Practice in micro propagation and Hardening methods.
16. Visit to tissue culture laboratory and controlled green houses.
17. Project preparation for commercial nurseries and visit to private nurseries.

## **REFERENCE BOOKS**

1. Adams, C.R., K.M. Bandford and M.P. Early . 1996. Principles of Horticulture CBS Publishes and Distributors 4596/1-A, Daryaganj, New Delhi 110 002.
2. Bose, T.K., S.K. Mitra, M.K. Sadhu and B. Mitra. 1991. Propagation of Tropical and subtropical Horticultural Crops, Naya Prakash 206, Bidhan Sarani, Calcutta, Six. India.
3. Edmond, J.B., T.L. Senna, F.S. Andrews and R.R. Halfacre. 1990. Fundamentals of Horticulture. Tata McGraw Hill Publishing Co. Ltd.
4. Hartmann, H.T., D.E. Kester, F.T. Davies and R.L. Greeneve. 1997. Plant propagation – Principles and Practices, Prentice Hall of India Private Ltd., New Delhi.
5. Prasad, S. and V. Kumar. 1999. Green House Management of Horticultural Crops, Agro-Bios India, Jodhpur.
6. Reddy, Y.T.N., T. Janakiram and D. Satyanarayana Reddy. 2001. Scientific Nursery Management, The House of Sarpan (Media), Bangalore.

## **AGR 113: INTRODUCTORY METEOROLOGY (1+1)**

### **OBJECTIVES**

This course is scheduled to study the problems of plant growth and yield in relation to environmental factors. Climatic factors alone affect the yield of crops to an extent of about 40%. In India the success of agriculture depends mainly on monsoon rains. Meteorology is mainly concerned with microclimatology in which the influence of the shallow layer of atmosphere immediately above the surface is studied.

### **THEORY**

#### **Unit I: Introduction to Meteorology**

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

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

Solar radiation - Light intensity, quality, direction and duration - Air and Soil temperature - Diurnal variation - importance in crop production- Heat unit and its importance in agriculture. Relative Humidity and its importance – Wind and its effect on crops.

#### **Unit III : Atmospheric pressure, Rainfall and Wind systems of the World**

Atmospheric pressure - cyclones, anticyclones, tornado, hurricane and storms -. Clouds - types and their classification. Precipitation - forms - monsoon - - Seasons of India- rainfall variability drought, flood and their effect - Cloud seeding – Evapotranspiration – transpiration - PET



#### **Unit IV: Agro climatic zones and Forecasting**

Agroclimatic Zones – Agroclimatic normals - Weather forecasting –importance, synoptic chart - crop weather calendar - Remote sensing - Impact of climate and weather on crop production and pest and diseases.

#### **Unit V: Climate change and its impact**

Climate change- climate variability – definition and causes of climate change - Impact of climate change on Agriculture, Forestry, Hydrology, marine and coastal ecosystem.

#### **PRACTICAL**

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

#### **THEORY - LECTURE SCHEDULE**

1. Meteorology - Definition, their importance and scope in crop production.
2. Coordinates of India and Tamil Nadu. Atmosphere - Composition of atmosphere - Vertical layers of atmosphere based on temperature difference / lapse rate.
3. Climate and weather - Factors affecting climate and weather. Macroclimate - Mesoclimate - Microclimate - Definition and their importance
4. Solar radiation - Wave length characteristics and their effect on crop production - Light – effect of intensity, quality, direction and duration on crop production.
5. Air temperature - Factors affecting temperature. Diurnal and seasonal variation in air temperature – Isotherm, Heat unit and its use - Heat and cold injuries.
6. Role of temperature in crop production. Soil temperature - Importance in crop production. Factors affecting soil temperature, diurnal and seasonal variation in soil temperature.
7. Humidity – Types - Dew point temperature - Diurnal variation in Relative humidity and its effect on crop production – Wind and its role on crop production.
8. Atmospheric pressure, diurnal and seasonal variation - causes for variation - Isobar - Low, depression, anticyclone, Tornado, hurricane.
9. **Mid Semester Examination**
10. Precipitation - Forms of precipitation - Isohyet - Monsoon – Different monsoons of India - Rainfall variability - Drought and flood – Impact on crop production.
11. Evaporation - Transpiration, evapotranspiration - Potential evapotranspiration - Definition and their importance in agricultural production. Agro climatic zones of Tamil Nadu - Agro climatic normals for field crops.
12. Weather forecasting - Types, importance, Agro Advisory Services
13. Synoptic chart - Crop weather calendar.
14. Remote sensing and its application
15. Effect of weather and climate on crop production, soil fertility and incidence of pest and diseases.
16. Climate change, climate variability – definition and causes of climate change including ENSO.
17. Impact of climate change on Agriculture, Forestry, Hydrology, marine and coastal ecosystem.

#### **PRACTICAL SCHEDULE**

1. Site selection and layout for Agromet Observatory - Calculation of local time - Time of observation of different weather elements.
2. An introduction to Annamalai University Meteorological Observatory
3. Measurement of air and soil temperature and grass minimum thermometers and thermographs
4. Measurement of solar radiation and sunshine hours
5. Humidity measurements – use of wet and dry bulb, assmannpsychrometer
6. Measurement of wind direction and wind speed – Beaufort’s scale.
7. Measurement of rainfall - Ordinary and self-recording rain gauges
8. Measurement of Dew - dew gauge.
9. Measurement of atmospheric pressure - barograph

10. Measurement of Evaporation - Open pan evaporimeter- application of evaporation data- Measurement of Evapotranspiration- Lysimeter.
11. Study of Automatic weather station
12. Data analysis for rainfall chart and thermo hygrograph chart data
13. Analysis of weather data
14. Preparation of crop weather calendars and forecast based agro advisories
15. Preparation of Synoptic charts
16. Mapping of agro climatic Zones of India and Tamil Nadu and its characterization.
17. Practical Examination.

## REFERENCES

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2. Lenka, D. 2000. Climate, Weather and Crops in India, Kalyani Publishers, Ludhiana.
3. Nanjappa and Ramachandrappa. 2007. Manual on Practical Agricultural Meteorology. Agrobios (India), Jodhpur.
4. Panda S.C. 2010. Agro meteorology and contingent crop planning. Agrobios (India), Jodhpur.
5. Prasad, Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Kerala Agricultural University, Press, Thrissur.
6. Radhakrishna Murthy, V. 2002. Basic Principles of Agricultural Meteorology. BS Publications Hyderabad.
7. Radhakrishna Murthy, V.2001. Practical manual on Agricultural Meteorology, Kalyani Publishers, Ludhiana.

## SAC 114 GENERAL BIOCHEMISTRY (2+1)

### OBJECTIVE

To impart knowledge on the fundamentals of Biochemistry. The students will have a clear idea of the basic concepts of biochemistry in general and will have an overall view of the different biochemical reactions taking place in plant cells. At the end of the course the students will have a conceptual understanding of the structure of biomolecules, separation of biomolecules using various biochemical techniques and qualitative identification and quantitative estimation of compounds.

### THEORY

#### Unit I: Proteins

Introduction to Biochemistry-importance and scope .Plant cell – various organelles and their functions; role of plant cell wall in livestock, food and paper industry.Biomolecules –structure, properties and applications.Proteins – amino acids – classification — reactions of amino acids.Peptides and their functions – Structure of proteins – Properties - Classification of proteins based on function – plant protein quality

#### Unit II: Enzymes, lipids and carbohydrates

##### Enzymes – characteristics - factors affecting enzyme activity – enzymeinhibition –Enzyme

Classification – immobilization and industrial applications of enzymes.Lipids – classification – functions and properties - Acyl lipids and their industrial applications. Carbohydrates – functions – structure and classification- Role in industry

#### UnitIII: Nucleic acids and metabolism of proteins

Nucleic acids – functions – structure - Various types of DNAs and RNAs – packing of DNA into chromosomes. Metabolism – anabolism – catabolism – stages of respiration – over all metabolicview of carbohydrates, proteins and lipids. Protein metabolism – central dogma – genetic code – ribosomes – ribozymes –tRNA – translation – enzymatic hydrolysis of protein – general reactionsof amino acid metabolism – Assimilation of ammonia – entry of carbon skeleton into various metabolic pathways

#### Unit IV: Metabolism of lipids and carbohydrates

Metabolism of lipids – anabolism of saturated &unsaturated fatty acidsand triacylglycerols-Catabolism of lipids –  $\alpha$  and  $\beta$  oxidation of fatty acids – glyoxylic acid cycle.Metabolism of carbohydrates – anabolism – photosynthesis.catabolism –hydrolysis of starch.Glycolysis and Tricarboxylic Acid (TCA) cycle. Oxidative pentose phosphate pathway - Oxidative **phosphorylation** – electron transportchain – metabolic regulation

#### Unit V: Secondary metabolites

Secondary metabolites – terpenoids – chemical nature – classification and applicationin food and pharmaceuticalindustry.Secondary metabolites – alkaloids – chemical nature – classification and

application in food and pharmaceutical industry. Secondary metabolites – phenolics – chemical nature – classification and application in food and pharmaceutical industry

## PRACTICAL SYLLABUS

Atomic models and reactions of Amino acids; Paper electrophoresis for the separation of plant pigments; Protein denaturation – heat, pH, precipitation of proteins with heavy metals, Protein estimation by Lowry method; Enzyme kinetics, competitive inhibition, enzyme immobilization; Extraction of nucleic acids, column chromatography of RNA hydrolysate; Characterization of lipids by Thin Layer Chromatography.; Extraction of oil from oil seeds; Estimation of fatty acids; Models of sugars, sucrose & starch; Quantitative determination of sugars; Paper chromatography for the separation of sugars; Determination of phenols.

## THEORY LECTURE SCHEDULE

1. Introduction – importance and scope of biochemistry
2. Plant cell – organelles in plant cell and their functions; Biomolecules – structure, properties and applications
3. Components of plant cell wall – primary and secondary cell wall – composition and functions – role of plant cell wall in livestock, food and paper industry
4. Proteins – amino acids – classification – protein and non protein amino acids, essential and non essential amino acids – classification based on their hydrophobicity of R(side chain) groups – reactions of amino acids like Ninhydrin reaction and peptide bond formation
5. Peptides and their functions – oligopeptides – cyclic and acyclic peptides – hormones – insulin
6. Structure of proteins – primary, secondary, tertiary and quaternary structures
7. Properties of proteins – Ultraviolet (UV) absorption – isoelectric point – zwitterions – immunological properties – denaturation – molecular chaperons – solubility – factors influencing solubility
8. Sequencing of amino acids by Edman degradation method – purification techniques – salting in and salting out, gel filtration, ion exchange chromatography
9. Classification of proteins based on function – plant protein quality evaluation methods - Protein Efficiency Ratio (PER), Digestibility Coefficient (DC) and Biological Value (BV)
10. Enzymes – characteristics of enzymes – chemical nature, speed, specificity, active site and mode of action – activation energy and change in free energy of enzyme catalyzed reaction
11. Measurement of enzyme activity – factors affecting enzyme activity – enzyme inhibition – isoenzymes – multienzyme complexes – allosteric enzymes and coenzymes
12. Classification of enzymes – industrial applications of enzymes
13. Lipids – classification – functions and properties – Fat constants
14. Acyl lipids and their industrial applications in soaps, detergents, paints, rubber, bio-diesel etc.
15. Carbohydrates – functions – structure and classification
16. Role of mono, oligo and polysaccharides in industry
17. Nucleic acids – functions – structure of nitrogen bases – nucleosides and nucleotides – secondary structure of DNA
18. Mid Semester Examination
19. Various types of DNAs and RNAs – packing of DNA into chromosomes
20. Metabolism – anabolism – catabolism – stages of respiration – overall metabolic view of carbohydrates, proteins and lipids
21. Protein metabolism – central dogma – genetic code – ribosomes – ribozymes – tRNA – translation and its inhibitors
22. Post translational modification – enzymatic hydrolysis of protein – general reactions of amino acid metabolism – decarboxylation, transamination and deamination
23. Assimilation of ammonia – entry of carbon skeleton into various metabolic pathways
24. Metabolism of lipids – anabolism of saturated fatty acids, unsaturated fatty acids and triacylglycerols
25. Catabolism of lipids – triacylglycerols –  $\alpha$  and  $\beta$  oxidation of fatty acids – glyoxylic acid cycle
26. Metabolism of carbohydrates – anabolism – photosynthesis in brief; catabolism – hydrolysis of starch
27. Glycolysis and Tricarboxylic Acid (TCA) cycle
28. Oxidative pentose phosphate pathway – metabolic energy generation in different cycles
29. Oxidative phosphorylation and substrate level phosphorylation – electron transport chain in mitochondria
30. Electron transport chain in chloroplast – metabolic regulation
31. Secondary metabolites – terpenoids – chemical nature – classification and application in food and pharmaceutical industry

32. Secondary metabolites – alkaloids – chemical nature – classification and application in food and pharmaceutical industry
33. Secondary metabolites – phenolics (lignins, tannins and flavonoids) – chemical nature-
34. Classification and application in food and pharmaceutical industry

### **PRACTICAL CLASS SCHEDULE**

1. Atomic models of amino acids
2. Reactions of amino acids
3. Protein denaturation – heat, pH – precipitation of proteins heavy metals, organicsolvents and acidic agents – immune reaction
4. Paper electrophoresis for separation of plant pigments
5. Paper model of protein – protein estimation by Lowry method
6. Enzyme kinetics (graphical representation) – competitive inhibition
7. Enzyme immobilization – enzyme induction
8. Extraction of DNA – test for DNA
9. Column chromatography of RNA hydrolysate
10. Fatty acid model – characterization of lipids by Thin Layer Chromatography (TLC)
11. Extraction of oil from oil seeds
12. Estimation of fatty acids by Gas Chromatography (GC)
13. Atomic models of sugars – paper model of starch
14. Quantitative determination of sugars s
15. Separation of sugars and amino acids by paper chromatography
16. Determination of phenols
17. **Practical Examination**

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2. Jayaraman, J. 1980. *Laboratory Manual in Biochemistry*. Wiley Eastern Publishers, New Delhi.
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4. Sadasivam S and Manickam, A. *Biochemical Methods*, 2009, 3<sup>rd</sup>edn, New Age International Publishers, New Delhi.
5. Thayumanavan, B, Krishnaveni, S and Parvathi, K. 2004. *Biochemistry for Agricultural Science*, Galgotia Publications Pvt Ltd., New Delhi
6. Voet, D. and Voet, J.G. 2004. *Biochemistry*. John Wiley and Sons Inc., USA.183

## **GPB 115: CROP PHYSIOLOGY (2+1)**

### **OBJECTIVE**

- To understand the mechanism of absorption and translocation of water and nutrients from the soil
- To study the different pathways in photosynthesis and respiration
- To study the topics on plant growth regulators and stress physiology.

### **THEORY**

#### **Unit I: Plant Water Relations**

Importance of Crop Physiology in Agriculture, Role of water –Water potential and components -Definitions - field capacity, water holding capacity of soil and permanent wilting point, Absorption and translocation of water and solutes, Transpiration - significance- antitranspirants.

#### **Unit II: Nutrio Physiology**

Mineral nutrition –mobility and Mechanism of uptake - physiological role of nutrients, Physiological disorders - nutritional disorders (deficiencies and toxicities) - Difference between Physiological and nutritional disorders - diagnosis, identification of disorders - foliar, tissue testing. Management Techniques- foliar feeding, root feeding, trunk feeding and fertigation.

#### **Unit III: Carbon Fixation**

Photosynthesis - light reaction and Photosynthetic pathways - C<sub>3</sub>, C<sub>4</sub> and CAM - Differences between C<sub>3</sub>, C<sub>4</sub> and CAM pathways - Factors affecting photosynthesis, Photorespiration and significance Phloem and xylem loading- Source sink relationship.

#### **Unit IV: Growth Physiology**

Growth - Growth analysis - LAI, LAD, SLW, SLA, LAR, NAR, RGR and CGR in relation to crop productivity,- - Photoperiodism - Role of phytochrome in flowering and regulation of flowering. Vernalisation – devernalisation- Plant growth regulators and commercial applications - physiological role of auxins and GA Physiological role of Cytokinin, Ethylene and ABA - novel growth regulators and retardants their uses in crop productivity, Post harvest Physiology - Physiology of seed germination, seed and bud dormancy and breaking methods, Parthenocarpy - Physiology of fruit ripening - climacteric and non-climacteric fruits- - factors affecting ripening and storage, Abscission – senescence, Shelf life and quality changes – use of PGRS and nutrients.

#### **Unit V: Stress Physiology**

Environmental stresses - water stress - physiological changes - adaptation to drought and its amelioration, Temperature stress - Physiological changes - low and high temperature - chilling injury - tolerance – alleviation, Low light and UV radiation stresses - salt stress - physiological changes and alleviation, Global warming – Carbon Sequestration - physiological effects on crop productivity,

#### **PRACTICAL**

Measurement of plant water status by different methods - Estimation of stomatal index and stomatal frequency - Measurement of leaf area by different methods - Physiological and Nutritional disorders in crops plants - Rapid Tissue tests - Estimation of chlorophyll stability Index - Estimation of RWC - Determination of photosynthetic efficiency in crop plants - Estimation of Nitrate reductase activity - Growth Analysis - Determination of LAI, lad, sla, slw, lar, NAR, rgr, cgr and HI - Bioassay of cytokinin and GA - Estimation of proline accumulation to assess the water stress in crop plants - Demonstration of crop response to growth regulators - Field visit for foliar diagnosis.

#### **THEORY SCHEDULE**

1. Importance of Crop Physiology in Agriculture.
2. Role of water – process and significance
3. Definition - field capacity, water holding capacity of soil and permanent wilting point.
4. Translocation of water and solutes - phloem and xylem transport.
5. Transpiration - mechanism – significance - guttation - antitranspirants.
6. Mineral nutrition - macro, secondary and micronutrients - sand, hydroponics and aeroponic culture .
7. Mechanism of uptake - physiological role of nutrients.
8. Foliar diagnosis - nutritional and physiological disorders
9. Foliar nutrition- root feeding, trunk feeding and fertigation
10. Photosynthesis - light reaction
11. Photosynthetic pathways - C<sub>3</sub>, C<sub>4</sub> and CAM
12. Differences between C<sub>3</sub>, C<sub>4</sub> and CAM pathways - Factors affecting photosynthesis.
13. Photorespiration - photorespiration process and significance of photorespiration.
14. Source sink relationship and their manipulations
15. Photoperiodism - short day, long day and day neutral plants.
16. Phytochrome. Role of phytochrome in flowering and regulation of flowering.
- 17. Mid Semester Examination**
18. Vernalisation - mechanism of vernalisation and its significance - devernalisation.
19. Growth analysis - LAI, LAD, SLW, SLA, LAR, NAR, RGR and CGR in relation to crop productivity.
20. Plant growth regulators - Physiological role of Auxins and GA.
21. Physiological role of Cytokinin, and ABA
22. Physiological role of Ethylene
23. Novel growth regulators and retardants and their uses in crop productivity.
24. Seed germination - physiological changes ,seed and bud dormancy, breaking methods
25. Abscission - senescence
26. Physiology of ripening- climatic, non climatic and factors affecting ripening and storage
27. Role of PGRS and nutrients in shelf life and quality changes
28. Environmental stresses - water stress - physiological changes - adaptation and amelioration.
29. Temperature stress - Physiological changes - low and high temperature – adaptation and amelioration
30. Chilling injury - tolerance - alleviation.
31. Low light and UV radiation stresses – physiological changes - adaptation and amelioration.
32. Salt stress - physiological changes- adaptation and alleviation
33. Global warming – physiological effects of green house gases

#### 34. Carbon Sequestration - physiological effects on crop productivity

### **PRACTICAL SCHEDULE**

1. Preparation of solutions
2. Measurement of plant water status by different methods.
3. Estimation of stomatal index and stomatal frequency.
4. Measurement of leaf area by different methods.
5. Physiological and Nutritional disorders in crops plants
6. Rapid Tissue Tests
7. Estimation of chlorophyll Stability Index
8. Estimation of RWC
9. Determination of photosynthetic efficiency in crop plants.
10. Estimation of Nitrate reductase activity
11. Growth Analysis - Determination of LAI, LAD, SLA, SLW, LAR, NAR, RGR, CGR and HI.
12. Bioassay of cytokinin
13. Bioassay of GA
14. Estimation of proline accumulation to assess the water stress in crop plants.
15. Demonstration of crop response to growth regulators.
16. Field visit for foliar diagnosis.
17. **Final Practical Examination**

### **REFERENCES**

1. Jain, J.K. 2007. Fundamentals of plant physiology, S.Chand & Company Ltd., New Delhi.
2. Pandey, S. N. and B. K.Sinha, 2006. Plant Physiology. Vikas Publishing House Private Limited, New Delhi.
3. Purohit, S.S, 2005. Plant physiology, Agrobios, Jodhpur.
4. Ray Noggle, G. and Fritz, G. J., 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi.
5. Taiz. L. and Zeiger. E., 2006. Plant Physiology. Sinauer Associates, Inc., Massachusetts, USA.

## **ENT 116: FUNDAMENTALS OF ENTOMOLOGY (2+1)**

### **OBJECTIVES**

- To study the basic structure and modifications of insect appendages.
- To study the physiology and behavior of insects.
- To know the position of insects in Animal kingdom by studying their taxonomic characters.

### **THEORY**

#### **Unit I: History and Importance**

Entomology as a science – branches of Entomology - History of Entomology in India – Importance and scope of entomology in Agriculture and Horticulture. Origin of insects - Position of insects in the animal kingdom – Classification and Characters of phylum Arthropoda. Relationship of class Insecta with other classes of Arthropoda. Reasons for insect dominance.

#### **Unit II: Morphology and Behaviour**

Body segmentation, Structure and functions of insect cuticle- cuticular appendages and moulting. Basic Structures of head, thorax and abdomen and their appendages. Modifications of insect antennae, mouth parts, legs, wings, wing venation and wing coupling apparatus. Modifications in abdomen and its appendages. Types of Metamorphosis- egg, larva and pupa. Insect behaviour – tropisms, biocommunication (Sound and light production), rhythm, diapause, migration, defense and offence.

#### **Unit III: Classification and characters of Apterygota and Exopterygota**

Taxonomy – Definition and importance. Binomial nomenclature. Classification of insects – orders and examples. Distinguishing characters of agriculturally important orders of Apterygotes - Collembola and Thysanura. Distinguishing characters of agriculturally important orders of Exopterygotes - Odonata, Phasmida, Dictyoptera, Dermaptera, Isoptera, Psocoptera, Mallophaga, Siphunculata and Thysanoptera. Distinguishing characters of agriculturally important orders of Exopterygotes up to families of economic importance - Orthoptera (Acrididae, Tettiigonidae, Gryllidae and Gryllotalpidae), Heteroptera (Tingidae, Reduviidae, Miridae, Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belastomatidae, Gerridae, Cimicidae) and Homoptera (Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerridae and Psyllidae).

#### **Unit IV: Classification and characters of Endopterygota**

Distinguishing characters of agriculturally important orders of Endopterygotes - Siphonaptera and Strepsiptera. Distinguishing characters of agriculturally important orders of Endopterygotes up to

families of economic importance – Neuroptera (Chrysopidae, Myrmeliontidae, Mantispidae, Ascalaphidae), Coleoptera (Cicindellidae, Carabidae, Dytiscidae, Curculionidae, Apionidae, Staphylinidae, Coccinellidae, Lampyriidae, Hydrophilidae, Scarabaeidae, Dynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae, Meloidae, Cetonidae, Buprestidae, Elateridae and Bostrychidae), Diptera (Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae), Lepidoptera (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochlidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae and Hesperidae) and Hymenoptera (Tenthredinidae, Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Chalcididae, Ichneumonidae, Bethyridae, Braconidae, Evaniidae, Encyrtidae, Eulophidae and Trichogrammatidae).

### **Unit V: Anatomy and physiology**

Elementary knowledge on Anatomy of digestive, excretory, respiratory, circulatory, nervous and reproductive systems in insects. Structure of male and female genitalia. Types of reproduction and Mating. Functions of secretory (Exocrine and Endocrine) glands. Sensory organs and their functions.

### **PRACTICAL**

Methods of collection and preservation of insects including immature stages - Preparation of Riker mount. Observations on segmentation and external features of Grasshopper/cockroach/Blister beetle. Observations on various types of insect head orientation, antennae, mouthparts, legs, wings, wing venation, and wing coupling apparatus and abdominal appendages. Studies on types of eggs, larvae and pupae. Demonstration of digestive system and male and female reproductive systems in grasshopper/cockroach. Observing the characters of agriculturally important orders - Collembola, Thysanura, Odonata, Phasmida, Orthoptera, Dictyoptera, Dermaptera, Isoptera, Psocoptera, Mallophaga, Siphunculata, Thysanoptera, Heteroptera, Homoptera, Neuroptera, Siphonaptera, Strepsiptera, Coleoptera, Lepidoptera, Diptera and Hymenoptera.

**Assignment:** Each student has to submit five pinned insects of various orders, five double mounted insects, one riker mount and immature stage of insect (wet preservation).

### **THEORY LECTURE SCHEDULE**

1. Definition and branches of Entomology, Its history and importance in Agriculture and horticulture. Origin of insects, Position of insects in the animal kingdom.
2. Characters of phylum Arthropoda and its classes.
3. Factors responsible for Insect dominance.
4. Segmentation and Structure of Insect body wall and cuticular appendages.
5. Moulting process in insects.
6. Basic Structures of head and its appendages, modifications of insect antennae.
7. Modifications of insect mouth parts.
8. Basic Structures of thorax and its appendages, modifications of legs, wings, wing venation and wing coupling apparatus.
9. Basic Structures of abdomen and its appendages.
10. Metamorphosis and types of eggs, larvae and pupae.
11. Tropism, Biocommunication in insects — Sound and light production, diapause, migration, defense and offence in insects.
12. Taxonomy – Definition, importance and binomial nomenclature. Classification of insects - Apterygotes, Exopterygotes, Endopterygota with examples.
13. Distinguishing characters of orders Collembola, Thysanura, Odonata, Phasmida, and Orthoptera (Acrididae, Tettigoniidae, Gryllidae and Gryllotalpidae).
14. Distinguishing characters of orders Dictyoptera, Dermaptera, Isoptera, and Thysanoptera
15. Distinguishing characters of orders Psocoptera, Mallophaga and Siphunculata
16. Distinguishing characters of orders Heteroptera and Homoptera and families of agricultural importance.
17. **Mid Semester Examination**
18. Distinguishing characters of orders Strepsiptera and Siphonaptera.
19. Distinguishing characters of order Coleoptera and families of agricultural importance.
20. Distinguishing characters of order Diptera and families of agricultural importance.
21. Distinguishing characters of order Lepidoptera and families of agricultural importance.
22. Distinguishing characters of order Hymenoptera and families of agricultural importance.
23. Elementary knowledge on digestive system, structure of alimentary canal and its modifications in certain groups.
24. Elementary knowledge on Digestive enzymes, digestion and absorption of nutrients.
25. Elementary knowledge on excretory system in insects - malpighian tubules - accessory excretory organs and physiology of excretion.
26. Elementary knowledge on respiratory system in insects - structure of trachea - tracheoles

27. Types of respiratory system - Spiracles - respiration in aquatic and endoparasitic insects.
28. Elementary knowledge on circulatory system in insects - haemocoel and dorsal vessel - circulation of blood - composition of haemolymph - haemocytes and their functions.
29. Elementary knowledge on nervous system in insects - structure of neuron – types of nervous systems.
30. Elementary knowledge on Nerve impulse conduction - axonic and synaptic transmissions.
31. Elementary knowledge on Male and female reproductive systems in insects – structure and modifications. Spermatogenesis and Oogenesis. Structure of male and female genitalia.
32. Types of reproduction - oviparous, viviparous, paedogenesis, polyembryony ovoviporous and parthenogenesis.
33. Elementary knowledge on structure and functions of Exocrine and Endocrine glands
34. Structure of sense organs - types of sensilla – photoreceptors, chemoreceptors and mechanoreceptors.

### **PRACTICAL SCHEDULE**

1. Practicing the methods of collection, killing, pinning, labelling, display and preservation of insects including immature stages. Preparation of riker mount.
2. Observations on segmentation and external features of grasshopper / cockroach/ Blister beetle.
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, housefly and butterfly.
5. Observations on the modifications in legs and wings (wing venation, regions, angles and wing coupling).
6. Observations on various types of abdominal appendages.
7. Studies on the types of metamorphosis. Observations on immature stages of insects – Eggs, larvae and pupae.
8. Observation on Distinguishing characters of Collembola, Odonata, Phasmida and Orthoptera (Families: Acrididae, Tettiigonidae, Gryllidae and Gryllotalpidae).
9. Observation on Distinguishing characters of Dictyoptera, Dermaptera, Isoptera and Thysanoptera.
10. Observation on Distinguishing characters of Heteroptera (Families: Reduviidae, Pentatomidae, Miridae, Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belastomatidae, Gerridae, Cimicidae, Tingidae), Homoptera (Families: Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerridae and Psyllidae).
11. 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).
12. Observation on Distinguishing characters of Neuroptera (Families: Chrysopidae, Myrmeliontidae, Mantispidae and Ascalaphidae),
13. Observation on Distinguishing characters of Lepidoptera (Families: Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochlidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae and Hesperidae)
14. Observation on Distinguishing characters of Diptera (Families: Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae).
15. Observation on Distinguishing characters of Hymenoptera (Families: Tenthredinidae, Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Chalcididae, Ichneumonidae, Bethyidae, Braconidae, Evaniidae, Encyrtidae, Eulophidae and Trichogrammatidae).
16. Demonstration of digestive system and male and female reproductive systems (grasshopper/ cockroach)
17. **Final Practical Examination**

### **REFERENCE BOOKS**

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2. Richards O.W. and R.G. Davies. 1977. Imm's General Text Book of Entomology, Vol.I and II. Chapman and Hall Publication, London. 692 p.
3. Romoser, W.S. 1998. The Science of Entomology. Mc millan Pub., New York. 449 p.
4. Norman F. Johnson, Charles A. Triple horn. 2004. Borror and DeLong's introduction to the study of insects (VII Edition). Thomson Pub., New York. 888p.
5. Selvanarayanan, V. and S. Arivudainambi. 2004. Introductory Entomology. Manivasagar Padhippagam, Chennai. 262 p.



**TAM 117: ,yf;fpa';fspy; ntshz;ika[k; mwptpay; jkpH;g; gadhf;fKk; 0+1**

**brk;Kiwg; gapw;rp ml;;ltiz**

1. ntshz;ik – brhw; bghUs; tpsf;fk; - bjhy;fhg;gpak; fhL;Lk; epyg;ghFghL kw;Wk; kz;zwptpay;.
  2. r';f ,yf;fpa';fspy; ntshz;ikj; bjhHpy; El;g';fs;
  3. gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ik mwptpay; - jpUf;Fws; - ehd;kzpf;foif - ,dpait ehw;gJ – ,d;dh ehw;gJ – le;jpizbaGgJ – jpizkhiy E}w;iwk;gJ
  4. r';f ,yf;fpa';fspy; bey; tiffs; - gs;S E}y;fspy; bey; tiffs;
  5. ntshz;ikg; gHbkhHpfs; - cHt[/ tpj/ ehw;W eLjy;/ vU/ ePh;g;ghrdk;/ fis/ gaph;g; ghJfhg;g/ mWtil/ fsh;epyr; rPh;jpUj;jk;/ thdpay;/ kiH/ gUt';fs; gw;wpa Fwpg;g[fs;
  6. ehL;Lg;g[wg; ghly;fs; tHp ntshz;ikr; bra;jpfis mwpjy;
  7. mwptpay; jkpHpd; tsh;r;rp epiyfs; - jkpHpy; ntshz;ik ,jH;fs;/ fl;Liur; RUf;fk; (Abstract) vGJ jy;.
  8. fUj;Jg; ghpkhw;wj; jpwd;fs; (Communication skills) nkilg; ngr;R – nfl;ly;/ ngRjy;/ goj;jy;/ vGJjy - nkk;gLj;Jtjw;fhd tHp Kiwfig; gapw;Wtpj;jy;.
- 9. ,ilg;gUtj; njh;t[**
10. bkd; jpwd;fis (Soft skills) nkk;gLj;Jjy;.
  11. bkhHpbgah;g;g[ - Xh; mwpKfk;. bkhHpbgah;g;g[ tiffis mwpjy; - ntshz; bra;jpfis; jkpHhf;fk; bra;jy;
  12. fiyr;brhy;yhf;fk; - fiyr;brhw;fis cUthf;Fk; Kiw – fiyr;brhw;fisj; jug;gLj;Jjy; - tl;lhu tHf;Fr; brhw;fisj; bjhFj;jy;
  13. mwptpay; jkpH; tsh;r;rpapy; fzdppad; g';F
  14. E}y; Kd;Diu/ mzpe;Jiu/ E}y; kjpg;gPL bra;jy; (kjpg;g[iu)
  15. bra;jp tiffs; - bra;jpj;jhs; - thbdhyp – bjhiyf;fhL;rp Mfpa jfty; bjhlh;g[ Clf';fspy; ntshz;ikr; bra;jpfis vGjg; gapw;rp mspj;jy;.
  16. ntshz; bjhHpy;El;g';fs; bjhlh;ghd tpsk;guk;/ Jz;Lg; gpuRuk;/ kog;gpjH;fs;/ g[JbkhHpfs;/ ifnaLfs; jahhpj;jy;.
  17. fye;Jiuahly;/ neh;fhzy;/ ehlfk;/ ftpij/ tpy;Yg;ghL;L \yk; ntshz;ikr; bra;jpfisg; gug;g[jy;.

**ghh;it E}y;fs;**

- fe;jrhkp/ ,y. br. 1974. ntshz;ika[k; gz;ghLk; - jkpH;ehL ntshz;ikg; gy;fiyf;fHfk;/ nfhaKj;J}h;.
- fe;jrhkp/ ,y. br. 1981. ,yf;fpaj;jpy; ntshz;ik - jkpH;ehL ntshz;ikg; gy;fiyf;fHfk;/ nfhaKj;J}h;.
- fe;jrhkp/ ,y. br. 1983. ntshz;ikg; gHbkhHpfs;. fiyr;bry;tk; gjpg;gfk; - nfhaKj;J}h;.
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- nrhkby. jkpH; ,jH;fs; - brd;idg; gy;fiyf; fHfk;. 1975.
- kPdhl;rp Re;juk;/ kh kw;Wk; V. ,y. tprayl;Rkp. 2002. jfty; bjhlh;g[ jkpH; bkhHpg;gad;ghL. nf. Mh;. v!;. Mg;brl; gphpz;lh;/ nfhit -3.
- kzpnkfiy/ k. 2002. jkpH; bkhHpj; jl;jpy; ntshz; mwptpaypd; RtLfs;. njtp gjpg;gfk;/ jpUr;rupuhg;gs;sp.
- kzit Kl;jgh. ,izaj; jkpH;.
- mide;jpe;jpa mwptpay; jkpH;f; fHfk; - fy;tp El;gtpay;.
- cyfj; jkpHhuha;r;rp epWtdk; - jkpHhpd; kug[r; bry;t';fs;.
- ,uh. re;jpunrfud;. bkhHpg; ghLk; - gilg;ghf;fj;jpww; tsh;j;jy;.

## ENG 117 DEVELOPMENT EDUCATION

(Equivalent course for non-Tamil students)

### OBJECTIVES

To enable the learner know, understand, apply and value items related to agriculture and help the farmers to implement them.

### PRACTICAL

Basic principles of learning- Taxonomy of educational objectives- Transferable skills -Multiple intelligence-Career development-Success story of entrepreneurs-Group learning-Brainstorming, Simulation, Role play, Ice breakers- Transactional communication- Types of ego- Interpersonal communication- Writing- Fax and e-mail, applying for a job, interviews, project report- Strategies and skills- Basic principles of scientific article editing.

### LECTURE SCHEDULE

1. Basic principles of learning. Binary terms viz., – growth and development, education – for – life and life – long education, motivation and morale – occupation and profession, training and education, lateral thinking and conventional thinking, teaching and learning – discussion.
2. Bloom's classification of educational objectives – Cognitive, Affective, Psychomotor domain(s) – discussion
3. Career development – opportunity for graduates of agriculture and allied sciences – discussion
4. Success story of a farmer – factors involved – role – play
5. Brainstorming – Demonstration
6. Simulation – Convergent task – demonstration
7. Simulation – Divergent task – demonstration
8. Role – play – interpersonal communication – Fax, email – Transactional communication – ice breaker
- 9. Mid Semester Examination**
10. Verbal and analytical skills – interactive CD-ROM
11. Writing and Editing – demonstration
12. Writing popular articles
13. Project Report – discussion on a mutilated cloze text
14. Project Report – Role play
15. Scientific articles – Selection, organization and presentation – a discussion
16. Writing a scientific article
- 17. Final Practical Examination**

### REFERENCES

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2. David H. Janessen (2009) *Learning to solve problems: A handbook for solving learning environments* Routledge. USA
3. Gay Lumsden, Donald Lymsaden, Carolyn Wiewtstoff (2009) *Communicating in Groups and Teams: Sharing Leadership*: Wadsworth Cengage Learning. Boston. USA
4. Michael, Michalko. *Thinkertoys: A Handbook of Creative-Thinking Techniques* (2nd Edition) (June 8, 2006) Ten Speed Press. Canada
5. Sudarsanam. R (1985) *Development Education: Vibhuvan publishers. Coimbatore.*

## 101 NATIONAL SERVICE SCHEME (0+1)

### I and II Semester

Orientation – NSS origin – motto – symbol – NSS administration at different levels – programme planning – Rural Projects – Urban projects – Government schemes – Career guidance – Self help groups – Environment protection – Use of natural energy – Conventional energy resources – Soil and Water conservation – Community health programmes – blood donation camp – government schemes for family welfare – immunization for major diseases – awareness camps - integrated women and child welfare – Education for all .

### **III and IV Semester**

Popularization of agro techniques – Self employment opportunities – Animal health, Dairy and Poultry farming – Road safety – Training on First aid and emergency cell. Popularization of small savings – communal harmony and National integration – Evils of alcohol – smoking – AIDS – care of Senior citizens – Personality development – meditation, Yoga Art of living – Activities on the preservation of National monuments, cultural heritage and folklore – special camp activities – campus development activities.

### **NATIONAL CADET CORPS (0+1)**

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

#### **REFERENCE:**

1. NCC cadets Diary.2002, cadets Centre, Chennai.
2. Major R.S.Mishra, 1999. A Handboo of NCC, Kanti Prakashan, 53, Barahi Tola Etawah , U.P.

### **SEMESTER-II**

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

#### **OBJECTIVES**

Growth is an outward expression of different physiological processes that continuously proceed in plants. This course outlines the different growth functions, flowering, fruit development and senescence in plants which will help the students to assess the time and methods of application of different horticultural practices.

#### **THEORY**

##### **UNIT-I: Growth and growth analysis**

Parameters of growth and development – types of growth cycles in horticultural crops – seed germination and seed dormancy – physiology of root formation in cuttings and grafts – graft incompatibility – vegetative physiology – bud dormancy – bud breaking – shoot types – canopy development – physiological basis of training and pruning.

##### **UNIT –II: Physiological Process of Flowering, Bulb and Fruit development**

Flowering – Factors affecting – physiology of flowering – photoperiodism – vernalisation and its application in Horticulture – Flower drop – Physiological basis of bulb, tuber and fruit development – pollination – fertilization – seedlessness – fruit drop – control – physiology and biochemistry of ripening – climacteric and non climacteric fruits.

##### **UNIT-III : Role of Macro and Micronutrients on plant growth**

Physiological functions of macro and micro nutrients for plant growth – mobility and forms of absorption – indicator plants – deficiency symptoms of macro and micro nutrients in Horticultural crops – Leaf sampling for tissue analysis – correction measures of nutrient deficiency – foliar absorption – importance and mechanism of absorption – physiological disorders in fruits and vegetables – identification and correction – internal corrections – source – sink relationship.

##### **UNIT-IV: Role of plant growth regulators in Horticultural crops**

Plant hormones – Auxin, gibberellin, cytokinin, ethylene – biosynthesis – distribution – basic functions in plants – synthetic forms of plant hormones – growth retardants – inhibitors – its role in crop growth and development – role of plant growth regulators in propagation, flowering, fruit setting, fruit development and fruit ripening.

## **UNIT-V: Senescence and Stress physiology**

Senescence – mechanism – biochemical and physiological changes – longevity of leaves in perennial and annual crops – stress physiology – heat, cold, moisture and salinity stresses – post harvest physiology in Horticultural crops.

### **PRACTICAL**

Estimation of photosynthetic potential of Horticultural crops – leaf area index – light intensity measurement in different tier cropping – growth analysis parameters including harvest index – preparation of hormonal solution and induction of rooting in cuttings – ripening of fruits and control of fruit and flower drop. Senescence index in plants – basic principles in identifying the deficiency symptoms of macro and micro elements in fruits, vegetables and flower crops – important physiological disorders and their remedial measures in fruits and vegetables – seed dormancy – tetrazolium test – seed germination and breaking seed dormancy with chemicals and growth regulators

### **LECTURE SCHEDULE**

1. Growth expression, factors influencing growth, types of growth
2. Physiology & biochemistry of perennial, semi perennial and annuals
3. Dormancy, bud break in horticultural crops, their importance, Physiology of rooting of cuttings and graft incompatibility.
4. Flowering – factors affecting – physiology of flowering, photoperiodism – long day, short day, day neutral plants, vernalization
5. Phase transition juvenile, vegetative, reproductive interface
6. Pollination – fertilization – seedlessness – fruit drop control – ripening – climacteric and non climacteric fruits
7. Functions of macro and micro nutrients for plant growth, absorption, nutrients deficiency symptoms, leaf sampling for tissue analysis
8. Induction of fruit set Apomixis, parthenocarpy and their physico chemical basis
9. Mid semester examination
10. Physico-chemical phenomena of pruning on flowering and fruiting
11. Physico-chemical phenomena of training on flowering and fruiting
12. Plant hormones –Auxin, gibberellins, cytokinin, ethylene – basic functions in plants
13. Bio-synthesis, growth retardants, inhibitors, role of growth and development and PGR's.
14. Propagation, flowering, fruit setting, fruit development and ripening.
15. Mechanism of senescence, longevity of leaves in perennial and annual crops.
16. Stress physiology – heat, cold, moisture and salinity
17. Post harvest physiology in fruits, vegetables and flower crops.

### **PRACTICAL SCHEDULE**

1. Observation on growth in different Horticultural crops
2. Components of growth analysis
3. Measurement of growth due to environmental factors and correlation of the same with growth
4. Experiments on seed germination – Tetrazolium test.
5. Use of chemicals in breaking bud dormancy
6. Use of cultural practices in bud break
7. Field visit to study the training and pruning practices in horticulture crops
8. Observation on different Horticultural floral materials on fruit set
9. Maturation induction through growth regulators
10. Crop regulation factors like pinching, pruning & training in young horticultural plants.
11. Identification of plant growth regulators
12. Use of PGR.'s in fruits and vegetables
13. Use of chemicals for ripening and induction of rooting in cuttings
14. Use of chemicals for controlling the flower and fruit drop
15. Identification of deficiency symptoms of fruits and vegetables
16. Use of growth retardants in selected horticultural crops
17. Experiments on post harvest losses in fruits and vegetable crops

### **REFERENCE BOOKS**

1. Bonner, J. and J.E. Warner, 1976. Plant biochemistry academic press, New York.
2. Hartmann, H.T. and D.E.Kester, 1989. Plant propagation Englewood cliffs: New Jersey, Prenticehall.
3. Hudson, T., Hartmann, Dale, E. Kester. Plant Propagation – Principles and Practices VI Edn. Published by Ashoke K. Ghosh Prentice Hall of India Pvt. Ltd. New Delhi.

4. Kitchen, H.B. 1982. Soil and Crop – Diagnostic techniques, International Book and Periodical Supply service, New Delhi.
5. Leopold, A.C. and P.E.Kriedermann, 1985. Plant growth and development. 3<sup>rd</sup> Ed. MC. Graw Hill, New York.
6. Rabinowitch, E. and Govindjee, 1969. Photo synthesis. Newyork, Wiley.
7. Salisbury, F.R., and C.Ross, 1979. Plant physiology. Calif: Wadsworth. Belmont.
8. William P. Jacobs. 1978. Plant hormones and Plant development, Cambridge University Press

## **AGR 122 INTRODUCTION TO MAJOR FIELD CROPS (2+1)**

### **OBJECTIVES**

To study the origin of major field crops and its importance and Impart knowledge on cultivation aspects of important field crops.

### **THEORY**

#### **Unit –I: Cereals**

Cereals: Rice, Maize, and Wheat- Origin, geographic distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and yield.

#### **Unit –II: Major millets**

Millets: Sorghum, Pearl millet and Finger millet -Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield

#### **Unit –III: Pulses**

Pulses: Red gram, Black gram, Green gram and Bengal gram - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

#### **Unit – IV: Oilseeds and sugar crops**

Oil seeds: Groundnut, sesame, sunflower, coconut, Jatropha-Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Sugar crops: Sugarcane, Sugar beet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

#### **Unit – V: Fibres, tuber crops and Tobacco**

Fibre crops: Cotton and Jute

Tuber crops-Potato and sweet potato-

Narcotics-Tobacco - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

### **PRACTICAL**

Identification of crops and crop varieties - Rice nursery preparation and transplanting - main field preparation for millets, pulses, oilseeds, sugarcane and Cotton ; Seed treatment techniques - Estimation of population - Sowing and manuring- Seeding equipment's - Study of growth and yield contributing characters, yield calculations, harvesting and yield estimation of above crops; Cost and returns - Study of cropping patterns and important agronomic experiments and farmers' fields.

### **THEORY - LECTURE SCHEDULE**

1. Introduction-importance of cereals, millets, pulses and oilseeds
2. Introduction-importance of sugar crops, fibres, tuber crops and Narcotics
3. Area, production and productivity of major cereals, millets, pulses and oilseeds of India and Tamil Nadu.
4. Importance and area, production and productivity of sugars, fibres, tubers and tobacco of India and Tamil Nadu.
5. Rice- Origin - geographic distribution - economic importance – varieties - soil and climatic requirement
6. Rice - cultural practices –Deficiency symptoms for major and micronutrients- yield - economic benefits -Special type of Rice cultivation – Rajarajan 1000 (SRI), Transgenic Rice - Hybrid rice.
7. Maize - Origin, geographic distribution, economic importance, soil and climatic requirement.
8. Maize -Varieties, cultural practices and yield.
9. Wheat - Origin, geographic distribution, economic importance, Soil and climatic requirement, varieties, cultural practices and yield
10. Sorghum - Origin, geographic distribution, economic importance, soil and climatic requirement
11. Sorghum- varieties, cultural practices and yield.

12. Pearl millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield
13. Finger millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
14. Blackgram and Greengram - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield - Agronomy of rice fallow pulses
15. Red gram and Bengal gram - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
16. Groundnut - Origin, geographical distribution, economic importance,
- 17. Mid-semester Examination**
18. Groundnut- Soil and climatic requirements - varieties, cultural practices yield and economics
19. Sesame– Origin, geographical distribution, economic importance,
20. Sesame-Soil and climatic requirements, varieties, cultural practices and yield.
21. Sunflower - Origin, geographical distribution, economic importance,
22. Sunflower- Soil and climatic requirements, varieties, cultural practices and yield.
23. Coconut– Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield
24. Castor and Jatropha – Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield
25. Sugarcane - Origin, geographical distribution, economic importance, soil and climatic requirements.
26. Sugarcane - Varieties, main field preparation-preparation of setts for planting -cultural practices and yield
27. Sugarcane - Crop logging, maturity and ripening sugar and gur manufacture - Value addition and byproduct utilization.
28. Sugar beet - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices, yield and by product utilization.
29. Cotton - Origin, geographic distribution, economic importance, soil and climatic requirement,
30. Cotton -Varieties, cultural practices, yield and quality parameters.
31. Jute - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
32. Potato- Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
33. Sweet potato- Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
34. Tobacco -Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

## **PRACTICAL**

1. Identification of cereals, millets, pulses and oilseed crops in the crop cafeteria
2. Identification of sugars and fibres crops in the crop cafeteria
3. Practicing various nursery types and main field preparation for rice crop.
4. Nursery and main field preparation for important millets, pulses and oilseeds
5. Nursery and main field preparation for sugarcane and cotton
6. Acquiring skill in different seed treatment techniques in important field crops
7. Estimation of plant population per unit area for important field crops
8. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for cereals, millets pulses, oilseeds, sugarcane and cotton
9. Acquiring skill in foliar nutrition for important field crops.
10. Observations on growth parameters of cereals millets and pulses
11. Observations on growth parameters of oilseeds, sugarcane and cotton.
12. Study of yield parameters and estimation of yield in cereals, millets and pulses
13. Study of yield parameters and estimation of yield in oilseeds, sugarcane and cotton
14. Working out cost and returns of +important cereals, millets, pulses and oilseeds crops.
15. Working out cost and returns of sugarcane, cotton, Tobacco
16. Visit to farmers field / research stations to study the cultivation techniques of millets, pulses, oilseeds sugarcane and tobacco.
- 17. Practical Examination**

## **REFERENCES**

1. Ahlawat, I.P.S., OmPrakash and G.S. Saini. 2000. Scientific Crop Production in India. Rama publishing House, Meerut
2. Balasubramaniam. P and Sp. Palaniappan. 2002. Principles and Practices of Agronomy, Agrobios (India), Jodhpur

3. Chidda Singh. 2010. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi
4. Hand Book of Agriculture. 2006. Indian Council of Agrl. Research, New Delhi.
5. Palaniappan, S.P. and K. Sivaraman, 2010. Cropping Systems in Tropics. Principles and Management, New Age Intel (P) Ltd., Publication.
6. Singh. S.S. 2002. Crop Management. Kalyani Publishers, New Delhi
7. Tomar, G.S., Taunk, S.K. and Choudhary, J.L. 2011. Science of Crop Production Part I and part II. Kushal Publications and Distributors, Varanasi (U.P.).

## PAT123 PRINCIPLES OF PLANT PATHOLOGY (2+1)

### OBJECTIVES

The subject covers basic aspects of plant pathology including history, taxonomy, general characters of fungi, bacteria, virus, algae and phanerogams and also symptoms of various plant diseases with its causal agent.

### THEORY

#### Unit I: Plant Pathogenic organisms

Introduction – Definition – Plant Pathology – History of Plant Pathology- Classification of plant diseases - Causes of plant diseases- Biotic and abiotic – Plant Pathogenic Organisms – Fungi, Bacteria, Phytoplasma, Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae, Protozoa and Phanerogamic Parasites

#### Unit II: Pathogenesis

Pathogenesis - Mode of infection – Pre-penetration, penetration and post penetration – Spread and survival of pathogens - Role of enzymes and toxins on disease development

#### Unit III: General characters and molecular phylogeny of fungi

General characters of fungi – somatic structures, types of fungal mycelia - Modification of mycelia – reproduction in fungi (Vegetative, asexual and sexual) – nutrition in fungi- Disease cycle – Symptoms of fungal diseases - Classification based on molecular phylogeny. I Kingdom: Protozoa, Phylum: Plasmodiophoromycota, Class: Plasmodiophoromycetes (Plasmodiophorales) II. Kingdom: Chromista, Phylum: Oomycota, Class :Oomycetes (Pythiales and Peronosporales). III. Kingdom: Fungi. Phylum: Chytridiomycota, Class: Chytridiomycetes (Chytridiales, Spizellomycetales); Phylum: Blastocladiomycota, Class: Blastocladiomycetes (Physodermaceae); Phylum: Zygomycota, Class : Zygomycetes (Mucorales).

#### Unit IV: Phylum : Ascomycota and Basidiomycota

Phylum: Ascomycota, Classes: Taphrinomycetes (Taphrinales), Dothideomycetes (Dothidiales, Capnodiales and Pleosporales) Eurotiomycetes (Eurotiales), Leotiomyces (Erysiphales and Helotiales), Sordariomycetes (Hypocreales, Phyllochorales and Diaporthales) and mitosporic ascomycetes; Phylum: Basidiomycota, Classes: Agaricomycetes (Agaricales, Corticiales, Cantharellales and Polyporales), Pucciniomycetes (Pucciniales) and Ustilaginimycetes (Exobasidiales, Ustilaginales and Tilletiales).

#### Unit V: Bacteria, Phytoplasma and Viruses

Classification of bacteria - general characters and symptoms of phytopathogenic bacteria – mode of entry and spread - general characters and symptoms of Phytoplasma, Spiroplasma, Fastidious vascular bacteria, viruses, viroids, algae, Phanerogamic parasites and Abiotic disorders.

### PRACTICAL

Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium*, *Phytophthora*, *Albugo*, *Sclerospora*, *Peronospora*, *Peronosclerospora*, *Pseudoperonospora*, *Plasmopara*, *Mucor*, *Rhizopus*, *Taphrina*, *Capnodium*, *Erysiphe*, *Phyllactinia*, *Uncinula*, *Leveillula*, *Claviceps*, *Puccinia*, *Uromyces*, *Hemileia*, *Sphacelotheca*, *Tolyposporium*, *Ustilago*, *Agaricus*, *Pleurotus*, *Calocybe*, *Volvariella*, *Ganoderma*, *Colletotrichum*, *Gloeosporium*, *Pestalotia*, *Macrophomina*, *Botryodiplodia*, *Pyricularia*, *Sarocladium*, *Drechslera* (*Helminthosporium*), *Alternaria*, *Cercospora*, *Curvularia*, *Rhizoctonia*, *Sclerotium*, Symptoms of bacterial, Phytoplasma, Fastidious vascular bacteria, Algal parasite, phanerogamic parasites and non-parasitic diseases/disorders  
Note: Students should submit 50 well-preserved specimens

### THEORY SCHEDULE

1. Definition of Plant Pathology – History of Plant Pathology
2. Causes of Plant diseases – biotic and abiotic- Biotic factors- fungi – bacteria, virus, viroid, and Phytoplasma.
3. Fastidious vascular bacteria – Spiroplasma – Algal and phanerogamic parasites- abiotic disorders

4. Pathogenesis - Mode of infection – pre-penetration, penetration and post penetration
5. Spread and survival of pathogens
6. Role of enzymes on disease development
7. Role of toxins on disease development
8. General characters of fungi- types of Mycelia – modification of mycelia, vegetative reproduction
9. Asexual and sexual reproduction in fungi
10. Fruiting bodies in fungi- Asexual and sexual
11. Nutrition / parasitism in fungi- Types of parasitism –parasite, saprophyte, facultative saprophyte, facultative parasite, obligate parasite, Biotrophs, hemibiotrophs, perthotrophs, necrotrophs, and symbiosis
12. Classification of Kingdom – Protozoa - important taxonomic characters and Symptoms and life cycle of *Plasmodiophora brassicae* and *Spongospora subterrenea*
13. Classification of Kingdom –Chromista- General characters - Classification of Oomycetes
14. Symptoms and life cycle of *Pythium*, *Phytophthora* and *Albugo*,
15. Symptoms and life cycle of *Peronosclerospora*, *Sclerospora*, *Peronospora*, *Pseudoperonospora* and *Plasmopara*
16. Classification of Kingdom– Chytridiomycota and Zygomycota - important characters, symptoms and life cycles of *Rhizopus* and *Mucor*
17. Mid Semester Examination
18. Classification of Kingdom– Ascomycota- important characters
19. Symptoms and life cycles of *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula* and *Podosphaera*
20. Symptoms and life cycles of *Taphrina*, *Capnodium*, *Eurotium*, *Talaromyces*, *Claviceps* and *Venturia*,
21. Symptoms and important characters of *Pyricularia*, *Sarocladium*, *Helminthosporium*, *Alternaria*, *Cercospora* *Curvularia*, *Fusarium* and *Verticillium*
22. Symptoms and important characters of *Colletotrichum*, *Gloeosporium*, *Pestalotia*, *Macrophomina*, *Botryodiplodia*, *Septoria* and *Ascochyta*
23. Classification of Kingdom - Basidiomycota- important characters
24. Symptoms and life cycles of *Puccinia*, *Uromyces*, and *Ustilago*
25. Symptoms and life cycles of *Ganoderma* and *Exobasidium*.
26. Important taxonomic characters of *Agaricus*, *Pleurotus*, *Volvariella* and *Calocybe*
27. Symptoms and important characters of *Corticium*, *Rhizoctonia* and *Sclerotium*
28. Classification and general characters of phytopathogenic bacteria- Mode of entry and spread
29. Symptoms and characters of *Xanthomonas* and *Pseudomonas* / *Ralstonia*, *Erwinia* (*Pantoea*), *Agrobacterium*, *Corynebacterium* (*Clavibacter*,) and *Streptomyces*
30. Virus - definition, nature and properties of plant virus, Single stranded, Double stranded RNA and DNA viruses and Transmission of plant viruses
31. Common symptoms of virus diseases – bract mosaic, citrus tristeza, tomato Spotted wilt, Sunflower necrosis, papaya ring spot, infectious chlorosis, yellow mosaic, vein clearing, leaf crinkle, leaf curl, bud necrosis, rosette and bunchy top
32. Important characters and symptoms of phytoplasma diseases – Phyllody, witches broom, little leaf, yellow dwarf and sandal spike
33. Important characters and symptoms of Viroid, Fastidious vascular bacteria, Algal and Phanerogamic parasites
34. Symptoms and characters of non-parasitic diseases

#### **PRACTICAL SCHEDULE**

1. General characters of fungi – Types of mycelia -Types of vegetative, asexual and sexual spores- asexual and sexual fruiting bodies.
2. Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium* and *Phytophthora*.
3. *Albugo*, *Sclerospora*, *Peronospora*, *Peronosclerospora*, *Pseudoperonospora* and *Plasmopara*
4. *Mucor* and *Rhizopus*.
5. *Taphrina*, *Capnodium*, *Erysiphe*, *Phyllactinia*, *Uncinula*, *Leveillula* and *Claviceps*.
6. *Puccinia*, *Uromyces*, and *Hemileia*
7. *Sphacelotheca*, *Tolyposporium* and *Ustilago*.
8. Study of important taxonomic characters of *Agaricus*, *Pleurotus*, *Calocybe*, *Volvariella* and *Ganoderma*.
9. Study of important taxonomic characters and symptoms produced by *Colletotrichum*, *Gloeosporium*, *Pestalotia*, *Macrophomina* and *Botryodiplodia*
10. Study of important taxonomic characters and symptoms produced by *Pyricularia*, *Sarocladium*, *Helminthosporium*, *Alternaria*, *Cercospora* and *Curvularia*, *Rhizoctonia* and *Sclerotium*.
11. Symptoms of bacterial diseases – leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.



12. Symptoms and vectors of viral diseases – infectious chlorosis, mosaic, vein clearing, leaf crinkle, leaf curl, bud necrosis, rosette, bunchy top, bract mosaic, citrus tristeza, tomato spotted wilt, sunflower necrosis, papaya ring spot
13. Symptoms of Phytoplasma and fastidious vascular bacterial diseases.
14. Study of important characters and symptoms produced by algal parasite and phanerogamic parasites
15. Symptoms of non-parasitic diseases
16. Field visit
17. Final practical examination.

Note: Students should submit 50 well-preserved specimens

## REFERENCES

1. Agrios, G.N. 2005. Plant Pathology – (5<sup>th</sup> Edition). Academic Press, New York.
2. Dube, H.C.2009. A textbook of Fungi, Bacteria and Viruses, Vikas Publishing House P. Ltd, New Delhi.
3. Singh, R.S.1982. Plant Pathogens – The Fungi. Oxford and IBH Publishing Co., New Delhi.
4. Darwin Christdhas Henry. 2009. Illustrated Plant Pathology- Basic Concept. New India Publishing Agency, New Delhi.
5. Vidyasekaran, P. 1993. Principles of Plant Pathology –. CBS Publishers & Distributors, New Delhi.

## AGM 124: INTRODUCTORY MICROBIOLOGY (2+1)

### OBJECTIVES

To study the fundamental principles and applied aspects of microorganisms in food soil and industries.

### THEORY

#### Unit - I: History and scope of Microbiology

Contributions of Anton Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Beijerinck, Winogradsky and Waksman; Position of microorganisms in living world; Prokaryotes Vs Eukaryotes; Groups of microorganisms; Bacterial size, shape and arrangement and morphology; functional anatomy of bacteria; Structure and organization of bacterial cell: Invariant and variant components, Structure and organization of microbial cells.

#### Unit-II: Microbiological Techniques

Microscopy – principles and types; Staining of microorganisms – principles; Sterilization and disinfection techniques; Principles and methods of sterilization – Physical methods – heat, filters and radiation; Chemical methods; Isolation and pure culture techniques – Enrichment culturing, dilution – plating, streak plate, spread plate methods; Preservation of microbial cultures.

#### Unit-III: Food Microbiology

Importance of Food Microbiology, Types of microorganisms in food, Sources of contamination, Factors influencing the microbial growth in food, Microbial spoilage of fruits, vegetables and canned foods, Fermented foods – Beer – Wine – Bread making. Fermented vegetables.

#### Unit – IV: 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, Phyllosphere microorganisms, Plant – microbe and Microbe – microbe interactions in soil. Types and importance of biofertilizers in Horticulture. Mass production and quality control of biofertilizers.

#### Unit – V: Industrial Microbiology

Fermentor – Design and characteristics – Upstream and Downstream process – Fermentation product process – Ethyl alcohol – Organic acids – Citric acid, Lactic acid and Glutamic acid. Antibiotics – Penicillin – Vitamin – Vitamin B<sub>12</sub>.

### PRACTICAL

Microscopy – Light microscopes; Staining Techniques – Simple and Differential staining; Sterilization – equipment and apparatus used for sterilization; Media preparation; Isolation and enumeration of soil microorganisms; Purification and preservation of microorganisms; morphological and biochemical characters of bacteria.

Quality analysis of soil microbial profile – Organic matter decomposition – measurement of CO<sub>2</sub> evolution; Isolation of N<sub>2</sub> fixing and Phosphate solubilizing microorganisms; Infection by Arbuscular mycorrhizae; Winogradsky column – Mass production of bacterial biofertilizers – Mass production of algal and fungal biofertilizers; Demonstration of antibiosis.

### **THEORY SCHEDULE**

- 1) Definition and scope of microbiology – Spontaneous generation theory.
- 2) Contributions of Anton Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Beijerinck, Winogradsky and Waksman – Germ theory of fermentation and disease.
- 3) Position of microorganisms in living world; Prokaryotes Vs Eukaryotes.
- 4) Bacterial morphology – size, shape and arrangement of cells.
- 5) Structure and organization of bacterial cells.
- 6) Functional anatomy and reproduction in bacteria.
- 7) Morphology of fungi and economic importance.
- 8) Morphology of algae and their economic importance.
- 9) Microscopy: principles of optics and light microscope – different types of microscopy.
- 10) Modified compound microscopes – Dark field, Phase contrast and Fluorescent microscopes.
- 11) Electron microscopes and types – Transmission electron microscope and Scanning electron microscope
- 12) Microbial staining – principles, Acidic, Basic and Neutral dyes
- 13) Simple staining and differential staining.
- 14) Sterilization- principles – physical and chemical methods.
- 15) Isolation of microorganisms from various sources.
- 16) Purification of microorganisms by different methods.
- 17) Preservation of microbial cultures.

### **18) Mid semester exams**

- 19) Importance of Food Microbiology
- 20) Types of microorganisms in food
- 21) Sources of contamination
- 22) Factors influencing the microbial growth in food
- 23) Microbial spoilage of fruits, vegetables and canned foods
- 24) Fermented foods – Beer – Wine – Bread making, Fermented vegetables.
- 25) Distribution and importance of soil microorganisms in soil fertility
- 26) Factors affecting the activities of soil microorganisms
- 27) Rhizosphere microorganisms and their importance
- 28) R:S Ratio, Phyllosphere microorganisms
- 29) Plant – microbe and Microbe – microbe interactions in soil.
- 30) Types and importance of biofertilizers in Horticulture
- 31) Mass production and quality control of biofertilizers
- 32) Fermentor – Design and characteristics, Upstream and Downstream process.
- 33) Fermentation product process – Ethyl alcohol – Antibiotics – Penicillin – Vitamin – Vitamin B<sub>12</sub>.
- 34) Fermented products - Organic acids – Citric acid, Lactic acid and Glutamic acid.

### **PRACTICAL SCHEDULE**

- 1) Microscopes – Handling light microscope.
- 2) Staining techniques – Simple and Differential staining.
- 3) Sterilization – equipment and apparatus used for sterilization.
- 4) Media preparation for bacteria, fungi and Actinomycetes.
- 5) Enumeration of soil microorganisms – serial dilution plate technique (bacteria, fungi and actinomycetes).
- 6) Purification and preservation of bacteria and fungi.
- 7) Wine making.
- 8) Observation of microorganisms from spoiled vegetables and fruits.
- 9) Conn's direct microscopic count and Burried slide technique.
- 10) Organic matter decomposition - measurement of CO<sub>2</sub> evolution

- 11) Demonstration of antibiosis – crowded plate assay.
- 12) Isolation of symbiotic N<sub>2</sub> fixing microorganisms – *Rhizobium*.
- 13) Isolation of associative and non-symbiotic N<sub>2</sub> fixer: *Azospirillum* and *Azotobacter*.
- 14) Isolation of phosphate solubilizing microorganisms and demonstration of Winogradsky column.
- 15) Assessment of AM fungi colonization in crop plants.
- 16) Mass production of biofertilizers.
- 17) **Final Practical Examination**

## REFERENCES

- 1) Black, J.G. 2005. Microbiology: Principles and Explorations, John Wiley, USA.
- 2) Michael Madigan, John Martinko and Jack Parker. 2006. Brock Biology of Microorganisms. 11<sup>th</sup> Edition. Benjamin Cummings, England.
- 3) Prescott, M.J., Harley, J.P. and Klein, D.A. 2002. Microbiology. 5<sup>th</sup> Edition, WBC Mc Graw Hill, New York.
- 4) Singh, T. Purohit, S.S. and Parihar, P. Soil Microbiology. 2010. Agobios, India.
- 5) Subba Rao, N.S. 2006. Soil Microbiology (4<sup>th</sup> Edition of Soil Microbiology and Plant Growth). Oxford & IBH, New Delhi.
- 6) Ramanathan, N. 2009. A Text book of Food Microbiology, Om Sakthi Pathippagam, Annamalai Nagar, Tamil Nadu, India.

## SAC 125: FUNDAMENTALS OF SOIL SCIENCE 2(1+1)

### OBJECTIVE

- ❖ This course is designed to provide better understanding of soils and their formation. It is aimed to inculcate knowledge among under graduate students regarding physical, chemical and biological properties of soils. Further, to make the students to understand about pedological and edaphological approaches of soil study.

### THEORY

#### Unit I

Composition of earth crust, soil as a natural body – major components. Rocks – definition, formation, classification – igneous, sedimentary and metamorphic rocks. Factors influencing parent material. Minerals – definition, occurrence, classification of important soil forming primary minerals - silicate and non silicate minerals, ferro and non-ferro magnesium minerals

#### Unit II

Physical parameters- soil texture-definition, methods of textural analysis, stokes law, assumptions, limitations, textural classes, use of textural triangle. Soil structure- definition, classification and factors influencing genesis of soil structure. Bulk density and particle density- definition, significance factors influencing and relationship between BD and PD. Soil colour- definition, significance, hue, value and chroma, munsell soil colour chart. Soil consistency - cohesion, adhesion, plasticity, Atterberg's constants – upper and lower plastic limits, plasticity number- significance of soil consistence.

#### Unit III

Pore space- factors affecting capillary and non capillary porosity. Soil moisture - forms of water, measurement, units of expression and pF scale. Soil water potentials – gravitational, matric, osmotic – soil moisture constants. Movement of soil water under saturated and unsaturated flow – infiltration, hydraulic conductivity, percolation, permeability and drainage. Soil temperature – measurement, soil air – composition - aeration, measurement - significance of soil temperature and soil air.

#### Unit IV

Soil organic matter - sources-General chemical composition-Decomposition-humus formation-Role and functions of organic matter in soil-Biological properties of soil-Nutrient availability-Factors influencing the availability. Chemical properties of soils- Chemical composition-Soil reaction-Buffering capacity of soils-Soil colloids-Inorganic colloids-Clay minerals-Amorphous-Ion exchange reactions-Organic colloids-Colloids in relation to fertility of soil and their effect on plant growth.

## Unit V

Soil classification – early system of soil classification – diagnostic horizons. Soil taxonomy – order, sub order, great group and family series – nomenclature according to soil taxonomy. Irrigation water quality, determination of quality parameters and management. Problem soils- acid soils, saline, alkali soils and soil physical constraints.

### PRACTICAL

Collection and processing of soil samples for chemical analysis – Particle size analysis – Determination of Soil moisture, EC, pH. Soil chemical analysis – Preparation of HCl extract – Estimation of sesquioxides, nitrogen, phosphorus and potassium, calcium, magnesium and micronutrients Estimation of organic carbon and CEC.

### LECTURE SCHEDULE

1. Origin of earth – theories – planetesimal and nebular hypothesis - Composition of Earth's crust.
2. Rocks – definition, formation, classification – igneous, sedimentary and metamorphic rocks
3. Brief description of important rocks – mineralogical composition
4. Minerals – definition, occurrence, classification of important soil forming primary minerals - silicate and non silicate minerals, ferro and non-ferro magnesium minerals
5. Physical properties-Texture-Soil separates-Textural analysis-International pipette method-Stoke's law-Assumption and limitations-Textural classes using triangular diagram
6. Bulk density-Particle density-Definition-Factors affecting bulk density and particle density.Pore space.
7. Definition of macro and micro pore space-Factors affecting pore space- Soil compaction-internal surface area-Factors influencing soil compaction
8. Mid - Semester Examination
9. Soil colour-Significance- Munsell colour chart-hue, value and chroma-Factors influencing soil colour.Soil structure-Definition-Classification. Genesis of soil structure-Factors influencing soil structure-Stability
10. Soil consistence-Cohesion-Adhesion-Plasticity-Atterberg's constant-Upper and lower plastic limits, plastic number
11. Soil air-composition – Factors affecting composition. Soil temperature-Importance on plant growth- Factors influencing soil temperature-Distribution of heat in the soil-Measurement of soil temperature.
12. Soil water-Forms of soil water-Soil moisture constants-infiltration, percolation, runoff and drainage. Moisture potential – pF scale – Soil water potential – Movement of moisture – Measurement of soil moisture.
13. Soil chemical properties-Chemical composition-Buffering capacity and its importance.Soil pH – Factors affecting soil pH – Soil pH and nutrient availability.
14. Soil colloids – Types – Inorganic colloids – Importance in soil – Sources of negative charges – Kaolinite, Montmorillonite, Illite and others. Organic colloids – Soil organic matter –Sources-Composition-Decomposition –Mineralisation, Immobilization.
15. Role and functions of organic matter in soil - Formation of clay humus complex. Ion exchange reaction – Cation exchange – Anion exchange
16. Soil classification – early system of soil classification – diagnostic horizons. Soil taxonomy – order, sub order, great group and family series – nomenclature according to soil taxonomy
17. Irrigation water quality, determination of quality parameters and management Occurrence, properties and management of acid soils, saline soils and alkali soils

### PRACTICAL SCHEDULE

1. Collection of soil samples and estimation of moisture
2. Estimation of EC and pH
3. Estimation of true specific gravity, Apparent specific gravity and pore space
4. Estimation of soil colour and soil texture by Feel method
5. Textural analysis of soils by international pipette method – Soil dispersion
6. Textural analysis of soils by international pipette method – clay and clay + silt
7. Textural analysis of soils by international pipette method – Coarse and fine sand

8. Preparation HCl extract
9. Estimation of Fe<sub>2</sub>O<sub>3</sub> and Al<sub>2</sub>O<sub>3</sub>
10. Estimation of total N
11. Estimation of total P
12. Estimation of total K
13. Estimation of total Ca and Mg
14. Estimation of total micronutrients
15. Estimation of organic carbon
16. Estimation of CEC
17. Practical Examination

## REFERENCES

1. Biswas, T.D. and Mukherjee, S.K. 1997. Text book of Soil Science. Tata McGraw Hill Publishing Co. Ltd., New Delhi
2. Brady, N.C. 1995. The Nature and Properties of Soils. Prentice Hall of India Pvt.Ltd., New Delhi
3. Dilip Kumar Das. 1997. Introductory Soil Science. Kalyani Publishers, Ludhiana
4. Donahue, R.L., Miller, T.W. and Shickluna, J.C. 1987. Soils – An introduction to Soils and Plant Growth. Prentice Hall of India (P) Ltd., New Delhi
5. Sahai, V.N. 2001. Fundamentals of Soil, Kalyani Publishers, Rajinder Nogan. Ludhiana
6. Sehgal, J. 1997. Pedology-Concepts and applications. Kalyani Publishers, Rajindar Nagar, Ludhiana
7. Sekhon, G.S. Eds., 2002. Fundamentals of Soil Science. Indian Society of Soil Science, IARI, New Delhi

## AEX 126: FUNDAMENTALS OF EXTENSION EDUCATION (1+1)

### OBJECTIVES

- To learn the concept, principles and philosophy of Extension Education
- To gain knowledge on TOT programmes of ICAR
- To gain knowledge about communication, programme planning and HRD

### THEORY

#### UNIT – I: Introduction to Extension Education

Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history.

#### UNIT – II: Horticultural Development Programmes

NHM-State Department of Horticulture –TANHODA, Structure, functions and linkages. Horticultural development Programmes.

#### UNIT – III: Rural Development

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

#### UNIT – IV: Communication and Programme Planning

Communication: meaning, definition, elements and selected models. Audio – visual aids: importance, classification and selection. Programming planning process – meaning, scope, principles and steps. Evaluation: meaning, importance and methods.

#### UNIT – V: PRA and HRD

Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA). Management and administration: meaning, definition, principles and functions. Concepts of Human Resource Development (HRD), rural leadership.

### THEORY SCHEDULE

1. Extension education: meaning, definition, nature, scope
2. Objectives, principles, philosophy of extension education, extension educational process and steps in extension teaching.

3. NHM-State Department of Horticulture –TANHODA, Structure, functions and linkages.
4. Horticultural development Programmes- Integrated horticultural development scheme, Integrated tribal Development programme
5. Hill area development programme – Micro Irrigation – TNIAMWORM
6. Rural development : Meaning, Definition, Objectives and Genesis
7. Transfer of technology programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD)
8. Krishi Vigyan Kendras (KVK), Technology Assessment and Refinement Programme (TARP)

### **9. Mid semester Examination**

10. Communication: meaning, definition, elements and selected models.
11. Audio – visual aids: importance, classification and selection.
12. Programming planning process – meaning, scope, principles and steps.
13. Evaluation: meaning, importance and methods.
14. Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA).
15. Management and administration: meaning, definition, principles and functions.
16. Concepts of human resource development (HRD)
17. Rural leadership.

### **PRACTICAL SCHEDULE**

1. Visit to study the extension programmes of a voluntary organization
2. Visit to study the extension Programmes of a mahila maudal
3. Visit to study the extension programmes of village Panchayat
4. Visit to study the extension programmes of Horticulture department
5. Visit to All India radio station
6. Exercise on distortion of message
7. Script writing for farm broadcast
8. Script writing for farm telecast
9. Planning preparation and use of posters
10. Planning Preparation and use of charts
11. Planning Preparation and use of flash card
12. Planning Preparation and use of folders
13. Planning Preparation and use of transparencies OHP
14. Preparation of slides with power point
15. Identification of local leaders to study their role in extension work
16. Evaluation of case studies of horticultural extension programmes
17. Preparation of village horticultural production plan

### **REFERENCES**

1. Adivi Reddy A.2001. Extension Education. Sree Laxmi Press, Bapatla.
2. Santha Govind, Tamilselvi, G. and J.Meenambigai. 2011. Extension Education and Rural Development. AGROBIOS India, Jodhpur.
3. Dahama OP and Bhatnagar, OP. 1998. Education and Communication for Development Oxford and IBH Co, New Delhi.
4. Katar Singh. 1999. Rural Development – Principles, Policies and Management. Sage Publications India Pvt Ltd., New Delhi
5. Ray GL. 1999. Extension Communication and Management. Naya prakash, Calcutta, West Bengal.

## AHS 127: LIVESTOCK AND POULTRY PRODUCTION (2+1)

### OBJECTIVE:

To gain current technical knowledge in the field of livestock and poultry production and thereby enabling them to apply their technical brilliance at field level. To acquire hands on training about livestock and poultry based farming, preparation of dairy products .To gain latest technology of livestock industries so as to acquire entrepreneurial attitude among the students.

### THEORY:

#### UNIT – I Introduction to livestock and Poultry production

Introduction – Significance of livestock in Agriculture and Indian economy – Different Livestock development programs of Government of India - common nomenclatures used in Animal Husbandry practices – various systems of livestock rearing – Record keeping - space requirement for different species of livestock and poultry

#### UNIT – II Management of Cattle

Classification of breeds – Breeds of white and black cattle – Sindhi, Kangayam, Umbalacherry, Jersey, Holstein Friesian, Murrah and Surti – Selection of site for housing – Systems of housing – Single row, double row – Oestrous cycle and Artificial Insemination –Care and management of new born calf, heifers, pregnant and lactating animals – Classification of feed - ration – balanced ration – Importance and qualities of green fodder – Disease control measures in cattle.

#### UNIT – III Management of Sheep, Goat and Pigs

Classification of sheep and goat breeds – Care and Management of Kid and Lamb – steaming up and flushing– Disease control measures in sheep and goats– common breeds of exotic pig – Care and management of piglets – control measures of pig diseases.

#### UNIT – IV Poultry Management

Classification of breeds –Housing management – Deep litter Vs Cage system – Brooding management – litter management –management of broiler and layers –feed conversion ratio - Disease control measures in poultry.

#### UNIT – V Livestock Products Technology

Importance of livestock and poultry products – clean milk production – Pasteurization of milk – composition and nutritive value of milk – nutritive value of meat of sheep, goat, pig, poultry and egg.

### PRACTICALS

Study of external parts of cattle - Identification of livestock – Common methods of restraining - Disbudding - Ageing – Design of cattle shed -Determination of specific gravity of milk– Demonstration and estimation of fat percentage and total solids in milk - Demonstration of cream separation - Identification of feed and fodder – Economics of Dairy farming - Brooder management – Dressing of chicken – Economics of broiler production - Visit to Dairy plant, layer and broiler farms.

### THEORY LECTURE SCHEDULE

1. Introduction to Livestock and Poultry Industry
2. Different Livestock development programs of Government of India
3. Common nomenclatures used in Animal Husbandry practices.
4. Systems of Livestock rearing – record keeping
5. Space requirement for different species of Livestock and Poultry
6. Introduction and classification of different breeds of white and black cattle
7. Selection of site for dairy farm and systems of housing
8. Introduction to Estrus cycle – Artificial Insemination
9. Care and management of calf
10. Care and management of heifers
11. Care and management of pregnant and lactating cows.
12. Classification of feed – Ration – Balanced ration
13. Importance of Green fodder – Qualities of good fodder
14. Disease control measures in Cattle
15. Introduction and Classification of sheep and goat breeds
16. Care and management of kid and lamb
17. Steaming up and flushing – Disease control measures of sheep and goat.
18. Common breeds of exotic pig
19. Care and management of piglets

20. Disease control measures of pig
21. Introduction to poultry production
22. Classification of breeds of poultry
23. Housing management – Deep litter Vs Cage system in poultry.
24. Brooding management in poultry.
25. Litter management in poultry farm
26. Management of broilers.
27. Management of layers.
28. Feed conversion ratio and disease control measures in poultry production.
29. Introduction and importance of Livestock and poultry products.
30. Clean milk production.
31. Pasteurization of milk.
32. Composition and nutritive value of milk
33. Nutritive value of meat of sheep, goat and pig.
34. Nutritive value of poultry meat and egg.

### **PRACTICAL SCHEDULE**

1. Study of external parts of livestock and poultry
2. Identification of livestock
3. Common methods of restraining
4. Disbudding
5. Ageing of cattle
6. Design of Cattle shed
7. Selection of dairy cow
8. Determination of specific gravity in milk.
9. Fat percentage and total solids in cows milk.
10. Demonstration of cream separation
11. Ice cream making
12. Identification of feed and fodder
13. Economics of Dairy farming
14. Brooder management.
15. Dressing of chicken
16. Economics of broiler production
17. Visit to Dairy plant, layer and broiler farms.

### **REFERENCES:**

1. Amarjeet Singh, 2008. Animal Husbandry, Rajat Publications, New Delhi.
2. Ashok kumar, 2006. Animal Husbandry, Discovery Publishing House, New Delhi.
3. Banerjee, G.C. 2010. The Text Book of Animal Husbandry, Oxford Book Company, Kolkata.
4. Carmen R. Parkhurst and George J. Mountney, 2002. Poultry Meat and Egg Production, CBS Publishers and Distributors, New Delhi - 2
5. Dairy India Year Book 2007. A-25, Periyadarshini Vihar, New Delhi.
6. ICAR, 2007. A Hand Book of Animal Husbandry

## **COM 128 INTRODUCTION TO COMPUTER APPLICATIONS (1+1)**

### **OBJECTIVES**

To make use of computer basic personal usage and to know how to use MS-office (word, Excel, Access, Power point) to increase personal and academic productivity. To get exposed to aspects of internet usage and to propagate the awareness of research facilities using browsing and searching.

### **THEORY**

#### **Unit – I: Introduction to Computer**

Introduction to Computers, Anatomy of Computers, Input and Output Devices, Units of Memory, Hardware, Software and Classification of Computers. Personal Computers, Types of processors, booting of computer, warm and cold booting. Computer Viruses, Worms and Vaccines, Operating System-DOS and WINDOWS. Disk Operating System (DOS): Some fundamental DOS commands. FORMAT, DIR, COPY, PATH, LABEL, VOL, MD, CD and DELTREE, Rules for naming files in DOS and Types of files.



## **Unit – II: WINDOWS**

WINDOWS: GUI, Desktop and its elements, WINDOWS Explorer, working with files and folders, setting time and date, starting and shutting down of WINDOWS. Anatomy of a WINDOW. Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars.

## **Unit – III: MS-Word & Excel**

Applications – MSWORD: Word, processing and units of document, features of word-processing packages. Creating, Editing, Formatting and saving a document in MSWORD; MSEXCEL: Electronic Spread sheets, concept, packages. Creating, Editing and Saving a spreadsheet with MSEXCEL. Use of in-built Statistical and other functions and writing expressions. Use of Data Analysis Tools, Correlation and Regression, t-test for two-samples and ANOVA with one-way Classification. Creating Graphs.

## **Unit – IV: MS-Power point & Access**

MS Power Point: Features of Power Point Package. MSACCESS: Concept of Database, Units of database, creating database.

## **Unit – V: Principles of Programming & Internet**

Principles of Programming: Flow Charts and Algorithms, illustration through examples. Internet: World Wide Web (www), Concepts, Web Browsing and Electronic Mail.

## **THEORY SCHEDULE**

1. Introduction to Computers, Anatomy of Computers.
2. Input and Output Devices, Units of Memory, Hardware, Software and Classification of Computers.
3. Personal Computers, Types of processors, booting of computer, warm and cold booting. Computer Viruses, Worms and Vaccines.
4. Operating System-DOS and WINDOWS. Disk Operating System (DOS): Some fundamental DOS commands. FORMAT, DIR, COPY, PATH, LABEL, VOL, MD, CD and DELTREE, Rules for naming files in DOS and Types of files.
5. WINDOWS: GUI, Desktop and its elements, WINDOWS Explorer, working with files and folders, setting time and date, starting and shutting down of WINDOWS.
6. Anatomy of a WINDOW. Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars.
7. MSWORD: Word, processing and units of document, features of word-processing packages.
8. Creating, Editing, Formatting and saving a document in MSWORD.
9. Mid-semester examination.
10. MSEXCEL: Electronic Spread sheets, concept, packages, Creating, Editing and Saving a spreadsheet with MSEXCEL.
11. Use of in-built Statistical and other functions and writing expressions.
12. Use of Data Analysis Tools, Correlation and Regression, t-test for two-samples and ANOVA with one-way Classification.
13. Creating Graphs.
14. MS Power Point: Features of Power Point Package.
15. MSACCESS: Concept of Database, Units of database, creating database.
16. Principles of Programming: Flow Charts and Algorithms, illustration through examples.
17. Internet: World Wide Web (www), Concepts, Web Browsing and Electronic Mail.

## **PRACTICAL SCHEDULE**

1. Exposure to computer-H/W & S/W – Power Switch On/ Off.
2. DOS commands: TIME, DATE, DIR, COPY, FORMAT, VOL, LABEL, PATH.
3. Windows GUI – usage(Handling Desktop).
4. Using Icons, understanding clicks, double clicks.
5. MS-Word – create/edit/print documents.
6. MS-Word – Formatting, Inserting, Table creation, Alignment.
7. MS-Excel – creating spreadsheet, Formatting cells, Auto calculation.
8. MS-Excel – Inbuilt functions, chart preparations.
9. MS-Access – Database creation.
10. MS-Access – Structuring with different types of field.
11. MS-Access – Report generation.
12. MS-Power point – preparation of slides on power point
13. MS-Power point – Animation Control, Transition Control
14. Transforming the data of WORD, EXCEL and ACCESS to other formats
15. Creating of E-Mail-ID
16. Email- Compose, Attaching, Inbox printing, Browsing a web page.
17. Practical examination.

## REFERENCE

1. Arthur Naiman. 1985. Introduction to word processing, BPB Publication, New Delhi.
2. Balagurusamy, E. 1990. Basic programming including IBM PC, Prentice Hall of India, New Delhi.
3. Microsoft – GWBASIC users guide and user manual, 1981 and 1988, reproduced by HCL – HP under licence.
4. Rajaraman. 1971. Computer Oriented Numerical Methods. Prentice Hall of India, New Delhi.
5. Rajaraman. 1984. Principles of Computer Programming. Prentice Hall of India, New Delhi.

## AEG 129 FARM POWER AND MACHINERY (1+1)

### OBJECTIVES

This subject will enable the student,

To gain knowledge on the various types of I C engines, types and selection of tractors.

To understand the construction and working of various farm implements like tillage implements, seed drills, transplanters, plant protection and harvesting equipments.

### THEORY

#### Unit I: Farm power

I C Engine – classification - Working principle of two stroke and four stroke I C engine - basic principle and operation of CI and SI engines and comparison.

#### Unit II: Tractors and its maintenances

Tractors and power tillers – types and uses. Selection of tractor and cost of tractor power -service – repairs, maintenance and lubrication– fuel – oil and miscellaneous cost.

#### Unit-III: Primary and secondary tillage Implements

Tillage-objectives-furrow terminology-methods of ploughing -field capacity and working our problems. Primary tillage implements-components and functions of indigenous ploughs-mould board, disc, rotary and chisel ploughs. Secondary tillage implements –components and functions of tillers, harrows, ridger, bund former, puddler, leveler and green manure trampler.

#### Unit -IV: Sowing and plant protection Equipments.

Sowing methods –equipment used –seed cum fertilizer drills and plants –components –functions. Area coverage, cost of equipment. Plant protection equipment –sprayers –classification and uses, dusters –types and uses. Light trap, suction type banana injector, tree sprayers and other plant protection equipments.

#### Unit V: Intercultural, Harvesting equipments.

Intercultural, implements – sweep – junior hoe – weeders – types and uses, area coverage and cost of operation. Harvesting equipment – principles – components – functions - threshers – types – principle of operation, - equipment for land development and soil conversation.

### THEORY LECTURE SCHEDULE

1. Working principles of IC engines and CI engines – farm mechanisms.
2. Tractors and power tillers parts and their working principles – maintenance
3. Introduction about tillage – ploughing – methods – furrow terminology.
4. Various primary tillage implements – working principle and uses.
5. Secondary tillage implements - working principle and uses.
6. Area coverage – simple problems – maintenance.
7. Sowing methods and sowing equipments.
8. Sprayers and dusters – types and uses – advantages.
9. Other plant protection equipment - working principle and uses.
10. Simple problems – area coverage – cost of operation
11. Intercultural implements – weeders – types and uses.
12. Harvesting and threshing equipments – calculation of threshing efficiency.
13. Combine – working principle – parts and uses.
14. Equipment for land development and soil conversation.

## **PRACTICAL SCHEDULE**

1. Study of different components of IC engines.
2. Study and working principle of four stroke IC engine.
3. Study and working principle of two stroke IC engine.
4. Study of Tractors and power tillers.
5. Identification of primary tillage implements – indigenous ploughs and mould board ploughs.
6. Identification of disc, rotary and TNAU ploughs.
7. Identification of harrows, ridger and bun former.
8. Identification of puddler leveler and green manure trampler.
9. Seed drill – parts – working principles
10. Identification of paddy harvester and thresher.
11. Identification of plant protection equipments – sprayers and dusters.

## **REFERENCE BOOKS:**

1. Bindra O.S. and Harcharan Singh, 1971, Pesticide applicator equipment. Oxford and IBH pub co. New Delhi
2. Jagadishwar Shay, 1992, Elements of agricultural engineering Jain brother, New Delhi.
3. Michel and T.P. Ojha, 1996 principles of agricultural engineering Jain brother.
4. Srivastava A.C. 1990, elements of farm machinery. Oxford and IBH pub co., New Delhi.
5. Khurmi R.s. Thermal Engineering, S. Chand & Co., New Delhi, 14<sup>th</sup> ed. 2005.

## **SEMESTER-III**

### **HOR 211: PRODUCTION TECHNOLOGY OF TROPICAL AND ARID ZONE FRUITS (2+1)**

#### **OBJECTIVES**

Fruit crops form an important division in Horticulture with high nutrient and yield potential. The tropical fruits like mango, banana, guava and others are predominately cultivated on commercial scale in Tamil Nadu and other states. With this background in view this course has been designed to include the latest technologies such as propagation, training and pruning systems, planting systems and crop regulation in different tropical fruit crops. Besides, it also highlights the important cultivars, varieties and hybrids developed from different Agricultural Universities and other institutes.

#### **THEORY**

##### **UNIT-I: Importance and Production Technology of Tropical Fruit Crops**

Horticultural classification of fruits – scope and importance of tropical fruits- cultivation – overview, global, national and regional level – area, production and export potential – horticultural zones of India and Tamil Nadu with emphasis on tropical fruits. Climate and soil requirements, varieties – propagation techniques – planting systems and planting densities – after care – training and pruning – irrigation, nutrient and weed management – specialized horticultural techniques including PGR's – physiological disorders – production constraints – pre and post harvest technologies – harvest, grading packaging, storage and transport – economics of production of: Mango and banana

##### **UNIT-II: Production Technologies-I**

Guava, grapes and papaya.

##### **UNIT-III: Production Technologies –II**

Acid lime, lemon, sweet oranges and sapota

##### **UNIT-IV: Production Technologies –III**

Ber, Pomegranate and Annona

##### **UNIT-V: Production Technologies –IV**

Aonla, Jack, Tamarind and minor fruits

#### **PRACTICAL**

Fruit plants nursery and management – description and identification of varieties – nursery preparation – propagation techniques for mango, banana, grapes, citrus, sapota, papaya, guava and arid zone fruits – manures and fertilizer application – visit to commercial orchards and diagnosis of maladies – working out production economics.

## LECTURE SCHEDULE

- 1) Tropical fruits- Importance – global, national and regional level – area, production and export potential.
- 2) Past and present status of tropical fruits in India.
- 3) Study of fruit growing regions / zones in India and Tamil Nadu.
- 4) Mango – area, production, productivity- varieties- varieties for specific purpose and export.
- 5) Mango – climate and soil requirements – effect of weather factors on growth, flowering and productivity – propagation techniques – planting.
- 6) Mango – nutrition, nutrition deficiency and management- after care – weed and water management practices.
- 7) Mango – flowering, fruit set- bearing problems – special horticultural techniques in mango – other specific problems in mango cultivation – physiological disorders.
- 8) Mango – harvesting techniques – post harvest handling and post harvest treatments, ripening of fruits – storage and processing.
- 9) Banana varieties- climate and soil requirements.
- 10) Genome classification – selection of planting material.
- 11) Banana - planting system – high density planting- inter-cropping.
- 12) Banana – manuring – nutrient deficiency and management – special horticultural techniques – disorders – specific production problems.
- 13) Banana – harvesting – post harvest handling, ripening, storage and processing.
- 14) Guava – climatic and soil requirements – varieties – propagation.
- 15) Guava – nutrient deficiency and management – weed and water management techniques.
- 16) Guava – use of growth regulators – bahar treatment – specific problems and constraints- harvesting – post harvest handling – storage – processing.
- 17) Mid-Semester Examination.
- 18) Grapes – area, production, productivity- classification- varieties.
- 19) Grapes – climate and soil requirements – effect of weather factors on growth, flowering and productivity – propagation techniques – planting.
- 20) Grapes – training and pruning-nutrition- weed and water management.
- 21) Grapes – Effect of growth regulators- harvesting techniques – post harvest handling and processing.
- 22) Papaya – climate and soil, varieties – propagation – planting requirements – manures and manuring.
- 23) Papaya – weed and water management – thinning – specific problems and constraints – harvesting – latex extraction – post harvest handling – storage – processing.
- 24) Acid lime – climate and soil requirements – varieties – propagation – planting requirements- manures and manuring – nutrient deficiency and management – weed and water management – use of growth regulators – specific problems and constraints – harvesting – post harvest handling – storage – processing.
- 25) Lemon – climate and soil requirements – varieties – propagation – planting requirements- manures and manuring – nutrient deficiency and management – weed and water management – harvesting, post harvest handling – storage – processing.
- 26) Sweet orange – climate and soil requirements – varieties – propagation – planting requirements , manures and manuring – nutrient deficiency and management – weed and water management – use of growth regulators – specific production problems.
- 27) Sapota - climate and soil requirement – varieties – propagation – planting – requirements – manures and manuring.
- 28) Sapota – weed and irrigation management – use of growth regulators – specific problems and constraints – harvesting post harvest handling – storage processing.
- 29) Ber – climate and soil requirements – varieties- propagation- planting-weed and nutrient management- training and pruning- effect of growth regulators- harvesting – post harvest handling– storage.
- 30) Pomegranate – climate and soil requirements – varieties- propagation- planting, high density planting – weed and nutrient management- training and pruning- effect of growth regulators- harvesting – post harvest handling – storage.

- 31) Annona- climate and soil requirements – varieties- propagation- planting- weed and nutrient management- harvesting – post harvest handling – storage.
- 32) Aonla - climate and soil requirements – varieties- propagation- planting- weed and nutrient management- harvesting – post harvest handling – storage.
- 33) Tamarind -climate and soil requirements – varieties-propagation- planting- weed and nutrient management- harvesting – post harvest handling – storage.
- 34) Minor fruit crops- climate and soil requirements – varieties- propagation- planting- weed and nutrient management- harvesting – post harvest handling – storage.

### **PRACTICAL SCHEDULE**

- 1) Study of mango varieties.
- 2) Practicing propagation methods of mango.
- 3) Study of banana varieties.
- 4) Scoring technique, sucker treatment and special practices in banana.
- 5) Study of guava varieties
- 6) Practicing propagation methods of guava
- 7) Study of grapes varieties and propagation techniques.
- 8) Sapota – Identification of varieties
- 9) Sapota – Propagation methods
- 10) Papaya – Varieties and propagation.
- 11) Papaya – Identification of sex forms.
- 12) Acid lime, lemon, sweet orange – varieties, suitable root stock and their propagation.
- 13) Ber, Pomegranate – varieties- propagation.
- 14) Jack – varieties – propagation.
- 15) Aonla, Annona – varieties – propagation.
- 16) Assessment of maturity standards for tropical and arid zone fruits.
- 17) Working out economics of production of tropical and arid zone fruits

### **REFERENCE BOOKS**

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- 2) Chattopadhyay, T.K. 1994. A Text Book of Pomology (Vol.1-3), Kalyani Publishers, New Delhi.
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- 5) Singh, S.P. 1995. Commercial Fruits, Kalyan Publishers, Ludhiyana.
- 6) Veeraraghavathatham, D., M. Jawaharlal. S. Jeeva, R. Rabindran and G. Umamathy. 2004. Scientific Fruit Culture, Soori Associates, Coimbatore.
- 7) Vishal Nath, Dinesh Kumar and V.Pandey.2008. Fruits for the future, Vol-I. Well versed Arid and Semi Arid Fruits. Satish Serial Publishing House, New Delhi.

## **HOR 212: PRODUCTION TECHNOLOGY OF TROPICAL VEGETABLES (2+1)**

### **OBJECTIVES**

This course aims to educate the students with the current development on various aspects of vegetable cultivation based on the results of research work. It also aims to provide pertinent information on the importance of vegetables, problems and latest agro techniques of vegetable production, post harvest handling and marketing of vegetables

### **THEORY**

#### **UNIT –I: Vegetable production and its importance**

Importance of vegetable growing – Area and production of vegetables in India and Tamil Nadu- Nutritive value of vegetables- classification of vegetables-effect of soil, climate and water on crop production and their management -types of vegetable growing- Kitchen garden-Market garden-Truck garden-Nutrition garden-cropping systems in vegetable crops-Protected cultivation of vegetables.

## **UNIT –II: Production technology of Solanaceous vegetables**

Climate and soil-varieties and hybrids – season – seeds and sowing-nursery management – preparation of field- planting-spacing-planting systems-weed management-irrigation management-Drip and fertigation-nutrient requirement-nutrient deficiencies-physiological disorders-Role of chemicals and plant growth regulators in vegetable production-maturity indices-harvesting and yield-seed production techniques-post harvest handling, storage and marketing of vegetables :Tomato, Brinjal, Chillies, Bhendi,

## **UNIT –III: Production technology of Leguminous and Cucurbitaceous vegetables**

Cluster beans, Cow pea, Vegetable Soybean, Lablab, Pumpkin, Ash gourd, Bitter gourd, Snake gourd, Ridge gourd , Bottle gourd, Cucumber, Gherkin, Water melon and Musk melon

## **UNIT –IV: Production technology of Tuber crops**

Tapioca, Sweet potato, Colocasia, Dioscorea and Amorphophallus

## **UNIT –V: Production technology of Bulbous and Leafy vegetables**

Onion, Amaranthus, Drumstick, Chekurmanis, Coccinia, Curry leaf, Basella and Portulaca.

## **PRACTICAL**

Identification and description of tropical vegetable crops and tuber crops-nursery practices-transplanting-preparation of field and sowing/planting-use of manures and fertilizers-intercultural operation-use of growth regulators-identification of nutrient deficiencies-physiological disorders-Harvest indices and maturity standards-Post harvest handling and storage-seed extraction-working out cost of cultivation- project preparation for commercial cultivation of vegetable crops.

## **LECTURE SCHEDULE**

- 1) Importance of vegetable growing in India and Tamil Nadu
- 2) Area, production, world scenario, industrial importance and export potential of vegetable crops.
- 3) Classification of vegetables
- 4) Types of vegetable growing
- 5) Cropping systems in vegetables
- 6) Vegetable growing in protected structures
- 7) Vegetable growing in poly houses
- 8) Production technology-soil, climate, land preparation, seeds and sowing, planting, cropping systems, intercultural operations, manuring, weed control, irrigation, harvesting and post harvest handling of the following vegetable crops:-  
Tomato
- 9) Brinjal
- 10) Chillies
- 11) Bhendi
- 12) Cluster bean and Field bean
- 13) Garden bean
- 14) Cow pea
- 15) Vegetable soybean
- 16) Pumpkin and Ash gourd
- 17) Mid semester examination
- 18) Bitter gourd and Snake gourd
- 19) Ridge gourd and Bottle gourd
- 20) Cucumber and Gherkin
- 21) Water melon and Musk melon
- 22) Tapioca
- 23) Sweet potato
- 24) Colocasia
- 25) Dioscorea and Amorphophallus
- 26) Onion
- 27) Moringa
- 28) Amaranthus and Chekurmanis
- 29) Curry leaf
- 30) Basella and Portulaca
- 31) Seed production techniques in vegetable crops

- 32) Post harvest handling of vegetable crops
- 33) Storage of vegetable crops
- 34) Value addition and Marketing of vegetable crops.

### **PRACTICAL SCHEDULE**

- 1) Nursery management and raising seedlings
- 2) Preparation of main field for growing vegetables
- 3) Layout of kitchen garden/Nutrition garden
- 4) Practices in manuring and fertilizer application for vegetable crops
- 5) Practices in irrigation of vegetable crops
- 6) Preparation and use of plant growth regulators in vegetables
- 7) Identification of physiological disorders in vegetable crops.
- 8) Identification of varieties / hybrids and description in solanaceous and leguminous vegetables.
- 9) Identification of varieties / hybrids and description in cucurbits and root and tuber crops.
- 10) Maturity standards of important vegetable crops.
- 11) Practices in seed production techniques of solanaceous and leguminous vegetables.
- 12) Practices in seed production techniques of cucurbits.
- 13) Practices in extraction of seeds in vegetable crops.
- 14) Working out cost of production of solanaceous crops.
- 15) Working out cost of production of leguminous crops and cucurbitaceous vegetables.
- 16) Commercial vegetable production in protected structures-visit to green house/poly house units.
- 17) Practical Examination

### **REFERENCE BOOKS**

- 1) Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. Vegetable Crops. Vols. I-III. Naya Udyog.
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- 3) Das, P.C.2003. Vegetable crops of India. Kalyani publishers, New Delhi.
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- 6) Veeraragavathatham, D.M. Jawaharlal and Seemanthini Ramadas, 1996. A guide to vegetable culture, A.E.Publication, Coimbatore.

## **HOR 213: PRODUCTION TECHNOLOGY OF PLANTATION CROPS, SPICES AND CONDIMENTS (2+1)**

### **OBJECTIVES:**

This course is intended to acquire knowledge on the cultivation aspects of plantation crops, spices and condiments. At the end of the course, the student can able to acquire knowledge about varieties, specialised training and pruning, application of plant growth regulators to improve yield and quality of plantation crops, spices and condiments, and harvesting & processing techniques.

### **THEORY:**

#### **Unit: 1 Plantation crops –I**

Importance of plantation crops, spices and condiments area and production, export potential - nutritive value – value added products – climate and soil requirements – varieties – propagation techniques – planting systems – after care – training and pruning – management of irrigation, nutrient and weeds – intercropping and multitier cropping – special horticultural techniques including plant growth regulators – harvesting methods – processing techniques – grading – packaging and storage of  
Tea, coffee, rubber, cocoa, cashew

#### **Unit: 2 plantation crops – II**

Coconut, arecanut, palmyrah, oil palm, cinchona

#### **Unit: 3 Major spices: Black pepper, cardamom, turmeric and ginger**

#### **Unit: 4 Seed spices& tree spices: coriander, fennel, cumin, fenugreek, clove, nutmeg, cinnamon, all spice.**

#### **Unit: 5 Other spices & Condiments: Curry leaf, Asafoetida, Vanilla, Saffron.**

**PRACTICALS:**

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

**LECTURE SCHEDULE:**

1. Introduction, importance, scope and export potential of plantation crops in India and Tamil Nadu
2. Area and production trends in India Tamil Nadu
3. Tea – scope and climatic requirements – propagation – cultivation aspects – harvesting & processing.
4. Coffee
5. Rubber
6. Cocoa
7. Cashew
8. Cinchona
9. Coconut
10. Arecanut
11. Palmyrah
12. Oil palm
13. Special nursery management practices in plantation crops
14. Value addition in plantation crops and product diversification
15. Introduction – importance and scope and export potential of spices and condiments in India and Tamil Nadu.
16. Area, production and classification of spices and condiments
17. Mid Semester Examination
18. Pepper – soil and climatic requirements – propagation – cultivation aspects – harvesting & processing
19. Cardamom
20. Turmeric
21. Ginger
22. Coriander
23. Fennel
24. Cumin
25. Fenugreek
26. Clove
27. Nutmeg
28. Cinnamon
29. All spice
30. Curry leaf
31. Asafoetida
32. Vanilla
33. Saffron
34. Value addition in spices & condiments and product diversification

**PRACTICAL SCHEDULE:**

1. Identification of plantation crops, spices and condiments
2. Processing in tea & coffee
3. Processing in rubber & cashew
4. Processing in cocoa
5. Product diversification in plantation crops
6. Role of growth regulators in plantation crops
7. Nursery techniques in plantation crops
8. Propagation in pepper & cardamom
9. Propagation in turmeric & ginger
10. Processing of pepper & cardamom
11. Processing of turmeric & ginger
12. Nursery techniques in seed spices
13. Nursery techniques in tree spices
14. Nursery techniques in other spices and condiments
15. Value addition in spices and condiments
16. Role of growth regulators in spices and condiments
17. Visit to the processing industries of plantation crops, spices and condiments.



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1. Chadha, K.L. and O.P. Pareek (Ed.), 1993. Advances in Horticulture vol.9 Plantation crops – Malhotra Publishing house – New Delhi, India.
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4. Nair, M.K., E.V.B. Baskararao, K.K.N. Nambiar and M.C. Nambiar. 1979. Cashew. CPCRI, Kasaragod.
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## HOR 214: BIO-TECHNOLOGY OF HORTICULTURAL CROPS (1+1)

### OBJECTIVES

The natural capability of plants to multiply by asexual means is the basis for multiplication *in vitro*. Tissue culture simply directs and assists the natural potential within the plants to putforth new growth and to multiply in a highly efficient and profitable way. New developments in plant research inspire the use of tissue culture techniques in several areas like anther, callus, cell and embryo culture, protoplast fusion, secondary metabolites, genetic engineering. In this course, the importance and scope of biotechnology will be highlighted and the various techniques of tissue culture will be dealt in detail.

### THEORY

#### UNIT-I: Importance, History, Factors affecting tissue culture

Plant, cell and tissue culture – History and applications – General techniques – harnessing biotechnology in horticultural crops – factors affecting organogenesis and somatic embryogenesis

#### UNIT –II: Techniques of tissue culture - I

Callus culture – Cell suspension culture – Meristem culture – Anthe/pollen culture – development of haploids – somatic embryogenesis – Principles, concepts and applications

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

Embryo culture – wide hybridization – Embryo rescue – in vitro pollination and fertilization – somaclonal variation and its application

#### UNIT-IV: Micropropagation and protoplast technology

Micro propagation – phases – advantages – synthetic seed production – protoplast culture – somatic hybridization – cryopreservation

#### UNIT-V: Genetic engineering and secondary metabolite production

Genetic engineering – invitro mutation – induction – secondary metabolite production

### PRACTICAL

Estimation of photosynthetic potential of Horticultural crops – leaf area index – light intensity measurement in different tier cropping – growth analysis parameters including harvest index – preparation of hormonal solution and induction of rooting in cuttings – ripening of fruits and control of fruit and flower drop. Senescence index in plants – basic principles in identifying the deficiency symptoms of macro and micro elements in fruits, vegetables and flower crops – important physiological disorders and their remedial measures in fruits and vegetables – seed dormancy – tetrazolium test – seed germination and breaking seed dormancy with chemicals and growth regulators

### THEORY LECTURE SCHEDULE

1. Harnessing bio-technology in horticultural crops
2. Influence of plant materials, physical and chemical factors on *in vitro* growth and development
3. Growth regulators on *in vitro* growth and development
4. Tissue culture, cell division, differentiation and cell organelles
5. Meristem, pollen, anther, suspension, embryo and ovule culture and micropropagation
6. Somaclonal variation and its application
7. Protoplast culture
8. Somatic cell fusion, cybrids
9. Mid Semester Examination
10. Wide hybridization and embryo rescue
11. Artificial seeds and micro grafting

12. Cryo preservation
13. *In vitro* pollination and *in vitro* chimeras
14. *In vitro* mutation, epigenetic variation.
15. Transgenic plants
16. Use of bioreactors in commercial micropropagation

### **PRACTICAL**

1. An exposure to tissue culture laboratory
2. Visit to leading Tissue Culture Units like Spic biotech, South India Viscose Coimbatore.
3. Media preparation
4. Inoculation of explants for clonal propagation
5. Inoculation of explants for callus culture
6. Sub-culture for regeneration of plantlets from direct and indirect organogenesis - techniques on anther culture
7. Sub-culture for regeneration of plantlets from direct and indirect organogenesis - techniques on ovule culture
8. Sub-culture for regeneration of plantlets from direct and indirect organogenesis - techniques on embryo culture
9. Induction of somaclonal variation
10. Mutation induction *in vitro*
11. Hardening Techniques
12. Protocol for mass multiplication
13. Rapid clonal propagation
14. Visit to leading Tissue Culture Units like Indo American, Growmore biotech, Manjushree, Harison Malayalam Hosur & Bangalore etc.
15. Cryo preservation
16. Project preparation for establishment of tissue culture laboratory
17. Final Practical Examination.

### **REFERENCES**

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5. Mizrahi, A., (1988). Biotechnology in agriculture, advances in biotechnological processes, Vol. 9, Alen R. Liss Loc; New York.
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## **AGR 215: WATER MANAGEMENT IN HORTICULTURAL CROPS (1+1)**

### **OBJECTIVES**

To study the principles and practices of irrigation in horticultural crops

### **THEORY**

#### **Unit – I: History and development of irrigation**

History and development of water / irrigation management - Role of water in plant growth – Water resources and irrigation potential of India and Tamil Nadu - History and development of irrigation in India – Importance of irrigation – Irrigation systems of India and Tamil Nadu

#### **Unit – II: Soil-plant-water relationship**

Water relations – Soil-plant-water relationship - Soil-plant atmospheric – Hydrological cycle – Soil water movement – soil moisture constants - Moisture extraction pattern in fruit crops– Absorption of water by vegetables–transpiration – factors affecting transpiration.

#### **Unit – III: Water requirement**

Water requirement – Water requirement for important horticultural crops - Factors affecting water requirement-Potential evapotranspiration (PET) and consumptive use – Definition and estimation — Critical stages for irrigation and water requirement of horticultural crops.

#### **Unit – IV: Micro irrigation and water use efficiency**

Scheduling of irrigation – Different approaches - Methods of irrigation: surface, sub-surface sprinkler and drip irrigation – Micro irrigation layout, suitability, merits and scope –fertigation- water soluble fertilizer use- Water use efficiency – Methods to improve WUE. Water management for different horticultural crops.

#### **Unit – V: Quality of water and drainage**

Irrigation water – measurement- methods- quality-management of poor quality water (saline, effluent and sewage water) for irrigation – tank irrigation, well irrigation –drainage- definition.

#### **PRACTICAL**

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

#### **THEORY - LECTURE SCHEDULE**

1. History and development of water-Role of water in plants -- Water resources of India and Tamil Nadu
2. Importance of irrigation and Irrigation systems of India and Tamil Nadu.
3. Soil – Plant –water relationship – Soil-plant-atmospheric - Hydrological cycle
4. Soil water movement- soil moisture constants -absorption of water and evapotranspiration.
5. Plant water stress – causes – plant response and adaptations – method to overcome plant water stress.
6. Crop water requirement – factors affecting crop water requirement – effective rainfall - potential evapotranspiration (PET), consumptive use (CU) – definition and estimation.
7. Available soil moisture – definition and importance – moisture extraction pattern - soil physical characteristics (texture, structure, porosity, bulk density and particle density) in influencing irrigation – soil moisture estimation methods
8. Factors affecting crop water requirement– Critical stages for irrigation – water requirement for different horticultural crops.
9. **Mid-Semester Examination**
10. Scheduling of irrigation – criteria based on plant, soil moisture - different approaches - climatological approach, empirical methods, crop co-efficient.
11. Methods of irrigation – surface (flooding, beds and channels, border strip, ridges and furrows, broad bed and furrows, surge irrigation) and sub-surface methods.
12. Micro irrigation system (drip and sprinkler irrigation) – suitability, components, layout, operation, advantage and disadvantage. –Fertigation –water soluble fertilizers
13. Water use efficiency – definition and concept – methods to improve WUE – conjunctive use of water- water budgeting
14. Water management for cereals, pulses and oilseeds
15. Water management for commercial crops (cotton, sugarcane, sugar beet, tobacco)
16. Quality of irrigation water – irrigation management under limited water supply- Agronomic practices for use of poor quality water (saline, effluent and sewage water).
17. Tank irrigation, well irrigation - on farm development – command area development and Agricultural drainage – importance of drainage and different methods of drainage.

#### **PRACTICAL SCHEDULE**

1. Estimation of soil moisture by gravimetric method and tensiometer
2. Estimation of soil moisture by resistance blocks and neutron probe and other improved devices
3. Measurement of irrigation water with flumes and weirs
4. Calculation of irrigation water based on source, water flow, soil moisture status and depth of irrigation.
5. Land leveling and land shaping - Beds and channels - ridges and furrows.

6. Land leveling and land shaping for border strips - broad bed furrow method of irrigation.
7. Layout, operation and maintenance of drip and sprinkler irrigation systems.
8. Estimation of crop water requirement by direct and indirect methods
9. Scheduling of irrigation based on indicator plants, soil-sand mini plot technique
10. Scheduling of irrigation based on depletion of available soil moisture and IW/CPE ratio.
11. Calculations on irrigation efficiency parameters
12. Assessment of irrigation water quality parameters.
13. Observation of irrigation structures in wetlands and irrigated dry lands.
14. Visit to irrigation command area and study of command area development.
15. Observation on drainage structures during on / off campus field visit.
16. Visit to water management and training institute
17. Practical Examination.

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3. Panda, S.C. 2007. Principles and Practices of water management. Agrobios Publishers
4. Ramachandrappa, B.K and H.V.Nanjappa.2008. Fertigation technology. Agrobios, Jodhpur.
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6. Sankara Reddy, G.H. and T. Yellamanda Reddy. 2003. Efficient use of irrigation water. Kalyani Publishers, New Delhi

## ENT 216: BENEFICIAL INSECTS AND NEMATODE PESTS (2+1)

### THEORY

#### Unit I: Apiculture

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 and seasonal management. Bee enemies, diseases of bees, bee pollination, bee products and their uses.

#### 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 - bivoltine hybrids – double hybrids - morphology and biology of mulberry silkworm – structure and function of silk glands. 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. Mulberry silk worm rearing - 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 III: Lac Culture and Minor Productive Insects

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 production – Seed lac –Button lac- Shellac. Lac products – Uses of lac. Minor productive insects - Cochineal insect, Gall insect, Food and Medicinal value of insects, Aesthetic and Scientific value of insects.

#### Unit IV: Morphology, Taxonomy, Biology and Ecology of Nematodes

Nematology - Introduction – Brief history and development in India - Position of nematodes in animal kingdom- Importance of plant parasitic nematodes and entomophilic nematodes – Economic loss in crop plants. Morphology and anatomy of nematodes – segmentation, cuticle, cephalic region, alimentary, excretory, reproductive and nervous system, sense organs. Classification based on feeding habits and ecology. Taxonomy of important plant parasitic nematodes – Biology and ecology of important plant parasitic nematodes - *Meloidogyne*, *Heterodera*, *Globodera*, *Tylenchulus*, *Pratylenchus*, *Rotylenchulus*, *Radopholus* and *Ditylenchus*.

## Unit V: Nematode pests on horticultural crops and Integrated nematode Management

Plant parasitic nematodes of horticultural crops - vegetables, fruits, spices and plantation crops, flower crops, ornamentals, medicinal and aromatic plants. Interaction with microorganisms (fungi, bacteria and viruses). Principles of nematode management – Legal methods, Physical methods, Cultural methods, Environmental monitoring – exclusion and population reduction. Host plant resistance to nematodes. Biological control –Entomophilic nematodes - Chemical control –Integrated nematode management.

### PRACTICAL

Acquaintance with honey bee species, structural adaptation, castes, Bee-keeping equipment, bee forage plants, enemies of bees and Handling of bee colonies. Acquaintance with silkworm types, life stages of mulberry silkworm, Mulberry varieties, Rearing appliances for silkworm, 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 and minor productive insects. Survey and sampling for plant parasitic nematodes. Extraction of plant parasitic nematodes and cysts from soil and roots (Cobb's sieving technique, Baermann funnel technique, conical flask technique, Sugar floatation technique, Fenwick can method, Incubation and Blender technique). Mounting of plant parasitic nematodes – Diagnostic characters of orders *Tylenchida* and *Dorylaimida*. Identification of important plant parasitic nematodes *Meloidogyne*, *Heterodera*, *Globodera*, *Tylenchulus*, *Radopholus*, *Rotylenchulus*, *Ditylenchus Hirschmanniella*, *Hemicriconemoides*, *Criconema*, *Aphelenchoides*, *Pratylenchus* and *Tylenchulus*. Important plant parasitic nematodes of major crops – symptoms, life cycle and management.

**Assignment:** Each student has to submit a report on Economics of bee keeping/ Economics sericulture/entomophilic nematodes/Plant parasitic nematodes

### THEORY LECTURE SCHEDULE

1. History of apiculture, species of bees, morphology, anatomy and structural adaptations.
2. Colony organization and life history – bee castes – duties – social behaviour.
3. Bee pasturage, bee foraging and swarming. Bee enemies and diseases of bees
4. Apiary – selection of site, bee-keeping equipment, seasonal management
5. Bee pollination, bee products and their uses.
6. History of sericulture – silk road – Organizations in sericulture industry, Types of silkworm - Non – mulberry, Eri, Tasar and Muga silkworms.
7. Voltinism - multivoltine - bivoltine - bivoltine hybrids – double hybrids
8. Morphology and biology of mulberry silkworm. structure and function of silk glands.
9. Mulberry cultivation – soil type – mulberry varieties – Methods of propagation – Nursery preparation – Main field preparation – Methods of planting –Nutritional requirements – Water management- Pruning methods – Methods of harvesting – preservation of leaves - Pests of mulberry plants.
10. Mulberry silk worm rearing - rearing house - room and bed disinfectants – grainage
11. Chawki rearing – feeding, cleaning and spacing, Rearing of late age worms – feeding, cleaning, spacing.
12. Mounting – mountages – harvesting of cocoons. Pests and diseases of mulberry silkworm and their management
13. Steps in Post cocoon technology – stifling to weaving. Uses of silk.
14. Pests and diseases of silkworm – symptoms - management practices.
15. Importance and history of Lac culture. Species of Lac insect.
16. Morphology, biology and secretion of lac.
17. **Mid Semester Examination**
18. Host plants of lac insect – maintenance of host plants. Inoculation of Lac insect and Yield. Enemies of lac insect.
19. Lac production – Seed lac –Button lac- Shellac. Lac products – Uses of lac.
20. Minor productive insects - Cochineal insect, Gall insect, Food and Medicinal value of insects, Aesthetic and Scientific value of insects.
21. Nematology - Introduction – Brief history and development in India - Position of nematodes in animal kingdom.

22. Importance of plant parasitic nematodes and entomophilic nematodes – Economic loss in crop plants.
23. Elementary knowledge on morphology of nematode – cuticle, segmentation, cephalic regions.
24. Elementary knowledge on alimentary, excretory, reproductive systems.
25. Elementary knowledge on nervous system and sense organs.
26. Classification based on feeding habits and ecology. Taxonomy of important plant parasitic nematodes.
27. Biology and ecology of important plant parasitic nematodes - *Meloidogyne*, *Heterodera*, *Globodera*, *Tylenchulus*.
28. Biology and ecology of important plant parasitic nematodes - *Pratylenchus*, *Rotylenchulus*, *Radopholus* and *Ditylenchus*.
29. Important plant parasitic nematodes of vegetables, fruits, spices and plantation crops – list and symptoms of damage.
30. Important plant parasitic nematodes of flower crops, ornamentals, medicinal and aromatic plants – list and symptoms of damage.
31. Interaction with microorganisms (fungi, bacteria and viruses).
32. Principles of nematode management – Legal methods, Physical methods, Cultural methods,
33. Environmental monitoring – exclusion and population reduction. Host plant resistance to nematodes.
34. Biological control –Entomophilic nematodes, Chemical control –Integrated nematode management.

### **PRACTICAL SCHEDULE**

1. Acquaintance with honey bee species, castes of bees and structural adaptation.
2. Acquaintance with Bee-keeping equipment and bee forage plants.
3. Studies on seasonal management and identification of enemies of honey bees.
4. Identification of Silkworm types – mulberry, Eri, Tasar and Muga silkworms and acquaintance with life stages of mulberry silkworm. Acquaintance with Mulberry varieties and preparation of mulberry cuttings.
5. Identification of rearing appliances of mulberry silkworm and acquaintance with methods of disinfection. Handling of silkworm in Chawki rearing and Late age rearing.
6. Identification of lac insect, lac products and other minor productive insects.
7. Soil and root sampling. Extraction of nematodes by Cobb's sieving method, Baermann funnel technique and modified Baermann funnel technique.
8. Extraction of nematodes by sugar flotation technique.
9. Extraction of cysts by conical flask technique, fenwick can method and Incubation and Blender technique.
10. Extraction of nematodes from roots and staining of roots infested with endoparasitic nematodes.
11. Preservation of nematodes and preparation of temporary and permanent slides.
12. Observing morphology of the order Tylenchida and Dorylaimida.
13. Identification of nematodes – *Meloidogyne*, *Heterodera*, *Globodera*, *Tylenchulus*, *Radopholus*, *Rotylenchulus*, *Ditylenchus Hirschmanniella*, *Hemicriconemoides*, *Criconema*, *Aphelenchoides*, *Pratylenchus* and *Tylenchulus*.
14. Observing the life stages of *Meloidogyne*.
15. Observing the life stages of *Rotylenchulus*, *Radopholus*.
16. Identification of symptoms of nematode damage in major crops.
17. **Final Practical examination.**

### **REFERENCE BOOKS**

1. Atwal, A.S. 2006. The World of the Honey Bee. Kalyani Publ., New Delhi. 257p.
2. Dandin, S.B., J.Jayaswal and K. Giridhar. 2003. Hand book of Sericulture Technologies. Central Silk Board, Bangalore, 287 p.
3. David, B.V. and Ramamurthy, V.V. 2010. Elements of Economic Entomology (Revised edition). Namurtha Publications, Chennai. 624 p.
4. Hariprasad, Y, R.Veeravel and R. Kannan. 2006. Basics of Plant Nematodes. Sowmi Publications. Chidambaram. 205p.
5. Jonathan, E.I. 2010. Fundamentals of Plant Nematology, Devi Publications, Triruchirapalli. P. 232.

## SAC 217: SOIL AND PLANT ANALYSIS (1+1)

### OBJECTIVES:

This course is designed to provide knowledge of soils and plant analysis using different instrumental methods. It is also aimed to inculcate knowledge on principles and methods involved in measurement of soil physical properties, soil fertility evaluation and problem soil and water. Further, the student will gain knowledge on the chemical constituents of horticultural crops.

### THEORY

#### Unit I : Soil and plant analysis

Collection of soil and plant samples and processing for analysis. Instrumental methods – Working principles of pH meter, EC meter, Spectrophotometer, Flame photometer and Spectrophotometer.

#### Unit II: Soil Physical properties

Minerals – Definition, abundance and quantification. Soil structure and aggregate analysis. Soil moisture- Theories and estimation of soil moisture – gravimetric, tensiometric, gypsum block, neutron probe and pressure plate methods. Soil air – composition, renewal of gases in soil, diffusion and mass flow. – Methods of estimation of ODR and redox potential.

#### Unit III : Soil fertility evaluation

Different approaches for soil fertility evaluation. Soil testing – Chemical methods, critical level of different nutrients in soil. Biological methods of soil fertility evaluation. Use of radio trace technique in soil fertility evaluation. Soil micro organism and their importance.

#### Unit IV : Appraisal and management of problem soil and irrigation water

Saline, alkali, acid, waterlogged and sandy soils – their appraisal and management. Irrigation water – water quality appraisal. Effect of poor quality water on soil and plant growth and management.

#### Unit V : Constituent of horticultural crops

Chemical and mineral composition of horticultural crops. Leaf analysis- standards, index tissue and interpretation of leaf analysis value.

### PRACTICALS

Collection and preparation of soil sample for analysis. Estimation of moisture. Determination of water holding capacity and hydraulic conductivity of soil. Determination of pH, EC, SAR and ESP of soils. Estimation of available macro and micro nutrients in soils. Collection and preparation of plant samples – Determination of moisture, macro and micro nutrients in plants. Irrigation water – quality analysis and interpretation.

### THEORY LECTURE SCHEDULE

1. Collection and processing of soil and plant samples – General principles in analytical chemistry.
2. Instrumental method of analysis – Principle and practices of potentiometry, conductometry, colorimetry and spectrophotometry.
3. Principles and practices of absorption and emission spectroscopy.
4. Minerals – definition, abundance, classification of important soil forming primary and secondary minerals.
5. Soil structure – Classification, genesis, factors influencing structural stability – aggregate analysis.
6. Soil moisture – forms of water, movements, soil water potentials and moisture estimations – gravimetry, tensiometer, neutron probe and pressure method.
7. Soil air – Composition, renewal and movement of soil air. Oxygen diffusion rate and redox potential
8. **Mid Semester Examination**
9. Soil fertility- Concepts and approaches of soil fertility evaluation – Liebig law, Mitscherlich law, Bray nutrient mobility concept. Approaches – deficiency symptoms, tissue analysis, biological and chemical test.
10. Methods of soil fertility evaluation – Inductive, deductive, ‘A’ value, crop logging, critical level, DRIS and Use of radio tracer technique.
11. Acid soils – Genesis and classification , lime requirement of acid soil and reclamation
12. Saline and sodic soil – characteristics, gypsum requirement and reclamation

13. Water logged and sandy soils – characteristics and their management. Soil micro organism and their importance
14. Quality of irrigation water and water quality criteria. Effect of poor quality water on soils and crops.
15. Chemical composition of vegetables, fruits, spices and condiments.
16. Chemical composition of beverages, essential oils, medicinal plants and narcotics
17. Leaf analysis – index leaves. Critical levels and interpretation of leaf analysis value.

## **PRACTICALS**

1. Collection of soil sample
2. Estimation of moisture and water holding capacity
3. Determination of soil pH and EC
4. Determination of water soluble cations and SAR
5. Determination of water soluble anions
6. Determination of exchangeable sodium and ESP
7. Determination of cations in irrigation water
8. Determination of anions in irrigation water
9. Computation of salts and interpretation of results of water analysis
10. Collection of plant sample
11. Estimation of moisture and preparation of tri acid extract
12. Estimation of nitrogen
13. Estimation of phosphorus
14. Estimation of potassium
15. Estimation of secondary nutrients
16. Estimation of micro nutrients

### **17. Practical Examination**

## **REFERENCES**

1. Brady, N.C., 1995. The nature and properties of soil. Prentice Hall of India Pvt. Ltd., New Delhi.
2. Biswas, T.S. and S.K. Mukherjee., 1997. Text book of soil Science. Tata Mc. Graw Hill Publishing Co. Ltd., New Delhi.
3. Dilip Kumar Das., 2004. Introductory Soil Science. Kalyani Publishers. New Delhi.
4. Sahai, V.N., 2001. Fundamentals of Soil Science. Kalyani Publishers, Ludhiana.
5. Sekhon, G.S. Eds., 2002. Fundamentals of Soil Science. Indian Society of Soil Science, IARI, New Delhi.
6. Westerman, R.L. (ed.) 1990. Soil testing and Plant analysis, 3rd. edition. Soil Science Society of America, Inc., Madison, WI.

## **GPB 218: GENETICS AND CYTOGENETICS (2+1)**

### **OBJECTIVES**

- To impart knowledge on inheritance and variation and to understand the parallelism between the behavior of chromosomes and genes.
- To understand the modern concepts of genetics at molecular level.

### **THEORY**

#### **Unit I: Cytology**

Earlier concepts of heredity - Definition of genetics, heredity, inheritance, cytology, cytogenetics; cell and cell organelles –Prokaryotes and Eukaryotes- Cell division – mitosis, meiosis and their significance, cell cycle - Sporogenesis-gametogenesis, Fertilization-Identical and fraternal twins.

#### **Unit II: Mendelian laws and Quantitative inheritance**

Mendel's Work – Laws of heredity- Chromosomal theory of inheritance. Allelic interactions – Dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance; Non allelic interaction –gene interactions- Lethal genes, Pleiotrophy, Penetrance and Expressivity, phenocopy: Multiple alleles, Quantitative inheritance – Multiple factor hypothesis modifying genotypes of gene action controlling quantitative traits.



### **Unit III: Quantitative inheritance, Linkage and Crossing over**

Linkage and Crossing over- Estimation of strength of linkage and recombination - cytological proof for crossing over - Two point and three point test cross; Double cross over, interference and coincidence; genetic map, physical map. Cytoplasmic inheritance and Maternal effects.

### **Unit IV: Chromosomes, Chromosomal variation and Sex determination**

Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram – chromosome banding; Types of chromosomes- Special chromosomes-Variation in chromosome number and structure –Aneuploidy and Euploidy-its genetic cytological implications and evolutionary significance. Definition of eugenics and eugenics-Nondisjunction-Klinefelter's syndrome and Turner syndrome-autosomes and allosomes- sex determination - Genic balance theory -Sex linked - sex influenced and sex limited inheritance.

### **Unit V: Modern concept of genetics and mutation**

Experiments showing DNA as genetic material – DNA Structure and function- DNA replication- RNA as genetic material – types of RNA– genetic code-Central dogma of life; gene expression- protein synthesis; Regulation of gene expression – Operon model ; Cistron, muton and recon; Complementation test; exons, introns – split genes – plant genome structure; Mobile genetic elements; Meaning of Developmental genetics, DNA methylation, siRNA, RNA<sub>i</sub>, Functional genomics, Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics. Mutation – Mutagens-characteristics of mutation – CLB technique - molecular basis of mutation.

### **PRACTICAL**

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

### **THEORY SCHEDULE**

1. Definition of genetics, heredity, inheritance, cytology, cytogenetics; Brief history of developments in genetics and cytogenetics.
2. Physical basis of heredity: Structure and function of cell and cell organelles – Differences between Prokaryotes and Eukaryotes.
3. 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.
4. Cell division – mitosis, meiosis and their significance, cell cycle; zygote formation and embryo development - identical and fraternal twins.
5. Work of Mendel – Characters studied reasons for Mendel's success, Law of dominance, Law of segregation and Law of independent assortment. Rediscovery of Mendel's work
6. Chromosomal theory of inheritance. Allelic interactions – Dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance.
7. Terminologies: gene, allele, locus, homozygous, heterozygous, hemizygous, genotype, phenotype, monohybrid, dihybrid, trihybrid, polyhybrid.
8. 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); Summary of epistatic ratios (i)to (vi).
9. Lethal genes, Pleiotrophy, penetrance and expressivity, phenocopy: Multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles.
10. Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle, his experiment on wheat kernel colour.
11. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits.
12. Linkage - coupling and repulsion; Experiment on Bateson and Punnett – Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group.
13. Crossing over – significance of crossing over; cytological proof for crossing over - Stern's experiment; Factors controlling crossing over.
14. Strength of linkage and recombination; Two point and three point test cross. Double cross over, interference and coincidence; genetic map, physical map.

## 15. Mid Semester Examination

- 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.
- Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram – chromosome banding.
- Types of chromosomes based on position of centromere, based on structure and function.
- Special chromosomes - polytene, lampbrush, based on the role in sex determination: autosomes and allosomes, Other types of chromosomes - B, ring and isochromosomes.
- 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; Nondisjunction - Klinefelter syndrome and Turner syndrome; Definition of eugenics and eutherics.
- Polyploid - auto and allopolyploids, their characters; meaning of genome; evolution of wheat, triticale, cotton, tobacco, brassicas,
- Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination - different types – sex determination in human, fowl, butterfly, grasshopper, honey bee, fumea; Genic balance theory of Bridges, quantitative theory, hormonal theory, barr bodies, metabolic differentiation theory; Gynandromorphs – sex reversal in chicken
- Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex limited inheritance.
- Sex determination in plants – Melandrium, papaya, maize.
- DNA, the genetic material – Griffith's experiment, experiment of Avery, McCleod and McCarthy – confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment.
- Structure of DNA – Watson and Crick model – Central dogma of life
- Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication.
- RNA types - mRNA, tRNA, rRNA; genetic code, transcription.
- Translation – protein synthesis; Regulation of gene expression – operon model of Jacob and Monad; Structural genes and regulator genes;
- Cistron, muton and recon; Complementation test; exons, introns – split genes – plant genome structure; Mobile genetic elements; Meaning of Developmental genetics
- DNA methylation, siRNA, RNA<sub>i</sub>, Functional genomics, Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics.
- Mutation – characteristics of mutation – micro and macro mutation – CIB technique.
- Molecular basis of mutation; major physical and chemical mutagens.

## PRACTICAL SCHEDULE

- Use of microscopes and study of cell shapes and cell organelles of active mitotic and meiotic tissues.
- Principles of killing and fixing; preparation of stains and preservatives.
- Study of the mitotic phases in root tips of onion / *Aloe sp.*
- Study of behaviour of chromosomes in mitosis.
- Procedure for fixing and observing different meiotic phases in the inflorescence of maize.
- Procedure for fixing and observing different meiotic phases in the inflorescence in pearl millet/ sorghum/ forest tree.
- Observation of bivalents, trivalents, quadrivalents and chromosome banding
- Repetition of meiotic studies in maize/ sorghum/ pearl millet/ forest tree and making temporary and permanent slides.
- Principles of dominance, recessive, back cross, test cross, incomplete dominance, codominance and lethal factor; Chi square test; Monohybrid genetic ratio with dominance, with incomplete dominance and test cross.
- Dihybrid ratio with dominance, with incomplete dominance and test cross
- Simple interaction of genes-comb character in fowls; Dominant epistasis.
- Recessive epistasis, Duplicate and additive epistasis.
- Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
- Multiple alleles and polygenic inheritance
- Estimation of linkage with F<sub>2</sub> and test cross data; Coupling and repulsion.
- Problems on two point test cross and three point test cross; Working out interference, coincidence and drawing genetic maps.
- Final Practical examination.**

## REFERENCES

1. Singh. B.D. 2003. Genetics, Kalyani publishers, New Delhi – 110 002.
2. Gupta P.K., 1997. Cytogenetics. Rastogi Publications, Meerut
3. Strick Berger. M.W. 1996. Genetics. Prentice-Hall of India Pvt. Ltd. New Delhi.
4. Singh, B.D. 2004. Fundamentals of genetics, Kalyani Publishers, New Delhi – 110 002.
5. Verma, P.S. and V.K. Agarwal. 2007. Genetics. S.Chand and Company Ltd., New Delhi.
6. Stansfield, W.D.1990. Theory and problems of genetics. Mc-Graw Hill Book Co., New York

## AEC 219 INTRODUCTORY ECONOMICS (1+1)

### OBJECTIVES

The objective of this course is to provide knowledge to the students about basic concepts of economics and their practical importance.

### THEORY

#### Unit 1: Nature and Scope of Economics

Nature and scope of economics: Importance – subject matter, science vs. art, positive vs. normative science - deductive and inductive methods. Different economic systems: Merits and demerits. Definitions of Economics: Wealth, welfare, scarcity and growth definitions. Divisions of Economics – Micro and macro economics. Agricultural Economics: Definition and scope. Basic concepts: Goods, service, value, cost, price, wealth, welfare. Wants: Characteristics and classification.

#### Unit 2: Theory of Consumption

Utility: Definition, measurement - cardinal and ordinal utility - marginal utility - Law of Diminishing Marginal Utility & Law of Equi-marginal Utility: Definition – assumptions - limitations and applications. Demand: Definition - kinds of demand, demand schedule, demand curve, Law of demand, determinants of demand - extension and contraction increase and decrease in demand. Elasticity of demand: Types, degrees of price elasticity of demand, methods of measuring elasticity, factors influencing elasticity of demand - importance of elasticity of demand - Engel's law of family expenditure – indifference curve. Consumer's surplus: Definition – importance.

#### Unit 3: Theory of Production

Concept of production – Factors of production: Land and its characteristics. Labour – division of labour - Malthusian theory and modern theory of population. Capital – characteristics of capital - capital formation. Entrepreneur - characteristics and functions of entrepreneur. Supply - definition – law of supply – factors influencing supply- elasticity of supply.

#### Unit 4: Theory of Distribution

Pricing of factors of production – rent and Ricardian theory of rent – quasi rent - wage – real wage and money wage – marginal productivity theory of wage. Interest – liquidity preference theory – profit – risk bearing theory of profit.

#### Unit 5: Macroeconomic Concepts

National Income: Concepts, GNP, GDP, NNP, disposable income and per capita income - measurement of national income. Public Finance: Meaning, principles. Public Revenue: Meaning, classification of taxes - service tax - canons of taxation, public expenditure principles. Money: Functions of money. Inflation: Meaning, definition, kinds of inflation - Welfare Economics: Meaning, pareto's optimality.

### THEORY SCHEDULE

1. Nature and scope of economics: Importance – subject matter, science vs. art, positive vs. normative science - deductive and inductive methods -Different economic systems: merits and demerits.
2. Definitions of economics – Wealth, welfare, scarcity and growth definitions. Divisions of Economics –Micro and Macro economics. Agricultural Economics: definition and scope.
3. Basic concepts: Goods, service, value, cost, price, wealth, welfare. Wants: Characteristics and classification.
4. Utility: Definition, measurement - cardinal and ordinal utility - marginal utility - Law of Diminishing Marginal Utility & Law of Equi-marginal Utility: Definition – assumptions - limitations and applications.
5. Demand: Definition - kinds of demand, demand schedule, demand curve, Law of demand, determinants of demand - extension and contraction - Increase and decrease in demand.
6. Elasticity of Demand: Types, degrees of price elasticity of demand, methods of measuring elasticity, factors influencing elasticity of demand - importance of elasticity of demand.
7. Engel's law of family expenditure - Consumer's surplus: Definition – importance.
8. Concept of production – Factors of production – Land and its characteristics. Labour– Division of labour.

## 9. Mid Semester Examination.

10. Malthusian theory and modern theory of population.
11. Market structure – Price determination in perfect competition & monopoly.
12. Capital – characteristics of capital - capital formation. Entrepreneur, characteristics and functions of entrepreneur.
13. Supply: Definition – law of supply – factors influencing supply – elasticity of supply.
14. Pricing of factors of production – rent and Ricardian theory of rent – quasi rent - wage – real wage and money wage – marginal productivity theory of wage.
15. Interest – liquidity preference theory – profit – risk bearing theory of profit - National Income: Concepts – GNP, GDP, NNP, disposable income and per capita income- measurement of national income.
16. Public Finance: Meaning, principles. Public Revenue: Meaning, classification of taxes - service tax - cannons of taxation, public expenditure: principles.
17. Inflation: Meaning, definition, kinds of inflation. Welfare Economics: Meaning, Pareto's optimality - Millennium Development Goals (MDG).

## PRACTICAL SCHEDULE

1. Exercise on Law of diminishing marginal utility.
2. Exercise on Law of equi marginal utility.
3. Demand schedule - graphical derivation of individual and market demand.
4. Indifference curve analysis – properties, budget line and consumer equilibrium.
5. Measurement of arc elasticity and point elasticity of demand - Estimation of own price elasticity, income and cross elasticity of demand.
6. Estimation of consumer surplus.
7. Exercise on Law of diminishing marginal returns – relationship between TPP, APP and MPP.
8. Cost concepts and graphical derivation of cost curves.
9. Analysis of growth in population and food grain production in India.
10. Estimation of supply elasticity.
11. Market structure – price determination.
12. Analysis of causes of inflation and control measures. Measurement of inflation –consumer price index and wholesale price index.
13. Types and functions of money.
14. Approaches to computation of National Income.
15. Analysis of trends in National Income and study of structural changes in the economy
16. Exercise on welfare indicators – HDI, PQLI, PPP, poverty line, etc
17. **Final Practical Examination.**

## REFERENCES

1. Dewett, K.K. 2002. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2. Koutsoyiannis,A. 1983.Modern Microeconomics, The Macmillan Press Ltd., Hongkong
3. Samuelson, P. 2004. Economics, (18/e), Tata Mcgraw-Hill, New Delhi.
4. Seth, M.L. 2000. Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi
5. Varian, H. R. 1987. Intermediate Microeconomics, WW Norton & Company, New Delhi.

## SEMESTER IV

### HOR 220: PRODUCTION TECHNOLOGY OF MEDICINAL AND AROMATIC CROPS (1+1)

#### OBJECTIVES

The main aim of this course is to provide information about scope and importance of medicinal and aromatic crops in national and state economy. It also highlights the recent development in the production and processing technology of medicinal and aromatic crops.

#### THEORY

History and background – scope and importance – uses in ayurvedic, siddha and unani system of medicines – Medicinal and aromatic plants wealth of India and Tamil Nadu – Area and production – Classification – annual, biennial and herbaceous perennial – Soil and climate – medicinal plants for temperate, sub tropical and tropical conditions, saline and alkaline, arid and marshy lands. Propagation and planting – manuring – irrigation – weed control, harvesting – post harvest handling – parts used – curing and processing practices – Storage methods – economics of cultivation:

#### Unit-I : Medicinal Plants-I

Senna, Periwinkle, Isabgol, Gloriosa, Phyllanthus

## **Unit –II: Medicinal Plants- II**

Aloe vera, Ashwagandha, Medicinal coleus, Gymnema, Medicinal solanum, Dioscorea.

## **Unit-III : Medicinal Plants –III**

Ipecac, Rauvolfia, Acorus, Safed musli, Long pepper

## **Unit-IV: Aromatic Crops-I**

Lemon grass, Citronella, Palmarosa, Vettiver, Geranium, Patchouli

## **Unit-V: Aromatic Crops-II**

Origanum, Artemisia, Mint, Ocimum, Lavender, Sandal wood.

## **PRACTICAL**

Identification and description of medicinal and aromatic crops, parts used and their products – Nursery raising and planting of Senna, Periwinkle, Isabgol, Gloriosa, Phyllanthus, Aloe vera, Ashwagandha, Medicinal coleus, Gymnema, Medicinal solanum, Dioscorea, Long pepper, Lemongrass, Palmarosa, Vettiver, Geranium, Patchouli, Mint and Ocimum – Study of varieties and propagation techniques in medicinal and aromatic crops – Harvesting curing and processing – Distillation units – Extraction and Identification of alkaloids and essential oils from medicinal and aromatic crops – preparation of project reports and working out economics of cultivation.

## **LECTURE SCHEDULE**

1. History and background – Scope and importance – Uses in Ayurvedic, Siddha and Unani medicinal systems, Medicinal plant wealth of India and Tamil Nadu – area and production – Industrial and pharmaceutical uses.
2. Varieties – soil and climate – propagation and planting – manuring /interculture – irrigation – weed control – harvesting and processing –economics of cultivation of Senna, Periwinkle.
3. Isabgol, Gloriosa
4. Phyllanthus, Aloe
5. Ashwagandha, Medicinal coleus
6. Gymnema, Medicinal solanum
7. Dioscorea, Ipecac
8. Rauvolfia, Acorus
9. Mid Semester Examination
10. Safed musli and long pepper
11. Scope, importance and uses – Industrial and cosmetic values – area and production – marketing – importance of aromatic plants in national and state economy.
12. Varieties – soil and climate – propagation and planting, manuring / irrigation, weed control – harvesting and processing – economics of cultivation of the following crops – lemongrass, citronella.
13. Palmarosa, vettiver
14. Geranium, patchouli
15. Origanum, artimesia
16. Mint, ocimum
17. Lavender and sandal wood

## **PRACTICAL SCHEDULE**

1. Identification of medicinal plants – parts used and their products.
2. Identification of aromatic crops – parts used and their products.
3. Collection of medicinal and aromatic plants under local conditions.
4. Study of varieties, propagation techniques and processing methods of following crops-senna, periwinkle.
5. Isabgol, Gloriosa
6. Phyllanthus, Aloe
7. Ashwagandha, Medicinal coleus
8. Gymnema, Medicinal solanum
9. Dioscorea, Ipecac, Rauvolfia
10. Acorus, safed musli long pepper
11. Lemon grass, citronella, palmarosa
12. Vettiver, geranium
13. Patchouli, mint, ocimum
14. Visit to herbal gardens
15. Visit to extraction Units and existing centres of medicinal and aromatic plants.
16. Extraction of essential oil in selected aromatic crops.

17. Working out economics of medicinal and aromatic plants cultivation and preparation of projects of commercial medicinal and aromatic plants.

## REFERENCE BOOKS

1. Akal, C.K. and B.M. Kapur. 1982. Cultivation and Utilization of Medicinal Plants, RRL, CSIR, Jammu.
2. Farooqi, A.A. and B.S. Sreeramu. 2001. Cultivation of Medicinal and Aromatic crops, University Press, Hyderabad.
3. Farooqi, A.A. M.M. Khan and M. Vasandhara. 1999. Production Technology of Medicinal and Aromatic Crops, Natural Remedies R&D Centre, Bangalore.
4. Kumar, N., J.B.M. Abdul Khader, P. Rangasamy and I. Irulappan. 1993. Introduction to Spices, Plantation Crops, Medicinal and Aromatic plants Rajalakshmi Publication, Nagercoil.
5. Bedi, Tanuja and Vyas. 2010. A Hand Book of Aromatic and Essential oil plants. Cultivation, Chemistry, Processing and uses. Agrobios, Jodhpur.
6. Sayed Nudrate Zawar. 2011. Medicinal plants. Holistic Approaches. New India Publishing Agency, New Delhi.

## HOR 221: ORNAMENTAL AND LANDSCAPE GARDENING (2+1)

### OBJECTIVES

- i) To study the basic principles and practices of landscape gardening .
- ii) To study the different styles of gardens, living and non-living components and special features in a garden.
- iii) To make on – site analysis, designing with garden elements and principles manually and using software's.

### THEORY

#### Unit-I : History, Garden types and principles of landscaping.

Ornamental and Landscape Horticulture – definitions – scope – importance of gardening – History of gardening – Types of gardens – Hindu, Buddhist, Persian, Mughul, Japanese, English, French and Italian garden – Formal, Informal and Picturesque types – Bio-aesthetic planning – Basic principles of gardening– Colour concept – Grouping concepts.

#### Unit-II: Softscape Elements

Softscape Elements (Living components) – Trees – shrubs – shrubbery – creepers – climbers – herbs – Annuals – Hedges – Edges – Topiary – Trophy – Flowers and foliage beds – Carpet beds – Palms – Ferns – Rosarium – Rockery – Sunken garden – Hanging baskets – Cacti and succulents plants for special purpose – basic function and utility – Their culture – Training and pruning– Lawn –lawn grasses – Layout and maintenance of lawn – living components for different situation – House plants –Indoor gardening.

#### Unit –III: Hardscape Elements

Hardscape elements (Non-living component) – Fences - Gates – Arches – Pergolas – Walks – Paths – Roads – Paving – Borders and edges – Water features – Canals, pools and ponds – Cascades – Falls – Bridges – Fountains – Lights and lamp posts – Garden seats – Statues – Decks – Bird's bath – Sundials – Urban – Planting boxes – Trellis – Gazebo – Band stands and design position – Basic function and utility – Maintenance – Non living components for special situations.

#### Unit-IV: Landscape designing and Execution

Site analysis – client preference – Landscape drawing – Fundamentals of manual drawing – Scale – Symbols – Layout – Plan view – Elevation and perspective diagrams – computer software – manual and computer aided designing – Designing for home, Institute and Industrial garden – public parks – Amusement and theme parks.

#### Unit-V: Special features in landscaping horticultural crafting and environmental horticulture

Water garden – Floating Plants – Oxygenerating plants – Bog garden – Vertical garden-Roof garden – Xeriscaping – Bonsai – Plants for bonsai – methods of bonsai culture - Terrarium – Flower arrangement – Dry flower making – Environmental Horticulture – Horticultural therapy – psychological and social aspects of Ornamental plants.

### PRACTICAL

Identification of ornamental plants and garden components – study of form, size shape, texture, flowering season and flower colour of different living components – Identification and description of trees, shrubs, flowers beds, foliage beds, climbers and creeper, Hedges, edges, cacti, succulents, ferns and palms. Evaluation of different garden sites in the campus based on the basic principles – Study of different styles of garden – Lawn - study of types of grasses - Establishment, care and maintenance of lawn – Art of topiary – Identification, planning and designing of non-living components – Principles and concepts in garden designing – Preparation of landscape design plan for home, institution and industries

– preparation of landscape project – study on horticultural crafts – Bonsai, Terrarium and flower arrangement.

### **LECTURE SCHEDULE**

1. Introduction to Ornamental Horticulture and landscaping, Definitions scope and importance.
2. History of gardening.
3. Types of gardens.
4. Bio-aesthetic planning and beauty components.
5. Principles of gardening.
6. Garden components, basic functions and utility.
7. Trees and shrubs in landscaping
8. Creepers, climbers in landscaping.
9. Herbs, Annuals, Hedges and Edges in landscaping
10. Topiary, Trophy, flower beds and other living components in landscaping.
11. Propagation of ornamental plants.
12. Training, pruning, care and maintenance of ornamental plants.
13. Lawn and lawn grasses.
14. Lawn making, care and maintenance.
15. House plants and indoor gardening
16. Hardscape elements in landscape
17. Basic function, utility and maintenance of non-living components.
18. Mid Semester Examination.
19. Study of ferns, cacti and succulents.
20. Water features, fountains in landscaping.
21. Fences, Gates, Arches, Pergolas and Garden Paths in landscaping.
22. Light, lamp posts and other ornamental structures.
23. Living and non-living components for special situations.
24. Site analysis, client preference and principles of landscape drawing.
25. Fundamentals of manual drawing – plan view, elevation and perspective diagrams.
26. Computer Aided designing in landscape
27. Designing for home institute and industry
28. Oxygenating plants and xeriscaping,
29. Bog, vertical and roof garden.
30. Horticultural crafting – Bonsai and bonsai culture.
31. Flower arrangements and Terrarium.
32. Horticultural therapy.
33. Environmental Horticulture
34. Psychological and social aspects of ornamental plants.

### **PRACTICAL SCHEDULE**

1. Identification of ornamental plants.
2. Identification of different components – their form, size, shape, texture flowering and other beauty components.
3. Evaluation of different garden sites in campus.
4. Description of trees, shrubs, and annuals.
5. Description of climbers, creepers, flowers and foliage beds.
6. Art of topiary, Trophy and carpet beds
7. Description of other living components
8. Methods of lawn making.
9. Propagation, maintenance, training and pruning of ornamental plants.
10. Identification and description of important non-living components.
11. Study on basic function, utility and maintenance of non living components.
12. Principles and fundamentals of designing garden.
13. Study on beauty components.
14. Practices on manual and computer aided landscape designing.
15. Preparation of landscape plan for home Institute and Industry.
16. Preparation of landscape plan for public parks.
17. Practices on horticultural crafts – Bonsai, Terrarium and flower arrangements.

### **REFERENCE BOOKS**

1. Bose, T.K. and D. Mukherjee. 1977. Gardening in India. Oxford and IBH Publication Co., Kolkata.
2. Beard, J.B. 1973. Turfgrass: Science and culture. Agro Botanica. Jodhpur.
3. Chadha, K.L. 1986. Ornamental Horticulture in India. ICAR. Krishi Bhavan, New Delhi.
4. Gopalasamy Iyyankar. 1970. Complete Gardening in Indian. Kalyan Printers, Bangalore.

5. Hari Krishna Pahiwal. 2009. Ornamental Gardening. National Book Trust, New Delhi, India.
6. Nambisan, K.M.P. 1992. Design Elements of Landscape Gardening, Oxford and IBH Publications Co. (P) Ltd., Kolkata.
7. Randhawa, G.S. 1973. Ornamental Horticulture in India. Today and tomorrow's printers and publishers, New Delhi.

## **HOR 222: PROTECTED AND PRECISION HORTICULTURE (1+1)**

### **OBJECTIVE**

Understanding the principles, theoretical aspects and developing skills in protected cultivation and precision farming of horticultural crops.

### **THEORY**

#### **Unit I Importance and basics of protected cultivation**

Protected cultivation-overview-importance- scope and current status of protected cultivation of horticultural crops in India- modes of protected cultivation- classification of greenhouses- basic considerations in establishment and operation of green houses- greenhouse construction and covering materials

#### **Unit II Environmental control and nutrient management**

Environmental control systems in greenhouse- ventilation –heating and cooling systems-lighting-carbon dioxide enrichment- hi-tech nursery management- bed preparation - media and sterilization-planting methods- water and nutrient management- greenhouse irrigation systems – fertigation-hydroponic systems

#### **Unit III cultural management under protection**

crop regulation- special horticultural practices under protected cultivation of rose, chrysanthemum, carnation, orchids, anthurium, gerbera, liliiums, cut foliage- technology for raising tomato, sweet pepper, cucumber and other vegetables in protected structures- harvest indices – harvesting

#### **Unit IV Post harvest handling and Marketing**

Postharvest handling- precooling, cooling, cold chain and storage- packing and transport - marketing-export- international standards and quarantine measures for various horticultural commodities- principles and guidelines for setting up of hi-tech protected cultivation units- role of corporate sectors in protected cultivation industry

#### **Unit V Precision horticulture**

Precision horticulture- principles and concepts- enabling technologies of precision farming- GPS, GIS, Remote sensing- sensors- variability management in precision farming- mapping- variable rate technology- precision equipments- computers and robotics in precision farming- post-harvest process management in horticulture using precision farming.

### **PRACTICAL**

Growing structures- basic considerations in establishment and operation of greenhouses- hi- tech nursery- environmental control systems in greenhouse- containers- substrate culture- soil decontamination techniques- scheduling irrigation and fertigation for horticultural crops- crop regulation- special horticultural practices under protected cultivation- Visit to protected cultivation unit, auction centre and cold storage unit- precision equipments- computers and robotics in precision farming- post-harvest process management in floriculture using precision farming.

### **THEORY SCHEDULE**

1. Protected cultivation-introduction- Scope and current status of protected cultivation in India
2. Classification of greenhouses- based on shape, utility, construction materials, covering materials etc.,
3. Environment control- ventilation –heating and cooling systems- lighting- carbon dioxide enrichment
4. Hi-tech nursery management- bed preparation - media and sterilization- planting methods
5. Water and nutrient management- greenhouse irrigation systems – fertigation
6. Hydroponic systems- methods, scope and advantages
7. Special horticultural practices under protected cultivation of flower crops- rose, chrysanthemum, carnation, orchids, anthurium, gerbera, liliiums, cut foliage
8. Special horticultural practices under protected cultivation of vegetable crops- tomato, sweet pepper, cucumber
9. Mid semester examination
10. Harvesting - Postharvest handling- Precooling, cooling, cold chain and storage
11. Principles and guidelines for setting up of hi-tech protected cultivation units
12. Role of corporate sectors in protected cultivation industry
13. Precision horticulture- Principles and concepts
14. Enabling technologies of precision farming- GPS, GIS, Remote sensing- sensors



15. Variability management in precision farming- mapping- variable rate technology
16. Precision equipments- computers and robotics in precision farming
17. Post-harvest process management in horticulture using precision farming.

### **PRACTICAL SCHEDULE**

1. Study of various modes of protected cultivation
2. Components of polyhouse and structural designs and styles
3. Study & design of greenhouse covering materials
4. Raising hi- tech nursery and its management
5. Selection and sterilization media for hi-tech culture
6. Designing and operating of environmental control systems
7. Bed preparation inside protected structure
8. Scheduling irrigation and fertigation for horticultural crops
9. Special cultural operations in flower crops
10. Special cultural operations in vegetable crops
11. Working out cost of production of flower crop under protected condition
12. Working out cost of production of vegetable crop under protected condition
13. Visit to protected cultivation unit- auction centre- cold storage unit
14. Export documentation and procedure
15. Operating of precision equipments
16. computers and robotics in precision farming
17. Post-harvest process management in floriculture using precision farming.

### **REFERENCE BOOKS**

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2. Chandra S & SomV. 2000. *Cultivating Vegetables in Green House. Indian Horticulture*45: 17-18.
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4. Radha Manohar and Igathanathane. 2000. *Greenhouse Technology and Management*. BSP. BS Publication, Hyderabad.
5. Reddy S, Janakiram B, Balaji T, Kulkarni S, & Misra RL. 2007. *Hightech Floriculture*. Indian Society of Ornamental Horticulture, New Delhi.
6. Tiwari GN. 2003. *Green House Technology for Controlled Environment*. Narosa Publ. House.

## **HOR 223: CROP PRODUCTION IN VEGETABLE CROPS (0 + 1)**

### **OBJECTIVES**

To give hands on experience to the students on crop production aspects Practical training and experience in vegetable production in one transplanted crop (tomato or brinjal or chillies) and one direct sown crop (bhendi or amaranthus or radish or aggregatum onion) –seed treatment – raising nursery - sowing seeds- field preparation- transplanting, manuring, irrigation, fertigation, weed control, after culture – growth regulators - plant protection – maturity indices and harvesting –maintenance of cultivation sheet - working out cost benefit ratio.

### **PRACTICAL SCHEDULE**

1. Practice in raising nursery for transplanted vegetables.
2. Seed treatment, sowing, after care and collection of stubbles.
3. Practice in application of FYM and its incorporation.
4. Field preparation – ploughing, formation of irrigation channels.
5. Formation of raised and flat beds, ridges and furrows.
6. Application of basal dressing of fertilizers.
7. Practice in transplanting and direct sowing of vegetables.
8. Practice in weeding and herbicide application.
9. Practice in scheduling of irrigation and fertigation.
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 application and other inter cultural operations.
14. Assessing maturity index and harvesting
15. Practice in seed extraction, processing, cleaning and packaging
16. Cost economics of production
17. Practical Examination

## REFERENCE BOOKS

- 1) Nem Pal Singh, A.K. Bharadwaj, Abnish Kumar and K.M.Singh.2004. Modern technology on vegetable production. International Book Distributing company, Lucknow.
- 2) Prem Singh Arya. 2002. A text book of vegetable culture, Kalyani publishers, New Delhi.
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- 4) Bailey, L. H 1999. Principles of Vegetable cultivation. Discovery Publishing House, New Delhi.
- 5) Veeraraghavathatham. D., M Jawaharlal and Seemanthini Ramdas. 1991. A guide on vegetableculture. A. E. Publication Coimbatore
- 6) Shanmugavelu, K. G. 1989. Production technology of vegetable crops. Oxford India Publication, New Delhi.

## HOR 223: CROP PRODUCTION IN FLOWER CROPS (0 + 1)

### OBJECTIVES

To give hands on experience to the students on crop production aspects Practical training and experience in flower production in Jasmine, Rose, Chrysanthemum, Tuberose, Marigold, Gomphrena and Celosia –raising nursery - propagation of cuttings – treatment and planting – seed treatment and sowing - media preparation field preparation – Layout and planting – transplanting, manuring, irrigation – pinching, training and pruning practices weed control, after culture – growth regulators - plant protection and harvesting and post harvest handling and storage –maintenance of cultivation sheet - working out cost benefit ratio.

### PRACTICAL SCHEDULE

- 1) Identification and description of species/varieties
- 2) Jasmine- propagation under mist–layout and planting
- 3) Jasmine- pruning, manuring and harvesting
- 4) Rose- ground layering-root stock raising and budding
- 5) Rose-layout and planting of Edward and Andhra Red varieties
- 6) Rose-Practicing disbudding, pinching and pruning
- 7) Chrysanthemum – preparation of suckers, rooting , layout and planting
- 8) Tuberose – Preparation of tubers, layout and planting
- 9) Marigold – raising nursery, seed treatment, sowing and planting
- 10) Gomphrena – practicing propagation techniques and planting
- 11) Celosia – practicing propagation techniques and planting
- 12) Practicing harvesting techniques
- 13) Practicing post harvest shelf life
- 14) Grading, sorting and packaging
- 15) Concrete extraction in rose, jasmine and tuberose
- 16) Economics of concrete extraction in rose, jasmine and tuberose
- 17) Practical examination

### REFERENCE BOOKS

1. Bhattacharjee, S.K. 2006. Advances in Ornamental Horticulture Vol. 1 to 3, Pointer publishers,Jaipur.
2. Bhattacharjee, S.K., and L.C. De. 2003. Advanced commercial floriculture (Vol. I and Aavishkar Publishers and Distributors, Jaipur.
3. Bose,T.K., L.P. Yadav, P. Pal, P. Das and V.A Parthasarathy. 2002. Commercial flowers (Vol. 1and 2). Naya Prokash, Calcutta.

## ENT 224: INSECT PESTS OF FRUIT, PLANTATION, MEDICINAL AND AROMATIC CROPS AND THEIR MANAGEMENT (1+1)

### OBJECTIVES

Distribution, bio-ecology, host range, injury, integrated management of important insect pests affecting tropical, sub-tropical and temperate fruits, plantation, medicinal and aromatic crops.

### THEORY

#### Unit I: Insect ecology and Pest categories in horticultural ecosystem

Insect Ecology –definition - anecology, synecology, biome, population, community, niche, ecosystem and agro-ecosystem. Balance of life in nature - trophic level, food chain, food web.

Population dynamics - J- shaped growth form, S- Shaped growth form, natality, mortality, dispersal, biotic potential and life table. Environmental resistance on insect population - abiotic factors and biotic factors. Pest – definition, categories, biotypes, losses and causes for outbreaks. Pest surveillance - sampling techniques and forecasting in horticultural crop eco- system. Concepts of ETL and EIL.

#### **Unit II: Pests of Fruits crops**

Pests on mango, sapota, citrus, banana, grapevine, guava, jack, custardapple, pomegranate, pine apple, papaya, ber, date palm, jamun, bael, wood apple, hill banana, grapefruit, avocado, mangosteen, litchi, rambutan, carambola, durian, passion fruit, apple, pear, peach, plum, strawberry, sweet and sour cherry, black and raspberry, currants, apricot, kiwi, and persimmon. Non insect pests on fruit crops – Plant Mites, Plant parasitic nematodes, Rodents, birds and other Vertebrates.

#### **Unit III: Pests of Plantation crops**

Coffee, Tea, cardamom, pepper, Rubber, Cashew, Coconut, Arecanut, Oil palm, Cocoa, Palmyrah, All Spice, Kokum, Paprika, Vanilla, , Thyme, Celery, Parsley. Non insect pests on plantation crops.

#### **Unit IV: Pests of Medicinal & Aromatic Plants, Mushroom and Locust**

Medicinal plants - senna, periwinkle, glory lily, ashwagandha, medicinal coleus, aloe, long pepper, Phyllanthus, amarus, stevia, isabgol, Opium poppy, medicinal solanum, medicinal dioscorea, rauwolfia, vasambu, vallarai and noni. Aromatic crops - ocimum, davana, mint, lemon grass, citronella, palmarosa, vetiver, geranium, patchouli and rosemary. Non insect pests on Medicinal & Aromatic Plants. Pests on mushroom. Locusts and their management.

#### **Unit V: Components of Integrated pest management in horticultural crops**

Components of IPM – Cultural, Mechanical, Physical and Legal methods – invasive insect pest. Host plant resistance in IPM, Biological methods In IPM – classical biological control, merits and limitations of biological control, Parasitoids, Predators and Pathogens - Important families of predators and parasitoids, Microbial control, Groups of microbial agents and their actions on insects, Traps in horticultural crop pests management, Semiochemicals in IPM – Pheromones, Allomones, Kairomones and Synomones and their role in pest management, Insect growth regulators in IPM – Moulting inhibitors and JH mimics, Biotechnology in IPM and Sterile male technique and gamma radiation in IPM.

### **PRACTICAL**

Sampling techniques for the estimation of insect population and damage in horticultural crops. Pest surveillance through light traps, pheromone traps and estimating field incidence in horticultural crops. Study of symptoms of damage and identification of pests affecting fruits, plantation, medicinal and aromatic crops. Practices in Cultural, Mechanical and Physical methods in relation to horticultural crops. Traps in horticultural crop pests management. Identification of parasitoids, predators and entomopathogens utilized in horticultural crop pests management. Mass multiplication of important groups of parasitoids, predators and entomopathogens. Study of botanicals in horticultural crop pests management.

#### **Assignment:**

1. Each student has to submit five numbers of insect damaged plant specimens (Herbarium) from Fruit, Plantation, Medicinal and Aromatic Crops.
2. Rearing and submission of five insect pests of fruits, plantation, medicinal and aromatic crops.

### **THEORY LECTURE SCHEDULE**

1. Definitions and Terminologies related to Insect ecology - anecology, synecology, biosphere, habit, habitat, biome, population, community, niche, ecosystem, agro-ecosystem, balance of life in nature, producers and consumers, food chain, food web. Population dynamics - J shaped and S Shaped growth form, natality, mortality, r strategists and k strategists, dispersal, biotic potential and life table.
2. Pest – definition, categories of pests, biotypes, Effect of abiotic and biotic factors on pest population and factors governing pest outbreaks.
3. Concept of economic threshold level and economic injury level. Pest surveillance - Sampling Techniques and forecasting in horticultural crop eco- system
4. Pests of mango, sapota, citrus, banana
5. Pests of grapevine, guava, jack, custard apple, pomegranate, pine apple, papaya
6. Pests of ber, date palm, jamun, bael, wood apple, hill banana, grapefruit, avocado, mangosteen, litchi, rambutan, carambola, durian, passion fruit, apple, pear, peach, plum, strawberry, sweet and sour cherry, black and raspberry, currants, apricot, kiwi, and persimmon.
7. Pests of Coffee, Tea, cardamom, pepper.
8. Pests of Rubber, Cashew, Coconut, Arecanut, Oil palm.

### 9. Mid semester examination

10. Pests of Cocoa, Palmyrah, All Spice, Kokum, Paprika, Vanilla, , Thyme, Celery, Parsley.
11. Pests of medicinal and aromatic plants. Pests on mushroom. Locusts and their management.
12. Important species of Plant Mites, Plant parasitic nematodes, Rodents, birds and other Vertebrates on fruits, plantation, medicinal and aromatic crops.
13. Cultural methods, Mechanical methods, Physical methods, Host plant resistance and Traps in horticultural crop pests management.
14. Biological methods in horticultural crop pests management – classical biological control, merits and limitations of biological control.
15. Important predators, parasitoids, pathogens and Entomophilic nematodes in pest management. Microbial control, groups of microbial agents and their actions.
16. Legal methods – invasive insect pest. Semiochemicals in horticultural crop pests management – Pheromones, Allomones, Kairomones and Synomones and their role in pest management. Insect growth regulators in horticultural crop pests management – Moulting inhibitors and JH mimics.
17. Biotechnology in horticultural crop pests management. Sterile male technique and gamma radiation in horticultural crop pests management. Insect antifeedants and repellants in pest management.

### PRACTICAL SCHEDULE

1. Sampling techniques for the estimation of insect population and damage in horticultural crops.
2. Identification of life stages of important pests of mango, sapota, citrus, banana,
3. Identification of life stages of important pests of grapevine, guava, jack, custardapple, pomegranate, pine apple, papaya
4. Identification of life stages of important pests of ber, date palm, jamun, bael, wood apple, hill banana, grapefruit, avocado, mangosteen, litchi, rambutan, carambola, durian, passion fruit, apple, pear, peach, plum, strawberry, sweet and sour cherry, black and raspberry, currants, apricot, kiwi, and persimmon.
5. Identification of life stages of important pests of coffee, tea
6. Identification of life stages of important pests of cardamom, pepper, rubber, cashew
7. Identification of life stages of important pests of coconut, arecanut, oil palm
8. Identification of life stages of important pests of Cocoa, Palmyrah, All Spice, Kokum, Paprika, Vanilla, , Thyme, Celery, Parsley.
9. Identification of life stages of important pests of medicinal and aromatic plants and mushroom.
10. Practicing Cultural, Mechanical and Physical methods in horticultural pest management.
11. Identification of traps used in horticultural pest management – Pheromone traps, light traps, sticky traps and other traps.
12. Identification of different types of parasitoids, predators and entomopathogens utilized in horticultural crop pests.
13. Mass multiplication of important groups of parasitoids.
14. Mass multiplication of important groups of predators.
15. Mass multiplication of important groups of pathogens.
16. Preparation of Botanical formulations.
17. **Practical examination**

### REFERENCE BOOKS

1. Alford, D.V. 2007. Pests of Fruit Crops. A Colour Handbook, Manson Publishing, UK.480 p.
2. Butani, D.K. 2009. Insects and Fruits. Periodical Expert Book Agency, New Delhi. 457p.
3. Gupta, H.C.L., O.P. Ameta and V.K. Chechani, 2005. Management of Insect Pests of Horticultural Crops. Agrotech Publishing Academy, Udaipur, 224p.
5. Nair, M.R.G.K. 1986. Insects and Mites of Crops in India. Indian council of Agricultural Research, New Delhi. 305p.
6. Regupathy, A., S. Palanisamy, N. Chandramohan and K. Gunathilagaraj. 2008. A Guide on Crop Pests. Sooriya Desktop Publishers, Coimbatore. 269p.

## PAT 225 MUSHROOM CULTURES (0+1)

### OBJECTIVES

The subject covers cultivation, maintenance, harvesting, Pest and diseases problems their management – nutritional value of edible mushrooms and their preservation.

### PRACTICAL

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

### PRACTICAL SCHEDULE

1. Introduction to mushrooms
2. Types of mushrooms
3. Preparation of culture media
4. Pure culture-maintenance of culture
5. Spawn and types of spawn
6. Poly bag method
7. Cultivation techniques
8. Mid – semester examination
9. Cultivation techniques
10. Cropping room
11. Harvest
12. Packing storage of mushroom
13. Problems in cultivation& its management
14. Nutritional value of mushroom
15. Post harvest technology
16. Other uses of mushroom & Cost analysis and project preparation
17. Final Practical Examinations

### REFERENCE BOOKS

1. Aneja, K.R. 1996. Experiments in Microbiology, Plant Pathology, Tissue culture and cultivation of Mushroom, Wishwa Prakasham, New Delhi.
2. Bahl,N. 2000, Handbook of Mushrooms. Oxford & IBH Publishing Co., Pvt., Ltd., New Delhi.
3. Chadha, K.L. and Sharma, S.R. 1995, Mushroom Bio-technology Advances in Horticulture. Volume 13, Malhotra Publishing House, New Delhi.

## AEX 226: EXTENSION METHODOLOGIES AND TRANSFER OF HORTICULTURAL TECHNOLOGY (1+1)

### OBJECTIVES

- To learn about communication process, models and elements
- To learn about the use of various communication methods
- To learn about modern information technologies

### THEORY

#### UNIT I: Communication

Communication – meaning – definition – models – elements and their characteristics – types and barriers in communication.

#### UNIT –II: Programme Planning and Training

Programme planning – meaning, definition, principles, steps in programme development process, monitoring and evaluation of extension programmes. Types of training, training to farmers, farm women and rural youth, FTC & KVK.

### **UNIT III: Extension Teaching Methods**

Extension teaching methods - Audio-Visual aids – definition – classification – purpose, planning and selection, combination and use – individual, group and mass contact methods – merits and demerits.

### **UNIT IV: Modern Communication Gadgets**

Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone

### **UNIT V: Diffusion and Adoption**

Diffusion – meaning and elements. Adoption – meaning –adopter categories and factors influencing adoption, stages of adoption, Innovation decision process and attributes of innovation consequences of adoption.

### **PRACTICAL**

Communication pattern in State Department of Agriculture, KVK – ongoing horticultural and rural development, ATMA and SHGs – preparation of visual aids – extension literature – news stories, feature stories – interview articles – photo journalism – writing script for radio and television – spread and acceptance of farm technologies at village level.

### **THEORY SCHEDULE**

1. Communication-meaning, definition, functions, elements and their characteristics.
2. Types and barriers of communication and models of communication.
3. Programme planning-definition, scope, principles, importance, steps, evaluation, keys for evaluation.
4. Training-types, institutions training for farmers, farm women and rural youths and importance
5. Extension teaching methods-definition, meaning, functions, selection and classification.
6. Individual contact methods-farm and home visit, office call, telephone call and personal letter-observation and result demonstration.
7. Group contact methods-method demonstration, meeting, lecture, debate, workshop, seminar, forum and conference
8. Group contact methods-symposium, panel, brainstorming, buzz session, role playing and simulation games.
- 9. Mid Semester Examination.**
10. Mass contact methods-campaign, exhibition, farmers day and field trips - purpose, procedures, advantages and limitations.
11. Mass contact methods-written communication-circular letter, leaflet, folder, pamphlet-purpose, procedures, advantages and limitations.
12. Audio visual aids-definition, scope and importance, classification-merits and demerits-factors influencing planning and selection.
13. Modern communication gadgets-computer networks, internet, video and teleconferencing.
14. Modern communication sources (e-extension)-multimedia devices-mobile phone, Kisan Call Centre, Village Knowledge Centre/information kiosks, portal, websites.
15. Diffusion-meaning, definition, elements. Innovation-adoption, meaning, definition.
16. Attributes of innovation and stages of adoption
17. Innovation-decision process, functions, adopter categories-factors influencing adoption-impact and constraints in technology transfer programmes.

### **PRACTICAL SCHEDULE**

1. Understanding the communication pattern in State Department of Horticulture.
2. Study on communication pattern in KVK.
3. Study of ongoing agricultural development programmes.
4. Preparation and practicing of posters, charts, graphs.
5. Preparation and practicing of circular letter, folders and leaflets.
6. Visit to the department of agricultural engineering to study the transfer of technology efforts in farm mechanization.
7. Visit to village and fixing the priorities and selecting a most important problem for preparation of a project.
8. Visit to ATMA implemented village.

9. Studying the role of print media communication in publishing the activities of horticulture and allied fields.
10. Practicing skill on photo journalism
11. Internet, E-Mail communication Practices
12. Visit to All India Radio, to study its role in horticultural development.
13. Script writing for Radio and Television
14. Preparation of interview schedule to study the spread and acceptance of farm technologies at village level.
15. Data collection
16. Tabulation
17. Presentation of reports.

## REFERENCES

1. Adivi Reddy A. 2001. Extension Education. Sree Laxmi Press, Bapatla.
2. Dahama OP and Bhatnagar, OP. 1998. Education and Communication for Development Oxford and IBH Co, New Delhi.
3. Ray, G.L., 1999. Extension Communication and Management, Naya Prakash, 206, Bidhan Sarani, Calcutta.
4. Rogers E.M. 2003. Diffusion of Innovations. 5th Ed. The Free Press, New York.
5. Sandhu, A.S. 1996. Agricultural Communication: Process and Methods, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

## GPB 227: PRINCIPLES AND METHODS OF PLANT BREEDING (2+1)

### OBJECTIVES

1. To impart knowledge on emasculation and pollination techniques of various crops
2. To impart knowledge on application of various genetic principles in crop improvement

### THEORY

#### Unit I: Introduction

Classification of plants, Botanical description, floral biology, emasculation and pollination techniques in cereals, millets, pulses, oilseeds, fibers and plantation crops. Objectives and role of plant breeding - historical perspective – activities in Plant Breeding. Centres of origin – contribution of Vavilov- law of homologous series. Plant genetic resources – importance – germplasm – gene erosion - gene bank - conservation – types of conservation – agencies – quarantine. Modes of reproduction – sexual – asexual - self and cross fertilization – significance of pollination. Self incompatibility – Sterility – male sterility – CMS, GMS, CGMS- inheritance and applications. TGMS, PGMS, Gametocides, Transgenic Male sterility and applications. Apomixis

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

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

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

Genetic structure of population in cross pollinated crop – Hardy Weinberg law – gene frequencies in random mating population – principles in population improvement. Breeding methods of cross pollinated crops without involving artificial hybridization: Mass selection in cross pollinated crops – Breeding methods of cross pollinated crops involving artificial hybridization: Recurrent selection, Heterosis breeding – procedure – use of male-sterility systems and manual emasculation in hybrid seed production – Synthetics and composites - steps in development of synthetics and composites –

achievements – merits and demerits. Genetic characters of asexual reproduction – breeding methods – clonal selection – hybridization and clonal selection – merits and demerits – achievements; Chimeras and its types; Tree breeding – clonal orchards.

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

Polyploidy breeding – classification – induction of polyploidy – diploid x tetraploid and diploid x hexaploid crosses - achievements – limitations. Wide hybridization-history-importance-barriers and techniques for overcoming barriers-utilization. Mutation breeding: mutation – types – mutagens – breeding procedure – applications – achievements – limitations. Somaclonal variation - utilization in crop improvement; *In vitro* selection techniques — Use of doubled haploids in crop improvement. Introduction to markers – morphological – biochemical- DNA markers – uses of marker assisted selection - major genes – merits – demerits – achievements.

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

Types of cultivars – procedure for release of new varieties – stages in seed multiplication – seed certification and TC plants certification. Maintenance Breeding: Breeding for biotic and abiotic stresses; Current trends in Plant Breeding- Marker assisted breeding -Transgenic crops - Varietal protection and geographical indications – DUS. Breeding for pest resistance - mechanisms of resistance; Breeding for disease resistance - mechanisms of resistance; Breeding for Abiotic stress – drought and cold. – mechanisms of resistance; Breeding for Abiotic stress – salinity and alkalinity - mechanisms of resistance; Breeding for quality produce; Ideotype breeding, PPV &FR act, 2001- Plant breeder's right, Farmer's right, Biodiversity act, 2002; Germplasm registration.

#### **PRACTICAL**

Observation on reproductive and pollination systems in plants – Alternation of generation and life cycle – Description and drawing of different pollination systems – Mechanisms enforcing self and cross pollination – Morphology of pollen grains – Assessment of pollen fertility and sterility in A, B, and R line – Maintenance of A, B lines. Emasculation technique – Selfing and crossing techniques – Breeder kit – Layout of different trials – Irradiation – dosimetry – Half life period – Procedure for irradiation – Chemical mutagenesis – Molar solution – Procedure for treatment – Calculation of heterosis, PCV, GCV, heritability, genetic advance – genetic divergence – Records maintained – Wild species maintenance and utilization - screening method for specific traits – marker assisted selection.

#### **THEORY SCHEDULE**

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



16. Comparison of pedigree and bulk breeding methods. Single Seed Descent (SSD) method – procedure – application – merits and demerits.

### 17. Mid Semester Examination

18. Backcross breeding – genetic principles – prerequisites – procedures for transferring dominant and recessive genes - merits – demerits – multi lines and multi blends - population improvement approach in self-pollinated crops.

19. Genetic structure of a population in cross pollinated crop – Hardy Weinberg law – gene frequencies in random mating population – principles in population improvement.

20. Breeding methods of cross pollinated crops without involving artificial hybridization: Mass selection in cross pollinated crops – modified mass selection – unit selection – mass selection with progeny testing – half sib family selection – full sib family selection.

21. Breeding methods of cross pollinated crops involving artificial hybridization: Recurrent selection principles – types – merits and demerits - Heterosis breeding – genetic basis – hybrid vigour – estimation of heterosis – inbreeding depression – development of inbreds.

22. Heterosis breeding – procedure – use of male-sterility systems and manual emasculation in hybrid seed production – maintenance of parental lines -types of hybrids – achievements – merits and demerits.

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

24. Genetic characters of asexual reproduction – breeding methods – clonal selection – hybridization and clonal selection – merits and demerits – achievements; Chimeras and its types; Tree breeding – clonal orchards.

25. Polyploidy breeding – classification – induction of polyploidy – diploid x tetraploid and diploid x hexaploid crosses - achievements – limitations.

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

27. Mutation breeding: mutation – types – mutagens – breeding procedure – applications – achievements – limitations.

28. Somaclonal variation - utilization in crop improvement; *In vitro* selection techniques — Use of doubled haploids in crop improvement.

29. Introduction to markers – morphological – biochemical- DNA markers – uses of marker assisted selection - major genes – merits – demerits – achievements.

30. Types of cultivars – procedure for release of new varieties – stages in seed multiplication – seed certification and TC plants certification.

31. Maintenance Breeding: General seed production techniques – steps in nucleus and breeder seed production – varietal rundown and renovation.

32. Breeding for biotic and abiotic stresses; Current trends in Plant Breeding - Marker assisted breeding -Transgenic crops - Varietal protection and geographical indications – DUS.

33. Breeding for pest resistance - mechanisms of resistance; Breeding for disease resistance - mechanisms of resistance; Breeding for Abiotic stress – drought and cold. – mechanisms of resistance; Breeding for Abiotic stress – salinity and alkalinity

34. Breeding for quality produce; Ideotype breeding, PPV &FR act, 2001- Plant breeders' right, Farmers right, Biodiversity act, 2002; Germplasm registration.

### PRACTICAL SCHEDULE

1. Emasculation and pollination techniques in rice, maize, pulses, castor and cotton.

2. Pollination and reproduction in plants - Alternation of generation and life cycle.

3. Description and drawing different pollination systems - Mechanisms enforcing self and cross pollination in crops; Pollen morphology - Exine structure of different crops. Fertility and sterility in A, B, R and TGMS lines.

4. Breeder kit and its components – uses; Basic steps of selfing and crossing techniques.

5. Emasculation and pollination techniques in field crops.

6. Emasculation and pollination techniques in horticultural crops.

7. Studies on segregating generations and maintenance of records.

8. Maintenance of A, B and R line and TGMS lines - Hybrid seed production techniques

9. Estimation of heterosis.

10. Induction of polyploidy using colchicine.

11. Studies on different wild species in crop plants and wide hybridization.

12. Irradiation - dosimetry - half life period - procedure for irradiation of seeds and planting materials. Chemical mutagenesis - molar solution preparation - procedure for chemical mutagenesis of seeds and planting materials.

13. Calculation of PCV, GCV, heritability, genetic advance, genetic divergence

14. Layout of different yield trials - Observing the experimental plots; Visit to nucleus and breeder seed production plots.
15. Screening methods – laboratory and field – for biotic and abiotic stresses.
16. Procedure for marker assisted selection.
- 17. Final Practical Examination.**

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3. Daniel Sundararaj, G. Thulasidas and M. Stephen Dorairaj. 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot. Chennai – 15.
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5. Allard, R. 1989. Principles of plant breeding. John Wiley and Sons, New Delhi.
6. Russell, G. E. 1985. Progress in Plant Breeding. Butter Worths, England.

## AEG 228: SOIL AND WATER CONSERVATION ENGINEERING (1+1)

### OBJECTIVES

To expose the students in the area of surveying, principles and practices of Chaining compass surveying, plain table and levelling, concept of dynamic process of a watershed resulting in soil erosion, understand the appropriate conservation measures to be adopted for remediation of watershed, various hydraulic Engineering problems like open channel flow, closed conduit, turbines and pumps, principles of ground water, characteristics of aquifers, construction of wells.

### THEORY

#### Unit I: Surveying

Surveying and Levelling – Chain, Compass and Plane Table survey – levelling – Land measurement and computation of area – Simpson’s rule and Trapezoidal rule.

#### Unit II: Soil erosion

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

#### Unit III: Soil conservation

Erosion control measures for Agricultural lands – biological measures – contour cultivation – strip cropping – cropping systems – vegetative barriers - windbreaks and shelterbelts - Shifting cultivation - mechanical measures – contour bund – graded bund – broad beds and furrows – basin listing – random tie ridging – Mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall – gully control structures – permanent and temporary structures. Farm ponds – percolation ponds- Watershed Management.

#### Unit IV: Irrigation and drainage

Irrigation - Measurement of flow in open channels - velocity area method - Rectangular weir - Cippoletti weir - V notch - Orifices - Parshall flume - Duty of water - Irrigation efficiencies - Conveyance of irrigation water - canal lining - Underground pipe line system - Surface irrigation methods - Borders, furrows and check basins - Drip and sprinkler irrigation– Agricultural drainage - Surface drainage systems – Sub-Surface drainage systems - Drainage coefficient-design of open ditches.

#### Unit V: Wells and Pumps

Groundwater occurrence – aquifers – types of wells – pump types – reciprocating pumps – centrifugal pumps – turbine pumps – submersible pumps – jet pumps – airlift pumps – selection of pumps – operation and their maintenance.

### PRACTICAL

Study of survey instruments - Chains and cross staff surveying - linear measurement - plotting and finding areas. Compass survey - observation of bearings - computation of angles- Radiation, intersection. Leveling – fly levels – determination of difference in elevation. Contouring – area and volume computation. Design of contour bund and graded bund. Visit to erosion affected areas. Problems on water measurement. Problems on duty of water, irrigation efficiencies. Problems on water

requirement - Layout of Sprinkler and Drip systems. Agricultural drainage. Study of different types of wells and its selection. Study of reciprocating pump, centrifugal pump, submersible pumps & jet pumps- Selection of pumps.

### **THEORY SCHEDULE**

1. Introduction - Land surveying - Uses in agriculture.
2. Chain cross staff and compass surveying - Computation of angles.
3. Radiation, intersection and traversing.
4. Dumpy level - setting, observation and tabulation of readings - computation of land slope - difference in elevation.
5. Computation of area and volume – Simpson’s rule and Trapezoidal rule.
6. Soil Erosion – causes and evil effects of soil erosion – geologic and accelerated erosion
7. Water erosion - causes - erosivity and erodibility - mechanics of water erosion
8. Splash, sheet, rill and gully erosion - Ravines - Land slides
9. Wind erosion - factors influencing wind erosion - mechanics of wind erosion – suspension, saltation, surface creep
10. Effects of water and wind erosion
11. Erosion control measures for Agricultural lands – biological measures – contour cultivation – strip cropping
12. Cropping systems – vegetative barriers - windbreaks and shelterbelts - Shifting cultivation
13. Mechanical measures – contour bund – graded bund
14. Broad beds and furrows – basin listing – random tie ridging
15. Mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall
16. Gully control structures – permanent and temporary structures.
17. Farm ponds – percolation ponds.
18. Irrigation - Measurement of flow in open channels - velocity area method
19. Rectangular weir - Cippoletti weir - V notch
20. Orifices - Parshall flume
21. Duty of water - Irrigation efficiencies
22. Conveyance of irrigation water - canal lining
23. Underground pipe line system
24. Surface irrigation methods - Borders, furrows and check basins
25. Components of Drip and sprinkler irrigation system
26. Agricultural drainage – need - Surface drainage systems
27. Surface drainage systems - Drainage coefficient
28. Groundwater occurrence – aquifers types
29. Types of wells
30. Pump types – Reciprocating pumps – Centrifugal pumps
31. Turbine pumps – Submersible pumps
32. Jet pumps – Airlift pumps
33. Selection of pumps – operation and their maintenance.

### **PRACTICAL SCHEDULE**

1. Study of survey instruments - chains - compass - plane table (only demo) - dumpy level.
2. Chains and cross staff surveying - linear measurement - plotting and finding areas.
3. Compass survey - observation of bearings - computation of angles.
4. Compass - Radiation, intersection.
5. Levelling – fly levels – determination of difference in elevation.
6. Contouring – area and volume computation.
7. Design of contour bund and graded bund.
8. Visit to erosion affected areas.
9. Problems on water measurement.
10. Problems on duty of water, irrigation efficiencies.
11. Problems on water requirement - agricultural drainage.
12. Layout of Sprinkler and Drip systems.
13. Study of different types of wells and its selection.
14. Study of reciprocating pump & centrifugal pump
15. Study of submersible pumps & jet pumps
16. Selection of pumps.

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- Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.
- Gunshyam Das 2005, Hydrology and soil conservation engineering, Prentice-Hall of India Pvt. Ltd., New Delhi
- Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.
- Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi.
- Michael, A.M. Irrigations, Theory and Practice, Vikas Publication House Pvt. Ltd., New Delhi.

## STA 229: STATISTICS (1+1)

### OBJECTIVES

- Statistics plays a major role in all fields of science. When elementary topics like primary data collection, presentation of data, diagrams and graphs etc are taught to the student of agriculture, first they learn the basic concepts of Statistics.
- By learning sampling methods, test of significance, correlation and regression they come to know practically how to select samples using various methods of sampling and how to test certain hypothesis based on student's 't' Statistic and, Chi-square Statistic. Using Regression analysis, they may be able to predict the future using the past data.
- By learning basic principles of design of experiments and basic designs they can conduct practically certain Agricultural experiments with their knowledge of Statistics.

### THEORY

#### Unit I: Data collection diagrams and graphs

Different kinds of data, Primary, Secondary, Quantitative and Qualitative data- Presentation of Data - Purpose and Uses – Bar diagrams, Comparative bar diagram, percentage bar diagram, Pie-diagram and Uses, Histogram frequency curve, frequency polygon  $O_{give}$  curves.

#### Unit II: Measures of Central Tendency and Measures of Dispersion

Mean, Geometric Mean, Median, Mode. Range, Standard deviation, Co-efficient of variation.

#### Unit III: Sampling methods and Tests of Significance

Kinds of Sampling: SRS (WR) and (WOR), Stratified Random Sampling, Systematic Sampling. Meaning and various steps involved in Tests of Significance. Tests based on 't' and  $\chi^2$ -Statistics: 't' test for mean, difference of means-Chi-square test for association of attributes – 2x2 contingency only limitations of Chi-square test.

#### Unit IV: Correlation and Regression

Direct and indirect correlation – scatter diagram -Karl Pearson's Correlation Co-efficient Meaning and uses of simple linear regression equation – prediction using the equations.

#### Unit V: Design of experiments and Basic Designs

Basic Principles – randomization replication and local control. Completely Randomized Design (CRD). Randomized complete Block Design (RBD) and Latin Square Design (LSD) and their analyses.

### PRACTICALS

Bar diagram – Frequency curve-frequency polygon – Mean, Geometric mean, Median, Mode, Standard deviation and Co-efficient of variation – t test for Mean, difference of means – Chi-square test for independence of attributes in 2x2 table- correlation co-efficient – Regression equation – Field visit – Completely randomized design – Randomized block design – Latin square design – Split Plot design – Factorial experiment  $2^2$ ,  $2^3$  factorial design conducted in RBD.

### THEORY LECTURE SCHEDULE

- Different kinds of data, primary and secondary data, qualitative and quantitative data, presentation of data.
- Bar diagrams, Component Bar diagram, Percentage Bar diagrams, Pie diagram, Picto grams, Uses.
- Histogram, Frequency curve, Frequency polygon,  $O_{give}$  curves, uses.
- Mean, Median, Mode.
- Range, Standard deviation, (raw data), Co-efficient of variation.
- Standard deviation (grouped data).
- Types of sampling, SRS (WR) and (WOR), stratified random sampling, Systematic sampling.
- Test of significance, test based on t, mean and difference of means.
- Mid semester examination.
- $\chi^2$  – test, test for association of attributes 2x2 contingents only, limitations of chi-square test. Correlation, scatter diagram and karl person's Co-efficient of correlation.

11. Regression, Simple linear regression, Prediction using the equation.
12. Design of experiments, Basic principles, randomization, replication and local control.
13. Basic designs.
14. Completely randomized design (CRD).
15. Randomized complete block design (RBD).
16. Latin square design (LSD).
17. Analysis of the above design.

### **PRACTICAL SCHEDULE**

1. Bar diagram, frequencies curve, frequencies polygon.
2. Mean, Geometric mean, median and mode.
3. Standard deviation and co-efficient of variation.
4. Test based on t-for-mean and difference of mean.
5. Chi-square test for independence of attributes.
6. Correlation Co-efficient.
7. Regression equation.
8. Completely randomized design.
9. Randomized complete block design.
10. Latin square design.
11. Split plot design.
12.  $2^2$  Factorial experiments conducted in RBD.
13.  $2^3$  Factorial experiments conducted in RBD.

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## **SEMESTER- V**

### **HOR 311: BREEDING OF HORTICULTURAL CROPS (2+1)**

#### **OBJECTIVES**

- To import knowledge on the basic concepts of breeding, different methods of breeding of horticultural crops.
- To import knowledge on breeding strategies and achievements made in improvement of horticultural crops through breeding.

#### **THEORY:**

##### **Unit I : Principles of plant breeding**

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

##### **Unit II : Advanced plant breeding**

Components of variation – estimation of single gene and polygene – segregation – breeding values – Application of biotechnology to plant breeding – embryo rescue – somoclonal variation – doubled haploid – protoplast fusion – transgenic molecular plant breeding.

### **Unit III : Crop improvement in fruit crops**

Objectives, breeding strategies and achievements in crop improvement of mango, banana, acid lime, mandarin orange, sweet orange, grapes, sapota, papaya, guave, pomegranate, jack and aonla.

### **Unit IV: Crop improvement in vegetable crops**

Objectives, breeding strategies and achievements in crop improvement of tomato, brinjal, chillies, bhendi, cucumber, snake guard, ridge guard, bitter guard, pumpkin, watermelon, peas, beans, onion, garlic, potato, tapioca, moringa, cabbage, cauliflower, carrot and amaranthus.

### **Unit V: Crop improvement in spices and plantation crops, flower crops, medicinal and aromatic crops**

Objectives, breeding strategies and achievements in crop improvement of pepper, cardamom, ginger, turmeric, coriander, fennel, vanilla, tea, coffee, cashew, cocoa, coconut, rose, jasmine, tuberose, marigold, chrysanthemum, crossandra, senna, ashwagandha and ocimum.

### **PRACTICAL**

Study of floral biology – anthesis – pollination mechanism and practicing – selfing and crossing in major horticultural crops. Heterosis breeding and techniques of F<sub>1</sub> hybrid production. Mutation and mutagenic treatments – methods of induction of polyploidy. Resistance breeding in horticultural crops. Breeding strategies in fruits, vegetables, flowers, spices and plantation crops.

### **THEORY LECTURE SCHEDULE**

1. History and importance of breeding
2. Sterility – male sterility – introduction – classification.
3. Self incompatibility – classifications – inheritance and application.
4. Methods of breeding and hybridization technique
5. Components of variation
6. Estimation of single and poly gene
7. Application of biotechnology to plant breeding
8. Transgenic molecular plant breeding
9. Centres of origin – germplasm – plant genetic resources, conservation, evaluation and utilization. National and international agencies engaged in conservation, gene sanctuaries, exploration etc.
10. Breeding strategies, merits, demerits and methods of improvement of sexually propagated crops.
11. Breeding strategies, merits, demerits and methods of improvement of self pollinated crops.
12. Breeding strategies, merits, demerits and methods of improvement of cross pollinated crops
13. Breeding strategies, merits, demerits and methods of improvement of mango and banana
14. Breeding strategies, merits, demerits and methods of improvement of citrus, grapes and sapota
15. Breeding strategies, merits, demerits and methods of improvement of papaya, guava and pomegranate
16. Breeding strategies, merits, demerits and methods of improvement of tomato and brinjal
17. Breeding strategies, merits, demerits and methods of improvement of chillies and bhendi
18. Breeding strategies, merits, demerits and methods of improvement of bitter guard, cucumber and watermelon
19. Breeding strategies, merits, demerits and methods of improvement of peas and beans
20. Breeding strategies, merits, demerits and methods of improvement of potato
21. Breeding strategies, merits, demerits and methods of improvement of tapioca and sweet potato
22. Breeding strategies, merits, demerits and methods of improvement of onion and moringa and amaranthus
23. Breeding strategies, merits, demerits and methods of improvement of cabbage, cauliflower and carrot
24. Breeding strategies, merits, demerits and methods of improvement of pepper and cardamom
25. Breeding strategies, merits, demerits and methods of improvement of ginger, turmeric, coriander and vanilla
26. Breeding strategies, merits, demerits and methods of improvement of tea and coffee
27. Breeding strategies, merits, demerits and methods of improvement of cashew, cocoa and coconut
28. Breeding strategies, merits, demerits and methods of improvement of rose, jasmine and chrysanthemum
29. Breeding strategies, merits, demerits and methods of improvement of crossandra, tuberose and marigold
30. Breeding strategies, merits, demerits and methods of improvement of senna, ashwagandha and ocimum.

## **PRACTICAL SCHEDULE**

1. Study of floral biology and pollination mechanism, practices in selfing and crossing in mango and banan
2. Study of floral biology and pollination mechanism, practices in selfing and crossing in citrus and grapes.
3. Study of floral biology and pollination mechanism, practices in selfing and crossing in sapota and papaya.
4. Study of floral biology and pollination mechanism, practices in selfing and crossing in guava and pomegranate
5. Study of floral biology and pollination mechanism, practices in selfing and crossing in tomato and brinjal.
6. Study of floral biology and pollination mechanism, practices in selfing and crossing in chillies and bhendi.
7. Study of floral biology and pollination mechanism, practices in selfing and crossing in bitter guard, and snake guard
8. Study of floral biology and pollination mechanism, practices in selfing and crossing in cucumber and watermelon
9. Study of floral biology and pollination mechanism, practices in selfing and crossing in peas and beans
10. Study of floral biology and pollination mechanism, practices in selfing and crossing in tapioca and sweet potato
11. Study of floral biology and pollination mechanism, practices in selfing and crossing in onion, moringa and amaranthus
12. Study of floral biology and pollination mechanism, practices in selfing and crossing in pepper, cardamom and coriander
13. Study of floral biology and pollination mechanism, practices in selfing and crossing in cashew, cocoa and coconut
14. Study of floral biology and pollination mechanism, practices in selfing and crossing in chrysanthemum and marigold
15. Heterosis breeding and techniques of F<sub>1</sub> hybrid production.
16. Study of mutation and polyploidy breeding
17. Resistance and tolerance breeding in horticultural crops.

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2. Harihar Ram. 1998. Vegetable breeding – principles and practices. Kalyani Publishers, New Delhi.
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## **HOR 312: COMMERCIAL FLORICULTURE (2 + 1)**

### **OBJECTIVES**

On completion of this course the students will have knowledge on cultivation techniques of commercial loose flower in open field and Cut flowers in protected structures with hands on training on important cultural practices and flower forcing techniques and value addition in flower crops.

### **THEORY**

#### **UNIT – I: Principles of growing commercial flowers**

Scope and importance of commercial floriculture in India – distribution of important flower crops – area and production – export potential – international and national floral industry. Institutions and developmental agencies involved in promotion of floriculture- TANFLORA, NHM, NHB, APEDA - Cropping systems in flower crops- Flower forcing.

Soil and climate – Botany – species and varieties - propagation –principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – intercultivation – Harvest and yield of rose, jasmine, chrysanthemum and tuberose.

## **UNIT – II: Loose flowers**

Soil and climate – botany – species and varieties - propagation –principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – inter cultivation – Harvest and yield of crossandra, marigold, nerium, gomphrena, celosia and China aster.

## **UNIT – III: Principles of protected cultivation**

Protected structures - controlled environmental conditions –Soil sterilization - factors influencing protected cultivation – cut flower production- flower forcing.

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

## **UNIT – IV: Cut flowers**

Soil and climate – botany – species and varieties - propagation –principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – inter cultivation – Harvest and yield of orchids, anthurium, china aster, bird of paradise, Asiatic lily, heliconias, alstromeria and flowering fillers viz., limonium, asparagus, ivy, gypsophila and baby eucalyptus.

## **UNIT – V: Post harvest handling of flowers**

Postharvest handling – principles and methods of extension of shelf life – methods of extraction of floral concrete from rose, jasmine and tuberose – natural dye extraction from flowers crops - uses - grading - export standards – packaging - marketing –Dry flower production- constraints in flower production - future thrust.

## **PRACTICAL**

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

## **LECTURE SCHEDULE**

1. Scope and importance of commercial floriculture in India –area and production–export statistics - Cropping systems in flower crops
2. industrial importance–floriculture industry in India and Tamil Nadu -Institutions and developmental agencies involved in promotion of floriculture- TANFLORA, NHM, NHB, APEDA -
3. Rose - importance and uses–origin and history- area and production – botany – species and varieties– classification -propagation – soil climate season and planting-nutrition and irrigation – management practices - role of growth regulators-pruning – plant protection -harvest and yield
4. Jasmine- importance and uses–origin and history- area and production – botany – species and varieties
5. Jasmine - soil climate propagation- - season and planting-nutrition and irrigation –management practices - role of growth regulators-pruning methods- plant protection - harvest and yield.
6. 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 - role of growth regulators- pinching and disbudding – plant protection - harvest and yield.
7. Tuberose - importance and uses-origin and history-distribution-area and production-botany - species and varieties - propagation- season and planting-nutrition and irrigation soil climate – management practices – nematode management - role of growth regulators- plant protection - harvest and yield.
8. 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 - plant protection -harvest and yield.
9. 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- plant protection -harvest and yield.



10. Nerium and Gomphrena 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- plant protection - harvest and yield.
11. Celosia and China aster 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- plant protection -harvest and yield.
12. Field visit – Loose flower growing areas and exporters
13. Economics - loose flower production
14. Material requirement and Designing and of protected structures for cut flower production and erection procedures.
15. Flower forcing and factors affecting flower production under controlled atmospheric conditions.
16. Cut rose - importance and uses-origin and distribution-area and production- botany and varieties -propagation and planting—environmental factors- pruning – pinching - production constraints-inter culture- nutrient requirement in fertigation systems- plant protection - harvesting and yield.
- 17. Mid semester examination**
18. Carnation-importance and uses-origin and distribution-area and production- botany, species and varieties –propagation-media and planting-environmental factors- netting – inter culture - nutrient requirement in fertigation systems- pinching-production constraints-plant protection-harvesting and yield.
19. Gerbera -importance and uses-origin and distribution-area and production- botany and varieties - propagation and planting-media – inter culture - nutrient requirement in fertigation systems - production constraints-harvesting and yield.
20. Chrysanthemum-importance and uses-origin and distribution-area and production- botany and varieties -propagation and planting media - environmental factors– inter culture - pinching-production constraints-plant protection-harvesting and yield.
21. Gladiolus-importance and uses-origin and distribution-area and production- botany and varieties -propagation and planting-media – environmental factors-inter culture - production constraints-plant protection-harvesting and yield.
22. Orchids - importance and uses-origin and history-distribution-area and production- botany and varieties –environmental factors- methods of propagation media and methods of nutrient management - irrigation – plant protection-harvesting and yield.
23. Anthurium - importance and uses-origin and history-distribution-area and production- botany and varieties – environmental factors - methods of propagation – media and methods of nutrient management - irrigation – plant protection-harvesting and yield.
24. Bird of paradise and heliconia - importance and uses-origin and history-distribution-area and production- botany and varieties – media and climate - methods of propagation – nutrient management - irrigation – plant protection-harvesting and yield.
25. Guest lecture – Automation in cut flower production.
26. Asiatic lily, alstromeria, Foliage and flowering fillers limonium, asparagus ivy, gypsopals, baby eucalyptus - importance and uses – origin and distribution– botany and varieties – propagation – planting – inter culture – plant protection-harvesting and yield.
27. Post harvest - principles and methods of extension of shelf life
28. Dry flower production.
29. Methods of floral concrete extraction from rose, jasmine and tuberose and other value addition processes in loose flowers.
30. Natural dye extraction of flower crops.
31. Packaging, grading and export standards for important commercial flowers.
32. Industry visit – Dye extraction / Concrete extraction
33. Working out economics cut flower production under protected structures.
34. Constraints in flower production and future thrust.

## **PRACTICAL SCHEDULE**

1. Rose—identification and description of species/varieties – propagation and planting –pruning management.
2. Jasmine sp.-identification and description of species/varieties – propagation and planting – pruning management.
3. Tuberose and crossandra – identification, description of species/varieties, propagation and planting
4. Chrysanthemum and marigold- identification and description of species/varieties - propagation and planting
5. Nerium and gomphrena - identification, description of species/varieties, nursery raising and planting

6. Celosia and china aster - identification, description of species/varieties, nursery raising and planting
7. Visit – Flower market and flower growing areas to get expertise in loose flowers.
8. Preparation of project – loose flower production – open condition
9. Cut rose - identification and description of species/varieties – media – planting – netting-pruning and other important inter cultural practices.
10. Carnation and gerbera - identification and description of species/varieties – media – planting-harvesting .
11. Cut chrysanthemum and gladiolus - identification and description of species/varieties – media – planting- plant propagation- pinching and dis-budding
12. Anthurium and orchids – identification and description of species/varieties – media preparation - planting
13. Bird of paradise and heliconia - identification and description of species/varieties – propagation - media preparation – planting- planting material - shade requirement-
14. Asiatic lily, alstromeria, flowering and foliage fillers - identification and description of species/varieties – propagation - media preparation – planting
15. Visit to cut flower growing areas, industries and Institutions– TANFLORA, Auction centre, APEDA.
16. Rose, jasmine and tuberose-extraction of floral concrete – Dry flower making-lecture / Field visit
17. Preparation of project – Cut flower production – controlled condition
18. Practical examination

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3. Bhattacharjee, S.K., 2004 – Landscape gardening and design with plants.
4. Bhattacharjee, S.K., 2004 – Post harvest technology of flowers and ornamental plants.
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## HOR 313 ORGANIC HORTICULTURE (1+1)

### OBJECTIVE

To impart knowledge about specific techniques followed in organic horticulture so as to enable the students to produce horticultural crops organically.

### THEORY

#### Unit-I : Importance of organic horticulture

Organic horticulture – definition – scope and importance – merits and demerits – present status – Global and Indian Scenario – History and genesis of organic farming in India and around the world.

#### Unit-II: Soil health in organic horticulture

Soil health – concepts – problem diagnosis – conservation of soil – problem soil reclamation under organic horticulture – soil physical, chemical and biological improvement – organic carbon status and improvement strategies – C:N ratio and its significance.

#### Unit-III: Bio inputs in organic horticulture

Organic manures – FYM, Coirpith, compost, vermicompost, pressmud compost, oil cakes, green manures – bio fertilizers – Biodynamic farming – Foliar supplements – Panchakavya, EM technology, Humic acid, sea weed extract, mushroom manchuiran tea, vermiwash.

#### Unit-IV: Bio control in organic horticulture

Weeds pests and disease management under organic horticulture – Non chemical weed management – Non chemical pest management and non chemical disease management.

#### Unit-V: Certification and Economics in organic horticulture

Certification process – agencies involved – export potential and marketing of organic produce – sustainability indices for evaluating long term and indirect benefits – economic evaluation of organic horticultural technologies

### LECTURE SCHEDULE

- 1) Scope and importance of organic horticulture and its merits and demerits
- 2) Global and Indian scenario of organic horticulture

- 3) History and development of organic farming in India and World.
- 4) Soil problems and its reclamation through organic horticulture
- 5) Soil physical, chemical and biological properties and conservation of soil resource under organic horticulture.
- 6) Importance of C:N ratio, its influence on nutrient availability and methodology to improve organic carbon status
- 7) Bulky and concentrated organic manures
- 8) Green manures, biofertilizers and bio dynamic farming
- 9) Mid Semester Examination.
- 10) Panchakavya and EM technology.
- 11) Humic acid, Sea weed extract, Mushroom, manchurian tea and vermiwash.
- 12) Non chemical weed control
- 13) Non chemical pest control
- 14) Non chemical disease control
- 15) Organic certification – standards and agencies – marketing and export avenues for organic produce.
- 16) Sustainability indices for evaluating indirect benefits of organic farming.
- 17) Economics Evaluation of organic horticultural technologies – net return and B:C ratio.

### **PRACTICAL SCHEDULE**

- 1) Soil physical parameters with relevance to organic horticulture
- 2) Estimate of soil chemical parameters (pH, EC and ESP)
- 3) Estimation of soil biological parameters
- 4) Estimation of farm wastes / agro industrial waste
- 5) Agrotechniques for composting farm wastes and agro industrial wastes.
- 6) Recycling of crop wastes through vermiculture
- 7) Preparation of Panchakavya
- 8) Preparation of activated EM solution.
- 9) Nutritive analysis for estimating the potential of organics.
- 10) Application of various mulch materials to horticultural crops.
- 11) Nursery bed soil solarization.
- 12) Study of bio agents for crop protection
- 13) Preparation of organic formulations for pest control
- 14) Preparation of organic formulations for disease control
- 15) Working out indices for organic horticulture
- 16) Economic evaluation of organic horticulture system
- 17) Visit to farmers field under organic cultivation.

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- 3) Palaniappan. SP. And K. Annadurai. 1999. Organic farming Theory and practice. Scientific Publishers Jodhpur.
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- 6) Thampan, P.K. 1995. Organic agriculture peekay tree crops development foundation Cochin.
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## **HOR 314 URBAN AND ENVIRONMENTAL HORTICULTURE (1+1)**

### **OBJECTIVE**

To update the knowledge on the recent advances in the field of environmental issues and Urban Horticulture with a spectrum of interests, from a traditional core of activities associated with ecosystem, environmental benefits from horticultural plants, pollution and environmental protection- recreation and leisure; economic vitality and business entrepreneurship, individual health and well-being; community health and well-being; landscape beautification; and environmental restoration and remediation.

### **THEORY**

#### **Unit-I : Ecology of Gardens in an Urban Environment**

Concept of ecosystem, Structure and function of an ecosystem, Producers consumers and decomposers, Energy flow in the ecosystem, types, characteristics features, structure and function of the

following ecosystem- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Invasive ornamental species - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust,

### **Unit-II : Environmental Pollution**

Causes, effects and control measures of Air, Water, Soil, Marine, Noise, Thermal and Nuclear pollutions through horticultural practices. Carbon sequestration – pollution controlling trees - Solid waste Management- Causes, effects and control measures of urban and industrial wastes through utilization in gardens and green cover development. Strategies and techniques to restore and rehabilitate urban landscapes. Environment Protection Acts - Bio-diversity Conservation Act. Waste management - Composting, Sewage treatments, effluent treatments, microbial examination.

### **Unit-III: Social and Therapeutic Horticulture**

Definitions and terms used in social and therapeutic horticulture practice, community gardening, methods and approaches used in therapeutic horticulture, planning, design and construction issues in the design of therapeutic landscapes, tools, equipment and materials – Aroma therapy- definition and applications- aroma garden- social involvements - flower arrangement- different types- vegetable carving-tools and basics.

### **Unit-IV : Sustainable Landscapes**

The role of Urban Agriculture in poverty alleviation, Principles and practices in managing environmental factors - temperature, water, light, atmospheric gases and pollutants, and soil and minerals - that influence growth and production of horticultural plants. Xeriscaping - urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.

### **Unit-V: Urban Horticulture**

Global trends in Urban Horticulture, Container gardening - vertical gardens - herbal garden, roof gardening- basics, techniques and layout- Hydroponics- introduction- different types – advantages and disadvantages. Social horticulture-Horticultural crafts-Bonsai culture-flower arrangements- Urban Parks and public gardens for townships.

## **PRACTICAL**

Eco-system - Carbon use efficiency – Noise pollution determination ; Estimation of respirable and non respirable dust in the air by using portable dust sampler; Total dissolved solids (TDS)- Estimation of species abundance of plants; - effects of nitrate contamination in ground water - Social Service Organization involved in creating environment awareness- Environmental Education Centre; Crop adaptation to environmental variables, soils conditions; Study of transpiration and water balance in plants; Visit to a local polluted site. Observations and remedial measures; Industrial sewage disposal unit. Mine spoil and pond ash reclamation through Horticultural crops - Urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds. Description and design of terrace garden, container gardening. Horticultural crafts for social welfare - bonsai culture-Flower arrangements.

## **LECTURE SCHEDULE**

1. Eco-system-structure and functions
2. Various Types of eco-system and their impact on atmosphere
3. Climate change and Global warming-its impact on environment
4. Environmental pollution-causes and impact
5. Modes of pollution-air, water, soil, marine, noise and thermal pollution
6. Carbon sequestration - Pollution control measures through Horticulture-trees for pollution control
7. Solid waste management-urban and Industrial waste management
8. Composting, sewage treatment, effluent treatment and microbial examination
9. Environment protection act- air, water, wild life, forest conservation act.
10. Social and therapeutic horticulture-Practices
11. Community gardening-methods and approaches in therapeutic horticulture
12. Planning, designing and construction of therapeutic landscapes
13. Aroma therapy-definitions and applications-aroma gardens
14. Horticultural crafts-social involvements

15. Urban Horticulture-principles and practices in managing environment
16. Urban area beautifications with plants – terrace gardens, container gardens, Vertical gardens
17. Global trends in urban horticulture-roof gardens, hydroponics and bonsai culture.

### **PRACTICAL SCHEDULE**

1. Assessment of various eco-system
2. Determination of Carbon use efficiency
3. Determination of sound level by using sound level meter;
4. Estimation of respirable and non respirable dust in the air by using portable dust sampler;
5. Determination of total dissolved solids (TDS) in effluent samples;
6. Estimation of species abundance of plants;
7. Estimation of nitrate contamination in ground water;
8. Visit to Social Service Organization
9. Visit to Environmental Education Centre;
10. Crop adaptation to environmental variables, soils conditions;
11. Study of transpiration and water balance in plants;
12. Visit to a local polluted site. Observations and remedial measures; Assessment of chlorophyll content of fresh water / sea water ecosystem.
13. Visit to industrial sewage disposal unit.
14. Mine spoil and pond ash reclamation through Horticultural crops
15. Urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.
16. Description and design of terrace garden, container gardening.
17. Horticultural crafts for social welfare - bonsai culture-Flower arrangements.

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1. Janeen R. Adil, 1994 .Accessible Gardening for People with Disabilities: A Guide to Methods, Tools and Plants Woodbine House.
2. Hank Bruce & Tomi Jill Folk, 2003. Garden Projects for the Classroom & Special Learning Programs . Petals and Pages.
3. Hank Bruce, 2000.Gardening Projects for Horticultural Therapy Programs. Petals and Pages
4. Sharon P. Simson, PhD and Martha C. Straus, 1998. Horticulture as Therapy: Principles and Practices , HTM , Haworth Press.
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6. Smit, J., A. Ratta, and J. Nasr. 1996. Urban agriculture. Food, jobs and sustainable USDA. 2000. A millennium free from hunger. U.S. National Progress Report on Implementation of the US Action Plan on Food Security and World Food Summit Commitments.

## **PAT315 DISEASES OF FRUIT, PLANTATION, MEDICINAL & AROMATIC CROPS (2+1)**

### **OBJECTIVES**

The subject covers the classification of plant diseases, various principles of plant diseases management, etiology, symptoms, mode of spread, survival and integrated management of important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non-parasitic causes of the fruit, medicinal and aromatic crops.

### **THEORY**

#### **Unit I: Principles of plant disease management**

History of Disease management – Definition for plant diseases – Causes of plant diseases – Classification of plant diseases-Principles of Plant Diseases Management – Prophylaxis & Immunization – Prophylaxis: Avoidance, exclusion, eradication and direct protection - Epidemiology of plant diseases – survival and dispersal of plant pathogens - Types of resistance.

## **Unit II: Biological and chemical control**

Biological Control - Biotechnological approach for crop disease management - Fungicides – characteristics of an ideal fungicide – classification – group of fungicides – antibiotics – Formulations – methods of application of fungicides and compatibility with other agrochemicals – Phytotoxicity of fungicides – precautions and safety measures in handling of fungicides.

## **Unit III: Fruit crops**

Mango, banana, citrus, grapes, guava, sapota, pomegranate, annona, papaya, jack, pineapple, ber, aonla, apple, pear, peach and plum.

## **Unit IV: Plantation crops**

Tea, coffee, cocoa, rubber, coconut, arecanut and vanilla.

## **Unit V: Medicinal plants, aromatic plants and post harvest diseases**

Aloevera, Ashwagandha, Medicinal coleus, Gymnema, medicinal solanum, dioscorea. gloriosa, stevia, coleus, aloe, lemon grass, citronella, palmarosa, vetiver, geranium, patchouli, organum, artimesia, mint, ocimum, lavender and sandal wood; Post-harvest diseases of fruit crops.

## **PRACTICAL**

Mass multiplication of biocontrol agents -method of application. Preparation of leaf extracts, Survey and Assessment of important plant diseases. Classification and grouping of fungicides. Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), and delivery system. Study of symptoms and host parasite relationship of the following crops : *Fruits* - mango banana, Citrus, Grapes Guava, sapota, pomegranate, annona, jack, papaya, pineapple, ber aonla, apple, pear, plum, peach, *Plantation crops* - Tea, coffee, cocoa, rubber, coconut, arecanut and vanilla. Medicinal plants - Aloevera, Ashwagandha, Medicinal coleus, Gymnema, Medicinal solanum, Dioscorea. Gloriosa, Stevia, Coleus and Aloe. *Aromatic plants* - Lemon grass, Citronella, Palmarosa, Vetiver, Geranium, Patchouli, Origanum, Artimesia, Mint, Ocimum, Lavender, Sandal wood. Post harvest diseases- Post harvest diseases of fruits and plantation crops

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

## **THEORY SCHEDULE**

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

1. History of Disease management
2. Classification of plant diseases
3. Principles of Plant Diseases Management
4. Prophylaxis & Immunization
5. Epidemiology of plant diseases
6. Survival and dispersal of plant pathogens
7. Types of resistance.
8. Biological control
9. Biotechnological approach for crop disease management
10. Fungicides – characteristics of an ideal fungicide
11. Classification – group of fungicides
12. Antibiotics – Formulations
13. Methods of application of fungicides and compatibility with other agrochemicals – Phytotoxicity of fungicides – precautions and safety measures in handling of fungicides.
14. Mango and banana
15. Citrus and grapes
16. Guava, pomegranate, annona, jack & sapota
17. Mid Semester Examinations
18. Papaya, pineapple, ber and aonla.
19. Apple, pear, plum and peach.
20. Tea
21. Coffee and cocoa
22. Rubber, coconut, Arecanut, Aloevera, Ashwagandha and vanilla.
23. Medicinal coleus, Gymnema, Medicinal solanum and Dioscorea
24. Gloriosa, stevia, coleus and aloe.
25. Lemon grass, palmarosa, vetiver and citronella,
26. Geranium, patchouli, organum, artimesia and mint,
27. Ocimum, lavender and sandal wood
28. Post harvest diseases – Fruits

29. Post harvest diseases – Plantation crops
30. Post harvest diseases – Medicinal plants
31. Post harvest diseases – Aromatic plants
32. Physiological disorders of fruits
33. Phanerogamic parasites
34. Post harvest technology

### **PRACTICAL SCHEDULE**

1. Mass multiplication of biocontrol agents -method of application.
2. Preparation of leaf extracts, oil emulsion of neem and antiviral principles.
3. Survey and assessment of important plant diseases.
4. Classification and grouping of fungicides.
5. Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), and delivery system.
6. Mango & banana.
7. Citrus & grapes.
8. Guava & sapota
9. Pomegranate, annona, jack, papaya, pineapple, ber and aonla.
10. Apple, pear, plum and peach.
11. Tea, coffee and cocoa
12. Field visit
13. Rubber, coconut, arecanut and vanilla
14. Diseases of medicinal plants
15. Gloriosa, stevia, coleus and aloe.
16. Diseases of aromatic plants
17. Final Practical Examinations

Assignment: Students should submit 50 well preserved diseased specimens.

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1. Arjunan.G. Karthikeyan, G, Dinakaran, D. Raguchander,T. 1999 Diseases of Horticultural Crops, AE Publications, Coimbatore.
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5. Nene,Y.L. and Thapliyal, P.N. 1998. Fungicides in Plant Disease Control. Oxford and IBH publishing Co. Ltd., New Delhi.

## **AGM 316: ENVIRONMENTAL SCIENCE (1+1)**

### **OBJECTIVES**

The emphasis of the course will be on the biosphere resource, Sustainable agro ecosystem, pollution and environmental protection.

### **THEORY**

#### **Unit - I: Introduction to Ecology and Environment**

Introduction – Ecology – Environment : components, segments (hydrosphere, atmosphere, lithosphere and biosphere) – Ecosystem concepts – Species, Population, Community and Succession, Species interaction – Energy efficiencies and Energy flow – Food chain, Food web and Ecological pyramids, cropping pattern.

#### **Unit – II: Natural resources and Biodiversity**

Natural resources – Soil, Water, Air, Mineral, Energy, Forest resource; Biodiversity – importance, hot spots and conservation.

#### **Unit – III: Environmental Pollution**

Pollution: problems, types and sources – Soil, Water and Air pollution: Sources, effects and control measures – Noise pollution: Sources, effects and control measures – Radioactive, Heavy metal, thermal and nuclear pollution – Global warming and climate change: Green House Gas (GHG) emission, Green House effect, impact on environment and horticulture – mitigation strategies.

#### **Unit – IV: Solid and Liquid waste management**

Types of wastes – Industrial wastes, Horticultural wastes, and Domestic wastes : Characteristics and Environmental impact – Solid waste management Techniques – Physical, Chemical and Biological methods. Standards for waste water disposal.

#### **Unit –V: Environmental protection**

Global treaties, conventions – National and State level organizations: Tamil Nadu Pollution Control Board (TNPCB), Central Pollution Control Board (CPCB) – Environmental Laws and Acts – Environmental Education – Clinic Development Mechanism (CDM) – Prevention of land degradation – Afforestation. Role of Information Technology on Environment.

#### **PRACTICAL**

Estimation of pollution indices of an agro-ecosystem – Diversity of flora and fauna in agricultural ecosystem – Laboratory safety and handling of chemicals and glass wares – Characterization of waste water and collection & sampling methods – Estimation of pH, EC and Total solids – Dissolved oxygen, Biochemical oxygen demand and Chemical oxygen demand – Acidity, Alkalinity, Hardness, Chlorides and Sulfates – Visit to common effluent treatment plant and degraded ecosystem – Assessment of water quality indicators (bio-indicators – coliforms) – Treatment of waste water: physical, chemical and biological methods – Monitoring Air pollution – Solid waste management – Composting of various solid wastes using microorganisms and vermicomposting – Heavy metals in contaminated soil and ecosystem.

#### **THEORY SCHEDULE**

1. Introduction to Ecology and Environment, Ecosystem concepts.
2. Species, population, community and succession, Species interactions.
3. Energy efficiencies and Energy flow – Food chain, food web and ecological pyramids.
4. Soil, water and mineral resources.
5. Forest and energy resources.
6. Biodiversity – importance, hot spots and conservation.
7. Pollution: Problems, types and sources – Soil pollution: Sources, effects and control measures.
8. Water pollution: Sources, effects and control measures.
9. Mid semester Examination.
10. Air pollution: Sources, effects and control measures.
11. Noise pollution: Sources, effects and control measures.
12. Global warming and climate changes: GHG emission, GH effect, impact on environment and horticulture – mitigation strategies.
13. Types of wastes – Industrial wastes, Horticultural wastes and Domestic wastes: Characteristics and Environmental impact.
14. Solid waste management techniques: Principles and practices.
15. Waste water treatment techniques – Physical, chemical and biological methods. Standards for waste water disposal.
16. Global treaties, conventions – National and State level organizations.
17. Environmental Laws and Acts – Environmental Education. Role of Information Technology on Environment.

#### **PRACTICAL SCHEDULE**

1. Laboratory safety and handling of chemicals and glass wares.
2. Estimation of population and its indices of species in an agro – ecosystem.
3. Diversity of flora and fauna in agricultural ecosystem.
4. Characterization of waste water: Collection and sampling methods.
5. Estimation of pH, EC and Total solids in waste water samples.
6. Estimation of Dissolved oxygen and Biochemical oxygen demand in waste water samples.
7. Estimation of Chemical oxygen demand in waste water samples.
8. Estimation of acidity, alkalinity and hardness in waste water samples.
9. Estimation of chlorides and sulfates in waste water samples.
10. Visit to common effluent treatment plant.
11. Visit to degraded ecosystem and Environmental impact assessment.



12. Assessment of water quality indicators (bio-indicators – coliforms).
13. Treatment of waste waters: Physical, chemical and biological methods.
14. Monitoring Air pollution and methods.
15. Solid waste management – Composting of various solid wastes using microorganisms and vermicomposting.
16. Estimation of Heavy metals in contaminated soil and water ecosystem.
17. Final practical Examination.

## REFERENCES

- 1) Balakrishnamoorthy. 2005. Environmental Management. Prentice – Hall of India Private Ltd. New Delhi.
- 2) Ramanathan N and Muthukkarupan SM. 2009. A Text book of Environmental Microbiology. Omsakthi Pathipagam, Annamalai Nagar.
- 3) Sharma P.D. 2006. Environmental Microbiology. Narosa Publishers, New Delhi.
- 4) Sharma, P.D. 2009. Ecology and Environment, Rastogi Publication, Meerat, India.
- 5) Stanley E. Manahan. 1997. Environmental sciences and Technology, Lewis publishers, New Delhi.
- 6) William P. Cunningham and Mary Ann Cunningham, 2007. Principles of Environmental sciences, Tata McGraw Hill Publishing Company, New Delhi.

## AEC 317 FUNDAMENTALS HORTI-BUSINESS MANAGEMENT (1+1)

### OBJECTIVES

The objective of this course is to impart skill, training, proficiency in decision making ability, to give direction, to coordinate and control the work at all levels of management for the farm graduates.

### THEORY

#### Unit I: Horti-business

Horti-business – definition – structure of horti-business (input, farm/orchard and product sectors). Horti-business management – special features of Horti-business – importance of Horti-business in Indian economy.

#### Unit II Planning & Organization

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.

#### Unit III Direction and Control of Business

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 for control.

#### Unit IV Operation Management

Functional area of management – operations management – physical facilities, implementing the plan, scheduling the work, controlling production in terms of quantity and quality. Materials management – types of inventories, inventory costs, managing the inventories, economic order quantity (EOQ).

#### Unit V Personnel & Marketing Management

Personnel management – recruitment, selection and training, job specialization. Financial management – financial statements and ratios, capital budgeting. Project management – project preparation evaluation measures.

### PRACTICALS

Exercise on Operations management in agribusiness firms – logistics management – inventory management – inventory types, costs and Economic Order Quantity (EOQ) – ABC analysis – procurement systems and vendor rating methods – exercise on Supply Chain Management. Market Research and segmentation – demand forecasting methods – farmers survey – buying behavior of agricultural inputs – market promotion measures – pricing methods. Exercise on human resource planning and management. Assessing and acquiring finance for agribusiness firms – Visit to agri hi-tech bank branch / commercial banks / RRB / NABARD. Procedure and constraints in establishing agro based industries – New agribusiness venture proposal preparation..

## **THEORY LECTURE SCHEDULE:**

1. Horti-business – definition – structure of Horti-business (input, farm and product sectors)
2. Horti-business management – special features of Horti-business – importance of horti-business in Indian Economy.
3. Planning – meaning, steps and methods of planning, types of plan, characteristics of effective plans
4. Organizations – forms of business organizations, organizational principles, division of labour
5. Unity of command, scalar pattern, job design, span of control responsibility, power authority and accountability.
6. Direction – guiding, leading, motivating, supervising, coordination
7. Meaning, types and methods of controlling – evaluation, control systems and devices.
8. Budgeting as a tool for planning and control. Record keeping as a tool for control.
- 9. Mid-semester examination**
10. Functional area of management – operations management
11. Physical facilities, implementing the plan, scheduling the work, controlling production in terms of quantity and quality. Materials management
12. Types of inventories, inventory costs, managing the inventories, economic order quantity (EOQ).
13. Personnel management
14. Recruitment, selection and training, job specialization. Marketing management
15. Definitions, planning the marketing programmes, marketing mix and four P's. Financial management
16. Financial statements and ratios, capital budgeting
17. Project management – project preparation evaluation measures.

## **PRACTICAL SCHEDULE:**

1. Exercise on Operations management in agribusiness firms
2. Logistics management
3. Inventory management - inventory types, costs and Economic Order Quantity (EOQ)
4. Procurement systems and vendor rating methods
5. ABC analysis
6. Exercise on supply chain management.
7. Market research and segmentation
8. Demand forecasting methods
9. Visit to agri hi-tech bank branch / commercial banks / RRB / NABARD
10. Exercise on human resource planning and management
11. Farmers survey – buying behavior of agricultural inputs
12. Market promotion measures
13. Pricing methods.
14. Assessing and acquiring finance for agribusiness firms
15. Procedure and constraints in establishing agro based industries
16. New agribusiness venture proposal preparation..
17. Final Practical Examination

## **REFERENCES:**

1. Acharya S.S. and N.L.Agarwal, 2002. Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Bhushan .Y.K., Fundamentals of Business Organization and Management. Sultan Chand and Sons, Delhi , 2001.
3. Francis Cherunilam, 2006, International Trade and Export Management, Himalaya Publishing House, Mumbai.
4. Prasad, L.M, 2005, 'Principles and Practices of Management', Sultan Chand and Sons Educational Publishers, New Delhi.
5. Richard, B Chase, Nicholas J., Acquilano and F.Robert Jacobs, 2007, 'Production and Operations Management - Manufacturing and service, Tata Mc Graw Hill Publishing Company Limited, New Delhi.

## **AEX 318. ENTREPRENEURSHIP DEVELOPMENT (1+1)**

### **OBJECTIVES**

- To impart knowledge on entrepreneurship and its importance in socio-economic development of the nation.
- To gain knowledge and skills in project formulation, project report preparation and evaluation of projects.

### **THEORY**

#### **UNIT – I: Concept of Entrepreneurship**

Concept of entrepreneur, entrepreneurship, functions of entrepreneur. Entrepreneurial characteristics - distinction between an entrepreneur and a manager. Agri entrepreneurship - concept, need and scope.

#### **UNIT – II: Entrepreneurship Development Programmes**

Assessing overall business environment in Indian economy – globalization – implications of social, political and economic systems on entrepreneurship. Entrepreneurship Development Programmes (EDPs) - objectives, phases, problems of EDPs, criteria for assessment or evaluation of EDPs. Generation, incubation and commercialization of business ideas.

#### **UNIT – III: Management of Enterprises**

Role of entrepreneurship in economic development. Motivation and entrepreneurship development. Managing an enterprise - Importance of planning, budgeting, monitoring, evaluation and follow up in running an enterprise. Managing competition - ways to define possible competitors, competitive information. SWOT analysis-concept, meaning and advantages.

#### **UNIT – IV: Marketing and Record Keeping**

Venture capital – concept, aims, features, financing steps sources, criteria to provide venture capital. Marketing - market segmentation, market positioning, marketing mix and product mix. Record keeping – purpose, needs and types of records to be maintained in an enterprise. Forms of business – contract farming, joint ventures and public private partnerships. Social responsibility and business ethics.

#### **UNIT – V: Government Schemes of Entrepreneurship**

Project – meaning – importance – components and preparation. Government schemes and incentives for promotion of entrepreneurship and government policy on small and medium enterprises. Women entrepreneurship-concept, problems and development of women entrepreneurs.

### **THEORY SCHEDULE**

1. Concept of entrepreneur, entrepreneurship and functions of an entrepreneur
2. Entrepreneurial characteristics – distinction between an entrepreneur and a manager – Agri-entrepreneurship- – concept need and scope
3. Assessing overall business environment in Indian economy – globalization – implications of social, political and economic systems on entrepreneurship.
4. Entrepreneurship Development Programmes (EDPs) – objectives, phases, problems of EDPs, criteria for assessment or evaluation of EDPs
5. Generation, incubation and commercialization of business ideas
6. Role of entrepreneurship in economic development, motivation and entrepreneurship development, managing an enterprise
7. Importance of planning, budgeting, monitoring, evaluation and follow up in running an enterprise
8. Managing competition – ways to define possible competitors, competitive information, SWOT analysis-concept, meaning and advantages
9. **Mid-Semester Examination**
10. Venture capital – concept, aims, features, financing steps sources, criteria to provide venture capital
11. Marketing - market segmentation, market positioning, marketing mix and product mix

12. Record keeping – purpose, needs and types of records to be maintained in an enterprise
13. Forms Business – contract farming, joint ventures and public private partnerships.
14. Social responsibility and business ethics
15. Project – meaning – importance – components and preparation
2. Government schemes and incentives for promotion of entrepreneurship and government policy on small and medium enterprises
3. Women entrepreneurship-concept, problems and development of women entrepreneurs.

### **PRACTICAL SCHEDULE**

1. Steps in formulating a project proposal
2. Field visit to successful agri-enterprise – study of characteristics of successful agripreneurs – case study
3. Working out Benefit – Cost Ratio for any agro based enterprise
4. Working out Break even analysis
5. Working out various financial ratios
6. Capital budgeting for any agro based enterprise
7. Preparation of balance sheet for an enterprise
8. Practicing tower building
9. Practicing test for achievement planning
10. Visit to agri clinics and agri business centers
11. Case study of successful Women entrepreneurs
12. Preparation of a sample project proposal for an agro based enterprise
13. SWOT analysis of selected enterprise
14. Development of project proposals – formulation of project plan – I
15. Development of project proposals – formulation of project plan – II
16. Presentation of project reports by the students – I
17. Presentation of project reports by the students – II

### **REFERENCES**

1. Gupta, C.B. 2001. Management: Theory and Practice. Sultan Chand and Sons, NewDelhi.
2. Khanka, S.S.1999. Entrepreneurial Development. S. Chand and Co., New Delhi.
3. Sagar Mondal and Ray, G.L. 2009. Text Book of Entrepreneurship and Rural Development, Kalyani Publishers, Ludhiana.
4. Vasant Desai. 1997. Small Scale Industries and Entrepreneurship. Himalaya Publishing House, New Delhi.
5. Vasant Desai. 2000. Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, New Delhi.

## **ENG 319 COMPREHENSION AND COMMUNICATION SKILLS (1+1)**

### **OBJECTIVES**

To enable the learner acquire the major skill -- listening, reading, speaking and writing --practice integrating all the skills for requires needs specific and general -asses the progress of comprehension and expression

### **THEORY**

#### **Unit – I**

Education – employment – unemployment – when is a person unemployed – applications – applying for a job- planning – A good job with prospects – Curriculum Vitae - word building – articles.

#### **Unit – II**

Interview – taking part in interviews - role play – word hunt – Look alike words – sound alike words – Rhyming words – Reporting – After the interview –General Knowledge – Quizzes – Review - Stress – Poem reading – No time - reported speech

#### **Unit – III**

Killers – Comprehension on cigarettes and sudden death – drugs and Youth - Galloping growth – A short story – Judging a story – Environment – Polluting the world – A dead planet – Is there life on earth - tenses

#### **Unit – IV**

Riddles – Puzzles in nature – Qahwah – All about coffee – A dilemma lesson – Computeracy – Review - phrases and clauses.

#### **Unit - V**

Entertainment – How to be entertaining – You and your English – reading, comprehension and answering the questions – Usage and abusage – War minus showing – A lesson from the text book “The sporting spirit” – Who’s who - fun with language.

#### **THEORY LECTURE SCHEDULE**

1. Education – Are you a clean slate – employment – unemployment – when is a person unemployed
2. Applications – applying for a job - A good job with prospects
3. Curriculum Vitae – Writing own Curriculum Vitae -word building – articles.
4. Interview – taking part in interviews - role play
5. Word hunt – Look alike words – sound alike words – Rhyming words
6. Reporting – After the interview –improve your General Knowledge – review – super toys
7. Stress – The rat race - Poem comprehension – on No time - reported speech
8. Killers – Comprehension on cigarettes and sudden death – drugs and Youth – hints developing
9. Mid semester Examination
10. Galloping growth – population – expulsion – A short story - Judging a story
11. Environment – polluting the world – A dead planet - Is there life on earth - tenses
12. Riddles – Puzzles in nature – Qahwah – All about coffee – Coffee discovery -phrases and clauses.
13. A dilemma lesson – a layman looks at science by Ramond B. Fostick – Comprehension pertaining
14. Computeracy – Computers by Peter Laurie – Review – use your English
15. Entertainment – How to be entertaining – You and your English – A lesson from the text book by G.B.Shaw
16. Usage and abusage
17. War minus showing – A lesson from the text book “The sporting spirit” – fun with language.

#### **PRACTICAL SCHEDULE**

1. Effective Listening – Developing Listening Skills – Honing Listening skills
2. Listening to Short talks and Lectures from the cassettes of EFL University
3. Spoken English, Vowels, consonants, monophthongs, diphtongs, 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. Practical examination.

#### **Prescribed Text book**

1. Krishnaswamy, N. and Sriraman, T. 2007. *Current English for Colleges*. Macmillan Indian Ltd., Chennai.

#### **REFERENCES**

1. Balasubramanian T. 1989. *A Text book of Phonetics for Indian Students*, Orient Longman , New Delhi
2. Balasubramanyam M. 1985. *Business Communication*, Vani Educational Books, New Delhi
3. Jean Naterop, B. and Rod Revell 1997. *Telephoning in English* Cambridge University Press, Cambridge
4. Krishna Mohan and Meera Banerjee 1990. *Developing Communication Skills*, Macmillan India Ltd. New Delhi.
5. Narayanaswamy V R 1979. *Strengthen your writing*, Orient Longman, New Delhi
6. Sharma R C and Krishna Mohan 1978. *Business Correspondence*, Tata Mc Graw Hill publishing Company, New Delhi.

## **SEMESTER VII**

### **HOR 321: PRODUCTION TECHNOLOGY OF SUB TROPICAL AND TEMPERATE FRUIT AND NUT CROPS (2 + 1)**

#### **OBJECTIVES**

To study the cultivation aspects of sub tropical and temperate fruit and nut crops

## **THEORY**

### **Unit-I : Introduction**

Subtropical, temperate and humid zones of India and Tamil Nadu – Classification of subtropical and temperate fruits – Area, production, scope and importance, role on national economy of temperate and subtropical fruit crops.

### **Unit-II: Sub Tropical Fruits – I**

Composition and uses – origin and distribution – species and cultivars, soil and climatic requirements - propagation - main field preparation – spacing, planting density and cropping systems. Planting and 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 :

Hill banana, mandarin, grapefruit, pummelo and avocado.

### **Unit –III: Sub Tropical Fruits - II**

Pine apple, mangosteen, litchi, loquat, rambutan, carambola, durian, passion fruit and rose apple.

### **Unit – IV : Temperate Fruits**

Composition and uses – origin and distribution – species and cultivars. soil and climatic requirements - propagation - main field preparation – spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning – problems in flowering, pollination and fruit set – planting of pollinizers - 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, strawberry, sweet and sour cherry, black and raspberry, currants, apricot, kiwi, persimmon.

### **Unit – V : Nut Crops**

Pistachio nut, macadamia nut, almond, walnut, pecan nut, chest nut and hazel nut.

## **PRACTICAL**

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

## **LECTURE SCHEDULE**

1. Temperate, Subtropical and humid zones of India and Tamil Nadu – Classification of temperate and subtropical fruits.
2. Area, production, scope and importance, role on national economy of sub tropical and temperate fruits.
3. Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management, training and pruning - use of plant growth regulators - physiological disorders and remedies - maturity indices and harvest – post harvest handling - ripening and storage of Hill Banana.
4. –do- Mandarin
5. –do- Grape fruit and Pummelo
6. –do- Avocado
7. –do- Pineapple
8. –do- Mangosteen
9. – do- loquat
10. –do- Litchi
11. –do- Rambutan

12. –do- Carambola
13. –do- Durian and Rose apple
14. –do- Passion fruit
15. Introduction to temperate fruit crops – climatic requirements and growth physiology
16. Bearing habits and training systems of temperate fruit crops
17. Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning – problems in flowering, pollination and fruit set – planting pollinizers of Apple
18. Use of plant growth regulators, physiological disorders and remedies maturity indices and harvest - post harvest handling and storage of Apple.
19. Mid semester examination.
20. Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning – problems in flowering, pollination and fruit set – planting pollinizers - use of plant growth regulators, physiological disorders and remedies maturity indices and harvest - post harvest handling and storage of Pear.
21. –do- Peach
22. –do- Plum .
23. –do- Strawberry
24. –do- Cherries
25. –do- Raspberry, Black Berry and Currants
26. –do- Apricot
27. –do- Kiwi
28. –do- Persimmon
29. –do- Pistachio nut
30. –do- Macadamia nut
31. –do- Almond
32. –do- Walnut
33. –do- Pecan Nut
34. –do- Chestnut and hazel Nut

### **PRACTICAL SCHEDULE**

1. Hill banana - description, pre treatment of suckers – intercultural operations viz., de suckering and clump management
2. Description of mandarin, pummelo and grape fruit, budding and training practices
3. Identification of physiological disorders and remedies in grapes, mandarin, pummelo and grape fruit
4. Identification and description of varieties of avocado, litchi and passion fruit
5. Study of varieties, propagation in pine apple
6. Planting systems and growth regulation in pine apple
7. Visit to sub-tropical fruit zones and identification of sub-tropical varieties
8. Visit to temperate orchards and identification of temperate fruit varieties
9. Visit to temperate orchard and identification nut crops.
10. Description of varieties and propagation methods of mangosteen, loquat and carambola
11. Description of apple and pear varieties
12. Study of propagation and growth regulation of apple and pear
13. Description of plum and peach varieties
14. Study of propagation and growth regulation of plum and peach
15. Identification and description of temperate nut crops
16. Study of maturity indices in major sub tropical and temperate fruit crops
17. Practical Examination

### **REFERENCE BOOKS**

1. Bose, T. K. 1996. Fruits of India – Tropical and sub – tropical. Nayaprakash, Calcutta
2. Bose, T. K. S. K. Mitra, and D. S. Rathore. 1998. Temperate Fruits - Nayaprakash, Calcutta

3. Bose, T.K., S.K. Mitra and D. Sanyal 2001, Fruits : Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta.
4. Bose, T.K., S.K.Mitra, A.A. Farooqi and M.K. Sadhu (Eds) 1999. Tropical Horticulture Vol.1. Naya Prokash, Calcutta.
5. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, Delhi
6. Chattopadhyay, T.K., 2001. A Text Book on Pomology (4 volumes) Kalyani Publishers, Ludhiana.
7. Mitra, S. K., T. K. Bose and D. S. Rathore. 1990. Temperate fruits. Horticulture and Allied Publishers.
8. Pal, J.S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.
9. Sadhu, M.K. and P.K. Chattopadhyay.2001. Introductory Fruit Crops. Naya Prokash, Calcutta.
10. Singh, S.P. 1995. Commercial Fruits. Kalyani Publishers, Ludhiana
11. T. K. Bose & S. K. Mitra, 1990. Fruits : Tropical and subtropical Nayaprakash, Bidhan Saranai, Calcutta – 700 116, India
12. Veeraraghavathatham, D., M. Jawaharlal, S. Jeeva and S. Rabindran 1996. Scientific Fruit culture, Suri Associates, Coimbatore.

## **HOR 322: PRODUCTION TECHNOLOGY OF TEMPERATE AND SUBTROPICAL VEGETABLE (2+1)**

### **OBJECTIVES**

To teach the students about the scenario of vegetable cultivation advanced production technologies and post harvest handling, production constraints of vegetables.

### **THEORY**

#### **UNIT-I : Overview**

Area, production, World scenario, industrial importance, effort potential of vegetables crops, classification of vegetable crops. Scope and importance of vegetable growing – Seed production techniques and constraints in temperate and sub tropical vegetable crops.

#### **UNIT –II: Cruciferous vegetables**

Composition and uses – origin and distribution – area and production – climate and soil requirements – season – 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.

Crops: Cabbage, Cauliflower, Knol-khol, sprouting broccoli and Chinese cabbage.

#### **UNIT-III : Bulbous and root vegetables**

Garlic, onion, potato, sweet potato, dioscorea, carrot, beet root, radish and turnip.

#### **UNIT-IV: Leguminous vegetables**

Peas, French beans, butter beans, cluster beans, vegetable soyabean and lab lab.

#### **UNIT-V: Leafy and salad vegetables**

Lettuce, palak, celery, asparagus, globe, artichoke, rhubarb, spinach, cherkumanis, basella, and portulaca.

### **PRACTICAL**

Identification and description of temperate subtropical vegetable crops – nursery practices and for transplanted vegetable crops – preparation of field and sowing / planting for direct sown / transplanted vegetable crops – herbicide use in vegetable culture – top dressing of fertilizers and inter-culture – use of growth regulators – identification of nutrient deficiencies – physiological disorder – maturity indices and harvesting – working out cost of cultivation of temperate vegetable crop – Visit to temperate vegetable farms research station commercial farm.

### **LECTURE SCHEDULE**

1. Area production, world scenario, industrial importance, export potential of temperate vegetable crops.



Origin, distribution, varieties, climate and soil, nursery management, seed treatment, nutrient requirement, nutrient deficiency and corrective measures. Use of chemical and PGRs. Mulching weed management, irrigation requirement, intercropping, maturity standards, harvesting and grading, seed production of the following crops.

2. Cabbage
3. Cauliflower
4. Knol-khol
5. Sprouting broccoli
6. Brussels sprout
7. Chinese cabbage
8. Garlic, Onion
9. Potato
10. Sweet potato
11. Dioscorea
12. Carrot
13. Beet root
14. Radish
15. Turnip
16. Mid Semester Examination
17. Peas
18. French beans
19. butter beans
20. Cluster beans
21. Vegetable soybean
22. Lab lab
23. Lettuce
24. Palak
25. Celery
26. Asparagus
27. Globe artichoke
28. Rhubarb
29. Spinach
30. Chekurmanis
31. Basella
32. Portulaca

### **PRACTICAL SCHEDULE**

1. Identification and description of temperate subtropical vegetable crops
2. Nursery practices and for transplanted vegetable crops I
3. Preparation of field and sowing / planting for direct sown / transplanted vegetable crops
4. Herbicide use in temperate and sub-tropical vegetable crops .
5. Top dressing of fertilizers and inter-culture.
6. Use of chemicals and growth regulators in vegetable crops.
7. Identification of nutrient deficiencies and adoption correction measures.
8. Physiological disorder and adoption correction measures.
9. Maturity indices and harvesting in temperate and sub-tropical vegetable crops.
10. Protected cultivation of temperate vegetables.
11. Visit to commercial farms in plains.
12. Visit to commercial farms in hills.
13. Visit to cold storage/ market/ processing centres.
14. Working out cost of cultivation of temperate and sub-tropical vegetable crops.

### **REFERENCE**

1. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. "Modern technology in vegetable production" New India Publishing Agency, New Delhi.

2. Prem Singh Arya and S. Prakash. 2002. "Vegetable growing in India", Kalyani publishers, New Delhi.
3. Bose, T.K. Kabir, J., Maity, T.K. Parthasarathy, V.A. and Som M.G., 2002. Vegetable Crops Vol. II & III Naya Prakash, Kolkata.
4. Sasanka Barooah. 1993. Vegetable growing in India, Kalyani Publisher, New Delhi.
5. Singh, S.P. 1997. Principles of vegetable production Agrotech publishing Academy – Udaipur
6. Hazra, P and M.G. Som. 1999. Technology of vegetable production and improvement, Naya Prakash, Calcutta.
7. Veeraragavathatham, A., M. Jawaharlal and Seemanthini Ramdoss. 1991. A guide on vegetable culture, Suri Associate, Coimbatore.
8. Prem Singh Arya, 1999. Vegetable seed production in Hills, M.D. Publication Pvt. Ltd., New Delhi.

## **HOR 323: PROCESSING AND POST HARVEST MANAGEMENT OF HORTICULTURAL CROPS (1+1)**

### **OBJECTIVES**

India is considered to be the second largest producer of fruits and vegetables and in the world. In spite of higher production achieved in the field of horticultural crops, considerable gap exists between gross production and net availability of fruits and vegetables due to huge post harvest loss. These losses are again due to lack of knowledge in the proper post harvest management or handling of fruit and vegetables right from harvesting to marketing. To overcome these bottlenecks, fruits and vegetables could be profitably disposed either by storing them in cold rooms or by processing and preserving them as different products.

Horticultural produce offer tremendous scope for value addition in to different products with commercial feasibility. The content of this course is so designed that it will help the students to become an entrepreneur in this potential area.

### **THEORY**

#### **Unit-I: Post harvest handling and ripening physiology**

Importance of post harvest technology and causes of post harvest losses – Maturity indices and time of harvesting – pre and post harvest physiological changes in Horticultural produce – methods to hasten or delay ripening of fruits.

#### **Unit-II: Post harvest treatments and storage**

Handling methods – pre-cooling, washing and grading – waxing – vapour heat treatment – irradiation – fumigation – storage methods – hypobaric, controlled and modified atmospheric storage techniques – storage disorders – handling of cut flowers – shelf life extension.

#### **Unit –III: Packaging of Horticultural produce**

Packaging of horticultural produce – type of containers and packaging materials – methods of packing – controlled and modified atmospheric packaging – vacuum, edible packaging. Role of NHB, APEDA, Plant Quarantine and other certifying agencies governing internal and foreign trade of harvested produce.

#### **Unit – IV: Methods of preservation**

Status and scope of fruit and vegetable processing industries in India – Principles of preservation – Preservation with sugar, salt – heat preservation – chemicals or bio-preservatives, dehydration and fermented beverages.

#### **Unit – V: Value added products and quality control**

Value added products – spice oil, oleoresin, curry powder – dehydrated and ground spice – consumer packed spices – waste and by product utilization from processing industry – quality control standards – BIS, AGMARK, Codex Alimentarius – Fruit products order (FPO).

### **PRACTICAL**

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

### **THEORY LECTURE SCHEDULE**

- 1) Importance and scope of post harvest technology of horticulture crops.
- 2) Post harvest losses, maturity indices
- 3) Pre and post harvest physiological changes during development, maturity and ripening of fruits.
- 4) Post harvest treatments like pre-cooling, washing, grading waxing, vapour heat treatment.

- 5) Irradiation of fruits and vegetables and fumigation.
- 6) Storage methods, controlled atmospheric storage and modified atmospheric storage and storage disorders.
- 7) Handling of cut flowers and methods to extend the shelf life.
- 8) Mid Semester Examination.
- 9) Packaging methods of fruits and vegetables – packaging materials.
- 10) Controlled and modified atmospheric packaging, vacuum and edible packaging.
- 11) Role of NHB, APEDA, plant Quarantine and other certifying agencies governing internal and foreign trade of harvested produce.
- 12) Importance and scope of vegetable preservation industry in India- principles of preservation.
- 13) Preservation with sugar and salt, chemicals and bio-preservatives.
- 14) Sterilization – pasteurization – dehydration.
- 15) Principles of preservation by fermentation, canning.
- 16) Value added products from spices and by product utilization from processing industry.
- 17) Quality control standards – Role of BIS, AGMARK, Codex Alimentarius – Fruits products order (FPO)

### **PRACTICAL SCHEDULE**

- 1) Practice in Judging the maturity of horticultural produce
- 2) Use of polyethylene bags in prolonging shelf life of perishables.
- 3) Wax coating and packaging studies for fruit, vegetables and cut flowers.
- 4) Identification and study of working of equipments used in processing units.
- 5) Preparation of squash, RTS and syrup.
- 6) Preparation of Jam
- 7) Preparation of Jelly and marmalade
- 8) Preparation of Sauce and ketch-up
- 9) Preparation of pickles and dehydrated products
- 10) Visit to food processing units.

### **REFERENCE**

- 1) Giridharilal, G.S. Siddappa and G.L. Tandon. 2000. Preservation of fruits and vegetables. Publication and information division. ICAR, New Delhi.
- 2) Srivastava, R. P and Sanjeevkumar. 1998. Vegetable preservation principles and practices. International Book distributing Co. Lucknow.
- 3) Jacob John, P. 2008. A Hand book of Post harvest management of fruits and vegetables. Daya publishing house, New Delhi.
- 4) Ashwani, K., Goel, Rajender kumar, Satwinder, S. Mann. 2007. Post harvest management and value addition. Daya publishing house, New Delhi.
- 5) Sudheer, K.P. and V. Indira. 2007. Post harvest technology of horticultural crops, New India Publishing Agency, New Delhi.

## **AGR324: WEED MANAGEMENT IN HORTICULTURAL CROPS ( 1+1)**

### **OBJECTIVES**

- To impart knowledge on identification of weeds and on several damages caused by weeds
- To equip the students with the concepts and principles of weed control and management in Horticultural crops

### **THEORY**

#### **Unit I: Weed biology and ecology**

Weeds – Definition, classification and characteristics of weeds – Losses caused by weeds-Weed ecology –Critical periods of weed competition-Principles and methods of weed management: preventive, cultural, mechanical, chemical, biological and alternate methods

#### **Unit II: Principles of weed control**

Concepts of weed prevention, control and eradication-IWM for horticultural crops –Merits and demerits- Management of problematic, parasitic and aquatic weeds - Chemical, weed management - classification herbicide formulations - adjuvants, herbicide protectants and antidotes -

#### **Unit III: Chemistry of Herbicides**

Mode and mechanism of action of herbicides –Introduction to selectivity of herbicides; -

Principles of herbicide selectivity - Compatibility of herbicides with other agro chemicals, Herbicide residue management and Herbicide resistance

#### **Unit IV: Herbicides physiology**

Principles and concepts - development of transgenic herbicide resistant crops – Success of herbicide resistant crops (HRC) in World and Indian agriculture.

#### **Unit V: Weed management**

Weed management in major horticultural crops, aquatic and problematic weeds and their control, invasive alien weeds.

#### **PRACTICAL**

Identification of weeds in wet, garden, dry land and hilly ecosystems - Weed control tools and implements -Preparation of herbarium of weeds; Characteristics of important herbicides - Herbicide spray equipments- Herbicide application techniques – Spray fluid calibration - Effect of herbicide on soil microflora - Economic evaluation of weed control methods in horticultural crops and cropping systems -Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops

#### **LECTURE SCHEDULE**

1. Weeds – Definitions and characteristics of weeds- Losses caused by weeds-weed seed dormancy – weed ecology – dissemination of weeds
2. Classification and characteristics of weeds of different agro ecosystems - lowland weeds, irrigated upland rainfed land weeds and hilly weeds -
3. Crop -weed interactions - Critical crop - weed competition, competitive and allelopathic effects of weeds and horticultural crops. Principles and methods of weed management: preventive, cultural, mechanical, chemical, biological and alternate methods
4. Concepts of weed prevention, control and eradication-IWM in horticultural crops and cropping systems and Non chemical weed management techniques in organic agriculture
5. Management of problematic, parasitic and aquatic weeds - Chemical, weed management –
6. Classification and characteristics of herbicides and herbicide formulations – History and development
7. Herbicide formulations - adjuvants, herbicide protectants and antidotes Herbicide use efficiency - Adjuvants, herbicide protectants and antidotes - Herbicide and herbicide mixtures in India
8. Mode of action of herbicides and their selectivity.
9. **Mid semester examinations**
10. Mechanism of action of herbicides and their selectivity
11. Introduction to selectivity of herbicides; - Principles of herbicide selectivity -
12. Compatibility of herbicides with other agro chemicals,
13. Herbicide residue management and Herbicide resistance
14. Principles and concepts - development of transgenic herbicide resistant crops
15. Herbicide resistant weeds and their impact on weed management, Development of transgenic herbicide resistant crops. Success of herbicide resistant crops (HRC) in world and Indian agriculture
16. Weed management in major horticultural crops
17. Aquatic and problematic weeds , Control of problematic weeds and invasive alien weeds

#### **PRACTICAL SCHEDULE**

1. Identification and classification of wet land weeds
2. Identification and classification of garden land weeds
3. Identification and classification of dry land and hilly weeds
4. Practicing Skill development on cultural and non chemical weed management
5. Identification, classification and characterization of herbicides
6. Practicing Skill development on herbicide application techniques
7. Practicing Skill development on spray equipment's and spray fluid calibration
8. Practicing Skill development on herbicide weed management in lowland, upland and rainfed ecosystems
9. Calculation of herbicide quantity and recommendation for different eco systems

10. Study on phytotoxicity symptoms of herbicides in different horticultural crops;
  11. Practising Skill development on mechanical weed management
  12. Identification and classification of herbicides
  13. Practising Skill development on herbicide application techniques
  14. Practising Skill development on spray equipments and spray fluid calibration
  15. Calculation of herbicide quantity and recommendation
  16. Economic evaluation of weed control methods in horticultural crops and cropping systems.
- 17. Practical Examination**

## REFERENCES

1. Das. T.K., 2008. Weed Science Basics and Applications. Jain brothers, New Delhi.
2. Gupta, O. P. 2000. Modern Weed Management. Agro Botanica Bikaner, India.
3. Rao, V. S. 2000. Principles of Weed Science. Oxford and IBH Publishing Co. New Delhi.
4. Walia. U.S. 2006. Weed Management, Kalayani Publishers, Ludhiana.

## **ENT 325: INSECT PESTS OF VEGETABLE, ORNAMENTAL AND SPICE CROPS AND THEIR MANAGEMENT (1+1)**

### OBJECTIVES:

Distribution, bio-ecology, host range, injury, integrated management of important insect pests affecting Vegetable, Ornamental and Spice Crops.

### THEORY

#### Unit I: Pests of vegetables

Tomato, brinjal, chilli and bhendi, Bulbous and Cucurbitaceous vegetables - Onion, ash gourd, pumpkin, bitter gourd, snake gourd, ribbed gourd, bottle gourd, watermelon, musk melon, cucumber and gherkin. Fabaceous vegetable crops and greens - Cluster beans, cowpea, lab-lab, peas, beans, moringa, palak, basella and amaranth.

#### Unit II: Pests of tubers and root vegetables

Tuber and root vegetables - potato, cassava, sweet potato, colocasia, vegetable coleus, yam, chow chow, carrot, beet root, radish and turnip. Cruciferous vegetables - cabbage, cauliflower and sprouting broccoli. Salad vegetables- Kale, cress, celery, rhubarb, asparagus, artichoke, leek, lettuce and spinach

#### Unit III: Pests of Flower crops and ornamentals

Flower crops and other ornamentals - rose, jasmine, chrysanthemum and tuberose. crossandra, marigold, nerium, lawn, turf and cut flowers.

#### Unit IV: Pests of spices crops, Tree crops and dry fruits and nuts

Turmeric, ginger, coriander, fenugreek, fennel, clove, nutmeg, cinnamon, betel vine. Tree crops - neem, teak, tamarind, sandalwood, eucalyptus, and casurina, dry fruits, nuts and other horticultural products.

#### Unit V: Chemical methods of Pest Management in horticultural crops and its Ecological Perspectives

Chemical control – importance and history. Classification of pesticides - Toxicity ranges – LD<sub>50</sub>, LC<sub>50</sub>, etc. Basic and newer formulations of insecticides. Hazards of insecticides - Symptoms of poisoning, first aid and antidotes, Insecticide residues, Insecticide resistance, Insect resurgence, Insecticide contamination and pollution, Bio accumulation and Bio magnification. Phytotoxicity. Insecticide resistance and residue management in horticultural crops and their tolerance limits.

### PRACTICAL

Identification of symptoms of damage and life stages of important pests of different horticultural crops: vegetables, tubers, spices, ornamentals, flower crops, tree crops, dry fruits and nuts. Different groups of pesticide formulations and label information. Precautions in pesticide applications - First aid and antidotes in case of insecticide poisoning. Pesticide application equipments – types and uses.

Preparations of spray fluids for field application. Calculation of dose/concentration of insecticides. Compatibility of pesticides and Phytotoxicity of insecticides. Effective application of insecticides.

**Assignment:**

1. Each student has to submit five numbers of insect damaged plant specimens (Herbarium) from Vegetable, Ornamental and Spice Crops and five insecticide labels.
2. Rearing and submission of five insect pests of Vegetable, Ornamental and Spice Crops.

**THEORY LECTURE SCHEDULE**

1. Pests of tomato, brinjal, chilli, bhendi.
2. Pests of onion, ash gourd, pumpkin, bitter gourd, snake gourd, ribbed gourd, bottle gourd, watermelon, musk melon, cucumber and gherkin.
3. Pests of fabaceous vegetable crops and greens - Cluster beans, cowpea, lab-lab, peas, beans, moringa, palak, basella and amaranth.
4. Pests of tuber and root vegetables - potato, cassava, sweet potato, colocasia, vegetable coleus, yam, chow chow, carrot, beet root, radish and turnip.
5. Pests of cruciferous vegetables - cabbage, cauliflower and sprouting broccoli.
6. Pests of Salad vegetables- Kale, cress, celery, rhubarb, asparagus, artichoke, leek, lettuce and spinach
7. Pests of Flower crops and other ornamentals - rose, jasmine, chrysanthemum and tuberose. crossandra, marigold, nerium, lawn, turf and cut flowers.
8. Pests of turmeric, ginger, coriander, fenugreek, fennel, clove, nutmeg, cinnamon, betel vine.
9. **Mid semester Examination**
10. Pests of trees - neem, teak, tamarind, sandalwood, eucalyptus, and casurina
11. Pests of dry fruits, nuts and other horticultural products.
12. Chemical control – importance and history. Classification of pesticides.
13. Toxicity ranges, LD<sub>50</sub>, LC<sub>50</sub>, etc., Basic and newer Formulations of insecticides.
14. Hazards of insecticides - Symptoms of poisoning, first aid and antidotes.
15. Insecticide residues, insecticide resistance.
16. Insect resurgence, insecticide contamination and pollution, bio accumulation and bio magnification. Compatibility and Phytotoxicity.
17. Insecticide resistance and residue management.

**PRACTICAL SCHEDULE**

2. Identification of life stages of important pests of tomato, brinjal
3. Identification of life stages of important pests of chilli, bhendi
4. Identification of life stages of important pests of onion, ash gourd, pumpkin, bitter gourd, snake gourd, ribbed gourd, bottle gourd, watermelon, musk melon, cucumber and gherkin.
5. Identification of life stages of important pests of cluster beans, cowpea, lab-lab, peas, beans
6. Identification of life stages of important pests of moringa, palak, basella and amaranth.
7. Identification of life stages of important pests of potato, cassava, sweet potato, colocasia, vegetable coleus, yam, chow chow, carrot, beet root, radish and turnip.
8. Identification of life stages of important pests of cabbage, cauliflower and sprouting broccoli. Salad vegetables- Kale, cress, celery, rhubarb, asparagus, artichoke, leek, lettuce and spinach
9. Identification of life stages of important pests of rose, jasmine, chrysanthemum and tuberose. crossandra, marigold, nerium, lawn, turf and cut flowers.
10. Identification of life stages of important pests of turmeric, ginger, coriander, fenugreek, fennel, clove, nutmeg, cinnamon, betel vine.
11. Identification of life stages of important pests of neem, teak, tamarind, sandalwood, eucalyptus, and casurina.
12. Identification of life stages of important pests of dry fruits, nuts and other horticultural products.
13. Identification of different groups of pesticide formulations.
14. Recognizing label information, Precautions in pesticide applications, First aid and antidotes information.
15. Identification of types of Pesticide application equipments and effective application of insecticides.

16. Preparations of spray fluids for field application. Calculation of doses/concentrations of insecticides.
17. Compatibility of pesticides and Phytotoxicity of insecticides.
18. **Practical examination**

## REFERENCE BOOKS

1. Butani, D.K. and M.G.Jotwani, 1984. *Insects of Vegetables*. Periodical Expert Book Agency, New Delhi.429p.
2. Hill, D.S. 1985. *Agricultural Pests of Tropics and their Control*, Cambridge University Press, London. 865p.
3. Kumaresan, D., A. Regupathy, and P. Baskaran, 1998, *Pests of Spices*, Rajalakshmi Publications, Nagercoil, India, 241 p.
4. Regupathy, A., S. Palanisamy, N. Chandramohan and K. Gunathilagaraj. 2008. *A Guide on Crop Pests*. Sooriya Desktop Publishers, Coimbatore. 269p.
5. Srivastava, K.P. and D.K.Butani, 1998. *Pest Management in Vegetables (Part I & II)* Research Periodicals and Book Publishing House, India.637p.

## PAT 326 Diseases of Vegetable, Ornamental and Spice crops (2+1)

### OBJECTIVES

The subject covers the etiology, symptoms, mode of spread, survival and integrated management of important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non-parasitic causes of the vegetable, ornamental and spice crops.

### THEORY

#### Unit I: Vegetable crops

Brinjal, tomato, bhendi, cucurbits, crucifers, beans and peas

#### Unit II: Tuber crops

Potato, sweet potato, beet root, raddish, yam, colacasia and cassava.

#### Unit III: Spices and condiments

Onion, garlic, chillies, cardamom, pepper, betel vine, turmeric, ginger, fenugreek, coriander, clove, nutmeg and cinnamon

#### Unit IV: Ornamentals

Jasmine, rose, crossandra, chrysanthemum, tuberose, marigold, orchid and gladiolus

#### Unit V: Post-harvest diseases

Post-harvest diseases of vegetables.

### PRACTICAL

Study of symptoms and host parasite relationships of the following crops: Tomato, brinjal, bhendi, cucurbits, crucifers, bean, peas, potato, cassava, sweet potato, yam, colacasia, onion, garlic, chillies, pepper, betel vine, turmeric, ginger, cardamom, fenugreek, coriander, clove, nutmeg, cinnamon, jasmine, rose, crossandra, chrysanthemum, tuberose, marigold, orchid and gladiolus. Post-harvest diseases of vegetables and ornamentals - Field visits.

### THEORY SCHEDULE

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

1. Brinjal
2. Tomato
3. Bhendi
4. Cucurbits
5. Crucifers
6. Beans and peas
7. Potato and sweet potato
8. Beet root and raddish
9. Yam and colacasia.

10. Field visit
11. Cassava
12. Onion
13. Garlic
14. Chillies
15. Cardamom
16. Pepper
17. Turmeric
18. Mid Semester Examinations
19. Ginger and fenugreek
20. Coriander
21. Clove
22. Nutmeg
23. Cinnamon
24. Jasmine
25. Rose
26. Crossandra
27. Chrysanthemum
28. Tuberose and marigold
29. Orchid and gladiolus
30. Post harvest diseases of vegetables
31. Post harvest diseases of spices
32. Post harvest diseases of condiments
33. Post harvest diseases of ornamentals
34. Importance of Post harvest disease management

### **PRACTICAL SCHEDULE**

Study of disease symptoms and host parasite relationship of:

1. Tomato
2. Brinjal.
3. Cucurbits
4. Field visit
5. Crucifers.
6. Bean and peas
7. Potato.
8. Field visit
9. Cassava, sweet potato, yam and colacasia.
10. Onion and garlic
11. Chillies
12. Pepper
13. Turmeric and ginger
14. Cardamom and fenugreek
15. Coriander, clove, nutmeg, and cinnamon
16. Post harvest diseases of vegetables, spices and condiments
17. Final Practical Examinations

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

### **REFERENCES**

1. Arjunan.G. Karthikeyan, G, Dinakaran ,D. Raguchander,T. 1999 Diseases of Horticultural Crops, AE Publications, Coimbatore.
2. Parvatha Reddy P. 2008 Diseases of Horticultural Crops ISBN8172335431 Scientific Publishers
3. Rangaswamy C.2005, Diseases of Crop Plants in India –. Prentice Hall of India, Pvt. Limited, New Delhi
4. Singh, R.S. 1994. Diseases of Vegetable Crops –. Oxford & IBM Publishing Co.Pvt.Ltd. New Delhi
5. Sohi, H.S, 1992. Diseases of Ornamental plants in India –. ICAR, New Delhi.

### **SAC 327: SOIL FERTILITY AND NUTRIENT MANAGEMENT (1+1)**

#### **OBJECTIVES:**

To impart knowledge on basic principles of soil fertility, its evaluation and gain knowledge on plant nutrients and its use for sustainable agriculture. Further it aims to gain knowledge on management of problem soil and irrigation water. This course also provides practical knowledge with respect to soil, plant and irrigation water analysis.



## **THEORY**

### **Unit I: Soil fertility**

Soil fertility – soil productivity – soil fertility evaluation – approaches - chemical methods, soil analysis – soil testing – methods – critical levels; plant analysis – methods – biological methods - DRIS – rapid tissue tests – indicator plants – critical levels

### **Unit II: Plant nutrients**

Soil as source of plant nutrients – essential , beneficial elements – sources – forms – mechanism of nutrient transportation to plants – factors affecting nutrient availability - nutrient deficiencies – toxicities – overcome measures

### **Unit III: Problem soils**

Problem soils – acid, saline and calcareous soils – genesis – characteristics – classifications – reclamation – methods – nutrient availability – effect of fertilizers and pesticides on soil

### **Unit IV: Irrigation water**

Irrigation water – sources - quality – appraisal – Indian standards for water quality – use of saline water for agriculture - Management of poor quality water - effect of fertilizers and pesticides on water and air

### **Unit V: Nutrients use**

Soil test crop response (STCR) fertilizer recommendation for different crops – Nutrient use efficiency (NUE) for N, P,K, S, Fe & Zn – factors affecting – nutrient cycles for N, P, K & S – sources - methods – nutrient schedule for different soils and crops grown under rainfed and irrigated conditions.

## **PRACTICALS**

Soil analysis - Estimation of available N, P, K & S; Plant analysis - Estimation of N, P, K & S ; Irrigation water analysis - Estimation of pH, EC, soluble cations and anions ; Problem soil analysis - Estimation of lime requirement and gypsum requirement

## **THEORY SCHEDULE**

4. Soil fertility – productivity – soil fertility evaluation – different approaches
5. soil fertility evaluation – methods – chemical methods, soil analysis - soil testings and critical level of nutrients in soil, plant analysis - methods
6. soil fertility evaluation – methods – plant analysis – biological methods - DRIS – tissue test – indicator plants – critical level of nutrients in plants
7. soil as a source of nutrients – plant nutrients – Arnon's criteria – essential nutrients – beneficial nutrients – sources – forms
8. Nutrient transformations to plant, factors affecting nutrients availability
9. Nutrient deficiencies, toxicities and overcome measures
10. Problem soils – acid, saline and calcareous soils – genesis – characteristics – classification –
11. Mid semester examination
12. Problem soils – reclamation – methods – nutrients availability - Effect of fertilizers and pesticides on problem soils
13. Mid semester examination
14. Irrigation water – sources - quality – appraisal – Indian standards for water quality
15. Use of saline water for agriculture - Management of poor quality water
16. Effect of fertilizers and pesticides on irrigation water and air
17. Soil test crop response (STCR) fertilizer recommendations for different crops
18. Nutrient use efficiency (NUE) for N, P,K, S, Fe & Zn – factors affecting –
19. Nutrient cycles for N and P. Nutrient transformation for K & S
20. Sources - methods – nutrient schedule for different soils and crops grown under rainfed and irrigated conditions.

## **PRACTICAL SCHEDULE**

1. Determination of soil organic carbon
2. Determination of available nitrogen in soil
3. Determination of available phosphorus in soil
4. Determination of available potassium in soil

5. Determination of available sulphur in soil
6. Preparation of di- acid, tri- acid extract and Estimation the nitrogen in plant
7. Estimation of phosphorus in plant
8. Estimation of potassium in plant
9. Estimation of sulphur in plant
10. Determination of pH and EC in irrigation water
11. Estimation of  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  in irrigation water
12. Estimation of  $\text{Na}^+$  and  $\text{K}^+$  in irrigation water
13. Estimation  $\text{CO}_3^{3-}$  and  $\text{HCO}_3^{3-}$  in irrigation water
14. Estimation of  $\text{Cl}^-$  in irrigation water
15. Estimation of lime requirement in acid soil
16. Estimation of gypsum requirement in alkaline soil
17. Practical Examination

## REFERENCES

1. John Havlin, James Beaten, Samuel Tisdale, Werner Nelson, 2005. Soil Fertility and Fertilizers - An Introduction to Nutrient Management. 7<sup>th</sup> Edition, Prentice Hall. Upper Saddle River, NJ.
2. Krishna, K.R.(Ed.) 2002. Soil fertility and crop production. Oxford and IBH Publishing Co., New Delhi
3. Tisdale, S.L., Nelson, W.L. and Becton, J.D. 1990. Soil fertility and Fertilizers. MacMillan Publishing Company, New York
4. Mengel, K. and E.A. Kirkby. 1987. Principles of Plant Nutrition, 4th ed. International Potash Institute, Worblaufen-Bern, Switzerland.
5. Westerman, R.L. (ed.) 1990. Soil testing and Plant analysis, 3rd. edition. Soil Science Society of America, Inc., Madison, WI.
6. Sankara reddy, G.H and T. Yellamanda reddy, 1997. Efficient use of irrigation water – Kalyani publishers, New Delhi
7. Nyle C. Brady. 1996. The nature and properties of soils. Prentice Hallof India Pvt Ltd, New Delhi

## AEC 328 PRODUCTION ECONOMICS AND ORCHARD MANAGEMENT (1+1)

### OBJECTIVES:

The objective of this course is to provide applied and practical understanding of production economics and farm management techniques with emphasis on its economics analysis

### THEORY

#### Unit I: Nature and Scope

Production economics: Meaning - definition – nature and scope. Orchard management: Definition - objectives of orchard management - Production economics Vs Orchard management - orchard management decisions - decision making process - scope of orchard management - Types and systems of farming : Types - specialized and diversified-mixed – systems of farming – peasant farming – state farming – capitalistic – collective- co- operative farming.

#### Unit II: Factor-Product Relationship

Factor-Product relationship: Meaning. Agricultural Production Function: Meaning – definition - Laws of returns: increasing, constant and decreasing returns - classical production function and three stages of production – elasticity of production – types/forms of Production functions - linear, cobb-douglas and quadratic – cost concepts and cost curves: Total, average and marginal cost – economics of scale - determination of optimum input and output - physical and economic optimum.

#### Unit III: Factor- Factor Relationship

Factor-factor relationship : Meaning- isoquant – definition and types - isoquant map - marginal rate of technical substitution - factor intensity - isocline- ridge line - returns to scale – elasticity of factor substitution- iso-cost line – principle of factor substitution and least cost combination of inputs –Expansion path - Effect of input price changes on the least cost combination.

#### Unit IV: Product-Product Relationship

Product-product relationship: Meaning – production possibility curve – marginal rate of product transformation. Enterprise relationship: joint products – complementary – supplementary – competitive products – iso-revenue line – optimum combination of products – principle of equi-marginal returns – principle of opportunity cost.

## Unit V: Farm Planning and Budgeting

Farm planning: importance – characteristics of good farm plan – farm planning procedure. Budgeting: definition and types – complete budgeting – partial budgeting – enterprise budgeting – cash flow budgeting – limitations of budgeting – linear programming: Assumptions – Linear programming model – graphical solution - advantages and limitations . Risk and uncertainty: definition – types of risk and uncertainty – safeguards against risk and uncertainty.

### PRACTICALS

Problems on factor-product relationship- determination of least-cost combination- determination of optimum product combination-computation of cost concepts- cost of cultivation and cost of production of agricultural crops, horticultural and livestock products - depreciation-methods of calculation of depreciation. Farm records and accounts – analysis of farm records and accounts. Farm inventory analysis – net worth statement – profit and loss statement – Break-even analysis — preparation of complete and partial budgets - preparation of farm plan – graphical solution to linear programming problem.

### THEORY LECTURE SCHEDULE

1. Production economics: Meaning - definition – nature and scope. Orchard management: Definition - objectives of orchard management - Production economics Vs Orchard management
2. Orchard management decisions - Decision making process - scope of orchard management
3. Types and systems of farming: Types - specialized and diversified-mixed – systems of farming – peasant farming – state farming – capitalistic – collective- co-operative farming.
4. Factor-Product relationship : Meaning - agricultural production function - Meaning – definition- Laws of returns: increasing, constant and decreasing returns
5. Classical production function and three stages of production – elasticity of production
6. Types of production functions- linear, cobb-douglas and quadratic
7. Cost concepts and cost curves: total, average and marginal cost concepts and curves, economics of scale.
8. Determination of optimum input and output: input approach and output approach - physical and economic optimum.
9. **Mid semester examination**
10. Factor-factor relationship: meaning- isoquant – definition and types - isoquant map - marginal rate of technical substitution - factor intensity – isoclines – ridge line
11. Returns to scale – elasticity of factor substitution- iso-cost line – principle of factor substitution and least cost combination of inputs – expansion path - effect of input price changes on the least cost combination
12. Product-product relationship: Meaning – production possibility curve – marginal rate of product transformation. Enterprise relationship: joint products – complementary – supplementary – competitive products
13. Iso-revenue line – optimum combination of products – principle of equi-marginal returns – principle of opportunity cost
14. Farm planning: importance – characteristics of good farm plan – farm planning procedure
15. Budgeting: definition and types – complete budgeting – partial budgeting –enterprise budgeting – cash flow budgeting – limitations of budgeting
16. Linear programming: Assumptions – linear programming model – graphical solution - advantages and limitations
17. Risk and uncertainty: Definition – types of risk and uncertainty – safeguards against risk and uncertainty

### PRACTICAL SCHEDULE

1. Estimation of optimum input – output combination.
2. Determination of least-cost combination
3. Determination of optimum product combination
4. Computation of cost concepts- cost of cultivation and cost of production of agricultural crops
5. Cost of cultivation and production of perennial crops/ horticultural crops.
6. Cost of production of livestock products
7. Depreciation: methods of calculating depreciation
8. Visit to a farm (government/private/corporate) to study the layout and organization
9. Farm records and accounts: Usefulness, types of farm records–farm production records-farm financial records
10. Visit to a private agricultural farm to collect information on farm business
11. Farm inventory analysis: Examination of assets – valuation of assets by different methods

12. Preparation and analysis of net worth statement and profit and loss statement
13. Estimation of break-even analysis
14. Preparation of complete budget and partial budgets
15. Preparation of farm plan
16. Graphical solution to linear programming problem

**17. Final Practical Examination**

**REFERENCES**

1. Doll, J.P. and F. Orazem. (1983) Theory of Production Economics with Applications to Agriculture. John Wiley, New York.
2. Debertin, D.L. (1986) Agricultural Production Economics. Macmillan, New York.
3. Johl SS & Kapoor TR. (1973). Fundamentals of Farm Business Management. Kalyani Publ.India
4. Kahlon AS & Singh K. (1992). Economics of Farm Management in India. Allied Publ. New Delhi
5. Sankayan, P.L. (1983). Introduction to Farm Management, (New Delhi:Tata Mc Graw Hill Publishing Company Ltd)

**GPB 329: SEED PRODUCTION OF HORTICULTURE CROPS (1+1)**

**OBJECTIVE**

- To understand the quality seed production methods of varieties and hybrids of horticultural crops.
- It impart the importance of seed certification.

**THEORY**

**Unit –I : Seed Morphology and Classification of seed**

Seed – structure and texture – monocot – dicot seeds and their importance – Characteristics of good quality seeds – seed multiplication systems – different classes Seed

**Unit -II Principles of seed production**

Influence of agro climatic condition on seed production – selection of seed production area, varietal release – state and central variety releasing committee.

**Unit – III: Seed Production**

Principles and methods of seed production in self and cross pollinated crops – varieties and hybrids of Tomato, Brinjal, Chillies, Bhendi, Amaranthus, Gourds, Cabbage, Cauliflower, Radish, Carrot, Onion,

**Unit - IV: Post Harvest Technology**

Harvesting and post harvest technology – methods of harvesting – drying- principles of seed processing – dormancy – methods of seed treatment

**Unit – V : Seed Certification and seed legislation**

seed standard – seed certification – organization – seed certification procedure, seed Act and seed rules and seed regulation.

**PRACTICAL**

Seed structure and texture – Monocot – Dicot seeds - Seed identification – identification of improved varieties – seed certification – field inspection – visiting seed production plots –supplementary pollination-planting ratio and planting design-isolation and rogueing- Physiological and harvestable maturity - harvesting and seed extraction -Packaging materials– godown sanitation.

**THEORY LECTURE SCHEDULE**

1. Seed structure and texture – Monocot – Dicot seeds and their importance
2. Characteristics of good quality sttdes – seed multiplication system
3. Influence of agro climatic condition of seed production – selection of seed production area.
4. Varietal release – state and central variety releasing committee
5. Different classes of seeds
6. Methods of seed production in self and cross pollinated crops.
7. Seed production methods in varieties and hybrids of Tomato and Brinjal
8. Seed production methods in varieties and hybrids of Chillies and Bhendi
9. Seed production methods in varieties and hybrids of Amaranthus
10. Seed production methods in varieties and hybrids of Gourds
11. Seed production methods in varieties and hybrids of Cabbage and Cauliflower
12. Seed production methods in varieties and hybrids of Onion
13. Seed dormancy-Classification - treatment to overcome dormancy
14. Seed treatment
15. Seed certification – organizations involved in certification
16. seed certification procedure
17. seed Act and seed rules

### **PRACTICAL SCHEDULE**

1. Seed structure of monocot & Dicot seeds
2. Seed identification of improved varieties of hybrid of vegetable crops
3. State and central variety release
4. Visit to seed production plots
5. Supplementary pollination
6. Planting ratio and planting design for horticultural crops
7. Isolation and roguing
8. Physiological and harvestable maturity – indices of maturity
9. Harvesting and seed extraction
10. Visit to seed processing unit
11. Seed certification
12. Visit to state seed certification agency
13. Seed storage of horticultural crops
14. Packaging materials
15. Godown sanitation
16. Practical Examination.

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