

**ANNAMALAI UNIVERSITY  
FACULTY OF AGRICULTURE  
ACADEMIC REGULATIONS FOR B.Sc. (AGRICULTURE)  
(WITH EFFECT FROM 2017-18)**

**1. Title and Scope**

- 1.1. These academic Regulations shall be called “Annamalai University Faculty of Agriculture B.Sc.(Ag.) Academic Regulations 2016” for obtaining Bachelor Degree in the Faculty of Agriculture.**
- 1.2. The regulations provided herein shall apply to the students admitted from the academic year 2017-18 onwards.**

**2. Definitions**

- 2.1. University: University means Annamalai University, Annamalainagar, Tamilnadu.**
- 2.2. State Government: State Government means the Government of Tamilnadu.**
- 2.3 Academic year: An academic year is a period during which a cycle of study is completed. It shall commence on or after 1<sup>st</sup> July of each year. There shall be two semesters in an academic year.**
- 2.4. Semester: A semester shall consist of 105 working days inclusive of the mid-semester and practical examinations.**
- 2.5. Curriculum: It is a series of courses offered to provide learning opportunities to meet the requirements for a degree.**
- 2.6. Course: A course is a unit of instructions, series of classes and work experience extending over a semester. It has a specific prefix, code number, title and credits. Each course is denoted by specific code number, which has specific meaning.  
The first three alphabets stand for the department offering the course. First digit is related to the year; second digit is related to the semester and the third digit is related to course number in a particular semester i.e. “SAC-112 Principles of Analytical Chemistry”. “SAC” stands for the Department of Soil Science and Agricultural chemistry; the first digit (1) stands for the year; second digit (1) stands for the semester and the third digit (2) stands for the serial number of course in a particular semester.**
- 2.7. Credit: It is a measure of quantity of work done in a course. One credit represents one contact hour for theory or two contact hours of laboratory or field work per week. For example, a 1+1 course (2 credits) means 1 hour theory and 2 hours practical per week.**
- 2.8. Credit load: It is the number of credits a student undergoes in a semester.**
- 2.9. Grade Point: “Grade Point” means the total marks in percentage divided by 10 and shall be expressed on 10 point scale upto second decimal place.**
- 2.10. Credit point: A credit point is a product of grade point obtained by a student and number of credits in a course.**
- 2.11. Grade Point Average (GPA): It is a measure of performance of a student in all the courses taken during a semester. The GPA is computed by dividing the total credit points earned by a student in a semester by the total number of credits taken during that semester.**
- 2.12. Overall Grade Point Average (OGPA): It is a measure of the cumulative performance of a student on completion of the second and subsequent semesters of the degree programme. It is computed by dividing the total credit points earned by a student up to the end of a particular semester by the total number of credits. It shall be expressed on 10 point scale up to second decimal place.**
- 2.13. The OGPA shall be rounded off to second digit of decimal point on the basis of third digit. If third digit of decimal point is 5 or more than 5, then second digit will be increased by one. If, however, it is less than 5, it will be ignored. This will be done at the end of each semester while calculating the OGPA.**
- 2.14. Calculation of OGPA: To arrive at the “Overall Grade Point Average (OGPA)” at the end of a semester, the grade point of each course is multiplied by the credit hours of the course to obtain the credit points. Then, the sum of the credit points secured by the student in all the courses taken till the end of that semester is divided by the total number of credit hours of the courses, provided that the credit hours and**

credit points of courses which are repeated are not counted more than once for this purpose.

For Example

- i. Total credit hours till the end of last semester : 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 :  $7.41 / 10.00$

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

### 3. Admission

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

### 3.2 Tuition fees and scholarships:

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

- a) In case of new admission, the fees for the semester are payable in advance failing which they will not be admitted.
- b) In other cases, the fees are payable within seven working days from the commencement of the semester.
- c) In the case of default, a fine as per the University rules will be collected.
- d) The students who fail to pay the tuition fees within a month of commencement of the semester will not be allowed to attend the classes and their names will be struck off from the rolls. However, if the defaulting students pay the fees along with the fines in addition to a prescribed readmission fee, they will be permitted to attend the classes. The period for which his/her name is struck off from the rolls will be treated as absence for the purpose of calculating the minimum attendance requirements.
- e) Students who are away on study tour, camp activities or other extracurricular activities organised by the University or the Faculty at the commencement of the semester may, however, pay their semester tuition fees and other fees within the third working day after they return from such programmes, without fine.
- f) A student who has been granted scholarships by the Welfare Departments or by the Government of India or by the State Government will, however, be exempted from the levy of fines, provided the fees are paid on the next day after the scholarship amount is actually disbursed to him/her. The concession referred above will apply to those who have actually been granted scholarships and not to those who have only applied and are expecting sanction.
- g) The candidate should obtain a Hall Ticket from the Controller of Examinations through the Dean after clearing all arrears including the hostel dues before the commencement of each semester final examination.

### 4. Advisory system

4.1. Dean shall nominate a co-ordinator from amongst the teaching faculty.

4.2. Student ward counsellors will be nominated soon after the students' admission. The counsellor shall be nominated from amongst the teaching faculty.

### 5. Curriculum and programme of study

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

## 6. Award of Degree, duration and credit requirements

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

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

## 7. Medium of Instruction

The medium of Instruction in Faculty of Agriculture shall be English.

## 8. Attendance Requirements

- 8.1 One hundred per cent attendance is expected from each student. A student who fails to secure 80 per cent of attendance prescribed for a course (subject) of study, separately in theory and practical shall not be permitted to appear for both theory and practical examinations in that course (subject) and shall be given 'E' (incomplete) and will be required to repeat the course (subject) when offered again.
- 8.2 For the first year first semester students, for calculating 80 per cent attendance the number of working days will be calculated only from the date of joining of the student.
- 8.3 If any student is absent for field trips, the student may be marked absent for all the compensating classes on the day of the field trip in addition to the field trip courses.
- 8.4 The attendance for mid semester examination will be counted as a theory class.
- 8.5 Students abstaining from the classes by prior permission from the Dean, Faculty of Agriculture on Official University business, shall be given due consideration in computing attendance requirements.
- 8.6 However, condonation of attendance deficiency may be considered by the Vice-Chancellor only in case of genuine reasons including indoor hospitalization with evidence in the form of Hospitalization certificate and Discharge summary recommended by the Dean, Faculty of Agriculture. The Vice-Chancellor may decide whether or not a condonation fee is required, based on the reason for condonation.
- 8.7 The student belonging to a batch will attend classes and earn attendance in the particular batch only as per the time table. No student shall be permitted to attend along with another batch to gain attendance either in theory or in practical.

## 9. Examinations

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

9.1. Course with both theory and practical	Marks
i) Mid Semester Examination	20
ii) Practical Examination (Written = 25, Record = 5 Specimen collection / Assignment = 5 and Viva-Voce = 5) (The question pattern in written part should be uniform in each department)	40
iii) Final Theory Examination	40
Total	<u>100</u>
9.2. Course with only Theory / Practical*	Marks
i) Mid Semester Examination	40
ii) Final Semester Examination	60
Total	<u>100</u>

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

## 9.3. Evaluation of course work

The results of the course shall be indicated by grade points ranging from 0 to 10.0. The minimum grade point to be secured for the successful completion of a course will be 6.00. Securing a grade point less than 6.00 in a course will be treated as

'RA' and the grade point will be 0 for calculating the GPA/OGPA. In case of course with theory and practical, minimum of 50 % mark separately in theory and practical with an aggregate of 60 per cent is essential. An OGPA of 6.50 shall be the minimum requirement for the award of Degree.

The following symbols shall be used in the grade sheets.

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

**9.4. Evaluation pattern for courses with only practical**

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

**A. PED 116 Physical Education (0+1)**

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

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

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

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

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

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

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

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

**C. NSS / NCC 118 (0+1)**

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

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

**NSS**

Each student enrolled in NSS should also attend at least one special camp not exceeding 10 days duration. 80 % attendance is mandatory for attending special camp. Marks will be awarded as follows.

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

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

#### NCC

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

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

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

#### E. Crop Production AGR 311/ AGR 321

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

#### F. Rural Awareness Work Experience (RAWE)

##### RAWE AEX 410 Rural Awareness Work Experience (0+5)

Course on Rural Awareness Work Experience will be offered in the VII Semester for eight weeks.

The village attachment will be organized by the Department of Agricultural Extension. Orientation programme will be organized in the first week of the semester. The final examination will be conducted separately at the end of the semester by the University. The marks will be awarded as detailed below.

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

**RAWE AGR 411, RAWE HOR 412 and RAWE CPT 413**

The marks will be awarded as detailed below.

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

**Educational Tours: AGR 221 (0+1) and AEX 414 (0+1)**

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

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

**AIA AEC 415 (Rural Economics and Agro Industrial Attachment) (0 + 6)**

Course on Agro Industrial attachment will be offered in the VII Semester for eight weeks:

The attachment of students to Agro based industries will be organized by Department of Agricultural Economics. Orientation programme for a week will be organized at the 11<sup>th</sup> week of the semester . The final examination will be conducted separately at the end of the semester by the University. The marks will be awarded as detailed below

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

**G. Experiential learning EXP 329 (0+6) and EXP 424 (0+6)**

These courses will be offered in the VI (0+6) and VIII (0+6) semester, respectively.

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

Periodical evaluation of the above course will be done by the course teacher during different stages of work. Final evaluation of the above course will be done by the teacher incharge and another examiner. The final 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.

Particulars	Max. marks	Evaluation by
Observation Note book	20	By Teacher in-charge
Proficiency in skill learning	20	
<b>Final examination</b>		
Skills learned	20	By the Examiners
Record	20	
Viva voce	20	
<b>Total</b>	<b>100</b>	

#### H. APW 425 Project work (0+2)

Course in Project work will be offered in the eighth semester.

A student can choose a research project of his/her choice in line with experiential learning course chosen during sixth semester (EXP 329).

Periodical evaluation of course will be done by the course teacher during different stages of work. Final evaluation of the above course will be done by the course teacher and another examiner. The final semester examination will be conducted by the university before the commencement of regular final semester examinations. The distribution of marks will be as follows.

Particulars	Periodical evaluation	Final examination
Research area identification and collection of literature	10	-
Work done	30	-
Report	-	40
Viva voce	-	20
<b>Total</b>	<b>40</b>	<b>60</b>

#### 10. Mid-semester examination (MSE)

- 10.1 Writing the mid-semester examination is a pre-requisite for writing the final theory and practical examinations. If a student does not appear for MSE, he/she is not eligible to appear for the final examinations. Such candidate has to reappear for the MSE as and when the respective examinations are conducted only after getting permission from the Dean, Faculty of Agriculture on payment of fee prescribed by the University. MSE will be conducted by the Dean, Faculty of Agriculture. The answer scripts will be shown to the student after valuation, and returned to the course teacher. The Head of the Department/Division will be responsible to ensure the distribution of answer papers to the students.
- 10.2 The MSE marks will not be shown separately in the grade sheet but will be combined with the respective final theory and practical marks. MSE marks awarded in a course will be added to the supplementary examinations also.
- 10.3 The MSE marks will be furnished to the Dean, Faculty of Agriculture through Head of the Department within 10 days after the conduct of MSE. If the student is not satisfied with the award of the marks, he/she shall appeal to the Dean, within three working days after the announcement of marks. The appeal will be considered and the results reviewed by a Cell consisting of the Dean and the Head of the

Department /Division of Studies concerned. The decision of the Review Cell shall be final. If the Head of the Department himself is the course teacher, one senior member of the department concerned shall be nominated by the Dean.

**10.4 The MSE of theory will be one hour duration**

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

	Marks
i) Fill up the blanks @ $\frac{1}{2}$ mark for 10 questions out of 12	5
ii) Definition @ 1 mark for 5 questions out of 7	5
iii) Short notes @ $2\frac{1}{2}$ marks for 2 questions out of 3	5
iv) Essay type @ 5 marks for 1 question out of 2	5
<b>Total</b>	<u>20</u>

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

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

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

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

**11. Final examinations**

**11.1.** The final theory and practical examinations will be of three hours duration each.

**11.2.** Theory examinations will be conducted after practical examinations.

**11.3.** The question papers for the final theory examinations will be set by the external examiners.

The 40 marks will be apportioned as shown below.

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

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

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

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



### **11.5. Practical Examination**

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

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

### **12. Re-appearance and improvement examination**

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

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

**12.3 The student having an OGPA of less than 6.50 only is eligible to improve the grade point only once in courses completed earlier in which he/she had obtained grade point of less than 8.00. In case a student fails to secure higher grade point in the subsequent attempts, the higher grade point secured by the student either in regular or improvement examination will be accounted.**

Improvement and re-examination will not be allowed in courses with only practical and those who fail in these subjects shall have to repeat the course in the subsequent year/ years.

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

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

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

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

### **13. Malpractices in examinations**

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

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

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

#### **14. Regulations of student conduct and discipline**

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

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

#### **14.3 Ragging – An offence**

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

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

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

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

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

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

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

#### **15. Award of degree**

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

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

**The University shall issue Provisional Certificate (PC) to the candidates after having passed all provisional examinations.**

**15.1 Class ranking**

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

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

**16. 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 the academic year 2017 – 2018.**

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

**17. Removal of difficulties**

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

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**B.Sc. (Agriculture ) - List of courses (Semester wise)**

**I semester**

Sl. No.	Course code	Title	Credit
1.	AGR 110	Principles of Agronomy and Agricultural Heritage	2+1
2.	AGR 111	Fundamentals of Agricultural Meteorology	1+1
3.	SAC 112	Principles of Analytical Chemistry	1+1
4.	GPB 113	Fundamentals of Plant Physiology	2+1
5.	TAM 114 (OR) ENG 114	jkpH; ,yf;fpa';fspy; ntszh;ika[k; mwptpay; jkpH;g; gad;ghLk; (OR) <b>Development Education</b>	0+1
6.	ENG 115	English for effective Communication	0+1
7.	PED 116	Physical Education	0+1
8.	PED 117	Principles and practices of Yoga	0+1
9.	NSS/NCC 118	National Service Scheme / National Cadet Corps	0+1
<b>Total</b>			<b>6+9=15</b>

**II semester**

1.	AGR 120	Weed Management	1+1
2.	AGR 121	Irrigation Management	1+1
3.	ENT 122	Fundamentals of Entomology	2+1
4.	AGM 123	Fundamentals of Microbiology	2+1
5.	SAC 124	Fundamentals of Biochemistry	2+1
6.	GPB 125	Introduction to Agricultural Botany	1+1
7.	AEC 126	Principles of Economics	1+1
8.	AEX 127	Fundamentals of Rural Sociology and Educational Psychology	1+1
9.	COM 128	Fundamentals of Information Technology	1+1
<b>Total</b>			<b>12+ 9= 21</b>

**III semester**

1.	AGR 210	Agronomy of Field Crops - I	2+1
2.	ENT 211	Economic Entomology and Introductory nematology	2+1
3.	PAT 212	Fundamentals of Plant Pathology	2+1
4.	SAC 213	Fundamentals of Soil Science	2+1
5.	GPB 214	Principles of Genetics and Cytogenetics	2+1
6.	HOR 215	Basic Horticulture and Plant Propagation	2+1
7.	AEC 216	Production Economics and Farm Management	1+1
8.	AEX 217	Dimensions of Agricultural Extension	1+1
9.	AHS 218	Livestock and Poultry Management	2+1
<b>Total</b>			<b>16+9=25</b>

**IV semester**

1.	AGR 220	Agronomy of Field Crops - II	2+1
2.	AGR 221	Study Tour -I	0+1
3.	ENT 222	Insect Ecology and Principles of Pest Management	2+1
4.	AGM 223	Soil and Applied Microbiology	2+1
5.	SAC 224	Soil Resource Inventory and Problem Soils	2+1
6.	GPB 225	Principles and Methods of Plant Breeding	2+1
7.	AEC 226	Agricultural Marketing, Trade and Prices	1+1
8.	STA 227	Agricultural Statistics	1+1
9.	ENG 228	Soft Skills of Employability	0+1
10.	AEG 229	Farm Power, Machinery and Renewable Energy	2+1
<b>Total</b>			<b>14+10=24</b>

**V semester**

1.	AGR 310	Climate Change and Disaster Management	1+0
2.	AGR 311	Crop Production-I	0+1
3.	ENT 312	Pests of Crops, Stored products and their Management	2+1
4.	PAT 313	Principles of Plant Disease Management	1+1
5.	AGM 314	Environmental Science	2+1
6.	SAC 315	Soil Fertility, Fertilizers and Manures	2+1
7.	GPB 316	Plant Biotechnology	2+1
8.	HOR 317	Production Technology of Fruits and Plantation Crops	2+1
9.	AEC 318	Agribusiness Management and Entrepreneurship	1+1
10.	AEG 319	Fundamentals of Soil and Water conservation Engineering	2+ 1
<b>Total</b>			<b>15+9=24</b>

**VI semester**

1.	AGR 320	Farming System and Organic Agriculture	2+1
2.	AGR 321	Crop Production-II	0+1
3.	PAT 322	Diseases of Field Crops and their Management	2+1
4.	SAC 323	Crop and Pesticide Chemistry and Nanotechnology	2+1
5.	GPB 324	Breeding of Field and Horticultural Crops	2+1
6.	HOR 325	Production Technology of Vegetables, Spices, Medicinal and Aromatic Crops	2+1
7.	AEC 326	Agricultural Finance, Banking and Co-operation	1+1
8.	AEX 327	Extension Methodologies and Transfer of Agricultural Technology	1+1
9.	AEG 328	Post Harvest and Food Engineering	1+1
10.	EXP 329	Experiential Learning - I	0+6
<b>Total</b>			<b>13+15=28</b>

**VII semester**

1.	RAWE AEX 410	Rural Awareness Work Experience	0+5
2.	RAWE AGR 411	Field Crop Production	0+3
3.	RAWE HOR 412	Horticultural Crop Production	0+2
4.	RAWE CPT 413	Crop Protection (Entomology and Plant Pathology)	0+4
5.	AEX 414	All India Study Tour	0+1
6.	AIA AEC 415	Rural Economics and Agro Industrial Attachment	0+6
<b>Total</b>			<b>0+21= 21</b>

**VIII semester**

1.	AGR 420	Agro Forestry and Dry Farming	2+1
2.	GPB 421	Principles of Seed Production, Seed Quality Regulation and Storage	2+1
3.	PAT 422	Diseases of Horticultural Crops and their Management	2+1
4.	HOR 423	Commercial Floricultural and Landscape Gardening	2+1
5.	EXP 424	Experiential Learning - II	0+6
6.	APW 425	Project work	0+2
7.	OPC 426	Optional Course	1+1
<b>Total</b>			<b>9+13=22</b>

**Abstract**

Semester	Number of Courses	Credit
I	9	6 + 9 = 15
II	10	12 + 9 = 21
III	11	16 + 9 = 25
IV	8	14 + 10 = 24
V	8	15 + 9 = 24
VI	11	13 + 15 = 28
VII	6	0 + 21 = 21
VIII	7	9 + 13 = 22
<b>Total</b>		<b>85+95 = 180</b>

**B.Sc. (Agriculture) - List of courses (Department wise)**

**Agronomy**

S. No.	Semester	Course code	Title	Credit
1.	I	AGR 110	Principles of Agronomy and Agricultural Heritage	2+1
2.	I	AGR 111	Fundamentals of Agricultural Meteorology	1+1
3.	II	AGR 120	Weed Management	1+1
4.	III	AGR 121	Irrigation Management	1+1
5.	III	AGR 210	Agronomy of Field Crops - I	2+1
6.	IV	AGR 220	Agronomy of Field Crops - II	2+1
7.	IV	AGR 221	Study Tour -I	0+1
8.	V	AGR 310	Climate Change and Disaster Management	1+0
9.	V	AGR 311	Crop Production-I	0+1
10.	VI	AGR 320	Farming System and Organic Agriculture	2+1
11.	VI	AGR 321	Crop Production-II	0+1
12.	VII	RAWE AGR 411	Field Crop Production	0+3
13.	VIII	AGR 420	Agro Forestry and Dry Farming	2+1
<b>Total</b>				<b>14+14= 28</b>

**Entomology**

S. No.	Semester	Course code	Title	Credit
1.	II	ENT 122	Fundamentals of Entomology	2+1
2.	III	ENT 211	Economic Entomology and Introductory Nematology	2+1
3.	IV	ENT 222	Insect Ecology and Principles of Pest Management	2+1
4.	V	ENT 312	Pests of Crops, Stored Products and their Management	2+1
5.	VII	RAWE CPT 413	Crop Protection (Entomology and Plant Pathology)	0+2
<b>Total</b>				<b>8+6=14</b>

**Plant Pathology**

S. No.	Semester	Course code	Title	Credit
1.	III	PAT 212	Fundamentals of Plant Pathology	2+1
2.	V	PAT 313	Principles of Plant Disease Management	1+1
3.	VI	PAT 322	Diseases of Field Crops and their Management	2+1
4.	VII	RAWE CPT 413	Crop Protection (Entomology and Plant Pathology)	0+2
5.	VIII	PAT 422	Diseases of Horticultural Crops and their Management	2+1
<b>Total</b>				<b>7+6=13</b>

**Microbiology**

Sl. No.	Semester	Course code	Title	Credit
1.	II	AGM 123	Fundamentals of Microbiology	2+1
2.	IV	AGM 223	Soil and Applied Microbiology	2+1
3.	V	AGM 314	Environmental Science	2+1
<b>Total</b>				<b>6+3 = 9</b>

**Soil Science and Agricultural Chemistry**

Sl. No.	Semester	Course code	Title	Credit
1.	I	SAC 112	Principles of Analytical Chemistry	1+1
2.	II	SAC 124	Fundamentals of Biochemistry	2+1
3.	III	SAC 213	Fundamentals of Soil Science	2+1
4.	IV	SAC 224	Soil Resource Inventory and Problem Soils	2+1
5.	V	SAC 315	Soil Fertility, Fertilizers and Manures	2+1
6.	VI	SAC 323	Crop and Pesticide Chemistry and Nanotechnology	2+1
<b>Total</b>				<b>11+6 =17</b>

**Genetics and Plant Breeding**

Sl. No.	Semester	Course code	Title	Credit
1.	I	GPB 113	Fundamentals of Plant Physiology	2+1
2.	II	GPB 125	Introduction to Agricultural Botany	1+1
3.	III	GPB 214	Principles of Genetics and Cytogenetics	2+1
4.	IV	GPB 225	Principles and Methods of Plant Breeding	2+1
5.	V	GPB 316	Plant Biotechnology	2+1
6.	VI	GPB 324	Breeding of Field and Horticultural Crops	2+1
7.	VIII	GPB 421	Principles of Seed Production, Seed Quality Regulation and Storage	2+1
<b>Total</b>				<b>13+7=20</b>

**Horticulture**

Sl. No.	Semester	Course code	Title	Credit
1.	III	HOR 215	Basic Horticulture and Plant Propagation	2+1
2.	V	HOR 317	Production Technology of Fruits and Plantation Crops	2+1
3.	VI	HOR 325	Production Technology of Vegetables, Spices, Medicinal and Aromatic Crops	2+1
4.	VII	RAWE HOR 412	Horticultural Crop Production	0+2
5.	VIII	HOR 423	Commercial Floriculture and Landscape Gardening	2+1
<b>Total</b>				<b>8+6=14</b>

**Agricultural Economics**

Sl. No.	Semester	Course code	Title	Credit
1.	II	AEC 126	Principles of Economics	1+1
2.	III	AEC 216	Production Economics and Farm Management	1+1
3.	IV	AEC 226	Agricultural Marketing, Trade and Prices	1+1
4.	V	AEC 318	Agribusiness Management and Entrepreneurship	1+1
5.	VI	AEC 326	Agricultural Finance, Banking and Co-operation	1+1
6.	VII	AIA AEC 415	Agro Industrial Attachment	0+6
<b>Total</b>				<b>5+11=16</b>

**Agricultural Extension**

Sl. No.	Semester	Course code	Title	Credit
1.	II	AEX 127	Fundamentals of Rural Sociology and Educational Psychology	1+1
2.	III	AEX 217	Dimensions of Agricultural Extension	1+1
3.	VI	AEX 327	Extension Methodologies and Transfer of Agricultural Technology	1+1
4.	VII	RAWE AEX 410	Rural Awareness Work Experience	0+5
5.	VII	AEX 414	All India Study Tour	0+1
<b>Total</b>				<b>3+9=12</b>

**Animal Husbandry**

Sl. No.	Semester	Course code	Title	Credit
1.	III	AHS 218	Livestock and Poultry Management	2+1

**Statistics**

Sl. No.	Semester	Course code	Title	Credit
1.	IV	STA 227	Agricultural Statistics	1+1

**Engineering**

Sl. No.	Semester	Course code	Title	Credit
1.	I	COM 128	Fundamentals of Information Technology	1+1
2.	IV	AEG 229	Farm Power, Machinery and Renewable Energy	2+1
3.	V	AEG 319	Fundamentals of Soil and Water Conservation Engineering	2+ 1
4.	VI	AEG 328	Post Harvest and Food Engineering	1+1
<b>Total</b>				<b>6+4=10</b>

**Languages (Tamil and English)**

Sl. No.	Semester	Course code	Title	Credit
1.	II	TAM 114 (OR) ENG 114	jkpH; ,yf;fpa';fspy; ntshz;ika[k; mwptpay; jkpH;g; gad;ghL k; (OR) <b>Development Education</b>	0+1
2.	I	ENG 115	English for effective Communication	0+1
3.	VI	ENG 228	Soft Skills of Employability	0+1
<b>Total</b>				<b>0+3=3</b>

**Common Courses**

Sl. No.	Semester	Course code	Title	Credit
1	I	PED 116	Physical Education	0+1
2	I	PED 117	Principles and practices of Yoga	0+1
3	I	NSS/NCC 118	National Service Scheme / National Cadet Corps	0+1
4	VI	EXP 329	Experiential Learning - I	0+6
5	VIII	EXP 424	Experiential Learning - II	0+6
6	VIII	APW 425	Project work	0+2
7	VIII	OPC 426	Optional Course	1+1
<b>Total</b>				<b>1+18=19</b>



### Abstract

<b>Departments</b>	<b>Credit hours</b>
<b>Agronomy</b>	<b>14 + 14 = 28</b>
<b>Entomology</b>	<b>8 + 6 = 14</b>
<b>Plant Pathology</b>	<b>7 + 6 = 13</b>
<b>Microbiology</b>	<b>6 + 3 = 9</b>
<b>Soil Science and Agricultural Chemistry</b>	<b>11 + 6 = 17</b>
<b>Genetics and Plant Breeding</b>	<b>13 + 7 = 20</b>
<b>Horticulture</b>	<b>8 + 6 = 14</b>
<b>Agricultural Economics</b>	<b>5 + 11 = 16</b>
<b>Agricultural Extension</b>	<b>3 + 9 = 12</b>
<b>Animal Husbandry</b>	<b>2 + 1 = 3</b>
<b>Statistics</b>	<b>1 + 1 = 2</b>
<b>Engineering</b>	<b>6 + 4 = 10</b>
<b>Languages (Tamil, English)</b>	<b>0 + 3 = 3</b>
<b>Common Courses</b>	<b>1 + 18 = 19</b>
<b>Total</b>	<b>85 + 95 = 180</b>

**ANNAMALAI UNIVERSITY  
FACULTY OF AGRICULTURE  
B.Sc. (Ag.) SYLLABUS FOR THE YEAR 2017-2018**

**AGR 110 PRINCIPLES OF AGRONOMY AND AGRICULTURAL HERITAGE (2 +1)  
OBJECTIVES**

Principles of Agronomy and Agricultural Heritage deal with principles and practices of crop production. To learn about the history of agriculture and agricultural development from ancient to modern age.

**THEORY**

**Unit – I : Introduction to Agriculture**

Agriculture – Definition – Importance and scope - Branches of agriculture - Agronomy – Definition – Meaning and scope. National and International Agricultural Research Institutes . Indian economy – National income . Role of women in agriculture.

**Unit – II: History of Agriculture Development**

History of Agricultural development in world and India. Agricultural heritage – Agriculture in ancient India – Evolution of man and agriculture – Development of scientific Agriculture - Stages of agriculture development - Era of civilization-Importance of Neolithic civilization - Chronological agricultural technology development in India. Kautilya's Arthasasthra – Thirukural - Sangam literature - ITK -Tamil Almanac and rainfall prediction.

**Unit – III : Crop Classification and Crop Production**

Crops and their classification– Economic importance. Major crops of India and Tamil Nadu. Major soils of India and Tamil Nadu . Factors affecting crop production – climate - edaphic- biotic - physiographic and socio economic factors. Seasons – Agricultural seasons of India and Tamilnadu. Tillage – Definition - Types- Objectives - Modern concepts of tillage.

**Unit – IV: Basic Agricultural Operations**

Seed rate- Seed treatment. Nursery . Sowing methods . Germination – Factors affecting germination . Plant population and geometry - effect on growth and yield. After cultivation – Thinning - Gap filling . Weeds – Definition – Beneficial and Harmful effects of weed. Irrigation and its role on plant growth. Manures and fertilizers – Time and methods of application – slow release nutrients - ways to improve FUE - INM – concepts and advantages.

**Unit – V : Harvesting and Storage**

Maturity symptoms of field crops – methods of harvesting – Cleaning and drying - methods of storage.

**PRACTICAL**

Visit to Experimental farm –Identification of seeds and crops- Crop classification. Identification and study of manures and fertilizers - working out seed rate - Study of seed treatment practices. Study of tillage implements (primary, secondary and special purpose)- Practicing methods of fertilizer applications and its calculations - Different methods of sowing - Study of seeding implements - Study of inter-cultivation implements and practice - Participation in ongoing field operations.

**THEORY LECTURE SCHEDULE**

1. Agriculture – Definition –Agriculture as Art, science and Business
2. Importance and scope of agriculture in India and Tamilnadu
3. Branches of agriculture
4. Agronomy – definition – meaning and scope
5. National and International Agricultural Research Institutes in India
6. Indian agriculture- Indian economy – National income– Agricultural income in GDP
7. Women in agriculture and empowerment
8. History of agricultural development in the world and India
9. Agricultural heritage – Agriculture in ancient India and Evolution of man
10. Development of scientific agriculture
11. Stages of agriculture development - Era of civilization
12. Importance of Neolithic civilization

13. Chronological agricultural technology development in India
14. Kautilya's Arthasasthra - Sangam literature
15. Tamil Almanac and rainfall prediction- ITK
16. Agronomic classification of crops
17. Economic and agricultural importance of crops in Tamil Nadu and India
18. Mid-semester Examination
19. Major crops of India and Tamil Nadu
20. Major soils of India and Tamil Nadu
21. Factors affecting crop production – climatic – edaphic - biotic- physiographic and socio economic factors
22. Tillage – Definition – objectives -Types of tillage
23. Field preparation - Modern concepts of tillage
24. Seeds - Seed rate – Seed treatment- Different methods of sowing
25. Germination –Factors affecting germination
26. Crop stand establishment – Plant Population and geometry
27. Inter cultivation - Thinning - gap filling and other intercultural operations
28. Weeds – Definition –beneficial and harmful effects of weeds
29. Irrigation and its impact on plant growth
30. Role of manures and fertilizers in crop production
31. Method of fertilizer application – slow release nutrients
32. Ways to improve FUE and concepts of INM
33. Maturity symptoms of field crops and methods of harvesting
34. Cleaning, drying and storage of field crops

#### **PRACTICAL SCHEDULE**

1. Visit to college farm to observe wet land, garden land and dry land farming systems
2. Identification of principle crops and seeds
3. Identification of manures and fertilizers
4. Identification of agrochemicals and their usage
5. Identification of green manures and green leaf manures and practicing incorporation methods
6. Identification of tools and implements-Acquiring skill in handling these implements
7. Identification of secondary tillage implements-Acquiring skill in handling these implements
8. Study of labour saving and special purpose implements
9. Practicing different methods of Seed treatments -Nursery preparation
10. Study on different methods of sowing and practicing seeding implements
11. Practicing application methods of manures and fertilizers
12. Acquiring skill in foliar fertilization
13. Calculation on plant population and working out seed rates
14. Practicing thinning, gap filling operations and intercultural operations
15. Working out fertilizer requirement of crops
16. Maturity symptoms and harvesting methods.
17. Orientation for final examination

#### **REFERENCE BOOKS**

1. Balasubramanian, P. and SP.Palaniappan, 2010. Principles and Practices of Agronomy. Agrobios. Jodhpur - 342 002.
2. Sudhagar Rao, G.B., M. Thirupathi., C.Ravikumar and K.P.Senthilkumar, 2015. Basic Agronomy, Manibharathi Publications, Chidambaram.
3. Chandrasekaran, B., K. Annadurai and E. Somasundaram. 2010. A Textbook of Agronomy. New Age International Publishers, New Delhi.
4. ICAR. 2011. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.
5. Panda, S.C. 2010. Agronomy. Agro bios (India), Jodhpur - 342 002.
6. Reddy, S.R. 2009. Principles of Agronomy. Kalyani Publishers, New Delhi
7. Yellamananda Reddy, T. and Sankara Reddi, G.H. 2010. Principles of Agronomy. Kalyani Publishers, New Delhi.

#### **e-resource**

1. [http://www.hillagric.ac.in/edu/coa/agronomy/lect/Teaching\\_Manual\\_on\\_Introductory\\_Crop\\_Production.pdf](http://www.hillagric.ac.in/edu/coa/agronomy/lect/Teaching_Manual_on_Introductory_Crop_Production.pdf)
2. [http://www.dphu.org/uploads/attachements/books/books\\_2248\\_0.pdf](http://www.dphu.org/uploads/attachements/books/books_2248_0.pdf)
3. <https://www.scribd.com/doc/119183030/PRINCIPLES-OF-AGRONOMY-AND-AGROMETEROLOGY>
4. <http://www.newagepublishers.com/samplechapter/001757.pdf>
5. [http://www.sun.worldcat.org/title/principles\\_of\\_agronomy/oclc/689265](http://www.sun.worldcat.org/title/principles_of_agronomy/oclc/689265)

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

#### **OBJECTIVES**

This course is scheduled to study the problems of plant growth and yield in relation to environmental factors. Agricultural 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 – List of extreme points with the Co-ordinates of India and Tamil Nadu - Atmosphere - Composition and vertical layers of atmosphere (stratification) - Climate - Weather - Factors affecting climate and weather - Climatic types - Different agricultural seasons of India and Tamil Nadu .

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

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

##### **Unit- III : Atmospheric pressure**

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

##### **Unit -IV: Clouds and Precipitation**

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

##### **Unit -V: Agro climatic zones and weather forecasting**

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

#### **PRACTICAL**

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

#### **THEORY LECTURE SCHEDULE**

1. Meteorology - - Definition, their importance and scope in crop production.
2. Extreme points / Coordinates of India and Tamil Nadu. Atmosphere - Composition of atmosphere - Vertical layers of atmosphere based on temperature difference / lapse rate.
3. Climate and weather - Factors affecting climate and weather. Macroclimate - Mesoclimate - Microclimate - Definition and their importance
4. Solar radiation - solar constant and energy balance - Wave length characteristics and their effect on crop production - Light – effect of intensity, quality, direction and duration on crop production.
5. Air temperature - Factors affecting temperature. Diurnal and seasonal variation in air temperature – Isotherm, Heat unit and its use - Heat and cold injuries.

6. Role of temperature in crop production. Soil temperature - Importance in crop production. Factors affecting soil temperature, diurnal and seasonal variation in soil temperature.
7. Humidity – Types - Dew point temperature - Diurnal variation in Relative humidity and its effect on crop production – Wind and its role on crop production.
8. Atmospheric pressure, diurnal and seasonal variation - causes for variation - Isobar - Low, depression, anticyclone, Tornado, hurricane.
9. Mid Semester Examination
10. Precipitation - Forms of precipitation - Isohyet - Monsoon – Different monsoons of India - Rainfall variability - Drought and flood – Impact on crop production.
11. Evaporation - Transpiration, evapotranspiration - Potential evapotranspiration / references crop ET<sub>o</sub> - Definition and their importance in agricultural production.
12. Weather forecasting / Warming - Types, importance, Agro Advisory Services, Agromet services for India
13. Agro climatic zones of Tamil Nadu - Agro climatic normals for field crops.
14. Synoptic chart
15. Crop weather calendar.
16. Remote sensing and its application on crop production.
17. Effect of weather and climate on crop production, soil fertility and incidence of pest and diseases.

#### **PRACTICAL SCHEDULE**

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

#### **REFERENCE BOOKS**

1. Ghadekar, S.R. 2008. Text book on Agro meteorology. Agromet Publishers, Nagpur.
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.

**e-resource**

1. <http://eslamian.iut.ac.ir/sites/eslamian.iut.ac.ir/files/u125/agrometeorology.pdf>
2. [http://www.wmo.int/pages/prog/wcp/agm/gamp/documents/WMO\\_No134\\_en.pdf](http://www.wmo.int/pages/prog/wcp/agm/gamp/documents/WMO_No134_en.pdf)
3. <https://www.scribd.com/doc/119183030/PRINCIPLES-OF-AGRONOMY-AND-AGROMETEROLOGY>

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

**OBJECTIVES**

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

**THEORY**

**Unit I: Analytical Principles**

General principles of analytical chemistry – common analytical methods – qualitative and quantitative analysis – accuracy and precision of analytical results-Preparation of laboratory reagents.

**Unit II: Standards and Indicators**

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

**Unit III: Gravimetric Analysis**

Gravimetric analysis – principles of precipitation reactions– solubility product – common ion effect – conditions of precipitation – choice of filters -washing solutions.

**Unit IV: Instrumentation**

Instrumental analysis – principles and practices of potentiometry, conductometry, colorimetry, spectrophotometry, absorption and emission spectroscopy and chromatography – choice of analytical methods.

**Unit V: Radiation Chemistry**

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

**PRACTICAL**

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

**THEORY LECTURE SCHEDULE**

1. General principles in analytical chemistry – common analytical methods – quantitative and qualitative analysis –Accuracy and precision of analytical results.
2. Preparation of laboratory reagents – digestion and distillation techniques.
3. Volumetric analysis – preparation of primary standard solutions.
4. Volumetric analysis – preparation of primary and secondary standard solutions – standardization.
5. Theory of indicators and buffers. Preparation of indicator and buffer solutions.
6. Theory of acidimetry, alkalimetry, oxidimetry, complexometry and thiocyanometry – titration curve.
7. Gravimetric analysis – Principles – techniques.
8. Precipitation – solubility product – common ion effect – conditions of precipitation.
9. Mid Semester Examination.
10. Filtration and choice of filters – washing – washing solutions and washing technique.
11. Instrumental methods of analysis- Principles and practices of potentiometry, conductometry, colorimetry and spectrophotometry.

12. Principles and practices of absorption and emission spectroscopy-ICPA
13. Principles and practices of chromatography – Paper chromatography, Gas Chromatography, TLC, HPLC and HPTLC.
14. Radiation chemistry – radioactivity.
15. Radiation – detection and measurement of radio activity – radiological safety.
16. Stable isotopes – Mass spectroscopic measurements and their application in agricultural research.
17. Use of radioactive and stable isotopes in analytical applications.

#### **PRACTICAL SCHEDULE**

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

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

#### **OBJECTIVES**

To impart basic knowledge on various functions and processes related to crop production, mineral nutrition, plant growth regulators and environmental stresses.

#### **THEORY**

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

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

stomatal pore- mechanisms of stomatal opening and closing – guttation – antitranspirants.

#### **Unit II: Plant Mineral Nutrition**

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

#### **Unit III: Photosynthesis and Respiration**

Light reaction – Photosystems- red drop and Emerson enhancement effect- Photolysis of water and photophosphorylation - Photosynthetic pathways – C<sub>3</sub> and C<sub>4</sub>, CAM – difference between three pathways - Factors affecting photosynthesis- Photorespiration – pathway and its significance - Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations - Glycolysis – TCA cycle - Oxidative phosphorylation – difference between photo and oxidative phosphorylation – energy budgeting - respiratory quotient.

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

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

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

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

#### **PRACTICAL**

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

#### **THEORY LECTURE SCHEDULE**

1. Importance of Crop Physiology in Agriculture – Structure of plasma membrane, chloroplast, mitochondria, peroxisome and vacuole
2. Structure and role of water –water potential and its components – Diffusion – Osmosis – imbibition – Plasmolysis - Field Capacity and Permanent Wilting Point
3. Mechanisms of water absorption – Pathways of water movement – Apoplast and symplast
4. Translocation of water – ascent of sap – mechanisms of xylem transport
5. Transpiration – significance – structure of stomata - mechanisms of stomatal opening and closing – guttation - antitranspirants
6. Mineral nutrition – criteria of essentiality - classification of nutrients – macro, micro, mobile and immobile – mechanism of nutrient uptake
7. Physiological functions and disorders of macro nutrients – Hidden hunger
8. Physiological functions and disorders of micro nutrients
9. Foliar nutrition- root feeding and fertigation – sand culture, hydroponics and aeroponics
10. Light reaction – photolysis of water and photophosphorylation



11. Photosynthetic pathways – C<sub>3</sub> and C<sub>4</sub> cycles
12. CAM pathway – difference between three pathways - Factors affecting photosynthesis.
13. Photorespiration – pathway and its significance
14. Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations
15. Glycolysis – TCA cycle
16. Oxidative phosphorylation – difference between photo and oxidative phosphorylation – energy budgeting - respiratory quotient
17. Growth – phases of growth – factors affecting growth – Hormones- classifications
18. Mid Semester Examination
19. Biosynthetic pathway and role of auxins
20. Biosynthetic pathway and role of gibberellins and cytokinin
21. Biosynthetic pathway and role of ethylene and ABA
22. Novel growth regulators – Brassinosteroids and salicylic acid – New Generation PGR's
23. Growth retardants and inhibitors -commercial uses of PGR's
24. Photoperiodism - short, long and day neutral plants – Chailakhyan's theory of flowering
25. Forms of phytochrome - Pr and Pfr - regulation of flowering
26. Vernalisation - theories of vernalisation – Lysenko and Chailakhyan's theories
27. Seed germination - physiological and biochemical changes - seed dormancy and breaking methods
28. Senescence and abscission – physiological and biochemical changes
29. Physiology of fruit ripening- climacteric and non climacteric fruits - factors affecting ripening and manipulations
30. Drought - physiological changes - adaptation – compatible osmolytes - alleviation
31. High and low temperature stress – physiological changes - membrane properties - adaptation
32. Salt stress - physiological changes - adaptation – compartmentalization - alleviation
33. Flooding and UV radiation stresses – physiological changes - adaptation
34. Global warming – green house gases –physiological effects on crop productivity- Carbon Sequestration

#### **PRACTICAL SCHEDULE**

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

#### **REFERENCE BOOKS**

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2. Jain, V.K. 2007. Fundamentals of plant physiology, S.Chand and Company Ltd., New Delhi.
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4. [www.plantphysiol.org](http://www.plantphysiol.org)

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

bjhy;fhg;gpak; fhL;Lk; Kjw;bghUs;/ fUg;bghUs; - r';f ,yf;fpaj;jpy; ntshz; bjhHpy; El;g';fs; - gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ik mwptpay; - gs;S ,yf;fpa';fs;/ VbuGgJ/ ,yf;fpaj;jpy; ntshz; bghwpapay; - njhl;ltpay; - tdtpay; kidapay; - NHypay; ntshz;ikg; gHbkhHpfs; - ,yf;fpak; fhL;Lk; thH;tpay; bewpKiwfs; - ,f;fhy ,yf;fpa';fspy; ntshz;ikr; rpe;jidfs; - gpiHapd;wp vGJk; Kiwfs; - ,yf;fpaj;jpy; bkd;jpwd;fs; - mwptpay; jkpH; tsh;r;rp epiyfs; fiyr;brhy;yhf;fk; - bkhHp bgah;g;ghsh; - Ml;rpj; jkpH; - cHth;fSf;fhd mwptpg;g[fiS btspapLjy; - fl;Liur; RUf;fk; vGJjy; - fzdpp cyfpy; jkpH;

**bra;Kiwg; gapw;rpfs;**

1. bjhy;fhg;gpak; fhL;Lk; Kjw;bghUs;/ fUg;bghUs; tHp ntshz; kug[fiS mwpyj;
2. r';f ,yf;fpaj;jpy; ntshz; bjhHpy; El;g';fs; - (vl;Lj;bjhif/ gj;Jg;ghL;L)
3. gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ik mwptpay;
4. gs;S ,yf;fpa';fs;/ VbuGgJ - cHth; thH;tpay; bewpKiwfSk; ntshz;ikj; bjhHpy; El;g';fSk;
5. ,yf;fpaj;jpy; ntshz; bghwpapay; - njhl;ltpay; - tdtpay; - kidapay; - NHypay;
6. ntshz;ikg; gHbkhHpfs; - cHt[ tpj mwptpay; - ehw;W eLjy; - vU ,Ljy; - ePh;g;ghrdk; - fis nkyhz;ik - gaph;ghJfhg;g[ - mWtil - cHth; rKjhak;
7. ,yf;fpak; fhL;Lk; thH;tpay; bewpKiwfs;
8. ,f;fhy ,yf;fpa';fspy; ntshz;ikr; rpe;jidfs; - ghujp/ ghujpjhrd; gilg;g[fs; - g[Jf;ftpij - rpWfij - gjjpdk;
9. ,ilepiyg; gUtj;njh;t[
10. gpiHapd;wp vGJk; Kiwfs; - vGj;Jg; gpiHfs; - brhw;gpiHfs; - brhw; gphpg;g[g;gpiH - thf;fpag;gpiH - bka;g;g[; jpUj;jk;
11. ,yf;fpaj;jpy; bkd;jpwd;fs; - jiyikg;gz;g[ - fhy nkyhz;ik
12. MSikg;gz;g[ nkk;ghL - kdpj cwt[j;wpwd;fs; tsh;j;jy;
13. mwptpay; jkpH; tsh;r;rp epiyfs;/ ntshz; E}y;fs;/ ntshz; ,jH;fs;
14. fiyr;brhy;yhf;fk; - ntshz; fiyr; brhw;fis cUthf;Fk; Kiw - jug;gLj;Jjy; - ,yf;fpa ntshz; fiyr;brhw;fs;/ tl;lhu ntshz;ik tHf;Fr; brhw;fs; - mfuhjpapay;
15. bkhHp bgah;g;g[ - Kf;fpa tpjpf; - goepiyfs; - bkhHp bgah;ghshpd; ,d;wpaikahg; gz;g[fs; - ntshz; bra;jpfis bkhHp bgah;j;jy;
16. Ml;rpj; jkpH; - murhizfs; mYtyf; foj';fs; - cHth;fSf;fhd mwptpg;g[f;fis btspapLjy; - fl;Liur; RUf;fk; vGJjy;
17. fzdpp cyfpy; jkpH; - xU';F FwpaPL gapw;Wtpj;jy; - tiyg; g[f;fs; - tpf;fpgPoah - ntshz; bra;jpfisg; gjpntw;wk; bra;jy; - ntshz; bra;jpfis ,izajs tHp mwpyj;

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

- fe;jrhkp.,y.br.ntshz;ika[k; gz;ghLk;/ jkpH;ehL ntshz;ikg; gy;fiyf;fHfk;/ nfhak;g[;J}h;/ 1974
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- kPdhl;rp Re;juk;. kh. kw;Wk; V.,y.tprayl;Rkp jfty; bjhlh;gpy; jkpH; bkhHpg;gad;ghL/ nf.Mh;.v.Mg;brl; gphpz;lh;/ nfhit - 2002
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- ,yf;fpaKk; ntshz;ika[k;/ midj;jpe;jpa mwptpay; jkpH;f; fHfk;/ j";rht{h;:/ 2006
- jkpHhpd; kug[r;bry;t';fs;/ cyfj; jkpHuha;r;rp epWtdk;/ brd;id
- re;jpunrud;/ ,uh/ bkhHpg;ghl; - gilg;ghf;fj;wpwd; tsh;j;jy;
- ntshz;fiyr;brhy; ngufuhjp/ jkpH; ehL ntshz;ikg; gy;fiyf;fHfk;/ nfhak;g[;J}h;/ 2008.
- ghnte;jd;/ ,uh/ jkpHpy; mwptpay; ,jH;fs;/ rhKnty;/ @gp#; fpwpd; gjpg;gfk;/ nfhak;g[;J}h;
- lh;f;lh; ,uhjh bry;y;gd;/ fiyr;brhy;yhf;fk;/ jkpH;g; gy;fiyf;fHfk;/ j";rht{h;

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

**OBJECTIVES**

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

**LECTURE SCHEDULE**

1. Basic principles of learning. Binary terms viz – growth and development, education – for – life and life – long education, motivation and morale –
2. Occupation and profession, training and education, lateral thinking and convergent thinking, teaching and learning – discussion.
3. Bloom’s classification of educational objectives – Cognitive, Affective, Psychomotor domain(s)
4. Career development – opportunity for graduates of agriculture and allied sciences – discussion
5. Success story of a farmer / entrepreneur – factors involved – role – play
6. Brainstorming – Demonstration
7. Simulation – Educational Simulation-Interactive Teaching - Business Simulation – Company’s annual report for analysis
8. Interpersonal communication – Transactional communication – ice breaker
9. Mid semester examination
10. The conduct of a symposium
11. Conferencing – the concept and presentation of a paper
12. Scientific Article Writing and Editing
13. Popular Article Writing, Editing and Blogging
14. Project proposal
15. Project Report – writing
16. Entrepreneur – intrapreneur – Managing an intrapreneur – motivation and entrepreneurship development – planning, monitoring and evaluation.
17. Orientation for final examination

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

### OBJECTIVES

To make the students competent in Listening – Receptive skill, Speaking – Productive skill, Reading - Receptive skill and Writing - Productive skill

#### Unit I - LISTENING

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

#### Unit II - SPEAKING

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

#### Unit III - READING

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

#### Unit IV - WRITING

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

#### Unit V

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

### PRACTICAL SCHEDULE

1. Introduction - Listening vs Hearing - listening modes - Types of listening - Intensive and Extensive Listening
2. Process of Listening - methods of enhancing listening
3. Barriers of listening - Note-taking
4. English Phonology - Influence of Language 1 on Language 2
5. English Stress and Intonation
6. Principles of speech preparation
7. Presentation skills
8. Techniques of speaking
9. Mid semester examination
10. Introduction to reading - Types - Scanning and Skimming -Idea reading (Reading for information) - Exploratory reading -Study reading (Text reading) - Critical reading - Analytical reading - Note-making-précis writing.
11. Word formation( prefix , suffix and word coining) - Word expansion ( root word and etymology) -Compound words - Single word substitute -Abbreviations and Acronyms
12. Sentence agreement - Sentence completion - Sentence correction - Writing definitions
13. Writing Practice -Mind mapping - sentence writing - Logical arrangement of sentences
14. Paragraph writing - techniques - Thesis sentence writing – Inferential sentence writing – coherence and cohesion in writing
15. Letter Writing – Types of letters
16. Text conversion- Interpreting charts, graphs diagrams into text - Poster making - Essay writing ( types of essays)
17. Orientation for final examination

### REFERENCE BOOKS

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| 3. <a href="http://www.eflweb.com">www.eflweb.com</a>                              | 4. <a href="http://www.softskills.com">www.softskills.com</a>                    |
| 5. <a href="http://www.teachingenglish.org.uk">www.teachingenglish.org.uk</a>      | 6. <a href="http://www.reportingskills.com">www.reportingskills.com</a>          |
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| 9. <a href="http://www.onestopenglish.com">www.onestopenglish.com</a>              | 10. <a href="http://www.negotiation.com">www.negotiation.com</a>                 |
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| 15. <a href="http://www.angelfire.com">www.angelfire.com</a>                       | 16. <a href="http://www.timethoughts.com">www.timethoughts.com</a>               |
| 17. <a href="http://www.primesl.com">www.primesl.com</a>                           | 18. <a href="http://www.appliesl.com">www.appliesl.com</a>                       |
| 19. <a href="http://www.learnbusinessEnglish.com">www.learnbusinessEnglish.com</a> | 20. <a href="http://www.teachersdesk.com">www.teachersdesk.com</a>               |
| 21. <a href="http://www.bogglesworld.com">www.bogglesworld.com</a>                 | 22. <a href="http://www.flexiblelearning.net.au">www.flexiblelearning.net.au</a> |

**PED 116 PHYSICAL EDUCATION (0+1)**

**OBJECTIVES**

Exercises for strength, agility, co-ordination, flexibility, co-operation, vitalcapacity endurance, speed and for various systems of our body and team spirit.

Exercise for Good Posture – Conditioning and calisthenics for various Athletic activities *i.e* (a) Before start – Arm stretch, hand stretch and cat stretch (b) Loosening up jogging, bending and twisting (c) Standing – Lateral Arc, triangle and hands to feet pose (d) Sitting – camel kneel, spinal twist and supine knee bend (e) Relaxation – The corpse pose, quick and deep relaxation. Basic gymnastic exercises – participation of athletic events – running, throwing and jumping events.

**SKILL DEVELOPMENT IN ANYONE OF THE FOLLOWING GAMES**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

#### **ATHLETICS**

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

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

(c) **Throws** : Grip, momentum, pre shift, sub phase, the wind up, foot work, entry to the turn, shift, angle of release, follow throw, delivery, front cross step, rear cross step, hop step, fuck method pary obraine, discoput, rotation, carry and glide.

(d) **Hurdles** : Finding lead leg, use of lead leg and trial leg, flight, clearing, finish.

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

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

##### **OBJECTIVES**

To inculcate the basics of yoga for the rejuvenation of body, mind and intellect.

##### **PRINCIPLES (20 hrs)**

###### **UNIT I**

Introduction to yoga : The origins of yoga – Definitions – concepts – Aims and objectives of yoga – Five principles of yoga – yoga Diet – Classification of Diet

###### **UNIT II**

Streams of yoga : Karma yoga – Bhakti yoga – Jnana yoga – Raja yoga (Astanga yoga)

###### **UNIT III**

Hatha yoga techniques: Introduction – meaning – Definition – Techniques- Asana -

Pranayama – Mudra – Bandha and Shat Kriya

###### **UNIT IV**

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

###### **UNIT V**

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

##### **PRACTICAL SCHEDULE (40 hrs)**

1. Prayer - Starting and closing
2. Breathing practices for awareness : Hands in and out breathing,-Hand stretch breathing- Ankle breathing
3. Preparatory practices: Loosening practices- Forward and backward bending – Lateral bending-Alternate toe touching-spinal twisting; Jogging-Forward-Backward and Sideward
4. Suryanamaskar – Start with prayer/mantra – 12 poses

5. Asana: Standing –Periyaasana, Padhastasana, Trikonasana; Siting – Vajrasana, Paschimotasana, Ushtrasana, Vakrasana; Prone – Makrasana; Bhujangasana, Shalabasana, Dhanurasana; Supine – Uttanapadasana, Sarvangasana, Matyasana, Halasana, Chakrasana, Savasana
6. Pranayama –Kapalabathi, Sectional Breathing, Nadi Shuddhi, Sitkari, Sadanta, Nada-Anu-Sandana
7. Mudra – Chin mudra, Chinmaya mudra, Adhi mudra, Brahma mudra, Namaskara mudra, Maha mudra, Vishnu mudra/Nasiga mudra, Yoga mudra
8. Bandha - Jalandra Bandha, Uddiyana Bandha, Moola Bandha
9. Kriya - Kapala pathi, Trataka-Jothi trataka, Jatru trataka; Neti-Jala neti, Sutra neti; Dhouti –Vamana dhouti
10. Dhayana practice – Meditation
11. Relaxation –Instant relaxation technique (IRT); Quick relaxation technique (QRT); Deep relaxation technique (DRT)
12. Practical record preparation

#### REFERENCE BOOKS

1. Rajayoga – Swamy Vivekananda, Ramakrishnan Ashrama Publication, 1998
2. Shivananda Saraswati, Yoga Therapy, Bihar School of yoga, Munger, 1998
3. Swami Satyananda Saraswati, Asana, Pranayama, Mudra and Bandha, Bihar School of Yoga , Munger, 2002
4. Swami Vishnu Devananda, Mantra and Meditation, International Sivananada Yoga centre, 2002
5. Hatha yoga Pradipika, Swami Satyananda Saraswati, Bihar School of Yoga , Munger, 2004

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

##### NATIONAL SERVICE SCHEME (NSS)

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

##### PRACTICAL SCHEDULE

1. Orientation of NSS volunteers and programme coordinator and Programme officers.
2. Origin of NSS in India and its development
3. NSS motto, symbol and NSS awards
4. Organizational set up of NSS at Central, State University and college levels.
5. Programme planning – Theme of the year – planning implementation at PC, PO and NSS volunteer level.
6. Visit to selected village - gathering basic data on socio economic status.
7. Participatory rural appraisal – studying the needs of the target group.
8. Visit of urban slum and gathering data on socio economic status.
9. Self involvement and methods of creating rapport with the target group.
10. Awareness campaign on welfare schemes of the central and state government.
11. Formation career guidance group with NSS volunteers and students welfare unit
12. Cycle rally on environmental protection.
13. Campus development activities – clean environment campaign, formation of plastic free zones.
- 14 – 17: Campus development, tree planting maintenance and greening the campus cleaning.

##### NATIONAL CADET CORPS (NCC)

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

## **PRACTICAL SCHEDULE**

- 1. NCC song – Aims and Motto of NCC – Motivation of cadets**
- 2. History of NCC and organization of NCC**
- 3. Food drill – General and word of Command**
- 4. Human Resource Development – Motivation – Duties of Good citizen**
- 5. National Integration – Indian History and Culture**
- 6. Health and Hygiene – Structure and Function of a human body, hygiene and Sanitation**
- 7. Social Service – weaker sections of our society and their needs**
- 8. Self Defence – Theory and practice, prevention of untoward incidence**
- 9. Map reading – introduction to map, and lay out of map**
- 10. Disaster Management Civil defence organization and its duties**
- 11. Communication – Different types – media**
- 12. Signals – introduction to radio, telephony procedures**
- 13. Field Engineering – principles and applications, camouflage and concealment**
- 14. Adventure training introduction, different types**
- 15. First Aid – methods and practices**
- 16. Environment and Ecology – conservation**
- 17. Besides the above schedule, NCC cadets will be involved during important occasions during convocation, Independence day, Republic day, etc.**



**II SEMESTER**  
**AGR 120 WEED MANAGEMENT (1+1)**

**OBJECTIVES**

Basic understanding on the biology and ecology of weeds. Equipping with the concepts and principles of weed control and management. Exposure to different scientific advancement in the field of weed science

**THEORY**

**Unit-I : Weed biology and ecology**

Weeds: Introduction, Definitions; harmful and beneficial effects, classification, propagation, dissemination and weed seed dormancy; Weed biology and ecology; Critical periods of crop weed competition and allelopathy.

**Unit-II : Principles of weed Management**

Concepts of weed prevention, control and eradication; Methods of weed management: Cultural, Mechanical, chemical, biological and biotechnological methods; Integrated weed management.

**Unit-III : Herbicides**

Herbicides: Definition - advantages and limitation of herbicide usage in India; Herbicide classification, formulations, methods of application; Introduction to Adjuvants and their use in herbicides.

**Unit-IV : Behaviour of herbicides and Herbicide resistance**

Introduction to selectivity of herbicides; Herbicide absorption and translocation; Compatibility of herbicides with other agro chemicals – Mechanism of action of herbicides - Herbicide persistence and degradation, Herbicide residue management and Herbicide resistant crops.

**Unit-V : Weed management**

Weed management in field crops; aquatic, problematic, invasive alien weeds and their management.

**PRACTICAL**

Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; weed seed bank; Biology of problematic weeds; Acquiring skill in mechanical and cultural methods of weed management, use of tools and implements; Calculations on weed indices; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipments and calibration; Methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Economics of weed management practices. Designing integrated weed management practices for various crops.

**THEORY LECTURE SCHEDULE**

1. Weeds – Definition, classification and characteristics, harmful and beneficial effect of weeds.
2. Classification and characteristics of weeds of different agro ecosystems – lowland weeds, irrigated upland and rainfed land weeds.
3. Classification and characteristics of weeds – Aquatic, parasitic and obnoxious weeds.
4. Life cycle of weeds, weed migration, weed seed distribution.
5. Weed dormancy, germination, establishment and perennation of weeds in different ecosystems.
6. Crop weed interactions – Critical crop weed competition, competitive and allelopathic effects of weeds and crops.
7. Principles and methods of weed management: Preventive, cultural, mechanical.
8. Principles and methods of weed management: chemical, biological and alternate methods.
9. Mid Semester Examination
10. Classification and characteristics of herbicides and herbicide formulations – History and Development.
11. Herbicide Use Efficiency – Adjuvants, herbicide protectants and antidotes – Herbicide and herbicide mixtures in India – Interaction with moisture, fertilizer and other agrochemicals.
12. Mode of action of herbicides and their selectivity – Mechanism of action of herbicides and their selectivity.

13. Herbicide persistence and degradation in plants and soils – Herbicide residue and management.
14. Herbicide resistant weeds and their impact on weed management.
15. Success of Herbicide Resistant Crops (HRC) in Indian and World agriculture.
16. IWM in crops and cropping systems – Agricultural Crops, Horticultural Crops.
17. Invasive alien weeds.

#### **PRACTICAL SCHEDULE**

1. Identification, classification and characterization of terrestrial weeds.
2. Identification, classification and characterization of aquatic weeds.
3. Identification, classification and characterization of problem and parasitic weeds.
4. Estimation of soil weed seed bank.
5. Study on seed production potential of problematic weeds
6. Weed survey and weed vegetation analysis – density, dominance, frequency, SDR and IVI.
7. Practicing skill development on cultural and non - chemical weed management.
8. Identification, classification and characterization of herbicides.
9. Practicing Skill development on herbicide application techniques.
10. Practicing Skill development on spray equipments.
11. Spray fluid calibration and calculation of herbicide quantity and recommendation for different eco systems.
12. Study on phytotoxicity symptoms of herbicides in different crops, visual scoring
13. Calculations on weed indices.
14. Herbicide residue determination by bioassay techniques.
15. Study of Integrated Weed Management
16. Economic analysis of different weed management methods in crops and cropping systems.
17. Orientation for final examination

#### **REFERENCE BOOKS**

1. Das. T.K. 2008. Weed Science Basics and Applications. Jain brothers, New Delhi.
2. Gupta, O. P. 2008. Modern Weed Management. Agrobios publishers, India.
3. Rao. V.S. 2006. Principles of Weed Science, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Walia, U.S. 2006. Weed Management, Kalayani Publishers, Ludhiana.

#### **e-resources**

1. <http://www.invasive.org/gist/products/handbook/methods-handbook.pdf>
2. <https://croplife.org/wp-content/uploads/2014/04/Implementing-Integrated-Weed-Management-for-Herbicide-Tolerant-Crops.pdf>
3. [http://nsdl.niscair.res.in/123456789/568 Weeds and their control methods - Formatted.pdf](http://nsdl.niscair.res.in/123456789/568>Weeds and their control methods - Formatted.pdf)

### **AGR 121 IRRIGATION AGRONOMY (1+1)**

#### **OBJECTIVES**

To impart knowledge on basic principles and practices of irrigation. To disseminate the scientific knowledge on water management practices to achieve higher yields and utilization of poor quality waters.

#### **THEORY**

##### **Unit - I: Importance and History of Irrigation**

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

##### **Unit - II: Soil, Water and Plant relationship**

Soil - water - plant relationship - Soil Plant Atmospheric Continuum (SPAC) - Hydrological cycle - Soil water movement - soil moisture constants - Moisture extraction pattern - Absorption of water - Evapotranspiration - Plant water stress and its effect and methods to overcome stress.

##### **Unit - III: Crop water requirement and Management**

Crop water requirement - Potential evapotranspiration (PET) and consumptive use - Definition and estimation - Factors affecting water requirement - Effective rainfall

- Critical stages for irrigation - Water requirement of crops - Water management for major field crops .

#### **Unit - IV: Methods of Irrigation**

Scheduling of irrigation - Different approaches - Methods of irrigation: surface, sub-surface sprinkler and drip irrigation - Micro irrigation: layout, suitability, merits and demerits - Fertigation - Water use efficiency - Methods to improve WUE - Conjunctive use of surface and ground water.

#### **Unit - V: Drainage and utilization of poor waters in Agriculture**

Agricultural drainage - Importance - Methods - Irrigation management under limited water supply, Quality of irrigation water - Agronomic practices for use of poor quality water (saline, effluent and sewage water) for irrigation.

#### **PRACTICAL**

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

#### **THEORY LECTURE SCHEDULE**

1. Role of water in plants - Importance of irrigation - water resources of India and Tamil Nadu - History and development of irrigation in India - Irrigation systems of India and Tamil Nadu.
2. Soil - Plant -water relationship - Soil - plant - atmospheric continuum - Hydrologic cycle - absorption of water and evapotranspiration.
3. Plant water stress - causes - plant response and adaptations
4. Methods to overcome plant water stress.
5. Soil water movement - saturated and unsaturated flow and vapour movement
6. Soil moisture constants and their importance in irrigation.
7. Available soil moisture - definition and importance -
8. Moisture extraction pattern - soil physical characteristics (texture, structure, porosity, bulk density and particle density) in influencing irrigation - soil moisture estimation methods.
9. Mid-Semester Examination
10. Crop water requirement - factors affecting crop water requirement - effective rainfall - potential evapotranspiration (PET), consumptive use (CU) - definition and estimation.
11. Critical stages for irrigation - water requirement for cereals, millets, pulses and oilseeds.
12. Water management for commercial crops (cotton, sugarcane, sugar beet, tobacco).
13. Methods of irrigation - surface (flooding, beds and channels, border strip, ridges and furrows, broad bed and furrows, surge irrigation) , sub-surface method and micro irrigation system (sprinkler and drip irrigation) - suitability, components, layout, operation, advantage and disadvantage.
14. Scheduling of irrigation - criteria based on plant, soil moisture - different approaches - climatological approach, empirical methods, crop co-efficient.
15. Water use efficiency - definition and concept - methods to improve WUE - conjunctive use of water- water budgeting.
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. Drainage - Methods -Tank irrigation, well irrigation -Canal irrigation.

#### **PRACTICAL SCHEDULE**

1. Estimation of soil moisture by gravimetric method and tensiometer.
2. Estimation of soil moisture by Irrrometer, resistance block and Neutron probe and other improved devices.
3. Measurement of irrigation water with flumes and weirs and their units.
4. Calculation on irrigation water based on source, water flow, soil moisture status and depth of irrigation and WUE.

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. Operation and maintenance of sprinkler irrigation systems.
8. Operation and maintenance of drip irrigation systems.
9. Estimation of crop water requirement by direct and indirect methods.
10. Scheduling of irrigation based on simple techniques and devices.
11. Scheduling of irrigation based on depletion of available soil moisture and IW/CPE ratio.
12. Assessment of irrigation water quality parameters in the laboratory.
13. Observation of irrigation structures in wetlands and irrigated drylands.
14. Visit to irrigation command area and study of command area development.
15. Visit to fields under different method of irrigation / off campus field visit.
16. Visit to water management and training institute.
17. Orientation for final examination

#### REFERENCE BOOKS

1. Michael, A.M. 1997. Irrigation: Theory and Practice Vikas Publishers, 1997, New Delhi.
2. Thiruppathi, M and R.Rex Immanuel. 2012. Irrigation and dry farming technology. Sri Velan Pathippagam, Chidambaram.
3. Sankara Reddy, G.H. and T. Yellamanda Reddy. 2015. Efficient use of irrigation water. Kalyani Publishers, 2015.
4. Mandal, R.C and P.K. Jana, 2003. Water resource utilization and micro irrigation. Kalyani publishers, 2003, Ludhiana.
5. Prihar, S.S and B.S. Sandhu. 2005. Irrigation of field crops – Principles and Practices. ICAR Publications, New Delhi.
6. Rajakumar. S.V and G.R Patil. 2016 Water management in Agricultural and Horticultural crops. Satish Serial Publishing House, New Delhi.

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1. <http://nsdl.niscair.res.in/123456789/554> Concepts of rainfed agriculture – Formatted.pdf
2. <http://nsdl.niscair.res.in/123456789/552> -IRRIGATION METHODS - formatted.pdf
3. <http://nsdl.niscair.res.in/123456789/495> -corrected water management.pdf <http://nsdl.niscair.res.in/123456789/549> Irrigation Water Resources - Formatted.pdf.

### ENT 122 FUNDAMENTALS OF ENTOMOLOGY (2+1)

#### OBJECTIVES

To study the external morphology, anatomy, physiology and behaviour of insects and their position in animal kingdom by studying their taxonomic characters up to family level.

#### THEORY

##### Unit-I : History and Importance

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

##### Unit-II : Morphology and Behaviour

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

##### Unit-III : Anatomy and Physiology

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

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

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

#### **Unit V : Taxonomy of Endopterygota**

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

#### **PRACTICAL**

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

#### **Assignment:**

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

#### **THEORY LECTURE SCHEDULE**

1. Definition and branches of Entomology, Its history and scope in Agriculture and Horticulture. Origin of insects, Position of insects in the animal kingdom
2. Characters of Phylum Arthropoda and its classes
3. Factors responsible for insect dominance
4. Segmentation and Structure of Insect body wall and cuticular appendages
5. Moulting process in insects
6. Basic structures of head and its appendages, modifications of insect antennae
7. Modifications of insect mouth parts

8. Basic structures of thorax and its appendages, modifications of legs, wings, wing venation and wing coupling apparatus
9. Basic structures of abdomen and its appendages
10. Metamorphosis and types of eggs, larvae and pupa
11. Tropism, biocommunication in insects - Sound and light production, diapause, rhythm, migration, defense and offence in insects
12. Elementary knowledge on digestive system, structure of alimentary canal and its modifications in certain groups
13. Elementary knowledge on digestive enzymes, digestion and absorption of nutrients
14. Elementary knowledge on excretory system in insects - malpighian tubules - accessory excretory organs and physiology of excretion
15. Elementary knowledge on respiratory system in insects - structure of trachea - tracheoles
16. Types of respiratory system - spiracles - respiration in aquatic and endoparasitic insects
17. Mid Semester Examination
18. Elementary knowledge on circulatory system in insects - haemocoel and dorsal vessel - circulation of blood - composition of haemolymph - haemocytes and their functions
19. Elementary knowledge on nervous system in insects - structure of neuron -types of nervous systems
20. Elementary knowledge on nerve impulse conduction - axonic and synaptic transmissions
21. Elementary knowledge on male and female reproductive systems in insects - structure and modifications. Spermatogenesis and Oogenesis. Structure of male and female genitalia
22. Types of reproduction - oviparous, viviparous, paedogenesis, polyembryony, ovoviviparous and parthenogenesis
23. Elementary knowledge on structure and functions of Exocrine and Endocrine glands
24. Structure of sense organs - types of sensilla - photoreceptors, chemoreceptors and mechanoreceptors
25. Taxonomy and systematics - Definition, importance and binomial nomenclature. Classification of insects - Apterygota, Pterygota, Endopterygota with examples
26. Distinguishing characters of orders Collembola, Protura, Diplura, Archaeognatha and Zygentoma.
27. Distinguishing characters of Paleoptera orders- Ephemeroptera and Odonata.
28. Distinguishing characters of Neoptera orders - Polyneoptera - Plecoptera, Dermaptera, Embioptera, Zoraptera, Orthoptera,
29. Distinguishing characters of orders Phasmatodea, Grylloblattodea and Mantophasmatodea, (Mantodea, Blattodea (Cockroach), Blattodea (Termites)
30. Distinguishing characters of Paraneoptera orders - Psocodea (free living), Psocodea (parasitic), Thysanoptera and Hemiptera
31. Distinguishing characters of order Endopterygotes - Neuroptera, Megaloptera, Raphidioptera, Coleoptera and families of agricultural importance
32. Distinguishing characters of order Strepsiptera, Mecoptera, Siphonaptera, Trichoptera and Diptera and their families of agricultural importance
33. Distinguishing characters of order Lepidoptera and families of agricultural importance
34. Distinguishing characters of order Hymenoptera and families of agricultural importance.

#### **PRACTICAL SCHEDULE**

1. Observations on segmentation and external features of grasshopper/ cockroach/blister beetle
2. Practicing the methods of collection, killing, pinning, labelling, display and preservation of insects including immature stages. Preparation of riker mount.
3. Observations on various types of insect head orientation and antennae
4. Demonstration of mouth parts of cockroach and plant bug and study of mouth parts of female mosquito, honeybee, thrips, antlion grub, house fly and butterfly

5. Observations on the modifications in legs and wings (wing venation, regions, angles and wing coupling)
6. Observations on various types of abdominal appendages
7. Studies on the types of metamorphosis. Observations on immature stages of insects – Eggs, larvae and pupae
8. Demonstration of digestive system and male and female reproductive systems (grasshopper/cockroach)
9. Observation on distinguishing characters of Collembola, Protura, Diplura and Archaeognatha, Zygentoma, Ephemeroptera and Odonata. Plecoptera, Dermaptera, Embioptera, Zoraptera and Orthoptera (Acrididae, Tettiigonidae, Gryllidae and Gryllotalpidae).
10. Observation on distinguishing characters of Phasmatodea, Grylloblattodea, Mantophasmatodea, Mantodea, Blattodea (Cockroach), Blattodea (Termites) Psocodea – free living, Psocodea (parasitic) and Thysanoptera.
11. Observation on distinguishing characters of Hemiptera (Families: Reduviidae, Pentatomidae, Miridae, Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belastomatidae, Gerridae, Cimicidae, Tingidae, Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerridae, Lophopidae and Psyllidae)
12. Observation on distinguishing characters of Neuroptera, Megaloptera and Raphidioptera.
13. Observation on distinguishing characters of Coleoptera (Families: Cicindellidae, Carabidae, Dytiscidae, Curculionidae, Apionidae, Staphylinidae, Coccinellidae, Gyrinidae, Lampyriidae, Hydrophilidae, Scarabaeidae Dynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae, Meloidae, Cetonidae, Buprestidae, Elateridae and Bostrychidae)
14. Observation on distinguishing characters of Strepsiptera, Mecoptera, Siphonaptera, Trichoptera, Diptera (Families: Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Pipunculidae, Drosophilidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae)
15. Observation on distinguishing characters of Lepidoptera (Families: Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochliidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae, Metarbelidae and Hesperidae)
16. Observation on distinguishing characters of Hymenoptera (Families: Tenthredinidae, Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Ichneumonidae, Braconidae, Platygasteridae, Bethyidae, Evaniidae, Chalcididae, Encyrtidae, Eulophidae and Trichogrammatidae)
17. Orientation for final examination

#### REFERENCE BOOKS

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

#### Web resources:

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

## AGM 123 FUNDAMENTALS OF MICROBIOLOGY (2+1)

### OBJECTIVES

1. To enable better understanding of students about the microscopic world around them
2. To acquaint students with the basic laboratory techniques and tools of microbiology
3. To introduce the fundamental characteristics of various microorganisms
4. To develop experimental skills, including the collection and analysis of data, the ability to draw valid conclusions and apply these conclusions within a larger framework

### THEORY

#### Unit I. History of Microbiology

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

#### Unit II. Microbiological Techniques

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

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

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

#### Unit IV. Growth, Nutrition and Metabolism

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

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

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

### PRACTICAL

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

### THEORY LECTURE SCHEDULE

1. Definition and scope of microbiology – Development of microbiology as science
2. Biogenesis and a biogenesis theory. Contributions by Antonie Van Leeuwenhoek, Louis Pasteur
3. Contributions of John Tyndall, Joseph Lister, Edward Jenner, Robert Koch,



- Alexander Fleming and Waksman. Germ theory of fermentation and disease
4. Microscopy; principles – resolving power and magnification. Light microscopy
  5. Different types of microscopes - UV, Dark Field, Phase Contrast, Fluorescence and Electron Microscopes; Atomic and Confocal Scanning Laser Microscopy
  6. Staining techniques - principle and types of stains staining techniques- simple, negative, differential and structural staining methods
  7. Sterilization – principle – physical agents and chemical methods
  8. Isolation and enrichment culture techniques; preservation techniques
  9. Evolutionary relationship - Position of microbes in living world – concepts and developments in classification of microorganisms
  10. Groups of microorganisms prokaryotes and eukaryotes
  11. Archaea – ecology; differences among archaea, eubacteria and eukaryotes
  12. Systematic bacteriology Bergey’s manual of systematic bacteriology – outline only
  13. Cell biology; size, shape, structure and arrangement of cells
  14. External structures in bacteria and their functionality
  15. Functional anatomy and reproduction in bacteria
  16. Morphology of fungi – economic importance
  17. Morphology of algae – economic importance
  18. Mid Semester Examination
  19. Bacterial growth population growth and growth cycle – continuous culture – chemostat and turbidostat; synchronous culture
  20. Conditions for growth temperature requirements aerobes and anaerobes – factors influencing growth and methods of assessment of growth
  21. Nutritional types of bacteria; energetic in bacteria. Metabolic diversity/ pathways specific to bacteria
  22. Microbial metabolism- Energy generation by substrate level phosphorylation, oxidative and Photo phosphorylation
  23. Aerobic respiration and anaerobic respiration
  24. Fermentative mode of respiration
  25. Viruses and their properties; types of viruses
  26. Bacteriophages – lytic and lysogenic and temperate phages
  27. Mutation in bacteria – principles and types
  28. Mutagens – physical, chemical and biological
  29. Genetic recombination – competency transformation
  30. Genetic recombination by Conjugation – concept of Hfr
  31. Genetic recombination by Transduction – generalized and specialized
  32. Basic concepts of Immunology
  33. Immunology – principles – specific and non specific defense
  34. Antigen – antibody reactions – vaccines applications

#### **PRACTICAL SCHEDULE**

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

#### **TEXT BOOKS**

1. Prescott, Harley and Klein, 2013. Microbiology, 9<sup>th</sup> edition, McGraw Hill Publishing

2. Michael J. Pelczar, JR., E.C.S. Chan, Noel R. Krieg, 2005. Microbiology
3. Ebook: Luis M. de la Maza, Marie T. Pezzlo and Ellen Jo Baron 1997. Color Atlas of diagnostic Microbiology, Published by Mosby- Year Book Inc.
4. Ebook: Michael J. Leboffee and Burton E. Pierce 2011. A photographic Atlas for the Microbiology Laboratory 4<sup>th</sup> edition, Marton Publishing Company

#### REFERENCE BOOKS

1. Hans G. Schlegel, 2012. General Microbiology, 7<sup>th</sup> edition
2. Ronald M. Atlas, 1997. Principles of Microbiology, Second edition
3. Tortora, G.J., B.R. Funke and C.L. Case, 2009. Microbiology- An Introduction, 9<sup>th</sup> edition
4. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.

#### e-references

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

### SAC 124 - FUNDAMENTALS OF BIOCHEMISTRY (2+1)

#### OBJECTIVES

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

#### THEORY

##### Unit I- Carbohydrates

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

##### Unit II – Proteins and Enzymes

Amino acids- classification and structure. Essential amino acids. Properties of amino acids- amphoteric nature and isomerism. Classification of protein based on functions and solubility- structure of proteins- primary structure, secondary structure, tertiary structure and quaternary structure – protein folding and denaturation. Properties and reactions of proteins.

Enzymes – properties, classification and nomenclature. Mechanism of enzyme action. Factors affecting enzyme activity. Enzyme inhibition – competitive, non-competitive and uncompetitive inhibition. Allosteric enzymes, co-enzymes, co-factor and iso-enzymes.

##### Unit III- Lipids:

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

##### Unit IV- Metabolism

Carbohydrate metabolism – breakdown of starch by amylases, glycolysis, TCA cycle and pentose phosphate pathway. Respiration – electron transport chain and oxidative phosphorylation. Bioenergetics of glucose- lipid metabolism- lipases and phospholipases. Beta-oxidation of fatty acids and bioenergetics – Bio synthesis of fatty acids and triacyl glycerol. General catabolic pathway for amino acids- transamination, deamination and decarboxylation. Ammonia assimilating enzymes. Metabolic interrelationship.

##### Unit V – Secondary Metabolites

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

## **PRACTICAL**

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

## **THEORY LECTURE SCHEDULE**

1. Introduction to Biochemistry, Carbohydrates - occurrence and classification.
2. Structure of monosaccharide, oligosaccharides and polysaccharides.
3. Physical properties of carbohydrates - Mutarotation, optical activity, isomerism.
4. Chemical reactions of carbohydrates.
5. Amino acids - Classification and structure.
6. Properties of amino acids - amphoteric nature, isomerism, essential amino acids.
7. Classification of proteins based on function and solubility.
8. Structure of protein - Primary, secondary, tertiary and quaternary structure.
9. Protein folding, physical and chemical properties of proteins.
10. Enzymes - Properties, classification and nomenclature.
11. Mechanism of enzyme action. Factors affecting enzyme activity.
12. Enzyme inhibition - competitive, non-competitive, uncompetitive and allosteric enzymes.
13. Coenzymes, cofactors and isoenzyme.
14. Lipids - occurrence and classification.
15. Storage lipids - Structural lipids - types and importance.
16. Sterols - basic structure and their importance.
17. MIDSEMESTER EXAMINATION
18. Physical and chemical constants of oils. Rancidity of oils.
19. Carbohydrate metabolism - breakdown of starch by amylases
20. Glycolysis - Reactions and bioenergetics.
21. TCA cycle - Reactions and bioenergetics.
22. Pentose phosphate pathway - Reactions.
23. Respiration - electron transport chain and oxidative phosphorylation.
24. Lipid metabolism - lipases and phospholipases.
25. Beta-oxidation of fatty acids and bioenergetics.
26. Biosynthesis of fatty acids and triacylglycerol.
27. Transamination, deamination and decarboxylation of amino acids.
28. Ammonia assimilating enzymes - GS, GOGAT and GDH.
29. Metabolic inter-relationship.
30. Secondary metabolites - occurrence, classification and functions of phenolics.
31. Occurrence, classification and functions of terpenes and alkaloids.
32. Vitamins - Definition - general characteristics and classification.
33. Plant Hormones - definitions - Roll of Auxins, Gibberellins in plants.
34. Cytokinins and other natural growth hormones and inhibitors in plants.

## **PRACTICAL SCHEDULE**

- I. Qualitative tests for carbohydrates
  1. Identification of glucose and fructose
  2. Identification of sucrose and maltose
  3. Identification of lactose
  4. Identification of dextrin
  5. Identification of starch
  6. Scheme for identification of unknown carbohydrates
- II. Quantitative analysis of carbohydrates
  7. Estimation of glucose (By copper reduction method)
  8. Estimation of sucrose (By Inversion method)
  9. Estimation of starch
- III. Analysis of proteins
  10. Estimation of amino acid ( by Sorenson method)
  11. Colour reactions of protein
- IV. Analysis of lipids
  12. Determination of acid value of an oil

13. Determination of iodine value of an oil
14. Determination of saponification value of an oil
15. Determination of peroxide value of an oil

#### V. Vitamins

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

#### REFERENCES

1. Jain.J.L, Sanjay Jain, Nitin Jain. (2005). **Fundamentals of Bio-Chemistry**, S.Chand and Company Ltd. New Delhi. ISBN – 8121924537
  2. Thayumanavan, B, Krishnaveni, S and Parvathi, K, (2004), **Biochemistry for Agricultural Sciences**, Galgotia Publications Pvt Ltd., New Delhi. ISBN: 81-7515-459-4.
  3. Sadasivam, S and Manickam, A. (2009), **Biochemical Methods**, 3<sup>rd</sup> Edn, New Age International
  4. Wilson, K. and Walker, J.M. (2000), **Principles and techniques of Practical Biochemistry**, 5<sup>th</sup> Edn. – Cambridge University Press.
  5. Anandhi.D. (2014). **Introduction to Bio-Chemistry and Metabolism**, Pearson India, Chennai. ISBN: 8131774856
  6. Uma Bharatwaj. (2014). **Bio-Chemistry for Life Sciences**, Pearson India, Chennai. ISBN. 9332528470
  7. Dhaka, R.P.S and Nanak Singh 2006. **A text book of Bio Chemistry**. Aman Publishing House. Meerut
  - 8 ,Gupta, S,N 2016. **Concepts of Biochemistry**. Rastogi Publication. Meerut
- e-references
1. [www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)
  2. <http://bcs.whfreeman.com/lehninger6e>

#### GPB 125 INTRODUCTION TO AGRICULTURAL BOTANY (1+1)

#### OBJECTIVES

To expose the students to the basic features of botanical description, economic parts and economic importance of different field and horticultural crops.

#### THEORY

##### Unit I: Systems of classification and general morphological description

Bentham and Hooker's classification of plant kingdom — Nomenclature and its major guidelines – author citation – Agricultural classification of crops; General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf; Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.

##### Unit II: Botanical description and economic uses of Poaceae

List of cultivated crops, economic parts, chromosome number and family description of Poaceae: Key botanical features of Rice, Wheat, Sorghum, Maize, Pearl millet, Finger millet, list of small millets, Guinea grass, Napier grass, *Cenchrus* and Sugarcane

##### Unit III: Botanical description and economic uses of Papilionaceae

List of cultivated crops, economic parts, chromosome number and family description of Papilionaceae: Key botanical features of Red gram, Bengal gram, Soybean, Black gram, Green gram, Cowpea, Lablab, Horse gram, Groundnut, Lucerne, *Stylosanthes*, Clitoria, Agathi and Sunnhemp,

##### Unit IV: Botanical description and economic uses of Pedaliaceae, Asteraceae, Brassicaceae, Euphorbiaceae, Arecaceae and Malvaceae

List of cultivated crops, economic parts, chromosome number and family description of the following families and Key botanical features of the crops given against them: Pedaliaceae - Gingelly; Asteraceae - Sunflower, Safflower, Brassicaceae - Rapeseed and Mustard, Cabbage, Cauliflower; Euphorbiaceae: Castor; Jatropha and Tapioca; Arecaceae: Coconut, Arecanut, Oilpalm; Malvaceae: Cotton, Mesta and Bhendi.

**Unit V: Botanical description and economic uses of Tiliaceae, Piperaceae, Chenopodiaceae, Solanaceae, Mimosae, Moraceae, Cucurbitaceae, Alliaceae, Musaceae, Rubiaceae, Theaceae**

List of cultivated crops, economic parts, chromosome number and family description of the following families and key botanical features of the crops given against them. Tiliaceae: Jute; Piperaceae: Betelvine; Chenopodiaceae: Sugar beet; Solanaceae: Tobacco, Potato, Chilli, Tomato and Brinjal; Mimosae: Desmanthes, Subabul and Acacia; Moraceae: Mulberry; Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic; Musaceae: Banana; Rubiaceae: Coffee; Theaceae: Tea; Medicinal crops - Fabaceae: Senna, Apocynaceae: Periwinkle, Asphodelaceae: Aloe vera, Lamiaceae: Ocimum, Poaceae: Vettiver.

#### **PRACTICAL**

Family features - observation and description of habit, morphology of root, stem, leaves, inflorescence, flowers, floral diagram, floral formula and economic parts of Poaceae: Rice, Wheat, Sorghum, Maize, Pearl millet, Finger millet, Guinea grass, Napier grass, *Cenchrus* and Sugarcane; Papilionaceae: Redgram, Bengal gram, Soybean, Blackgram, Greengram, Cowpea, Lab-lab, Horse gram, Groundnut, Lucerne, *Stylosanthes*, Clitoria, Agathi and Sunnhemp; Pedaliaceae: Gingelly; Asteraceae: Sunflower, Safflower; Brassicaceae: Rape and Mustard, Cabbage, Cauliflower; Euphorbiaceae: Castor, Jatropha, Tapioca; Arecaceae: Coconut, Arecanut, Oilpalm; Malvaceae: Cotton, Mesta, Bhendi; Tiliaceae: Jute; Piperaceae: Betelvine; Chenopodiaceae: Sugar beet; Solanaceae: Tobacco, Potato, Chilli, Tomato and Brinjal; Mimosae: Desmanthes, Subabul and Acacia; Moraceae: Mulberry; Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic; Musaceae: Banana; Rubiaceae: Coffee; Theaceae: Tea

#### **THEORY LECTURE SCHEDULE**

1. Bentham and Hooker's classification of plant kingdom — International code of nomenclature and its major guidelines - author citation - Agricultural classification of crops
2. General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf
3. Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.
4. List of cultivated crops, economic parts, chromosome number and family description of Poaceae; Key botanical features of Rice and Wheat.
5. Key botanical features of sorghum, maize, pearl millet and finger millet. List of small millets
6. Key botanical features of Guinea grass, Napier grass, *Cenchrus* and sugarcane.
7. List of cultivated crops, economic parts, chromosome number and family description of (Papilionaceae) Key botanical features of Red gram, Bengal gram and Soybean
8. Key botanical features of Black gram, Green gram, Cowpea, Lab lab, Horse gram and Groundnut.
9. Mid Semester Examination
10. Key botanical features of Lucerne, *Stylosanthes*, Clitoria, Agathi, and Sunnhemp.
11. List of cultivated crops, economic parts, chromosome number and family description of Pedaliaceae and Asteraceae: Key botanical features of Gingelly, Sunflower, Safflower.
12. List of cultivated crops, economic parts, chromosome number and family description of Brassicaceae and Euphorbiaceae; Key botanical features of Rapeseed and Mustard, Cabbage, Cauliflower, Castor, Jatropha and Tapioca
13. List of cultivated crops, economic parts, chromosome number and family description of Arecaceae and Malvaceae; Key botanical features of Coconut, Arecanut, Oilpalm, Cotton, Mesta and Bhendi.
14. List of cultivated crops, economic parts, chromosome number and family description of Tiliaceae, Piperaceae and Chenopodiaceae; Key botanical features of Jute, Betelvine, Sugar beet.

15. List of cultivated crops, economic parts, chromosome number and family description of Solanaceae, Mimosae and Moraceae; Key botanical features of Tobacco, Potato, Chilli, Tomato and Brinjal, Desmanthes. Subabul, Mulberry
16. List of cultivated crops, economic parts, chromosome number and family description of Cucurbitaceae and Alliaceae; Cucurbitaceae: Key botanical features of Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic
17. List of cultivated crops, economic parts, chromosome number and family description of Musaceae, Rubiaceae and Theaceae; Key botanical features of Banana, Coffee and Tea

#### **PRACTICAL SCHEDULE**

1. Observing general morphology of roots, stems and leaves.
2. Observing general morphology of inflorescence - flowers, stamens and pistils.
3. Family characters, Botany, Economic parts, Floral diagram and Floral formula of the following crop plants:- Poaceae: Rice and Wheat
4. Poaceae: Sorghum, Maize, Pearl millet, Finger millet.
5. Poaceae: Guinea grass, Napier grass, *Cenchrus* and Sugarcane.
6. Papilionaceae: Redgram, Bengal gram and Soybean.
7. Papilionaceae: Blackgram, Greengram, Cowpea, Lab-lab, Horse gram and Groundnut.
8. Papilionaceae: Lucerne, *Stylosanthes*, Clitoria, Agathi, Sunnhemp, and Sesbania.
9. Pedaliaceae: Gingelly; Asteraceae: Sunflower, Safflower.
10. Brassicaceae: Rapeseed and Mustard, Cabbage, Cauliflower.
11. Euphorbiaceae: Castor, Jatropha, Tapioca; Arecaceae: Coconut, Arecanut, Oilpalm.
12. Malvaceae: Cotton, Mesta, Bhendi
13. Tiliaceae: Jute; Piperaceae: Betelvine; Chenopodiaceae: Sugar beet;
14. Solanaceae: Tobacco, Potato, Chilli, Tomato and Brinjal; Mimosae: Desmanthes, Subabul, Moraceae: Mulberry
15. Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic
16. Musaceae: Banana; Rubiaceae: Coffee; Theaceae: Tea
17. Orientation for final examination

#### **Assignment**

1. Collection and preparation of 25 herbarium specimens representing minimum of ten families of the crop species studied.
2. Collection of crop seeds of 10 traditional varieties.

#### **REFERENCE BOOKS**

1. Daniel Sundararaj, D. and G. Thulasidas, 1993. Botany of field crops. MacMillan India Ltd., New Delhi.
2. Sambamurthy, V.S. and N.S. Subramanian, 1989. Text Book of Economic Botany, Wiley Eastern, New Delhi

### Further reading

1. Purse glow, 1988. Tropical Crops - Monocotyledons. The English Language book Society and Longman Co., Singapore
2. Purse glow. 1988. Tropical Crops - Dicotyledons. The English language book Society and Longman Co., Singapore.
3. Albert F. Hill and O.P. Sharma, 1996. Economic Botany. Tata McGraw - Hill Publishing Co. Ltd., New Delhi.
4. John Joel, A., C. Vanniarajan, T.S. Raveendran, and A. Gopalan 2006. Fundamentals of Crop Botany, Directorate of ODL, Tamil Nadu Agricultural University, Coimbatore-641 003.

## AEC 126 - PRINCIPLES OF ECONOMICS (1+1)

### OBJECTIVE

The objective of this course is to provide knowledge to students about basic concepts of economics and their relevance and importance in Agricultural Science.

### THEORY

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

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

#### Unit II: Theory of Consumption

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

#### Unit III: Theory of Production

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

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

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

#### Unit V: Macroeconomic Concepts

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

### PRACTICAL

**Law of Diminishing Marginal Utility - Law of Equi-Marginal Utility - Indifference curve analysis and consumer equilibrium - Law of Demand, demand schedule - Graphical derivation of individual and market demand - Estimation of own price, income and cross price elasticities of demand - Estimation of Consumer surplus - Illustration on Engel's Law of Family Expenditure - Law of supply - Estimation of supply elasticity - Equilibrium price determination. Types and functions of money -**

**Inflation: Analysis of causes of inflation and control measures. Approaches to computation of national income - Study of structural changes in the economy. Food grain production in India - Growth rate analysis - Study of demographic changes in India - Measures of human development: Welfare indicators - Human Development Index (HDI) and Physical Quality of Life Index (PQLI).**

#### **THEORY LECTURE SCHEDULE**

1. **Economics: Nature and scope of economics: Agricultural Economics: Definition and scope, importance, subject matter: Science Vs. art, positive science Vs. normative science, deductive method Vs. inductive method**
2. **Basic concepts - Goods, services, use value and exchange value, cost, price, wealth and welfare - Wants: Characteristics and classification of wants.**
3. **Definitions of Economics - Wealth, welfare, scarcity and growth - Divisions of Economics: Micro economics and macroeconomics Different economic systems: merits and demerits.**
4. **Utility: Definition, Measurement: Cardinal and ordinal utility - Marginal utility - Law of Diminishing Marginal Utility.**
5. **Law of Equi-Marginal Utility: Definition, assumptions, limitations and applications - Indifference curve analysis: Definition and properties of indifference curves and budget line.**
6. **Standard of Living - Definition, Engel's Law of Family Expenditure - Consumer surplus: Definition and importance.**
7. **Demand: Definition, Kinds of demand, Demand schedule, Demand curve, Law of Demand, Determinants of demand - Extension and contraction of demand Vs. Increase and decrease in demand.**
8. **Elasticity of Demand: Own price, cross price and income elasticities of demand, Degrees of price elasticity of demand - Factors influencing elasticity of demand and Importance of Elasticity of demand.**
9. **Mid Semester Examination.**
10. **Concept of production - Factors of production - Land and its characteristics.**
11. **Labour: Characteristics of labour - Division of labour - Malthusian and modern theories of population.**
12. **Capital: Characteristics of capital - Capital formation: Phases of capital formation - Entrepreneur: Characteristics and functions of entrepreneur.**
13. **Supply: Definition, Law of Supply, Factors influencing supply - Elasticity of supply.**
14. **Exchange: Market - Definition - Equilibrium price determination. Distribution: Definition - Marginal productivity theory of distribution - Pricing of factors of production: Rent: Ricardian theory of rent and quasi rent.**
15. **Wages: Real wage and money wage - Wage theories - Interest: Pure interest and gross interest - Theories of interest - Profit: Meaning of economic profit - Profit theories.**
16. **Macroeconomics: Definition and subject matter - National income: Concepts - GNP, GDP, NNP, disposable income and per capita income - Money: Definition, Types and functions of money - Inflation: Meaning and Types of inflation.**
17. **Public Finance: Meaning, Principles - Public revenue: Meaning, Classification of taxes - Canons of taxation - Public expenditure: Principles. Welfare Economics: Meaning.**

#### **PRACTICAL SCHEDULE**

1. **Exercise on Law of Diminishing Marginal Utility.**
2. **Exercise on Law of Equi-Marginal Utility.**
3. **Indifference curve analysis and consumer equilibrium.**
4. **Law of Demand, demand schedule - Graphical derivation of individual and market demand.**
5. **Estimation of own price, income and cross price elasticities of demand.**
6. **Estimation of Consumer surplus.**
7. **Illustration on Engel's Law of Family Expenditure.**
8. **Law of supply - Estimation of supply elasticity.**
9. **Equilibrium price determination.**
10. **Types and functions of money.**
11. **Inflation: Analysis of causes of inflation and control measures.**



12. Approaches to computation of national income.
13. Study of structural changes in the economy.
14. Food grain production in India - Growth rate analysis.
15. Study of demographic changes in India.
16. Measures of human development: Welfare indicators - Human Development Index (HDI) and Physical Quality of Life Index (PQLI).
17. Orientation for final examination

#### **REFERENCE BOOKS**

1. Dewett, K. K. 2010. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2. Subba Reddy, S. et al., 2013, Agricultural Economics, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
3. Seth, M. L. 2005. Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi
4. Sankaran, S., 2000. Principles of Economics, Progressive Corporation Pvt., Chennai.
5. Samuelson, P. 2004, Economics, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.

### **AEX 127 FUNDAMENTALS OF RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY (1+1)**

#### **OBJECTIVES**

This course will enable students to acquire knowledge on basic concepts related to rural sociology and educational psychology. Students will also learn the practical applications of important sociological and psychological concepts.

#### **THEORY**

##### **UNIT I : Introduction to Sociology, Social groups and Culture**

Sociology and Rural Sociology – definitions; Society – rural and urban, differences and relationships, important characteristics of Indian rural society; Social groups – definition, classification, role of social groups in extension; Culture – concept, cultural traits, characteristics, functions, Ethnocentrism, Cultural lag, Cultural diffusion, Marginal man, Ethos.

##### **UNIT II : Social Structure, Social Stratification, Migration**

Structure of Rural Society – patterns of rural settlement, Social Institutions - Types and Functions, Social Stratification – concept, functions, types, differences between class and caste system;

##### **UNIT III: Social Control, Social Customs, Leadership**

Social Control – definition; Customs – conventions, folkways, mores, rituals, taboos; Social Interaction Process – definition, basic social processes; Social Change – concept, factors influencing social change, Leadership – definition of leader and leadership, characteristics, types, functions, methods of selecting leaders.

##### **UNIT IV : Introduction to Educational Psychology, Teaching-Learning Process**

Education – Psychology – Educational Psychology – Social Psychology – definitions, importance of psychology in extension; Basic principles of Human behaviour – Attention, Perception – meaning, characteristics; Intelligence – concept, types, measurement, factors affecting intelligence; Personality – concept, types, factors influencing personality; Teaching-Learning Process – Teaching – definition, meaning, principles of teaching, steps in extension teaching; Learning – definition, meaning, principles, learning situation.

##### **UNIT V: Motivation, Attitude**

Motivation – concept, Maslow's hierarchy of needs, techniques of motivation, importance in extension; Attitude – concept, factors influencing the development of attitudes.

## **Practical**

Visit to a village to study the sociological characteristics of a rural society - patterns of settlement, culture, social stratification, social values, social control, customs, social interaction processes, social change, and social problems; Study of basic social institutions and social organizations and their functions in a village setting; Exercise on selection of leaders in a village; Practice on Personality and Intelligence measurement techniques.

## **THEORY LECTURE SCHEDULE**

1. **Sociology and Rural Sociology – Definitions, nature of rural sociology, importance of rural sociology in extension education.**
2. **Society – rural and urban, characteristics, differences and relationship, important characteristics of Indian rural society; Social Groups – definitions, classification, role of social groups in extension.**
3. **Culture – concept, cultural traits, characteristics, functions, Ethnocentrism, Cultural lag, Cultural diffusion, Marginal man, Ethos.**
4. **Structure of Rural Society – patterns of rural settlement, Social Institutions - Types and Functions**
5. **Social Stratification – concept, functions**
6. **Types, differences between class and caste system;**
7. **Social Control – definition; Customs – conventions, folkways, mores, rituals, taboos; Social Interaction Process – definition, basic social processes.**
8. **Social Change – concept, factors influencing social change.**
9. **Mid semester Examination.**
10. **Leadership – definition of leader and leadership, characteristics, types, functions, Methods of selecting leaders.**
11. **Education – Psychology – Educational Psychology – Social Psychology – definitions, importance of psychology in extension.**
12. **Basic principles of Human behaviour –Attention, Perception – meaning,**
13. **Intelligence – concept, types, measurement, factors affecting intelligence; Personality – concept, types, factors influencing personality.**
14. **Teaching–Learning Process – Teaching – definition, meaning, principles of teaching, steps in extension teaching.**
15. **Learning – definition, meaning, principles, types of learning, learning situation.**
16. **Motivation – concept, Maslow’s hierarchy of needs techniques of motivation, importance of motivation in extension.**
17. **Attitude – concept, factors influencing the development of attitudes.**

## **PRACTICAL SCHEDULE**

1. **Understanding the sociological characteristics of a rural society – (Brainstorming).**
2. **Data collection methods – survey, questionnaire, mailed questionnaire, interview schedule, observation method, case study.**
- 3 and 4. **Preparation of interview schedule to study the social characteristics of rural society – pattern of settlement, culture, social stratification, social values, social control, customs, social interaction process, social change and social problems (Group exercise).**
5. **Visit to a village for data collection (Group exercise).**
- 6 and 7. **Processing of data and presentation of Reports.**
- 8 and 9. **Preparation of interview schedule to study the basic social institutions and social organizations and their functions in a village setting (Group exercise). Preparatory work for selection of leaders in a village (Group exercise).**
10. **Visit to a village for data collection (Group exercise).**
- 11and12. **Processing of data and presentation of reports.**
- 13and14. **Practicing Personality measurement techniques (Group exercise).**
- 15and16. **Practicing Intelligence measurement techniques (Group exercise).**
17. **Orientation for final examination**

## Reference Books

1. Adivi Reddy, A. 2001. Extension Education, Sree Lakshmi Press, Bapatla, Andhra Pradesh.
2. Chatterjee, S.K 2000. Advanced Educational Psychology and Allied (P) Ltd., Calcutta.
3. Chauhan, S.S. 2001. Advanced Educational Psychology, Vikas Publishing House Pvt. Ltd., New Delhi.
4. Chitambar, J.B.1997. Introductory Rural Sociology, New Age International (P) Ltd., Publishers, New Delhi.
5. Dahama, O.P. and O.P. Bhatnagar. 2007. Education and Communication for Development, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Mangal, S.K. 2000. Educational Psychology, Prakash Brothers, Ludhiana.
7. Supe. S.V. 2012. Text book of Extension Education, Agrotech Publishing Academy, Udaipur.
8. Usha Rao. 2008. Advanced Educational Psychology, Himalaya Publishing House, New Delhi.
9. Vidya Bhushan and Sachdeva, D.R. 2003. An Introduction to Sociology, Kitab Mahal, Allahabad.

## e- resources

- [www.sociologyguide.com](http://www.sociologyguide.com)
- [eu.wikipedia.org](http://eu.wikipedia.org)
- [www.princeton.edu](http://www.princeton.edu)

## COM 128 FUNDAMENTALS OF INFORMATION TECHNOLOGY (1+1)

### THEORY

#### UNIT I: COMPUTER BASICS

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

#### UNIT II: OPERATING SYSTEM AND SOFTWARE

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

#### UNIT III: COMPUTER NETWORKS AND INTERNET

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

#### UNIT IV: COMPUTER PROGRAMMING AND LANGUAGES

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

#### UNIT V: DATABASE MANAGEMENT SYSTEMS

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

### THEORY LECTURE SCHEDULE

- 1 Introduction to Computer, Evolution of Computers, Generation of Computers and Classification of Computers.
- 2 The Computer System, Computer Organization and Architecture, Central Processing Unit, Inside a Computer.
- 3 Data Representation in Computers, Computer Memory and Storage, Input Output Media and Current Trends in Computer.
- 4 Introduction to Software, Categories of Software, System Software, Evolution of Operating System, Types of Operating System, Functions of Operating System.

- 5 Introduction to Application Software, Installation and Un-installation of software, Software Piracy, Software Terminologies, Office Automation Software, Word Processing, Spread sheet, Presentation.
- 6 Introduction to Multimedia, Building Blocks of Multimedia, Multimedia Systems, Multimedia Applications, Virtual Reality. Current Trends in System and Application softwares.
- 7 Introduction to Computer Networks, Network Topologies, Communication Protocol, Network Devices
- 8 Introduction to Internet, Internet Applications, Internet Tools, Web Browser and Email client
- 9 Mid-semester examination
- 10 Search Engines, Instant Messaging, Computer Security. Current Trends in Computer Networks and Internet.
- 11 Introduction to Computer Programming, Algorithm, Flowchart, Decision Tables, Pseudo code and Program Control Structures
- 12 Programming paradigms, Introduction to Programming Languages
- 13 Generation of Programming Languages, Current Trends in Computer Programming and Languages.
- 14 Introduction to Database, Logical and Physical Data Concepts, Data Base Management System and its Architecture, Database Models
- 15 Normalization Techniques, Types of Databases, Introduction to Structured Query Language
- 16 Data Definition Language, Data Manipulation Language
- 17 Current Trends in Database Management Systems.

#### **PRACTICAL SCHEDULE**

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

#### **Text book**

1. Pearson , Introduction to Information Technology, 2013 Second Edition, IITL Education Solutions Limited.

#### **REFERENCE BOOK**

1. Pearson , Express Learning: Introduction to Information Technology, 2012 Edition, IITL Education Solutions Limited.

#### **e-reference :**

1. <http://pearsoned.co.in/ITLEducationSolutionsLimited/>

**III SEMESTER**  
**AGR 210 - AGRONOMY OF FIELD CROPS - I (2+1)**

**OBJECTIVES**

Acquiring knowledge on agronomical aspects of various Field crops such as cereals, Millets, Pulses, Forage and green manure crops.

**THEORY**

**Unit - I: Agronomy of Cereals**

Rice, Wheat, Maize, Barley, Oat, Rye and Triticale - Origin, geographic distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and yield. Post harvest management practices. Value addition and by products utilization of cereals.

**Unit - II: Agronomy of Major and Minor Millets**

Sorghum, Pearl millet, Finger millet, Foxtail millet, Little millet, Kodo millet, Barnyard millet and Proso millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield. Post harvest management practices. Value addition and by products utilization of millets.

**Unit - III: Agronomy of Pulses**

Redgram, Blackgram, Greengram, Bengalgram, Horsegram, Cowpea, Soybean and Lentil - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield. Post harvest management practices. Value addition and by products utilization of pulses.

**Unit - IV: Agronomy of Fodder and Forage Crops**

Fodder crops: Sorghum, Maize, Pearlmillet, Forage crops: Guinea grass, Cumbu - Napier, Water grass, Buffalo grass, Elephant grass, Kolukkattai grass, Lucerne, Berseem, Desmanthus, Stylosanthus and Cowpea - Economic importance, soil and climatic requirement, varieties, cultural practices and yield. Fodder preservation techniques.

**Unit - V: Agronomy of Green Manures**

Daincha, Sunnhemp Sesbania, Kolingi, Glyricidia, Subabul, Pungam, Poovarasu and Neem - Origin, economic importance, soil and climatic requirement, Varieties, cultural practices and yield. *In situ* incorporation of green manures.

**PRACTICAL**

Maintenance of crop cafeteria - Identification of crop plants, varieties and seeds of cereals, millets, pulses, green manures and forage crops - nursery preparation and management for rice, sorghum, cumbu and ragi - Main field preparation - Seed treatment techniques - Methods of sowing and manuring - Seeding implements - Estimation of plant population, seed rate and fertilizer requirement - After cultivation practices - Study of growth and yield parameters and yield estimation. Harvesting of crops; Cost Analysis. Fodder preservation techniques - Silage and hay making, - Visit to farmers fields, institutes and industries.

**THEORY LECTURE SCHEDULE**

1. Importance and area, production and productivity of cereals and major and minor millets of India and Tamil Nadu.
2. Rice - Origin - geographic distribution - economic importance - varieties - soil and climatic requirement.
3. Rice - Rice eco systems - cultural practices - Nursery management and main field preparation.
4. Rice - Cultural practices - Nutrient management, weed management and Irrigation management - Pest and disease management - yield
5. Rice - Economic benefits - Special type of Rice cultivation - Rajarajan 1000 (SRI), Transgenic Rice - Hybrid rice.
6. Rice - Quality of rice - Post harvest management - Value addition and by products utilization.
7. Maize - Origin, geographic distribution, economic importance, classification soil and climatic requirement
8. Maize - varieties, cultural practices, yield and post harvest management.
9. Wheat - Origin, geographic distribution, economic importance, soil and climatic requirement varieties
10. Wheat - varieties, cultural practices, yield and post harvest management.
11. Barley - Origin, geographic distribution, economic importance, soil and climatic

- requirement, varieties, cultural practices , yield and post harvest management
12. Oats, Rye and Triticale - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield and post harvest management
  13. Sorghum - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield and post harvest management.
  14. Pearl millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield and post harvest management.
  15. Finger millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield and post harvest management.
  16. Minor millets - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield and post harvest management.
  17. Importance and area, production and productivity of pulses of India and Tamil Nadu.
  18. Mid semester Examination.
  19. Redgram - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield and post harvest management.
  20. Greengram, blackgram, chickpea and cowpea - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield - Post harvest management - Agronomy of rice fallow pulses.
  21. Chickpea and cowpea - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield
  22. Soybean - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties – Main field preparation – Nutrient management and weed management.
  23. Soybean - Irrigation management– Pest and disease management – yield - Post harvest management - Agronomy of rice fallow pulses.
  24. Lentil and Horse gram - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
  25. Forage crops – Fodder Sorghum, Maize, Pearlmillet - Economic importance, soil and climatic requirement, varieties, cultural practices and yield.
  26. Importance and area, production and productivity of green manures and forage crops of India and Tamil Nadu.
  27. Forage crops – Cumbu, Napier Hybrid grass, Guniea grass and water grass - Economic importance, soil and climatic requirement, varieties, cultural practices and yield.
  28. Forage crops – Buffalo grass, Elephant grass, Kolukkattai grass - Economic importance, soil and climatic requirement, varieties, cultural practices and yield.
  29. Forage crops – Lucerne, Berseem and Desmodium : Economic importance, soil and climatic requirement, varieties, cultural practices and yield.
  30. Forage crops - Stylosanthus and cowpea: Economic importance, soil and climatic requirement, varieties, cultural practices and yield.
  31. Forage crops - Tree fodders - Preservation of fodders - Silage and hay making.
  32. Green manures –Daincha, Sunhemp and *S.rostrata* - Importance - Soil and climatic requirement - cultural practices and yield
  33. Green manures – Importance - Glyricidia, Subabul, Kolingi, Pongam and Neem - Soil and climatic requirement - Cultural practices and yield
  34. *Insitu* incorporation of greenmanures.

#### **PRACTICAL SCHEDULE**

1. Identification of cereals, millets, pulses, green manures and forage crops in the crop cafeteria.
2. Practicing various nursery types and main field preparation for rice crop.
3. Nursery and main field preparation for important millets and pulses.
4. Acquiring skill in different seed treatment techniques in important field crops.
5. Estimation of plant population, seed rate and fertilizer requirement for important field crops.
6. Acquiring skill in field preparation, sowing and manuring of crops under pure and

- intercropping situations for cereals and millets.
7. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for pulses, green manures and forage crops
  8. Acquiring skill in using seed drill for sowing operations.
  9. Acquiring skill in foliar nutrition for important field crops.
  10. Observations on growth parameters of cereals, millets, pulses, green manures and forage crops.
  11. Study on yield parameters and estimation of yield in cereals and millets.
  12. Study on yield parameters and estimation of yield in pulses and forage crops.
  13. Acquiring skills in post harvest technology for important cereals, millets and pulses
  14. Working out cost and returns of important cereals, millets and pulses.
  15. Visit to Dairy Unit / farmers field to acquire skill and silage and hay making.
  16. Visit to farmers field / research stations to study the cultivation techniques of cereal, millets, pulses, green manures and forage crops.
  17. Orientation for final examination.

#### REFERENCE BOOKS

1. Ahlawat, I.P.S., Om Prakash and G.S. Saini. 1998. Scientific Crop Production in India. Rama publishing House, Meerut.
2. Chidda Singh. 1997. Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
3. Crop Production Guide. 2012. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
4. Singh. S.S. 1997. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.

#### e- resources

1. <https://www.scribd.com/doc/22308132/AGRONOMY-OF-FIELD-CROPS-1>
2. <http://nsdl.niscair.res.in/123456789/524 RICE - FORMATTED.pdf>  
<http://nsdl.niscair.res.in/123456789/502 -WHEAT - formatted.pdf>  
<http://nsdl.niscair.res.in/123456789/505 GRAM - Formatted.pdf>  
<http://nsdl.niscair.res.in/123456789/503 BARLEY - FORMATTED.pdf>
3. [http://nsdl.niscair.res.in/123456789/527 Millets \(Sorghum, Pearl Millet, Finger Millet\) - Formatted.pdf](http://nsdl.niscair.res.in/123456789/527 Millets (Sorghum, Pearl Millet, Finger Millet) - Formatted.pdf)

#### ENT 211 ECONOMIC ENTOMOLOGY AND INTRODUCTORY NEMATOLOGY (2+1) OBJECTIVE

1. To study the techniques in rearing honey bees, silkworm, and lac insects.
2. To know about minor productive insects and their importance.
3. To know about helpful and injurious insects and their uses
4. To study the basic morphology, biology and extraction of important plant parasitic nematodes.

#### Unit-I: Apiculture

Economic classification of insects. Importance and history of apiculture, species of bees, morphology, anatomy-structural adaptations. Colony organization and life history – bee castes, duties, social behaviour, bee pasturage, bee foraging, communication, swarming. Apiary –selection of site-bee-keeping equipments seasonal management and Artificial queen rearing. Enemies and diseases of bees, bee pollination, bee products and their uses, bee poisoning and Scope of beekeeping in India.

#### Unit-II: Sericulture

Importance and history of sericulture, organizations involved in sericulture, silkworm types – mulberry silkworms and non – mulberry silkworms –eri, tasar and muga silkworms. voltinism – multivoltine – bivoltine –hybrid–double hybrids – morphology and biology of mulberry silkworm – structure and function of silk glands. 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 processing – Seed lac- Button lac – Shellac. Lac products – Uses of lac. Minor productive insects – Cochineal insect, Gall insect. Aesthetic, Scientific and Medicinal value of insects. Forensic entomology – Definition - insects used in criminal investigations - salient examples – their biology. Entomophagy – Definition – Edible insects and advantages. Insects used as animal feed.

### **Unit-IV: Helpful and injurious insects**

Helpful insects - Parasitoids, Predators, difference between predators and parasitoids, Types of parasitoids and parasitism, Weed killers, pollinators, scavengers and soil builders. Injurious insects – identification of insects injurious to human beings, cattle and poultry. Identification and management of house hold insects.

### **Unit-V : Morphology, Taxonomy, Biology and Extraction 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, Biology and ecology of important plant parasitic nematodes –*Meloidogyne*, *Heterodera*, *Globodera*, *Tylenchulus*, *Hoplolaimus*, *Aphelenchoides*, *Xiphinema*, *Pratylenchus*, *Rotylenchulus*, *Radopholus* and *Ditylenchus*. Extraction of nematodes – Soil and root sampling, Cobb's sieving method, Baermann funnel technique and modified Baermann funnel technique, sugar flotation technique, cysts by conical flask technique, fenwick can method and Incubation and Blender technique.

### **PRACTICAL**

Acquaintance with honey bee species, structural adaptation, castes, Bee – keeping equipment, bee forage plants, enemies of bees and Handling of bee colonies and Artificial queen rearing. Acquaintance with silkworm types, life stages of mulberry silkworm, Mulberry varieties, Rearing appliances for silkworm, Enemies of silkworm, Preparation of mulberry cuttings and Handling of silkworm – shelf and shoot rearing skill involved in brushing – feeding – moulting care – bed cleaning –spacing – mountages – spinning and cocoon harvest. Identification of pests and diseases of silkworm – symptoms. Identification of lac insect, lac products 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*, *Hoplolaimus*, *Aphelenchoides*, *Xiphinema*, *Radopholus*, *Ditylenchus*, *Pratylenchus*, *Rotylenchulus* and *Tylenchulus*. Important plant parasitic nematodes of major crops – symptoms and biology.

Assignment: Each student has to submit an assignment on bee keeping / sericulture / Parasitoids and Predators/ Forensic entomology / Entomophagy / entomophilic nematodes / Plant parasitic nematodes.

### **THEORY LECTURE SCHEDULE**

1. Economic classification of insects. Importance and history of apiculture, species of bees.
2. Morphology, anatomy and structural adaptations of bees.
3. Colony organization and life history – bee castes – duties – social behavior.
4. Bee pasturage, bee foraging, communication and swarming.
5. Apiary – selection of site, bee – keeping equipment, seasonal management and Artificial queen rearing.
6. Bee enemies and diseases of bees.
7. Bee pollination, bee products and their uses and Scope of beekeeping in India
8. History of sericulture – silk road – Organizations in sericulture industry, Types of silkworm – Non – mulberry, Eri, Tasar and Muga silkworms.



9. Voltinism – multivoltine – bivoltine – bivoltine hybrids – double hybrids.
10. Morphology and biology of mulberry silkworm. structure and function of silk glands.
11. 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.
12. Mulberry silk worm rearing – rearing house – room and bed disinfectants – grainage.
13. Chawki rearing – feeding, cleaning and spacing, Rearing of late age worms – feeding, cleaning, spacing.
14. 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.
15. Pests and diseases of silkworm – symptoms – management practices.
16. Importance and history of Lac culture. Species of Lac insect.
17. Mid Semester Examination.
18. Morphology, biology and secretion of lac.
19. Host plants of lac insect – maintenance of host plants. Inoculation of Lacinsect and Yield. Enemies of lac insect.
20. Lac processing – Seed lac – Button lac – Shellac. Lac products – Uses of lac.
21. Minor productive insects –Cochineal insect, Gall insect. Aesthetic, Scientific and Medicinal value of insects
22. Forensic entomology – Definition - insects used in criminal investigations-salient examples – their biology. Entomophagy – Definition – Edible insects and advantages. Insects as animal feed.
23. Helpful insects - Parasitoids, Predators, difference between predators and parasitoids, Types of parasitoids and parasitism.
24. Weed killers, pollinators, scavengers and soil builders.
25. Injurious insects – identification of insects injurious to human beings, cattle and poultry.
26. Identification and management of house hold insects
27. Nematology – Introduction – Brief history and development in India – Position of nematodes in animal kingdom.
28. Importance of plant parasitic nematodes and entomophilic nematodes –Economic loss in crop plants.
29. Elementary knowledge on morphology of nematode – cuticle, segmentation, cephalic regions.
30. Elementary knowledge on alimentary, excretory, reproductive systems, nervous system and sense organs.
31. Classification based on feeding habits and ecology. Taxonomy of important plant parasitic nematodes.
32. Biology and ecology of important plant parasitic nematodes – *Meloidogyne*, *Heterodera*, *Globodera*, *Tylenchulus*, *Hoplolaimus* *Aphelenchoides*, *Xiphinema*
33. Biology and ecology of important plant parasitic nematodes – *Pratylenchus*, *Rotylenchulus*, *Radopholus* and *Ditylenchus*.
34. Extraction of nematodes – Soil and root sampling, Cobb's sieving method, Baermann funnel technique and modified Baermann funnel technique, sugar flotation technique, cysts by conical flask technique, fenwick can method and Incubation and Blender technique

#### **PRACTICAL SCHEDULE**

1. Acquaintance with honey bee species, castes of bees and structural adaptation.
2. Acquaintance with Bee – keeping equipments 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 for 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. Identification of Parasitoids, Predators, Weed killers, pollinators, scavengers and soil builders.
8. Identification and management of insects injurious to human beings ,cattle ,poultry and house hold insects
9. Soil and root sampling. Extraction of nematodes by Cobb's sieving method, Baermann funnel technique and modified Baermann funnel technique.
10. Extraction of nematodes by sugar floatation technique.
11. Extraction of cysts by conical flask technique, fenwick can method and incubation and blender technique.
12. Extraction of nematodes from roots and staining of roots infested with endoparasitic nematodes.
13. Preservation of nematodes and preparation of temporary and permanent slides.
14. Observing morphology of the order Tylenchida and Dorylaimida.
15. Identification of nematodes – *Meloidogyne*, *Heterodera*, *Globodera*, *Tylenchulus*, *Radopholus*, *Rotylenchulus*, *Ditylenchus*, *Hirschmanniella*, *Hemicriconemoides*, *Criconema*, *Aphelenchoides*, *Pratylenchus* and *Tylenchulus*.
16. Observing the life stages of *Meloidogyne*.
17. Orientation for final examination.

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1. Abrol. D. P. 2009. *Bees and Bee-keeping in India*. Kalyani Publishers, New Delhi. 705p.
2. Atwal, A.S. 2006. *The World of the Honey Bee*. Kalyani Publishers, New Delhi. 257p.
3. Dandin, S.B., and K. Giridhar.2015. *Hand book of Sericulture Technologies*. Central Silk Board, Bangalore, 427p.
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8. Ronald N. Perry and Maurice Moens. 2006. *Plant Nematology*. CABI Publishing. 463 pages.

### PAT 212 FUNDAMENTALS 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 – Koch's Postulates – Causes of plant diseases – Biotic and abiotic factors – Losses due to plant diseases – Plant Pathogenic organisms – Protozoa, Chromista, Fungi, Bacteria, *Candidatus Phytoplasma*, *Spiroplasma*, Fastidious vascular bacteria, Viruses, Viroids, Virusoids, Algae, Phanerogamic parasites and Nematodes.

## Unit II: Pathogenesis

Pathogenesis – Mode of infection – pre-penetration, penetration and post penetration – Effect of pathogen on physiological functions of the plants – Role of enzymes and toxins on disease development – Plant defense mechanisms

## 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) – 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, Subphylum: Mucoromycotina (Mucorales).

## Unit IV: Phylum Ascomycota and Basidiomycota

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

## Unit V: Bacteria, Phytoplasma, Virus, Viroid, Virusoid, Algae, Phanerogams and Abiotic disorders

Classification of bacteria - general characters and symptoms of phytopathogenic bacteria- growth and reproduction-mode of entry and spread- general characters and symptoms of *Candidatus Phytoplasma*, Spiroplasma, Fastidious Vascular Bacteria, viruses - virus vector relationship-symptoms and transmission of Viral diseases - Viroids, Virusoid, Algae-flowering plant parasites - Abiotic disorders.

## PRACTICAL

Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium*, *Phytophthora*, *Albugo*, *Sclerospora*, *Peronospora*, *Peronosclerospora*, *Pseudoperonospora*, and *Plasmopara*, *Mucor*, *Rhizopus*, *Taphrina*, *Capnodium*, *Cercospora*, (*Mycosphaerella*), *Diplodia*, *Botryodiplodia* (*Botryosphaeria*), *Curvularia*, *Drechslera* (*Helminthosporium*), *Alternaria*, *Venturia*, *Erysiphe*, *Phyllactinia*, *Uncinula*, *Leveillula* and *Claviceps*, *Fusarium* (*Gibberella*, *Nectria*), *Verticillium*, *Colletotrichum* (*Glomerella*) *Pestalotia* (*Pestalosphaeria*), *Pyricularia* (*Magnaporthe*), *Sarocladium*, *Macrophomina*, *Puccinia*, *Uromyces*, *Hemileia*, *Ustilago*, *Sphacelotheca* (*Sporisorium*), *Tolyposporium* (*Moesziomyces*), *Exobasidium*, *Sclerotium*, *Rhizoctonia* (*Thanatephorus*), *Ganoderma*, *Agaricus*, *Pleurotus*, *Volvariella* and *Calocybe*. Symptoms of bacterial diseases, *Candidatus Phytoplasma*, Fastidious Vascular Bacteria, Algal parasite, Phanerogamic parasites and Non-parasitic diseases

Note: Students should submit 50 well-preserved Herbariums

## THEORY LECTURE SCHEDULE

1. Definition of Plant Pathology – History of Plant Pathology
2. Koch's Postulates
3. Causes of Plant diseases – Protozoa , Chromista, Fungi, Bacteria, Fastidious Vascular Bacteria, Spiroplasma, *Candidatus Phytoplasma*
4. Causes of Plant diseases -Virus, Viroid, Virusoid, Algal, Phanerogamic parasites, Nematodes and Abiotic disorders
5. Pathogenesis – stages in pathogenesis – pre-penetration, penetration and post penetration
6. Role of enzymes and toxins in disease development
7. Effect of pathogen on physiological functions of the plants- Effect on Photosynthesis- Transpiration- Respiration- translocation of water and nutrients
8. General characters of fungi- Mycelia – vegetative resting structures
9. Asexual reproduction in fungi
10. Sexual reproduction in fungi

11. Parasitism in fungi- Types of parasitism – parasite, saprophyte, obligate parasite, facultative parasite, facultative saprophyte-biotrophs, hemibiotrophs, perthotrophs/ necrotrophs and symbiosis
  12. Classification of Kingdom– Protozoa - important taxonomic characters, symptoms and life cycle of *Plasmodiophora brassicae* and symptoms of Protozoan diseases
  13. Classification of Kingdom Chromista- General characters of Oomycetes- Symptoms and life cycle of *Pythium*, *Phytophthora* and *Albugo*
  14. Symptoms and life cycle of *Peronosclerospora*, *Sclerospora*, *Perenospora*, *Pseudoperonospora* and *Plasmopara*
  15. Classification of Kingdom– Chytridiomycota and Zygomycota - important characters, symptoms and life cycles of *Synchytrium*, *Rhizopus* and *Mucor*
  16. Classification of Kingdom– Ascomycota- important characters
  17. Symptoms and life cycles of *Taphrina*, *Capnodium*, *Cercospora*, (*Mycosphaerella*), *Diplodia*, *Botryodiplodia* (*Botryosphaeria*), *Drechslera* (*Helminthosporium*), *Alternaria*, *Venturia* and *Macrophomina*
  18. Mid Semester Examination
  19. Symptoms and life cycles of *Eurotium*, *Talaromyces*, *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula*, *Podosphaera* and *Sphaerotheca*
  20. Symptoms and important characters of *Claviceps*, *Fusarium* (*Gibberella*, *Nectria*) and *Verticillium*
  21. Symptoms and important characters of *Colletotrichum* (*Glomerella*), *Pestalotia* (*Pestalosphaeria*), *Pyricularia* (*Magnoportha*) and *Sarocladium*
  22. Classification of Kingdom - Basidiomycota- important characters
  23. Symptoms and life cycles of *Puccinia*, *Uromyces* and *Hemileia*
  24. Symptoms and life cycles of *Ustilago*, *Sphacelotheca* (*Sporisorium*), *Tolyposporium* (*Moesziomyces*), *Tilletia* and *Exobasidium*
  25. Symptoms and life cycles of *Athelium*, *Thanatephorus* and *Ganoderma*
  26. Important taxonomic characters of *Agaricus*, *Pleurotus*, *Volvariella* and *Calocybe*
  27. Classification and general characters of phytopathogenic bacteria
  28. Symptoms of plant pathogenic bacteria
  29. Mode of entry, spread and survival of bacterial pathogens
  30. Important characters and symptoms of *Candidatus Phytoplasma* diseases – Phyllody, little leaf, yellow dwarf and sandal spike, Fastidious Vascular Bacteria and Spiroplasma
  31. Virus - definition, nature and properties of plant virus, Single stranded, Double stranded RNA and DNA viruses and Transmission of plant viruses
  32. Virus vector relationship-symptoms of viral diseases
  33. Important characters and symptoms of Viroid, Virusoid, Algal and Phanerogamic parasites
  34. Non-parasitic disorders
- 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. Study of important taxonomic characters and symptoms produced by *Sclerospora*, *Peronospora*, *Peronosclerospora*, *Pseudoperonospora* and *Plasmopara*
  4. Study of important taxonomic characters and symptoms produced by *Albugo* and *Rhizopus*.
  5. Study of important taxonomic characters and symptoms produced by *Taphrina*, *Capnodium*, *Cercospora* (*Mycosphaerella*), *Diplodia*, *Botryodiplodia* (*Botryosphaeria*), *Drechslera* (*Helminthosporium*) and *Alternaria*
  6. Study of important taxonomic characters and symptoms produced by *Eurotium*, *Talaromyces*, *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula*, *Podosphaera* and *Sphaerotheca*
  7. Study of important taxonomic characters and symptoms produced by *Claviceps*, *Fusarium* (*Gibberella*, *Nectria*) and *Verticillium*
  8. Study of important taxonomic characters and symptoms produced by *Colletotrichum* (*Glomerella*), *Pestalotia* (*Pestalosphaeria*), *Pyricularia* (*Magnoportha*), *Sarocladium* and *Macrophomina*

9. Study of important taxonomic characters and symptoms produced by *Puccinia*, *Uromyces*, and *Hemileia*
10. Study of important taxonomic characters and symptoms produced by *Ustilago*, *Sphacelotheca (Sporisorium)*, *Tolyposporium (Moesziomyces)* and *Exobasidium*
11. Study of important taxonomic characters of *Agaricus*, *Pleurotus*, *Calocybe*, *Volvariella* and symptoms produced by *Athelium*, *Thanatephorus* and *Ganoderma*
12. Symptoms of bacterial diseases – leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.
13. Symptoms of *Candidatus Phytoplasma* and Algae
14. Symptoms and vectors of viral diseases – mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunched top
15. Phanerogamic parasites and non-parasitic diseases
16. Field visit
17. Orientation for final examination

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

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2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2010. Introductory Mycology. John Wiley and Sons Ltd., New York.
3. Alice, D, and Jeyalakshmi, C. 2014. Plant Pathology. A.E Publications, Coimbatore
4. Chaube, H. S. and Singh, R. 2015. Introductory Plant Pathology. CBS Publishers, New Delhi.
5. Dube, H.C. 2009. A Text Book of Fungi, Bacteria and Viruses, Vikas Publishing House Pvt., Ltd., New Delhi.
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1. Agrios, G.N. 2005. Plant Pathology – (5<sup>th</sup> Edition). Academic Press, New York.
2. Janse, J.D. 2006. Phytobacteriology- Principles and Practice, CABI Publishing, U.K.
3. Phyllis G. Weintraub and Phil Jones. 2010. Phytoplasmas- Genomes, Plant Hosts and Vectors, CABI Publishing, U.K.

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3. [www.bspp.org.uk](http://www.bspp.org.uk)
4. [www.ictv.org](http://www.ictv.org)
5. [www.bibo.library.cornel.edu](http://www.bibo.library.cornel.edu)

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

#### OBJECTIVES

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

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

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

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

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

### **Unit III : Physical properties -1**

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

### **Unit IV: Physical properties -II**

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

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

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

### **Practical**

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

### **THEORY LECTURE SCHEDULE**

- 1 History and development of Soil Science and its branches – Origin of the Earth – Composition of Earth's crust**
- 2 Rocks – definition, formation, classification – igneous, sedimentary and metamorphic rocks. Brief description of important rocks – mineralogical composition**
- 3 Minerals – definition, occurrence, classification of important soil forming primary minerals - silicate and non silicate minerals, ferro and non-ferro magnesium minerals Formation of secondary minerals – clay minerals and amorphous minerals**
- 4 Weathering – types of weathering – physical weathering of rocks – agents of physical weathering and their role**
- 5 Chemical weathering – solution, hydration, hydrolysis, carbonation, oxidation and reduction; Biological weathering – role of flora and fauna in weathering process**
- 6 Soil formation – soil forming factors – classification – active and passive. And their role in soil formation – catena – definition**
- 7 Fundamental soil forming process – Eluviation, Illuviation and humification. Specific Soil forming processes – podzolization, Laterization, salinization, alkalization, calcification, decalcification, Pedoturbation, melanization**
- 8 Soil profile description – master horizons – pedon and poly pedon**
- 9 Soil and Phases of soils – solid, liquid and gaseous phase-mineral matter, organic matter, water and air – definition and functions of soil and various concepts of soil- Pedological and edaphological concepts**
- 10 Soil physical properties- soil texture – definition – various inorganic components in soil and their properties – particle size analysis – methods – various textural classes in soil and their properties**
- 11 Stoke's Law – assumptions and limitations – significance of soil texture**
- 12 Soil structure – classification – types, classes and grades of soil structure – factors affecting soil structure**
- 13 Genesis of soil structure- importance of soil structure and its management**

- 14 Density of soil – bulk density and particle density – factors affecting density parameters – importance of bulk density of soil – soil compaction – its importance
- 15 Porosity of soil- factors affecting it- calculation. Soil colour – components – significance of soil colour
- 16 Soil consistence – cohesion, adhesion, plasticity, Atterberg’s constants – upper and lower plastic limits, plasticity number- significance of soil consistence
- 17 Mid Semester examination
- 18 Soil water –forces of soil water retention – forms of water- pF concept– Soil water potential – components of water potentials – soil moisture constants – field capacity, wilting coefficient, hygroscopic water and saturation
- 19 Determining soil moisture constants – pressure plate apparatus – soil moisture content- methods Gravimetric , gypsum block ,Tensiometer, TDR and neutron probe
- 20 Soil water movement – Darcy’s Law – saturated, unsaturated and vapor flows – infiltration, percolation, permeability and drainage. importance of soil water in relation plant growth
- 21 Soil temperature – sources of heat – heat capacity and conductivity – movement of heat soil- Fourier’s law-factors influencing soil temperature
- 22 Measurement of soil temperature – importance of soil temperature on crop growth – management of soil temperature
- 23 Soil air – compositions of atmospheric air and soil air – gaseous exchange – Fick’s law-
- 24 Influence of soil air on plant growth, soil properties and nutrient availability – measurement of oxygen diffusion rate – measures to improve soil aeration
- 25 Soil colloids – definition – general properties – shape, surface area, electrical charge, adsorption, flocculation, deflocculation, plasticity, cohesion, swelling, shrinkage, Tyndall effect and Brownian movement. Types of soil colloids- inorganic and organic colloids
- 26 Layer silicate clays – genesis and classification – 1:1, 2:1 expanding and non expanding, 2:2 clay minerals, amorphous minerals and iron and aluminum oxides
- 27 Origin of charge in organic and inorganic colloids – negative and positive charges – organic colloids - differences between organic and inorganic soil colloids
- 28 Adsorption of ions – types of ion exchange – cation and anion exchange – cation and anion exchange capacities of soil
- 29 base saturation – factors affecting ion exchange capacity of soils – importance of Cation Exchange Capacity (CEC) and Anion exchange capacity ( AEC) of soils
- 30 Soil reaction (pH) – definition, pH scale, factors affecting soil pH, buffering capacity – signification Soil Electrical Conductivity – factors affecting EC – significance
- 31 Soil organic matter – various sources – composition – compounds in plant residues – their decomposability -mineralization and immobilization– humus – definition – synthesis of humus
- 32 Importance of soil organic matter and humus – fractionation of soil humus – carbon cycle – biomass carbon and nitrogen
- 33 Carbon: nitrogen (C:N) ratio of commonly available organic residues – significance of C:N ratio in soil fertility . Functions of soil organic matter in soil
- 34 Soil organisms – soil flora and fauna –beneficial and harmful roles – earth worms – microorganisms and their influence on soil properties

## PRACTICAL SCHEDULE

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

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2. Dilip Kumar Das. 2015. Introductory Soil Science. Kalyani Publishers, Ludhiana.
3. Sahai, V.N. 2001. Fundamentals of Soil, Kalyani Publishers, Ludhiana
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5. R.K.Mehra. 2006. Text Book of Soil Science. ICAR. New Delhi
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## GPB 214 PRINCIPLES OF GENETICS AND CYTOGENETICS (2+1)

### OBJECTIVES

The fundamental concepts of Genetics and Cytogenetics will be exposed to the students quoting classical examples.

### THEORY

#### Unit I: Cytology

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



## Unit II: Mendelian laws and modifications of Mendelian laws

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

## Unit III: Modern concept of genetics and mutation

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

## Unit IV: Quantitative inheritance, Linkage and Crossing over

Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits. Linkage - coupling and repulsion; Experiment on Bateson and Punnet – Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group. Crossing over – significance cytological proof - Stern's experiment; Factors controlling crossing over. Strength of linkage and recombination; Two point and three point test cross. Double cross over, interference and coincidence; genetic map and physical map.

## Unit V: Sex determination, sex linkage and cytoplasmic inheritance

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

### PRACTICAL

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

### THEORY SCHEDULE

1. Definition of genetics, heredity, inheritance, cytology, cytogenetics; Brief history of developments in genetics and cytogenetics.
2. Physical basis of heredity: Structure and function of cell and cell organelles – Differences between Prokaryotes and Eukaryotes.
3. Cell division – mitosis, meiosis and their significance, cell cycle; zygote formation and embryo development - identical and fraternal twins.
4. Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram – chromosome banding.

5. **Types of chromosomes based on position of centromere, based on structure and function: normal and special chromosomes - polytene, lampbrush, based on the role in sex determination: autosomes and allosomes, Other types of chromosomes - B, ring and isochromosomes.**
6. **Chromosomal aberration: Variation in chromosome structure - deletion, duplication, inversion and translocation - genetic and cytological implications.**
7. **Chromosomal aberration: Variation in chromosome number - euploid, aneuploid, types of aneuploids and their origin; Nondisjunction - Klinefelter syndrome and Turner syndrome; Definition of eugenics and euthenics.**
8. **Polyploid - auto and allopolyploids, their characters; meaning of genome; evolution of wheat, Triticale, cotton, tobacco, *Brassica***
9. **Pre-Mendelian ideas about heredity - Vapour and fluid theory, Magnetic power theory, Preformation theory, Lamarck's theory, Darwin's theory, Germplasm theory and Mutation theory.**
10. **Mendel's experiments and laws of inheritance. Rediscovery of Mendel's work**
11. **Terminologies: gene, allele, locus, homozygous, heterozygous, hemizygous, genotype, phenotype, monohybrid, dihybrid, trihybrid, polyhybrid.**
12. **Chromosomal theory of inheritance. Allelic interactions - Dominance vs recessive, complete dominance, codominance, incomplete dominance, over dominance.**
13. **Deviation from Mendelian inheritance - Non allelic interaction without modification in Mendelian ratio - Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio - i.) Dominant epistasis (12:3:1)**
14. **ii.) Recessive epistasis (9:3:4) iii.) Duplicate and additive epistasis (9:6:1). iv.) Duplicate dominant epistasis (15:1)**
15. **v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); Summary of epistatic ratios (i) to (vi).**
16. **Lethal genes, Pleiotrophy, penetrance and expressivity, phenocopy: Multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles.**
17. **Mid Semester Examination**
18. **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.**
19. **Structure of DNA - Watson and Crick model - Central dogma of life**
20. **Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication.**
21. **RNA types - mRNA, tRNA, rRNA; genetic code, protein synthesis - transcription. Translation**
22. **Regulation of gene expression - operon model of Jacob and Monad; Structural genes and regulator genes. Cistron, muton and recon;**
23. **Complementation test; exons, introns - split genes - Transposable genetic elements - Ac - Ds system in maize - Functional genomics, Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics**
24. **Mutation - characteristics of mutation - micro and macro mutation - CIB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.**
25. **Quantitative inheritance - Multiple factor hypothesis - Nilsson Ehle experiment on wheat kernel colour.**
26. **Polygenes - transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits.**
27. **Linkage - coupling and repulsion; Experiment on Bateson and Punnet - Chromosomal theory of linkage of Morgan - Complete and incomplete linkage, Linkage group.**
28. **Crossing over - significance of crossing over; cytological proof for crossing over - Stern's experiment; Factors controlling crossing over.**
29. **Strength of linkage and recombination; Two point and three point test cross.**
30. **Double cross over, interference and coincidence; genetic map, physical map.**

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

#### **PRACTICAL SCHEDULE**

1. Use of microscopes
2. Principles of killing and fixing; preparation of stains and preservatives.
3. Study of behavior of chromosomes in mitosis.
4. Study of the mitotic phases in root tips of onion / *Aloe sp.*
5. Procedure for fixing and observing different meiotic phases in the inflorescence of rice/maize.
6. Procedure for fixing and observing different meiotic phases in the inflorescence in pearl millet/ sorghum/ horticultural crop/forest tree.
7. Repetition of meiotic studies in maize/ sorghum/ pearl millet/ forest tree and making temporary and permanent slides.
8. Observation of bivalents, trivalents, quadrivalents and chromosome banding.
9. Principles of dominance, recessive, back cross, test cross, incomplete dominance, codominance and lethal factor; Chi square test; Monohybrid genetic ratio with dominance, with incomplete dominance and test cross.
10. Dihybrid ratio with dominance, with incomplete dominance and test cross
11. Simple interaction of genes-comb character in fowls; Dominant epistasis.
12. Recessive epistasis, Duplicate and additive epistasis.
13. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
14. Multiple alleles and polygenic inheritance
15. Estimation of linkage with F<sub>2</sub> and test cross data; Coupling and repulsion.
16. Problems on two point test cross and three point test cross; Working out interference, coincidence and drawing genetic maps.
17. Orientation for final examination

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  2. Verma, P.S. and V.K. Agarwal. 2007. Genetics. S.Chand and Company Ltd./ New Delhi.
  3. Stansfield, W.D. 1990. Theory and problems of genetics. Mc-Graw Hill Book Co., New York
  4. Pundhan singh. 2014. Elements of Genetics. Kalyani Publishers
- Further reading**
1. Benjamin Lewin. 2005. Genes IX Oxford University Press, Oxford.
  2. Russel, P.J. 2000. Fundamentals of genetics. Addition Wesley Longman Publishers, USA
  3. Daniel Sundararaj, G. Thulasidas and M. Stephen Dorairaj, 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai – 15.
  4. Strickberger. M.W. 1996. Genetics. Prentice-Hall of India Pvt. Ltd. New Delhi.
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## **HOR 215 BASIC HORTICULTURE AND PLANT PROPAGATION (2+ 1)**

### **OBJECTIVES**

This course will expose the basic and fundamental aspects of horticulture including propagation methods, planting systems, training, pruning, orchard layout, growth regulation and components of protected cultivation.

### **THEORY**

#### **Unit-I : Basic concepts of horticulture**

Horticulture – definition- scope and importance of horticulture – divisions of horticulture – area and production – export and import – classification of horticultural crops – climatic zones of India and Tamil Nadu in relation to horticultural crops – Factors limiting horticultural crop production - Horticultural developmental agencies.

#### **Unit-II : Methods of propagation in horticultural crops**

Propagation techniques– Seed and vegetative propagation methods – Advantages and disadvantages–Techniques of seed propagation – Dormancy and methods of overcoming dormancy – Vegetative propagation methods– Principles underlying - Cutting, layering, grafting and budding – Stock-Scion relationship – Nursery practices- Mist propagation – Micro propagation – propagation by specialized plant parts.

#### **Unit-III : Orchard management and cropping systems**

Establishment of an orchard – Planting system - Intercultural operations – Weed, irrigation and fertilizer management- Cropping systems – Intercropping – Multi-tier cropping – Cover crops – Mulching - Organic farming.

#### **Unit-IV : Growth and development of horticultural crops**

Bearing habits – Training and pruning – flowering, pollination, fruit set - Unfruitfulness - causative factors – Fruit drop –causes and prevention- Role of growth regulators in horticultural crops – Rejuvenation of old and senile orchards –Top working.

#### **Unit-V : Protected cultivation**

Protected cultivation – definition, importance and scope in india- modes of protected cultivation- types of green houses – factors controlled under green house – media – Hydroponics – Methods and Advantages.

### **PRACTICAL**

Study of different features of an orchard – Tools, implements and machineries used for horticultural operations –Planning and layout of orchard and planting-Media and containers for propagation of plants-Preparation of pot mixture, potting and repotting of plants – Preparation of nursery beds for raising rootstocks and seedlings – Methods of propagation – Cutting, layering grafting and budding – Specialized plant parts for propagation – Rejuvenation – Micro propagation, protocol for mass multiplication and hardening — Propagation structures, mist chamber, shade net, glass houses and poly houses – Their operations and maintenance – Preparation and application of PGR's for propagation and crop regulation – Bearing habits – Training, pruning and special practices –Visit to commercial orchards and nurseries.

### **THEORY SCHEDULE**

1. Horticulture –definitions, scope and importance of horticulture– Divisions of horticulture.
2. Classifications of horticultural crops.
3. Area and production ,export and import of horticultural crops
4. Different climatic zones of India and Tamil Nadu in relation to horticultural crops.
5. Factors limiting horticultural crop production - Horticultural developmental agencies.
6. Principles of propagation – Advantages and disadvantages of seed propagation.
7. Dormancy and measures to overcome seed dormancy.
8. Techniques of vegetative propagation – Advantages and disadvantages of Vegetative/Asexual propagation.
9. Detailed study about principles underlying cutting and layering.
10. Detailed study about grafting and budding – Stock and scion relationship.
11. Nursery practices, principles and practices of mist propagation.
12. Principles and practices of micro propagation.
13. Principles and practices of propagation by specialized plant parts.

14. Detailed study of establishment of an orchard.
15. Study about different planting systems followed in horticulture.
16. Study of different types of manures and manuring practices
17. Mid Semester Examination
18. Study of different types of irrigation methods followed in horticultural crops.
19. Study of different methods of cropping systems – intercropping – multi-tier cropping – cover crops-mulching-
20. Detailed study of organic farming.
21. Detailed study on bearing habits in horticultural crops.
22. Principles and methods of training in horticultural crops.
23. Principles and methods of pruning in horticultural crops.
24. flowering, pollination and fruit set in horticultural crops.
25. Unfruitfulness - causes and prevention in horticultural crops.
26. Fruit drop - causes and prevention in horticultural crops.
27. Role of growth regulators in horticultural crops.
28. Rejuvenation of old and senile orchards- Top working.
29. Protected cultivation – definition, importance and scope in india
30. types of protected structures for propagation and crop production.
31. types of green house.
32. factors controlled under green house.
33. different media used for protected cultivation.
34. hydroponics – methods and advantages

#### **PRACTICAL SCHEDULE**

18. Visit to Orchard and study of different features of an orchard
19. Planning, layout and planting of horticultural crops
20. Machineries, tools and implements used for various horticultural operations
21. Media and containers for propagation of plants
22. Preparation of potting mixture, potting and repotting of plants
23. Seed treatment techniques
24. Preparation of nursery beds for raising rootstocks and seedlings
25. Demonstration of propagation through cutting
26. Demonstration of propagation through layering
27. Demonstration of propagation through grafting and top working
28. Demonstration of propagation through budding
29. Propagation through specialized plant parts
30. Bearing habits of horticultural crops
31. Special training and pruning practices followed in horticultural crops
32. Preparation of plant growth regulators and methods of application in horticultural crops
33. Visit to tissue culture laboratory and study of micropropagation protocols and hardening
34. Plant propagation structures including mist chamber, shade net, glass houses and poly houses and Orientation for final examination

#### **REFERENCE BOOKS**

1. Chadha, K.L. 2015, Handbook of Horticulture, ICAR, New Delhi.
2. Hartmann, H.T., D.E. Kester's, Davies Jr. F.T. and Geneve, RL. 2002. Plant Propagation – Principles and Practices. Prentice Hall of India Ltd., New Delhi.
3. Jitendra Singh. 2006. Basic Horticulture. Kalyani Publishers, New Delhi.
4. Kumar, N.2010. Introduction to Horticulture, (7th Ed.) Oxford IBH Publication, New Delhi.
5. Rajan, S. and B.L. Markose. 2007. Propagation of Horticultural Crops. New India Publishing, New Delhi.

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

##### **OBJECTIVES**

The objective of this course is to provide knowledge to the students of B.Sc. (Ag.) about the principles of farm management. It would help the students in using different methods and tools for decision making in farm management, which would facilitate profit maximization through optimizing resource use.

## **THEORY**

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

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

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

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

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

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

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

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

### **Unit V: Farm Planning and Budgeting**

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

## **PRACTICAL**

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

## **THEORY LECTURE SCHEDULE**

- 1. Production Economics: Definition and nature and scope - Farm Management: Definition - Objectives - Scope of farm management - Farm management decisions.**
- 2. Production Economics Vs Farm Management - Basic terms and concepts: Resources - Fixed, variable, flow and stock resources - Choice indicator.**
- 3. Factors of production - Types/Forms of production function - Linear, quadratic and cobb-douglas.**
- 4. Factor - Product relationship: Meaning - Agricultural production function: Meaning, definition - Laws of Returns: Law of constant, increasing and decreasing returns.**
- 5. Law of Diminishing Marginal Returns - Relationship between total, average and marginal products - Three stages of production function.**
- 6. Elasticity of production - Determination of optimum input and output - Physical and economic optimum.**
- 7. Cost principles and cost curves.**

8. Economies of scale - Economies of size - Factor - Factor relationship: Meaning - isoquant: Definition - Types.
9. Mid-Semester Examination
10. Isoquant map - characteristics / properties - Factor intensity.
11. Marginal rate of technical substitution - Elasticity of factor substitution - Iso-cost line - Principles of cost minimization / Least cost combination of inputs.
12. Isoclines, ridgelines and expansion path - Effect of input price changes on the least cost combination - Returns to scale.
13. Product - Product relationship - Meaning - Production possibility curve - Marginal rate of product substitution.
14. Enterprise relationship: Joint products, complementary, competitive and supplementary products - Iso-revenue line - Optimum product combination - Principle of equi-marginal returns - Opportunity cost principle - Principle of comparative advantage - Minimum loss principle.
15. Farm planning: Meaning - Types - Elements - Farm planning procedure - Characteristics of good farm plan - Farm budgeting: Definition and types - Partial budgeting - Complete budgeting and cash flow budgeting - Limitations.
16. Types and systems of farming: Types - Specialized, diversified, and mixed farming - Systems of farming: Co-operative, collective, capitalist, state and peasant farming.
17. Risk and Uncertainty: Definition - Types of risk and uncertainty - safeguards against risk and uncertainty.

#### **PRACTICAL SCHEDULE**

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

#### **REFERENCES**

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2. Johl, S.S. and Kapoor, T.R., 2000. Fundamentals of Farm Business Management, Kalyani Publications, India.
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4. Raju, V.T. and Rao, D.V.S., 2000. Economics of Farm Production and Management, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Sankayan, P.L., 1983. Introduction to Farm Management, Tata McGraw Hill Publishing Company Ltd., New Delhi.

#### **AEX 217 DIMENSIONS OF AGRICULTURAL EXTENSION (1+1)**

##### **OBJECTIVE**

The course intends to expose students to the fundamentals of extension education, extension systems in India, programme planning and rural development efforts. The course will also provide an opportunity to students to visit different organizations involved in extension activities and rural development work.

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

**Extension Education – meaning, definition, scope, objectives, philosophy, principles; Extension Education Process; Differences among formal, informal and non-formal education.**

#### **UNIT II : Early Rural Development attempts, Extension approaches in India**

**Historical development of extension in India – Scheme of Rural Reconstruction, Economic Conference of Mysore, Gurgaon Experiment, Sriniketan, Sevagram, Marthandam project, Firka development scheme, Etawah pilot project, Nilokheri Experiment; Extension programmes of Ministry of Agriculture – Training and Visit (TandV) System, Broad Based Extension System (BBES), Farming System Research Extension(FSRE) , Agricultural Technology Management Agency (ATMA); Firstline Extension System – KVK, ATIC, Frontline demonstrations.**

#### **UNIT III :Major Rural Development Programmes**

**Rural Development – meaning, definition, concept, importance; - Democratic Decentralization – Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup –Community Development Programme (CDP), National Extension Service (NES), IADP, IAAP, HYVP, IVLP, NATP, ITDP, IRDP, SFDA, MFAL, NREP, RLEGP, DPAP, CADP, FFW, JRY, EAS, IAY, SGSY, SJSRY, PMGSY, SGRY, MGNREGA, PURA, NAIP, NADP (RKVY).**

#### **UNIT IV : Women and Youth Development Programmes**

**Women Development Programmes – DWCRA, MSY, TANWA; Youth Development Programmes – TRYSEM, Nehru Yuva Kendra (NYK), ARYA.**

#### **UNIT V : Extension Programme Planning**

**Extension Programme Planning – definition, principles; meaning of project, plan, calendar of work, plan of work; steps in programme planning.**

#### **PRACTICAL**

**Visit to District Rural Development Agency (DRDA) to study the organizational set up and rural development programmes; Visit to Panchayat Union office to learn their functions; Exposure to Grama Panchayat activities; Study of the functions of JDA / ADA and to learn about ATMA and other schemes; Interaction with a Self-Help Group to study its activities; Exposure to a Non-Governmental Organization (NGO) to study its role in rural development; Study of the activities of State Department of Horticulture to learn their extension activities; Visit to Krishi Vigyan Kendra (KVK) to learn their roles and activities; Visit to Social Welfare Department to study the women development programmes; Exercise to assess the awareness and participation of village people in rural development programmes in a rural setting.**

#### **THEORY LECTURE SCHEDULE**

- 1. Extension Education – meaning, definition, scope, objectives, philosophy, principles.**
- 2. Extension Education Process, Differences among formal, informal and non-formal education.**
- 3. Historical development of extension in India – Scheme of Rural Reconstruction, Economic Conference of Mysore, Gurgaon experiment, Sriniketan.**
- 4. Sevagram attempt, Marthandam Project, Firka Development Scheme, Etawah Pilot project, Nilokheri Experiment.**
- 5. Extension programmes of Ministry of Agriculture – Training and Visit (TandV) System, Broad Based Extension System (BBES), Farming System Research Extension (FSRE), Agricultural Technology Management Agency (ATMA).**
- 6. Firstline Extension System – Krishi Vigyan Kendra (KVK) Agricultural Technology Information Centre (ATIC), Frontline demonstrations.**
- 7. Rural Development – meaning, definition, concept and importance. Rural Development in India. Democratic Decentralization –Meaning of Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup.**
- 8. Community Development Programme (CDP), National Extension Service (NES), Intensive Agricultural District Programme (IADP), Intensive Agricultural Area Programme (IAAP).**



9. **Mid Semester Examination**
10. **High Yielding Variety Programme (HYVP), Institution Village Linkage Programme (IVLP), Integrated Rural Development Programme (IRDP).**
11. **National Agricultural Technology Project (NATP), Integrated Tribal Development Agency (ITDA), Small Farmers Development Agency (SFDA), Marginal Farmers and Agricultural Labourers Development Agency (MFAL) - National Rural Employment Programme (NREP).**
12. **Rural landless Employment Guarantee Programme (RLEGP), Drought Prone Area Programme (DPAP), Command Area Development Programme (CADP), Food for Work Programme (FFW), Jawahar Rozgar Yojana (JRY).**
13. **Employment Assurance Scheme (EAS), Indira Awaas Yojana (IAY), Swarnajayanthi Gram Swarozgar Yojana (SGSY), Swarna Jayanthi Shahari Rozgar Yojana (SJSRY), Pradhan Mantri Gram Sadak Yojana (PMGSY).**
14. **Sampoorna Grameen Rozgar Yojana (SGRY), Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Providing Urban Amenities to Rural Areas (PURA), National Agricultural Innovation Project (NAIP), NADP (RKVY).**
15. **Women Development Programmes – Development of Women and Children in Rural Areas (DWCRA), Mahila Samridhi Yojana (MSY), Tamil Nadu Women in Agriculture (TANWA).**
16. **Youth Development Programmes – TRYSEM, Nehru Yuvak Kendra (NYK), Attracting Rural Youth towards Agriculture (ARYA).**
17. **Extension Programme Planning – definition, principles; meaning of project, plan, calendar of work, plan of work; steps in programme planning.**

#### **PRACTICAL SCHEDULE**

1. **Visit to District Rural Development Agency (DRDA) to study the organizational set up and rural development programmes.**
2. **Visit to a Panchayat Union Office to learn about its functions.**
3. **Exposure to the activities of a Gram Panchayat.**
4. **Study of the functions of JDA / ADA and to understand the reorganized extension system, organizational setup, functions, ATMA scheme and other schemes.**
5. **Interaction with a SHG to study its activities.**
6. **Exposure to an NGO to study their role in rural development activities.**
7. **Study of the extension activities of the State Department of Horticulture.**
8. **Visit to a nearby KVK to study its role and activities.**
9. **Visit to the Social Welfare Department to study the social welfare and women development programmes.**
10. **and 11. Construction of interview schedule to study the awareness and participation of people in rural development programmes implemented in a village (Group exercise)**
- 11 **Visit to a village to collect data (Group exercise).**
- 12 **Visit to a village to collect data (Group exercise).**
- 13 **Visit to a village to collect data (Group exercise).**
- 14 **Preparation of report.**
- 15 **Preparation of report.**

#### **Reference Books**

1. **Dipak de and Basavaprabhu Jirli. 2010. A Handbook of Extension Education, Agrobios, India.**
2. **Pandey, B.K. 2005. Rural Development, ISHA Books, New Delhi.**
3. **Puran, Chandra. 2005. NGOs in India. A. Kansha Publishing, New Delhi.**
4. **Ray, G.L. 1999. Extension Communication and Management, Naya Prakash, Kolkatta, West Bengal.**
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6. **Sagar Mandal and Ray, G.L. 2007. Text book of Rural Development, Kalyani Publishers, New Delhi.**
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**AHS 218 LIVESTOCK AND POULTRY MANAGEMENT (2+1)**

**OBJECTIVES**

1. The course aims to provide the students with holistic knowledge about the livestock and poultry management so that it can be applied at field level.
2. To provide hands on training about livestock, poultry-based farming and preparation of dairy products.
3. To impart knowledge and latest technologies adopted in livestock industries to infuse entrepreneurial attitude among the students.

**THEORY**

**Unit I: Introduction to Livestock and Poultry Management**

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

**Unit II: Dairy Cattle Management**

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

**Unit III: Sheep and Goat Management**

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

**Unit IV: Swine Management**

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

**Unit V: Poultry Management**

Breeds – Classification - Commercial strains of broiler and layer – Housing – deep litter and cage system – Brooding – Litter management – Care and management of broiler and layer - Nutrition of chick, grower, layer and broiler – Feed conversion ratio - Prophylactic and control measures of diseases.

**PRACTICAL**

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

## **THEORY LECTURE SCHEDULE**

1. **Significance of livestock and poultry in Indian economy - livestock and poultry census.**
2. **Different livestock development programmes of Government of India and Tamil Nadu.**
3. **Zoological classification of livestock - common nomenclatures used in Animal Husbandry practices**
4. **Various systems of livestock rearing - extensive - semi intensive - intensive - farming systems - mixed - integrated and specialized farms.**
5. **Definition of breed - classification of cattle breeds - breed characteristics of Indian cattle - Sindhi, Gir, Sahiwal, Tharparkar and Kangayam.**
6. **Breed characteristics of exotic cattle - Jersey and Holstein friesian - Indian buffaloes - Murrah, Surti and Toda.**
7. **Breeding - cross breeding - upgrading - economic traits of cattle - culling and its importance.**
8. **Estrous cycle - signs of estrous - Artificial Insemination - merits and demerits**
9. **Housing management - selection of site and floor space requirement for calves, heifer, and milch animals.**
10. **Systems of housing - loose housing - conventional barns - single row system - double row system - head to head and tail to tail arrangement - merits and demerits.**
11. **Care and management of new born calf, heifers, pregnant and lactating cows.**
12. **Nutrition - concentrate and roughage - dry matter - TDN - ration - balanced ration - desirable characteristics of a ration**
13. **Classification of feed stuff - Importance of green fodder.**
14. **Milking methods - Clean milk production.**
15. **Factors affecting composition of milk - Pasteurization of milk.**
16. **Prophylactic and control measures of diseases.**
17. **Mid Semester Examination.**
18. **Sheep and goat farming - classification of breeds of Indian and exotic origin - economic traits.**
19. **Systems of rearing - housing management - floor space requirement for adult and young stock.**
20. **Care and management of young and adult sheep and goat.**
21. **Nutrition- feed and fodder - flushing - steaming up.**
22. **Prophylactic and control measures of diseases.**
23. **Swine farming - merits and demerits - breeds - classification.**
24. **Economic traits - housing of swine.**
25. **Care and management of sow, boar and piglets - nutrition - creep feeding.**
26. **Prophylactic and control measures of diseases.**
27. **Classification of chicken breeds - commercial strains of broiler and layer.**
28. **Systems of housing- deep litter and cage system- merits and demerits - floor space requirement.**
29. **Brooding management - Common litter material - litter management - care and management of broiler.**
30. **Care and management of grower and layer.**
31. **Nutrition - feed formulation - composition of chick, grower, layer - broiler -starter and finisher mashes.**
32. **Feed conversion ratio /dozen egg or kg of meat production.**
33. **Prophylactic and control measures of diseases.**
34. **Vaccination schedule for broiler and layer.**

## **PRACTICAL SCHEDULE**

1. **Study of external parts of cattle**
2. **Common methods of restraining in cattle**
3. **Identification methods of livestock**
4. **Disbudding and deworming in cattle**
5. **Determination of age in cattle**
6. **Study and design of cattle shed**
7. **Selection of dairy cow by score card method**

8. Determination of weight in cattle
9. Determination of specific gravity in milk
10. Demonstration of fat percentage and total solids estimation in milk
11. Demonstration of cream separation
12. Demonstration of ice cream making
13. Identification of feed and fodder
14. Identification of poultry farm equipments
15. Measures of performance efficiency in broiler and layer
16. Visit to dairy plant, layer and broiler farms
17. Orientation for final examination

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5. Jull, M.A. 2003 Successful Poultry Management
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9. [www.indiagronet.com](http://www.indiagronet.com)
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### IV SEMESTER

#### AGR 220 AGRONOMY OF FIELD CROPS - II (2+1)

#### OBJECTIVE

To obtain knowledge on cultivation aspects of oilseeds, Sugar, Fibre, Tuber and Narcotic crops.

#### THEORY

##### Unit - I : Agronomy of Oilseed crops

Groundnut, sesame, sunflower, castor, coconut, oilpalm Rape seed and mustard, safflower, Linseed, Niger and Jatropha - Origin and geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices (from land preparations to harvest) and yield. Post harvest management practices. Value addition and by products utilization of oilseed crops.

## **Unit - II: Agronomy of sugar crops**

**Sugarcane, Sugarbeet and Sweet sorghum - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield. Post harvest management practices. Value addition and by products utilization of Sugar crops.**

## **Unit - III: Agronomy of fibre crops**

**Cotton, Jute, Mesta, Sunnhemp and Agave - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield. Post harvest management practices. Value addition and by products utilization of fibre crops.**

## **Unit IV: Agronomy of Tuber Crops**

**Tapioca, Potato and Sweet potato - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield. Post harvest management practices. Value addition and by products utilization of tuber crops.**

## **Unit V: Agronomy of Narcotics**

**Tobacco and Betelvine - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield. Post harvest management practices.**

## **PRACTICAL**

**Maintenance of crop cafeteria - Identification of oil seeds, sugar, fibre, Tuber and narcotic crops - nursery preparation and management for sugarcane and tobacco - main field preparation; Seed treatment techniques - Sowing and manuring - Seeding implements - Estimation of plant population, seed rate and fertilizer requirement - After cultivation practices - Study of growth - Yield parameters and yield estimation. Harvesting of crops - Cost analysis- Visit to farmers' fields, institutes and industries.**

## **THEORY LECTURE SCHEDULE**

- 1. Introduction – Importance and constraints of oil seeds, sugar crops, fibre, tubers and narcotics crops.**
- 2. Area, production and productivity of oil seeds, sugar, fibre crops and tuber crops in India and Tamil Nadu.**
- 3. Groundnut - Origin, geographical distribution, economic importance, soil and climatic requirements**
- 4. Groundnut – season and varieties, cultural practices, yield and economics.**
- 5. Sesame - Origin, geographical distribution, economic importance, soil and climatic requirements- season and varieties- cultural practices and yield.**
- 6. Sunflower - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices and yield.**
- 7. Castor - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices and yield.**
- 8. Coconut - Origin, geographical distribution, economic importance, soil and climatic requirements season and varieties- Preparation of nursery - cultural practices and yield - Post harvest technologies – Special problems in coconut cultivation.**
- 9. Oilpalm - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties- Preparation of nursery - Cultural practices and yield.**
- 10. Rape seed and Mustard - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices and yield.**
- 11. Safflower - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices and yield.**
- 12. Linseed and Niger - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices and yield.**
- 13. Jatropha - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices and yield.**
- 14. Sugarcane - Origin, geographical distribution, economic importance, soil and climatic requirements- season and varieties –Main field preparation – preparation of setts for planting – cultural practices and yield, preharvest practices.**
- 15. Sugarcane – Ratoon management techniques, crop logging, maturity and ripening sugar and gur manufacture – value addition and by product utilization.**
- 16. Sugarbeet - Origin, geographical distribution, economic importance, soil and**

- climatic requirements, season and varieties, cultural practices, yield and by product utilization.
17. Sweet sorghum - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices, yield and by product utilization.
  18. Mid-semester Examination.
  19. Cotton - Origin, geographical distribution, economic importance, soil and climatic requirements - Season and varieties.
  20. Cotton – Cultural practices, yield and quality parameters.
  21. Rainfed Cotton - Rice fallow Cotton and transgenic cotton.
  22. Jute - Origin, geographical distribution, economic importance, soil and climatic requirements- Season and varieties.
  23. Jute – Cultural practices and yield- economics
  24. Mesta and Agave - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices and yield
  25. Post harvest management practices. Value addition and by products utilization of fibre crops.
  26. Potato - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices and yield.
  27. Sweet potato - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices and yield.
  28. Tapioca - Origin, geographical distribution, economic importance, soil and climatic requirements, season and varieties, cultural practices and yield.
  29. Tobacco - Origin, geographical distribution, economic importance, soil and climatic requirements, Season and varieties.
  30. Post harvest management practices. Value addition and by products utilization of tuber crops.
  31. Tobacco –cultural practices and yield- Curing methods.
  32. Betelvine - Origin, geographical distribution, economic importance, soil and climatic requirements, Season and varieties.
  33. Betelvine – Cultural practices and yield.
  34. Post harvest management for narcotics crops.

#### **PRACTICAL SCHEDULE**

1. Identification of oil seeds, sugar crops, fibre, tubers and narcotics in the crop cafeteria.
2. Nursery preparation and management for Sugarcane and Tobacco.
3. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations.
4. Acquiring skill in different seed treatment techniques and foliar nutrition of crops.
5. Estimation of plant population per unit area for crops – Seed rate and fertilizer requirement for oilseeds, fibre, sugar, tuber and narcotics.
6. Acquiring skill in after - cultivation practices in sugarcane - detrashing, Cotton - earthing up, Tobacco - topping.
7. Study on growth parameters of oil seeds and sugar crops.
8. Study on growth parameters of fibre, tubers and narcotics.
9. Study on yield parameters and estimation of yield in oil seeds / sugar.
10. Study on yield parameters and estimation of yield in tuber, fibre and narcotics.
11. Cost and returns of important oil seeds, sugar, fibre, tuber and narcotics.
12. Visit to oil seeds research station.
13. Visit to Sugarcane Breeding Institute/ Research Station to study cultivation of sugarcane and its byproducts.
14. Visit to - nearby sugar mill, for observing juice extraction, quality assessment, sugar manufacture and by products.
15. Visit to - Cotton Research Station, nearby ginning factory and Tobacco curing centre.
16. Visit to farmers field to study sugarcane and cotton based cropping systems.
17. Orientation for final examination

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1. Rajendra Prasad. 2012. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.
2. Ahlawat, I.P.S., Om Prakash and G.S. Saini. 2010. Scientific Crop Production in India. Rama publishing House, Meerut
3. Chidda Singh, Prem Singh and Rajbir Singh. 2011. Modern Techniques of Raising Field Crops. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.
4. Crop Production Guide. 2012. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.

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3. <http://nsdl.niscair.res.in/123456789/512SUNFLOWER - FORMATTED.pdf>
4. <http://nsdl.niscair.res.in/123456789/511 NIGER - FORMATTED.pdf>
5. <http://nsdl.niscair.res.in/123456789/513 SUGARCANE - Formatted.pdf>

## AGR 221 – STUDY TOUR (0+1)

Students will be taken to tour within South India to study soil types, crops and cropping pattern and cultivation practices for major crops in the various agroclimatic zones. During the tour, the students will visit important Research Station / Institutions at least one in each zone. Students should maintain a tour diary to record their observations regarding the places of visit. A tour record has to be submitted after the tour.

## ENT 222 INSECT ECOLOGY AND PRINCIPLES OF PEST MANAGEMENT ( 2+1)

### OBJECTIVES

1. To study the influence of ecosystems on insect populations.
2. To know about various pest management methods.
3. To study the importance of pollinators, weed killers, scavengers and other vectors

### THEORY

#### Unit I: Insect Ecology

Insect Ecology – introduction and 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. Pests – definition, categories, biotypes, losses and causes for outbreaks. Symptoms and nature of damage. Pest surveillance - sampling techniques and forecasting. Concepts of ETL and EIL.

#### Unit II: Integrated Pest Management and its Components

IPM - Introduction, definition, importance, limitations of IPM. Components of IPM – Cultural, Mechanical, Physical and Legal methods – invasive insect pests, Host plant resistance in IPM, Biological methods in IPM - classical biological control, merits and limitations of biological control, Parasitoids, Predators and Pathogens, difference between predator and parasitoid Types of parasitoids and parasitism, Important families of predators and parasitoids, Microbial control - groups of microbial agents and their actions on insects, Mass multiplication and application techniques of important groups of parasitoids, predators, pathogens and entomophilic nematodes. Conservation, importation, augmentation and release of bio control agents. Role of birds in insect and rodent management.

#### Unit III: Bio rational Pest Management Strategies

Semiochemicals in IPM – Pheromones, Allomones, Kairomones and Synomones and their role in pest management- Traps - Insect growth regulators in IPM – Moulting inhibitors and JH mimics - Push and Pull techniques - Botanical insecticides in IPM – antifeedants and repellants. Formulation techniques of botanicals. Traditional methods in IPM - Biotechnology, Sterile male technique and gamma radiation in IPM.

#### **Unit IV: Chemical methods of Insect Pest Management**

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. Handling hazards of insecticides - Symptoms of poisoning, first aid and antidotes, Compatibility and phytotoxicity. Newer insecticides in pest management.

#### **Unit V: Ecological Perspectives of chemical methods and IPM Strategies for crops**

Insecticide residues, Insecticide resistance, Insect resurgence, Insecticide contamination and pollution, Bio accumulation and Bio magnification, Acute Chronic toxicity, Insecticide resistance and residue management. Integrated pest management strategies in different crop ecosystems – Rice, cotton, sugarcane, coconut, Brinjal and Mango.

#### **PRACTICAL**

Studies on terrestrial/pond ecosystems. Types and symptoms of insect damage. Sampling techniques for the estimation of insect population and damage. Pest surveillance through light traps, pheromone traps and estimating field incidence. Practices in Cultural, Mechanical and Physical methods. Studies on distinguishing characters of resistant varieties. Traps in pest management. Identification of parasitoids, predators and entomopathogens. Mass culturing techniques of *Trichogramma*, *Chrysopa* and Coccinellids. Mass production of NPV and Fungal pathogens. Models of bird perches, owl nesting and placement. Identification of plants of insecticidal value. Preparation of Botanical formulations. Practices in Traditional methods of pest management. Different groups of pesticide formulations and label information. Precautions in pesticide applications - first aid and antidotes in case of insecticide poisoning. Pesticide application equipments – types and uses. 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: Each student has to submit 15 numbers of insect damaged plant specimens (Herbarium) and five insecticide labels.

#### **THEORY LECTURE SCHEDULE**

1. Definition and importance of Insect ecology. Terminologies related to Insect ecology - anecology, synecology, biosphere, habit, habitat, biome, population, community, niche, ecosystem and agro-ecosystem.
2. Balance of life in nature - Trophic level- 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.
3. Effect of abiotic factors on insect population – temperature, moisture, humidity, rainfall, light, atmospheric pressure, air currents etc.
4. Effect of biotic factors on insect population– intra specific, inter specific relations.
5. Definition and categories of pests, biotypes and causes for pest outbreak. Symptoms and losses of pest attack. Sampling techniques, Surveillance and pest forecasting. Concepts of Economic Injury Level (EIL) and Economic Threshold Level (ETL).
6. Definition of IPM. Concepts, Scope and limitations of IPM.
7. Definition and examples of Cultural, Physical and Mechanical methods of pest management
8. Host plant resistance – Definition, Types of Resistance-Ecological Resistance - Host evasion - Induced Resistance – Escape. Genetic Resistance - Monogenic-Oligogenic-Polygenic - Major gene - Minor gene. Vertical and Horizontal resistance. Pureline and Multiline resistance. Cross and Multiple resistance. Sympatric and Allopatric resistance.
9. Mechanisms of Host plant resistance – Antixenosis - Antibiosis – Tolerance. Compatibility of HPR in IPM. Advantages and Disadvantages of HPR. Examples of resistant varieties in major crops.
10. Legal methods of pest control - Important provisions, Plant Quarantine, Insecticides Act 1968 – Invasive insect pest.
11. Biological methods- classical biological control, merits and limitations, Parasitoids and Predators – definition - difference between a predator and a parasitoid - Types of parasitoids - Types of parasitism.
12. Important families of predators and parasitoids and their role in pest management.



13. Microbial control – definition, Important groups of microbial agents, Mode of action and symptoms of pathogenicity. Their role in pest management.
14. Mass multiplication and application techniques of important groups of Parasitoids and Predators.
15. Mass multiplication and application techniques of important Entomopathogenic Viruses, Bacteria, Fungi and nematodes.
16. Conservation, importation, augmentation and release of natural enemies. Role of birds in insect and rodent management.
17. Mid Semester Examination
18. Pheromones in IPM – Sex pheromones, Alarm pheromones, trail pheromones and aggregation pheromones
19. Allelochemicals in IPM -Allomones, Kairomones and Synomones. Insect growth regulators in IPM – Moulting inhibitors and JH mimics.
20. Traps in management of crop and storage pests. Push and Pull techniques.
21. Biotechnology in IPM – genetic engineering – transgenic crops – Constraints in using transgenic crops. Sterile male technique and gamma radiation in IPM.
22. Botanical insecticides in IPM – Neem and other examples. Antifeedant, Repellent and Insect growth disturbance properties of botanicals.
23. Formulation techniques of Botanicals.
24. Traditional methods in IPM.
25. Chemical control – importance and history.
26. Classification of pesticides – different modes of classification.
27. Toxicity ranges. Basic and newer Formulations of insecticides.
28. Hazards of insecticides - Symptoms of poisoning, first aid and antidotes.
29. Insecticide residues, insecticide resistance, Insect resurgence
30. Insecticide contamination and pollution, bio accumulation and bio magnification. Compatibility and Phytotoxicity.
31. Newer insecticides in pest management. Insecticide resistance and residue management.
32. Integrated pest management strategies for Rice and cotton, sugarcane and coconut.
33. Integrated pest management strategies for Sugarcane and Coconut
34. Integrated pest management strategies for Brinjal and Mango.

#### **PRACTICAL SCHEDULE**

1. Characterization of terrestrial / pond ecosystems and preparation of charts.
2. Observation on types of damage and major symptoms caused by insect pests.
3. Practicing various sampling techniques and assessment of insect population and their damage in field/horticultural crops.
4. Practicing Pest surveillance through light traps/ pheromone traps and forecasting of field incidence.
5. Practicing common Cultural, Mechanical and Physical methods in pest management.
6. Analysing distinguishing characters of few resistance varieties of important crops.
7. Observation on models of traps in pest management – Pheromone traps, light traps, sticky traps and other traps.
8. Identification of different types of parasitoids, predators and entomopathogens.
9. Practicing Mass culturing techniques of *Trichogramma*.
10. Practicing Mass culturing techniques of *Chrysopa* and Coccinellids
11. Practicing Mass production of NPV and Fungal pathogens.
12. Studies on models of bird perches, owl nesting and placement. Preparation of Botanical formulations. Practicing few Traditional methods of pest management.
13. Identification of different groups of pesticide formulations.
14. Recognizing label information, Precautions in pesticide applications, First aid and antidotes information. Identification of types of Pesticide application equipments and practicing of application of insecticides.
15. Preparations of spray fluids for field application. Calculation of doses/concentrations of insecticides.
16. Observation on compatibility of pesticides and Phytotoxicity of insecticides. Effective application of insecticides.
17. Orientation for final examination

## REFERENCE BOOKS

1. Dhaliwal, G.S. and Ramesh Arora. 1998. *Principles of Insect Pest Management*. Kalyani Publishers, New Delhi. 395p.
2. Jain, P.C. and M.C. Bhargava. 2007. *Entomology – Novel approaches*. New India Publishing agency, New Delhi. 533 p.
3. Koul, O., G. S. Dhaliwal and G.W. Cuperus. 2004. *Integrated pest management: potential, constraints and challenges*, CABI Publishing Series, 329 p.
4. Rao, V., Umamaheswari and R. Prasad. 2010. *Integrated Insect Pest Management Agrobios*, Jodhpur. 266p.
5. Srivastava, K.P. 2003. *A text book of Applied Entomology*. Vol. I and II. Kalyani Publishers. 257 p and 319p.

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2. <http://www.ipmnet.org>

## AGM 223 SOIL AND APPLIED MICROBIOLOGY (2+1)

### OBJECTIVES

1. To enlighten the students with the knowledge of microbial diversity in soils and their interaction with plants.
2. To high lighten the role of soil microorganisms in soil fertility and plant growth promotion
3. To develop experimental skills in soil microbiology which includes isolation of beneficial microorganisms from soil and plant and their mass production
4. To make students gain expertise in practical aspects of production of industrial products

### THEORY

#### Unit I Introduction to Soil Microbiology

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

#### Unit II Microbial Processes in soil

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

#### Unit III Soil Microorganisms and plants

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

#### Unit IV Microbial inoculants

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

#### Unit V Industrial Microbiology

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

### PRACTICAL

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

bacterial bioinoculants, blue green algae, azolla and AM fungi. Isolation of yeast and *Lactobacillus*. Industrial products – wine and sauerkraut fermentation.

#### **THEORY LECTURE SCHEDULE**

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

#### **PRACTICAL SCHEDULE**

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

16. Wine fermentation
17. Orientation for final Examination

#### Text Books

1. Alexander, M. 1977. Soil Microbiology. John Wiley and Sons. New York
2. Waite, M.J., N.L. Morgan, J.S. Rocky and G. Higton. 1999. Industrial Microbiology – An Introduction. Blackwell Scientific
3. E book: Paul, E. A. 2007. Soil Microbiology, Ecology and Biochemistry. 3rd Ed., Academic Press, USA
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1. Rangaswamy, G. and Bagyaraj, D.J. 1992. Agricultural Microbiology, Asia Publishing House, New Delhi.
2. Subba Rao, N.S. 1999. Soil Microorganisms and plant Growth. Oxford and IBH, New Delhi
3. Osborn, M., Smith, C.J. 2005. Molecular Microbial Ecology. Taylor and Francis.

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

### SAC 224 SOIL RESOURCE INVENTORY AND PROBLEM SOILS (2+1)

#### OBJECTIVES

To impart proficiency to the students in exploring the problems and potentials of soil and water so as to decide the most appropriate land use planning and water use.

#### THEORY

##### Unit-I - Concepts of Soil Survey and Soil taxonomy

Soil resource inventory - Early and modern concepts - Standard soil survey - Scope and objectives - Soil systematics - Soil mapping units - Methods and types of soil survey - Soil maps.

Soil Classification - Earlier and genetic systems - Modern Soil Taxonomy - USDA System - Salient features, structure - Diagnostic horizons - Differentiating characteristics - Soil orders - Characteristics and distribution - Soils of India and Tamil Nadu.

##### Unit-II - Soil Survey Interpretations and Land Use Planning

Soil Survey Reports – Preparation, Soil Survey Interpretations - Land Capability Classification - Soil and Land Irrigability Classification - Storie's Index Rating - Productivity potential - Fertility Capability Classification- Land suitability for field crops and horticultural crops and forest trees - Land Use Planning - concepts and objectives.

##### Unit- III- Modern tools for Soil resource inventory

Remote Sensing – Components and principles - EMR, Types of remote sensing, Sensors and platforms - Data interpretations – Applications of Remote sensing in Agriculture- Advantages and disadvantages of Remote Sensing - Remote Sensing in India. Aerial photography - definition, Basic concepts- Types of aerial photography, Advantages and disadvantages – Aerial photo interpretations

GIS – Definition-, principles – Components- Role of GIS in Agriculture. GPS- Definition- principles – Components- Role of GPS in Agriculture.

##### Unit-IV- Soil constraints

Problem soils - physical constraints - Slow permeable, Excessively permeable, surface crusting, sub surface hard pan and fluffy paddy soils . Chemical constraints - Acid soils, Acid sulphate soils and salt affected soils - Genesis, characteristics, effects on plant growth and management - Reclamation of problem soils .

##### Unit-V- Irrigation water quality and use

Quality of irrigation water - Criteria used for assessing the quality of irrigation water - Water quality appraisal - Effect of poor quality water on soil and crop growth - Management of poor quality irrigation water.

#### PRACTICAL

Morphological study of soil profile - Study of base maps, aerial photographs and satellite imagery - Interpretation of soil survey data and maps. Nomenclature of soils- Estimation of CEC, exchangeable cations and ESP. Analysis of problem soils - Lime requirement of acid soil — Gypsum requirement of sodic soils. Analysis of irrigation

waters - pH, EC, TSS , anions and cations - Quality appraisal of irrigation waters and computation of salts. Visit to soil survey and land use organisation.

#### **THEORY LECTURE SCHEDULE**

1. Early and modern concepts of soil resource inventory, Concepts of Standard Soil Survey, its scope and objectives
2. Soil systematics - Characteristics of genetic horizons, subordinate distinctions, pedon, polypedon and control section,
3. Soil mapping units - Soil series, soil association, soil complex, variants, inclusions and miscellaneous land types.
4. Methods of soil survey - Free and grid survey
5. Types of soil survey - Reconnaissance, Detailed soil survey
6. Semi detailed, Exploratory and Rapid reconnaissance survey
7. Soil classification - Purpose, early, genetic and modern systems of classification
8. USDA Soil taxonomy - Structure and differentiating characters - Appreciation and Criticism.
9. USDA Soil taxonomy – Epipedons and Endopedons
10. Diagnostic organic materials, diagnostic soil characteristics - Soil moisture and Temperature regimes.
11. Soil orders - Characteristics and distribution in world ,
12. Soils of India and Tamil Nadu
13. Soil maps, kinds of soil maps and their preparation
14. Soil survey report preparation and interpretation
15. Land Evaluation - Land Capability Classification (LCC)- Fertility Capability Classification (FCC)
16. Soil and Land Irrigability Classification,
17. Mid semester Examination
18. Storie Index Rating and Productivity potential - Land Suitability Classification
19. Land Use Planning - Concepts and objectives - Tropical, subtropical and Temperate regions.
20. Remote Sensing- Definition, stages in remote sensing , principles of remote sensing
21. EMR, Atmospheric windows, Energy matter, Interactions, Spectral signatures
22. Types of remote sensing- Sensors and plat forms
23. Application of Remote sensing in Agriculture- Advantages and disadvantages of Remote Sensing - Remote Sensing in India.
24. Aerial photography - definition, Advantages and disadvantages, Basic concepts- Types of aerial photography, Aerial photo interpretations.
25. GIS – Definition-, principles – Components- Role of GIS in Agriculture
26. GPS- Definition- principles – Components- Role of GPS in Agriculture
- 27 . Soil physical constraints - slow permeable, excessively permeable soils, Soil crusting, sub soil hard pan, fluffy paddy soil, shallow soil - Characteristics and management
- 28 . Aeolian , ill drained and polluted soils- Characteristics and their management
29. Acid soil and Acid sulphate soils - Genesis and characteristics.
30. Lime requirement of acid soil, liming materials and reclamation of acid soil
31. Genesis and classification of salt affected soils - Effect of saline soils on plant growth and their management
- 32 .Genesis and classification sodic and saline sodic soil - characteristics and their management
33. Quality of irrigation waters - quality criteria and appraisal- USSL and other systems
34. Effect of poor quality water on soil health, crop growth and management.

#### **PRACTICAL SCHEDULE**

1. Profile description
2. Nomenclature of soil as per Soil Taxonomy
3. Study on Soil survey maps, Land evaluation methods
4. Estimation of pH and EC in saturation paste of problem soils
5. Estimation of CEC in problem soils
6. Estimation of Exchangeable calcium and magnesium
7. Estimation of Exchangeable sodium and potassium and working out ESP
8. Estimation of lime requirement of acid soil

9. Estimation of gypsum requirement of sodic soil
10. Estimation of pH, EC, TSS and chloride in irrigation water
11. Estimation of carbonate and bicarbonate in irrigation water
12. Estimation of sulphate in irrigation water by gravimetry
13. Estimation of calcium and magnesium in irrigation water
14. Estimation of sodium and potassium in irrigation water
15. Classification of irrigation waters as per USSL and other systems and Computation of salts in irrigation water
16. Visit to Soil Survey and Land Use Organization
17. Record certification

#### REFERENCE BOOKS

1. Dipak Sarkar.2003. Fundamentals and Applications of pedology. Kalyani publishers, New Delhi.
2. Gupta, I.C., N.C.S. Yaduvanshi and S.K.Gupta. 2012. Standard Methods for Analysis of Soil, Plant and Water. Scientific Publishers. Jodpur
3. Gupta, S.K. and I.C. Gupta 2014. Salt affected soils: Reclamation and Management. Scientific Publishers. Jodpur
4. Jawahar L. Sehgal .2006. Introductory pedology (Soil Genesis, Survey and classification). Kalyani publishers, New Delhi.
5. Panda, B.C.2005. Remote Sensing principles and applications. Viva books private Ltd. New Delhi.
6. Poonkodi. P., A. Angayarkanni., R. Singaravel and K. Dhanasekaran. 2002. Soil Survey and Land Use planning. Rasi Offset, Chidambaram.
7. Sahu., D.D and R.M. Solanki. 2008. Remote Sensing Techniques in Agriculture. Agrobios (India), Jodhpur.
8. Sree Ramulu, U.S. 2003. Principles in the quantitative analysis of waters, fertilizers, plants and soil. Scientific Publishers.

#### e-references

1. <ftp://ftp-fc.sc.egov.usda.gov/NSSC/NCSS/Conferences/scanned/>
2. [www.iuss.org/Bulletins/00000096.pdf](http://www.iuss.org/Bulletins/00000096.pdf)

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

**OBJECTIVES** To expose the students to basic and applied principles of plant breeding.

#### THEORY

##### Unit I: Reproductive systems in plant breeding

Objectives and role of plant breeding - historical perspective - activities in Plant Breeding. Centres of origin - contribution of Vavilov, Harlan, Zhukovosky - law of homologous series. Plant genetic resources - importance - germplasm - types - activities - gene erosion - gene bank - collection - conservation - types of conservation - agencies - quarantine. Germplasm: evaluation - use of descriptors, documentation, utilization; Agencies - national and international; germplasm exchange - quarantine. Modes of reproduction - sexual - asexual - self and cross fertilization - significance of pollination. Self incompatibility - classifications - mechanisms - application - measures to overcome and limitations. Sterility - male sterility - classification - CMS, GMS, CGMS - inheritance and applications. TGMS, PGMS, Gametocides, Transgenic Male sterility and applications. Apomixis - introduction - classification - applications; Parthenocarpy and its types.

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

Basic biometrics - nature and significance of qualitative and quantitative variation - phenotypic, genotypic and environmental - heritability and genetic advance. Plant introduction as a breeding method - types of introduction - objectives - quarantine - acclimatization - achievements - merits and demerits. Genetic basis of self pollinated crops - Vilmorin principle of progeny selection - Johannsen's pure line theory. Breeding methods for self pollinated crops without involving artificial hybridization: Pure line selection - merits and demerits - achievements; Mass selection in self pollinated crops - types - comparison of mass and pureline selection - achievements. Breeding methods of self pollinated crops involving artificial hybridization: Creating variability in self pollinated crops - Hybridization and selection - choice of parents - combining ability - combination breeding and transgressive

breeding – kinds of emasculation. Pedigree breeding – mass pedigree – merits – demerits – achievements; Bulk breeding – merits – demerits – achievements. Comparison of pedigree and bulk breeding methods. Single Seed Descent (SSD) method – application – merits and demerits. Backcross breeding – prerequisites – procedures for transferring dominant and recessive genes – merits – demerits – multi lines and multi blends - population improvement approach in self-pollinated crops.

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

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

**Unit IV: Special breeding methods**

Polyploidy breeding – classification – induction of polyploidy – diploid x tetraploid and diploid x hexaploid crosses - achievements – limitations. Wide hybridization-history - importance-barriers and techniques for overcoming barriers-utilization. Shuttle Breeding - Mutation breeding: mutation – types – mutagens – breeding procedure – applications – achievements – limitations. Ideotype concept. Somaclonal variation - utilization in crop improvement; *In vitro* selection techniques — Use of doubled haploids in crop improvement. Concept of biotic and abiotic stress resistance Breeding.

**Unit V: Maintenance breeding**

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

**PRACTICAL**

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

## **THEORY LECTURE SCHEDULE**

1. Objectives and role of plant breeding - historical perspective - activities in Plant Breeding.
2. Centres of origin - contribution of Vavilov, Harlan, Zhukovosky - law of homologous series.
3. Plant genetic resources - importance - germplasm - types - activities - gene erosion - gene bank - collection - conservation - types of conservation - agencies - quarantine.
4. Germplasm: evaluation - use of descriptors, documentation, utilization; Agencies - national and international; germplasm exchange - quarantine.
5. Modes of reproduction - sexual - asexual - self and cross fertilization - significance of pollination.
6. Self incompatibility - classifications - mechanisms - application - measures to overcome and limitations.
7. Sterility - male sterility - introduction - classification - CMS, GMS, CGMS - inheritance and applications.
8. TGMS, PGMS, Gametocides, Transgenic Male sterility and applications.
9. Apomixis - introduction - classification-applications; Parthenocarpy and its types.
10. Basic biometrics-nature and significance of qualitative and quantitative variation-phenotypic, genotypic and environmental-heritability and genetic advance
11. Plant introduction as a breeding method - types of introduction - objectives - quarantine - acclimatization - achievements - merits and demerits.
12. Genetic basis of self pollinated crops - Vilmorin principle of progeny selection - 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. Backcross breeding - genetic principles - prerequisites - procedures for transferring dominant and recessive genes
18. Mid Semester examination
19. Back cross breeding - merits - demerits - multi lines and multi blends - population improvement approach in self-pollinated crops.
20. Genetic structure of a population in cross pollinated crop - Hardy Weinberg law - gene frequencies in random mating population - principles in population improvement.
21. Breeding methods of cross pollinated crops without involving artificial hybridization: Mass selection in cross pollinated crops - modified mass selection - unit selection - mass selection with progeny testing - half sib family selection - full sib family selection.
22. Breeding methods of cross pollinated crops involving artificial hybridization: Recurrent selection principles - types - merits and demerits.
23. Heterosis breeding - theories - genetic basis - hybrid vigour - estimation of heterosis - inbreeding depression - development of inbreds.
24. Heterosis breeding - procedure - use of male-sterility systems and manual emasculation in hybrid seed production - maintenance of parental lines -types of hybrids - achievements - merits and demerits - hybrid variety - merits and demerits.
25. Synthetics and composites - steps in development of synthetics and composites - achievements - merits and demerits



26. Genetic characters of asexual reproduction – breeding methods – clonal selection – hybridization and clonal selection – merits and demerits – achievements; Chimeras and its types; Tree breeding – clonal orchards.
27. Polyploidy breeding – classification – induction of polyploidy – diploid x tetraploid and diploid x hexaploid crosses - achievements – limitations.
28. Wide hybridization-history-importance-barriers and techniques for overcoming barriers-utilization
29. Mutation breeding: mutation – types – mutagens – breeding procedure – applications – achievements – limitations. Ideotype concept
30. Somaclonal variation - utilization in crop improvement; *In vitro* selection techniques – Use of doubled haploids in crop improvement. Concept of biotic and abiotic stress resistance Breeding
31. Types of cultivars – procedure for release of new varieties – stages in seed multiplication – concept of seed certification and TC plants certification.
32. Maintenance Breeding: General seed production techniques – steps in nucleus and breeder seed production – varietal rundown and renovation.
33. Current trends in Plant Breeding: Marker assisted breeding
34. Transgenic crops. Concept of Plant Varietal protection, geographical indications and DUS

#### **PRACTICAL SCHEDULE**

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

#### **REFERENCES**

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

#### **AEC 226 AGRICULTURAL MARKETING, TRADE AND PRICES (1+1)**

##### **OBJECTIVE**

The aim of the course is to give exposure to the Under Graduate students on market concepts, marketing of agricultural commodities, intermediaries involved, domestic and export trade, risk in agricultural marketing, marketing institutions involved, price dynamics and the role of government in regulation of markets.

## **THEORY**

### **Unit I: Agricultural Marketing – Nature and Scope**

**Market and marketing - Definitions. Agricultural marketing - Concepts, scope and subject matter. Classification of markets. Approaches to study of marketing. Characteristics of agricultural marketing. Marketing of agricultural and manufactured goods. Selling behaviour of farmers. Market forces and price determination. Producers' surplus of agricultural commodities: Marketable and marketed surplus - Definition, importance, relationship and factors affecting marketable surplus.**

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

**Marketing functions - Definition and classification. Buying and selling - Assembling and distribution - Storage and warehousing - Processing and value addition - Grading and standardization: Agmark, FPO, BIS, HACCP, FSSAI and ISO - Steps in market research - Market information and intelligence - Market finance - Risk in agricultural marketing: Contract farming, forward trading, speculation and hedging. Marketing channels - Definition, types and factors affecting marketing channels. Market integration - Definition and types. Marketing efficiency - Meaning, marketing costs, margins, price spread and factors affecting marketing costs. SCP paradigm - Meaning, components, dynamics of conduct and performance.**

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

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

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

**International trade - Definition. Terms of trade - Balance of payments and balance of trade. Theories of trade - Absolute and comparative advantage. India's foreign trade policy - Export potential for agricultural sector - Share of agricultural commodities in export. Barriers to trade - Tariff and non tariff measures. Role of institutions like UNCTAD and WTO in promoting trade. Free trade agreements - Implications of AoA: Market access, domestic support and export subsidies. Export promotion organizations - APEDA, MPEDA, Export Promotion Council, AEZ, EXIM bank and ITPO. Export - import policy.**

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

**Agricultural prices - Meaning, functions and importance. Characteristics of agricultural product prices. Important terms and concepts – Farm harvest price, wholesale price, retail price, FOB price, border price, CIF price, MSP, procurement price, remunerative price, parity price, fair price and SAP. Pricing efficiency - Physical and allocative efficiency. Fluctuations and instability in prices - Factors causing price fluctuation - Price stabilization measures. Government intervention in pricing of agricultural commodities - Objectives, forms of intervention, agricultural price policy in India, Role of CACP.**

## **PRACTICAL**

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

## **THEORY LECTURE SCHEDULE**

- 1. Market and marketing - Definition. Agricultural marketing – Concepts, scope and subject matter. Classification of markets.**
- 2. Approaches to study of marketing. Characteristics of agricultural marketing.**
- 3. Marketing of agricultural and manufactured goods. Selling behaviour of farmers. Market forces and price determination.**
- 4. Producers' surplus of agricultural commodities. Marketable and marketed surplus - Definition, importance, relationship and factors affecting marketable surplus.**

5. **Marketing functions - Definition and classification. Buying and selling, Assembling and distribution, Storage and warehousing Processing and value addition**
6. **Grading and standardization - Agmark, FPO, BIS, HACCP, FSSAI and ISO. Market research – Steps - Market information and intelligence.**
7. **Market finance and risk in agricultural marketing. Contract farming, forward trading, speculation and hedging. Marketing channels - Definition, types and factors affecting marketing channels.**
8. **Market integration - Definition and types. Marketing efficiency - Meaning, marketing costs, margins, price spread and factors affecting marketing costs. SCP paradigm - Meaning, components, dynamics of conduct and performance.**
9. **Mid Semester Examination**
10. **Role of government in promoting agricultural marketing - DMI, Regulated market, cooperative marketing, State Agricultural Marketing Board, NAFED, TANFED, State trading, FCI, PDS**
11. **Commodity boards viz., Coffee board, Tea board, Spices board, Rubber board, NMPB, NHB, NDDB. Marketing of inputs - Seeds, Fertilizers and Pesticides - E marketing.**
12. **International trade - Definition. Terms of trade – Balance of payments and Balance of trade. Theories of trade - Absolute and comparative advantage. India's foreign trade policy - Export potential for agricultural sector - Share of agricultural commodities in export.**
13. **Barriers to trade - Tariff and non tariff measures. Role of institutions like UNCTAD and WTO in promoting trade. Free trade agreements - Implications of AoA, market access, domestic support and export subsidies.**
14. **Export promotion organizations - APEDA, MPEDA, Export Promotion Council, AEZ, EXIM bank and ITPO. Export - import policy.**
15. **Agricultural prices - Meaning, functions and importance. Characteristics of agricultural product prices. Important terms and concepts - Farm harvest price, Wholesale price, Retail price, FOB price, Border price, CIF price, MSP. Procurement price, Remunerative price, Parity price, Fair price and SAP.**
16. **Pricing efficiency - Physical and allocative efficiency. Fluctuations and instability in prices - Factors causing price fluctuation , price stabilization measures.**
17. **Government intervention in pricing of agricultural commodities - Objectives, forms of intervention, agricultural price policy in India, Role of CACP.**

#### **PRACTICAL SCHEDULE**

1. **Market survey**
2. **Estimation of marketable and marketed surplus**
3. **Identification of marketing channels and estimation of price spread for agricultural products.**
4. **Identification of marketing channels and estimation of price spread for horticultural products.**
5. **Visit to Regulated market.**
6. **Visit to Cooperative marketing society**
7. **Visit to Farmers' market and shandy.**
8. **Visit to FCI, CWC and TNCSC**
9. **Visit to Agmark laboratory**
10. **Visit to agricultural processing units**
11. **Farm input marketing**
12. **Visit to cashew export unit**
13. **Commodity boards**
14. **Time series analysis**
15. **Construction of index numbers**
16. **Case studies on implications of trade liberalization.**
17. **Orientation for final examination**

#### **REFERENCES**

1. **Acharya S.S. and Agarwal, N.L., 2011, Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.**
2. **Jhingan, M.L., 2011, International Economics, Vrinda Publications (P) Ltd., New Delhi.**
3. **Francis Cherunilam, 2000. International Economics, Oxford and IBH, New Delhi.**

4. Kahlam A.S. and S.D. Tyagi, 2000, Agricultural Price Policy in India, Allied Publishers Pvt. Ltd., Bombay.
5. Acharya S.S. and Agarwal, N.L., 1994. Agricultural Prices – Analysis and Policy, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

**STA 227      AGRICULTURAL STATISTICS (1+1)**

**OBJECTIVE**

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

**Theory**

**Unit I: Descriptive Statistics**

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

**Unit II: Sampling Theory and Probability Distributions**

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

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

**Unit III: Testing of hypothesis**

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

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

**Unit IV: Correlation and Regression**

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

**Regression – simple linear regression – fitting of simple linear regression equation – properties of regression coefficient.**

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

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

**THEORY LECTURE SCHEDULE**

1. Introduction – Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode –Merits and demerits. TBI 1-5, TBI 25 - 35
2. Measures of dispersion: Range, Quartile deviation, Mean deviation, standard deviation, and coefficient of variation - Skewness and kurtosis. TBII 41 – 48
3. Sampling theory – population – sample – parameter and statistic – sampling distribution - sampling vs complete enumeration –Types of sampling - simple random sampling – selection using random numbers Stratified - Systematic sampling. TBII 316 - 321
4. Probability distributions – Discrete distributions: Bernoulli TBI 55 - 57
5. Binomial and Poisson distribution TBI 58 - 61
6. Continuous distribution: Normal distribution TBI 55 - 57
7. Null and alternative hypothesis – types of errors - critical region and tests of significance. TBII 16-17
8. Large sample test – single mean and difference between two means. Single proportion and difference between two proportions. TBII 20-24
9. Mid Semester Examination
10. Small sample tests – F-test - t-test for testing the significance of single mean TBII 26-28
11. independent and paired t test TBII 29-38
12. Chi square test for testing the association of  $r \times c$  contingency table. TBII 43-45
13. Correlation – Scatter diagram - Karl Pearson’s correlation coefficient – Spearman’s rank correlation - computation and properties. TBI 142 – 145

14. Regression – simple linear regression – fitting of simple linear regression equation – properties of regression coefficient. 157 - 165
15. Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs. TBI 227 - 231
16. Completely Randomized Design (CRD) – Randomized Block Design (RBD). TBI 269 - 284
17. Latin Square Design (LSD). TBI 315 - 320

#### **PRACTICAL SCHEDULE**

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

#### **Text Books**

- I. Rangaswamy, R. 2009, A Text book of Agricultural Statistics, Wiley Eastern Limited, New Delhi.
- II. Dhamu. K. P and K. Ramamoorthy. 2007. Statistical Methods. Agrobios (India), Jodhpur.

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1. Gupta.S.C and V.K.Kapoor. 1977. Fundamentals of Applied Statistics. Sultan Chand and Sons, New Delhi.
2. Gupta S.P, Statistical Methods, 2004, Sultan Chand and Sons, New Delhi.
3. S.C. Gupta and V.K. Kapoor. 2003. Fundamentals of Mathematical Statistics. Sultan Chand and Sons, New Delhi.
4. Panse. V. G and P.V. Sukhatme. 1954. Statistical methods for agricultural workers. ICAR, New Delhi.
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6. Kailasam. G and R.Gangaiselvi. 2010. Applied Statistics. Kalyani Publishers. New Delhi.

#### **Web resources**

1. <http://www.statistics.com/resources/glo.ssary/>
2. [www.statsoft.com](http://www.statsoft.com)
3. [http://www.iasri.res.in/ebook/EB\\_SMAR/index.htm](http://www.iasri.res.in/ebook/EB_SMAR/index.htm)
4. [www.stats.gla.ac.uk/steps/glossary/index.html](http://www.stats.gla.ac.uk/steps/glossary/index.html)
5. <http://davidmlane.com/hyperstat/>
6. <http://www.stattrek.com/>
7. <http://www.businessbookmall.com/Statistics Internet Library.htm>
8. <http://www.stat-help.com/>
9. [www.statsci.org/jourlist.html](http://www.statsci.org/jourlist.html)

**OBJECTIVES**

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

**UNIT I : Introduction to Soft Skills**

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

**UNIT II : Life Skills**

**1. Attitude**

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

**2. Emotional Intelligence**

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

**3. Interpersonal skills**

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

**4. Self Development/Empowerment**

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

**UNIT III : Communication Skills**

**5. Types of Communication**

Communication - Basic Communication Model - Verbal and Non-verbal Communication.

Business Communication

Writing memo - short notes – short reports, Agenda , minutes, Business proposals, newspaper advertisement.

**6. Group Dynamics**

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

**7. Kinesics**

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

**8. MID SEMESTER**

**UNIT IV : Employability Skills**

**9. Interview Skills – I**

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

**10. Interview Skills – II**

Telephone interview – Skype interview - Panel Interview - Five stages of interview –how to answer the questions

**11. Group Discussion**

Definition – contexts – why and how? – techniques and skills.

**UNIT V : Corporate Skills**

**12. Leadership qualities**

Definition - basic requirements – (responsibility - self – knowledge - rapport with subordinates- knowledge of the assignment- goal setting- decision making – team work) – leadership and vision.

**14. Negotiation skills**

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

**15. Time management**

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

## 16. Stress management

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

## 17. Orientation for final examination

### PRACTICAL SCHEDULE

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

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2. Beverly Jaeger, *Making Work Work for the Highly Sensitive Person*, Tata McGraw – Hill, USA, 2004.
3. Dipali Biswas, *Enhancing Soft Skill*, Shoraff Publishers and Distributors, 2009.
4. Gloria. J. Galanes, Kathreine Adams, John. K. and Brilhart, *Effective Group Discussion*, Tata McGraw – Hill, New Delhi, 2004.
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8. Patsy McCarthy and Caroline Hatcher, *Presentation Skill: The Essential Guide for Students*, Sage Publications, CA, 2002.
9. Peggy Claus, *The Hard Truth about Soft Skills*, Harper Collins Publishers, New York, USA, 2007.
10. Peter. J. Gosling, *Scientists Guide to Poster Presentations*, Kluwar Academic Pub, N.Y, USA, 2002.
11. Richard Ellis, *Communication Skills; Step ladders to success for professionals*, Intellect Books, Chicago, USA, 2009.
12. Robert, A. Day, *How to Write a Scientific Paper*, ELBS, U.K, 2000.
13. Sarvesh Gulati, *Corporate Soft Skills*, Rupa Publishers, New Delhi, 2006.

14. Soleman. D, *Working with Emotional Intelligence*, Bloomsbury Publishing, London, 1998.

**Text book**

1. Hariharan.S., Sundararajan.N and Shanmugapriya,S.P, *Soft Skills*, MJP Publishers, Chennai.2010.

**e-books**

1. URL : <http://www.citehr.com/28484-hand-book-soft-skills-e-book-doc.html>
2. URL : <http://promeng.eu/downloads/training-materials/ebooks/soft-skills/advanced-communication-skills.pdf>

**e-reference**

1. [www.softskills.com](http://www.softskills.com)
2. [www.reportingskills.com](http://www.reportingskills.com)
3. [www.writing-skills.com](http://www.writing-skills.com)
4. [www.negotiation.com](http://www.negotiation.com)
5. [www.businessballs.com](http://www.businessballs.com)
6. [www.study-habits.com](http://www.study-habits.com)
7. [www.timethoughts.com](http://www.timethoughts.com)

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

**OBJECTIVES**

This subject will enable the student

1. To gain knowledge on the various types of IC engines, types and selection of tractors.
2. To understand the construction and working of various farm implements like tillage implements, seed drills, transplanters, plant protection and harvesting equipments.
3. To gain knowledge on the various renewable energy sources like solar, wind ,biogas and biomass energy.
4. To understand the construction and working of various solar energy gadgets, wind mill, bio gas plants and production of bio diesel and ethanol from agricultural produce.

**THEORY**

**UNIT I – Tillage and Tillage Machinery, Sowing, Planting, Intercultural Equipment**

Farm power in India- sources -Tillage – Ploughing Methods - Primary Tillage Implements -Types of plough – Secondary tillage implements –Cultivators, Harrows and rotavators – Wetland equipment - Puddlers, Trampers and Cage Wheel. Sowing Methods - Seed Drills, Seed cum fertilizer drills - Paddy transplanters.

**UNIT II –Plant Protection Gadgets, Harvesting Machinery and Equipment for Land Development**

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

**UNIT III – Agriculture Diesel Engine and Tractors**

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

**UNIT IV: Energy scenario and biomass energy conversion systems**

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

**UNIT V: Solar energy, Wind energy and bio – fuels and its applications**

Solar energy– Solar energy applications – Solar collectors-Types – Solar energy gadgets –Solar air heaters – Solar cookers – Solar water heating systems –Solar grain dryers – Solar photo voltaic systems and application–Solar lights –Solar pumping systems – Solar refrigeration system – Solar ponds – Solar space heating and cooling systems. Wind energy –Types of wind mills – Constructional details and applications.



**Energy from agricultural wastes – Liquid Bio fuels – Bio diesel and ethanol from agricultural produce – Its production and Uses.**

**PRACTICAL**

Study of different components of IC engine, four stroke petrol engine, two stroke petrol engine. Study of MB plough, disc plough, seed-cum-fertiliser drills, their mechanisms. Operation of tractor and implements – operation and maintenance of power tiller – Study of different inter-cultivation equipments – Sprayers and dusters – their operation, repairs and adjustment - Paddy transplanting. Harvester for paddy, sugarcane, groundnut – horticultural tools .

Study of constructional details of KVIC and JANATHA type and Deen Bandu type bio gas plants and different types of gasifier and briquette preparation from biomass – Study and find the Performance of a solar still, solar dryer and solar cooker –Study about the working of solar photovoltaic pumping system and solar street light- Study of different types of wind mills- Study the processing of Bio diesel production from Jatropha.

**THEORY LECTURE SCHEDULE**

- |  |                            |
|--|----------------------------|
| 1. Farm power in India – human, animal, mechanical and electrical energy sources   | TB1: 1-10                  |
| 2. Objectives of Primary tillage, mould board ,disc plough, chisel plough and subsoiler, components and functions, types, advantages and disadvantages | TB1: 177-179               |
| 3 Secondary tillage equipment – harrows, land forming equipment – rotavator  | TB1: 177-198               |
| 4 Wet land equipment – puddlers, Green manure trawlers and cage Wheels   | TB1:216-221                |
| 5 Seed Sowing methods and Equipments   | TB1:223-225                |
| 6 Seed drills, seed cum fertilizer drills – components and functions,  | TB1:222-227                |
| 7 Paddy transplanters, types, working principle, field and nursery Requirements  | TB1:232-235                |
| 8 Sprayers and their functions, classification, manually operated Sprayers, power sprayers – dusters, types and uses                                   | TB1:261-271                |
| 9 Harvesting tools and equipment- sickles, paddy harvester   | TB1:273-280                |
| 10 Combine – Harvesting machinery for groundnut, tuber crops and Sugarcane   | TB1:273-288<br>TB1:293-297 |
| 11 Equipment for land development and soil conservation – dozers   | TB1:323-327                |
| 12 Equipment for intercultural tools levelers, chisel plough, sub soil plough, Blade harrow and bund former  | TB1:185-211                |
| 13 Implements for intercultural operations – cultivators, sweep, junior hoe, Manual weeders and  | TB1:213-221                |
| 14 Power operated weeders for wet land and garden land   | TB5:216-222                |
| 15 IC engines- working principles, two stroke and four stroke engines, Different systems of IC engine  | TB1:22-35<br>TB2:1-21      |
| 16 Electronic fuel injection system, dual fuel operation engine, Tractors- types and utilities.  | TB1:107-117<br>TB2:313-319 |
| 17 Introduction – Energy crisis – Classification – Availability – Renewable energy sources – significance.   | TB3:387-411                |
| 18 Mid-Semester Examination  |                            |
| 19 Potential of Solar, Wind, Biogas, Biomass, and other Renewable Energy sources achievements in India   | TB4:1-44                   |
| 20 Methods of energy conversion – Thermo chemical conversion methods –Principles of combustion, Pyrolysis  | TB3:428-438                |
| 21 Gasification – Types of gasifiers –Producer gas and its utilization.  | TB4:385-433                |
| 22 Briquettes – Types of briquetting machines – Uses of briquettes – Shredders   | TB4:387-420                |
| 23 Biochemical conversion methods – Biogas and Ethanol Production – Applications   | TB3:439-464                |
| 24 Biogas technology – Feed stocks – Factor influences biogas yield– Biogas Plants Types – Construction and Working – Applications                     | TB4:311-381                |
| 25 Solar energy– Solar energy applications   | TB5:1-16                   |

26	Solar collectors-Types – Solar energy gadgets.	TB5:89-155
27	Solar air heaters – Solar cookers – Solar water heating systems – Solar grain dryers.	TB5:156-199
28	Solar photo voltaic systems and application	TB5:433-487
29	Solar lights –Solar pumping systems – Solar refrigeration system – Solar ponds	TB5:488-500 TB5:288-311
30	Solar space heating and cooling systems	TB5:346-370 TB5:387-402
31	Wind energy –Types of wind mills – Constructional details and applications.	TB4:227-310
32	Energy from agricultural wastes – Liquid Bio fuels	TB4:414-418
33	Bio diesel and ethanol from agricultural produce	TB4:418-430

34 Bio diesel and ethanol production and Uses.

**PRACTICAL SCHEDULE**

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

**Text Books**

1. Jagadishwar Sahay, 2010. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi. ISBN: 978-8180140440
2. IC Engines , 2007..V Ganesan Tata McGraw-Hill Publishing Company Limited New Delhi. ISBN 13:978-0-07-064817-3
3. Energy technology - Non conventional, renewable and conventional, Rao, S. and B.B. Parulekar, 2002. Khanna Publishers, New Delhi, India.
4. Non Conventional Energy Sources, Rai GD 2001. Khanna publishers, New Delhi.
5. Solar Energy Utilization, Rai G.D 2005. Khanna Publishers, New Delhi.

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1. Ojha, T.P and A.M.Michael 2005. Principles of Agricultural Engineering Vol-I. Jain Brothers, New Delhi. ISBN: 978-8186321638
2. Nakra C.P 1970. Farm Machinery and Equipment,: Dhanpat Rai Publishing Company Ltd, New Delhi ISBN: 978-8187433231
3. Srivastava, A.C., 1991. Elements of Farm Machinery. Oxford and IBH Publishing Co Pvt Ltd, New Delhi. ISBN: 978-8120405134
4. Senthilkumar, T., R. Kavitha and V.M.Duraisamy 2015. A Text Book of Farm Machinery, Thannambikkai Publications, Coimbatore . ISBN: 978-9381102305
5. Renewable Energy, Godfrey Boyle (Editor) ISBN: 0199261784 / ISBN-13: 9780199261789.
6. Solar Energy, Sukhatme SP 1985. Tata McGraw Hill publishing Co. Ltd., New Delhi.

7. **Renewable Energy Resources** , John Twidell and Tony Weir - (Paperback - 24 Nov 2005).
8. **Biotechnology and other Alternate Technology**, Chakravarthy A 1989. Oxford and IBH Publishing Co. Ltd. New Delhi.
9. **Renewable Energy Sources and Conversion Technology**, Bansal N.K. et al 1990. Tata McGraw Hill publishing Co.Ltd., New Delhi.

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1. [www.agricoop.nic.in/dacdivision/Machinery1/directory.htm](http://www.agricoop.nic.in/dacdivision/Machinery1/directory.htm)
2. [www.farmmachineryshow.org](http://www.farmmachineryshow.org)
3. [www.freesolaronline.com](http://www.freesolaronline.com)
4. [www.rsnz.org](http://www.rsnz.org)
5. [www.finwea.org](http://www.finwea.org)
6. [www.mnre.gov.in](http://www.mnre.gov.in)

**V SEMESTER**

**AGR 310 CLIMATE CHANGE AND DISASTER MANAGEMENT (1+0)**

**OBJECTIVES**

Acquiring knowledge on ecological principles, concepts, basic understanding of climate change and its impact key concepts of disasters and practices of mitigation, assessment of hazards and their management.

**THEORY**

**Unit – I : Climate change and its impact**

Climate change – Causes – Impact on Agriculture – Mitigation strategies – Global warming – Sea level rise - Ozone layer depletion – Acid rains – Pollution – Pollutants – Types.

**Unit – II : Resource conservation**

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

**Unit – III : Natural disasters**

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

**Unit – IV : Disaster management**

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

**Unit – V : Disaster Rehabilitation**

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

**THEORY LECTURE SCHEDULE**

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

## 17. Preparedness - EOCs

### REFERENCE BOOKS

1. Purohit, S.S., Q.J. Shammi and Agarwal. A.K. 2004 – Environmental Sciences new Approach. Abrobios, India.
2. Gautam, D.R.2009. Community based Risk Reduction, Mercy corps, Lalitpur, Nepal.
3. Gupta. H.K.2003. Disaster management. Indian National Science Academy Orient Blackman.
4. Ministry of home affairs 2010. Standard operating procedure for responding to natural disaster. Ministry of home affairs – Disaster management Division, New Delhi.
5. Sharma. V.K 2001. Disaster management. National centre for Disaster management, India.

### e-resources

1. <http://nsdl.niscair.res.in/123456789/458> global issues -formatted.pdf
2. <http://nsdl.niscair.res.in/123456789/607> Biosafety.pdf
3. <http://nsdl.niscair.res.in/123456789/1069> environments.ppt

## AGR 311 CROP PRODUCTION - I (0+1)

### OBJECTIVES

This course is designed to impart practical aspects of scientific cultivation of rice to the students and to acquire sound knowledge in each and every aspects of rice cultivation and to make them competent to suggest appropriate technology to the farmers based on the varying soil and climatic conditions. Each student will be allotted a minimum land area and he / she will do all field operations in the allotted land from field preparation to harvest and processing of irrigated lowland rice (*Transplanted rice or Direct sown rice*).

#### Transplanted rice

- Rice ecosystems - Climate and weather - Seasons and varieties of Tamil Nadu.
- Preparation of nursery - Application of manures to nursery - seed treatment - Forming nursery beds and sowing seeds - Weed and water management and plant protection to nursery.
- Preparation of main field - Application of organic manures - Green manuring - Bio-fertilizers - Pulling out seedlings and transplanting - SRI - weed management - Water management - Nutrient management - Plant protection measures - Mechanization in rice cultivation - Recording growth, yield attributes and yield.
- Harvesting, threshing, drying and cleaning the produce – Working out cost of cultivation and economics.
- Value addition and by products utilization.

### PRACTICAL SCHEDULE

#### Transplanted rice

1. Study of rice ecosystems, climate, weather, seasons and varieties of Tamil Nadu
2. Acquiring skills in selection of nursery area and preparation of different types of nursery.
3. Acquiring skills in seed treatment, seed soaking and incubation, nursery sowing and management and calculation of seed requirement.
4. Study and practice of main field preparation and green manuring and bio-fertilizer application in rice
5. Study of different growth stages of rice.
6. Study and practice of transplanting techniques in lowland rice
7. Study of system of rice intensifications
8. Bio- metric observations and estimation of plant population and acquiring skills in cultural operations.
9. Mid – Semester examination
10. Study of weeds and weed management in rice.
11. Acquiring skill in nutrient management , calculation on fertilizer requirement and practicing top dressing techniques.
12. Study of water management practices for lowland rice.
13. Observation of insect pests and diseases and their management.

14. Yield parameters and estimation of yield in rice.
15. Post harvest techniques , value addition and by products utilization in rice.
16. Working out cost of cultivation and economics.
17. Orientation for final examination

#### REFERENCE BOOKS

1. Ahlawat, I.P.S., Om Prakash and G.S.Saini. 1998. Scientific Crop Production in India. Rama Publishing House, Meerut.
2. Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. ICAR 2006. Hand book of Agriculture. Indian Council of Agriculture, New Delhi.
4. Crop Production Guide. 2005. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
5. Rajendra Prasad. 2004. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.
6. K Annadurai and B Chandrasekaran. 2009. A Text Book Of Rice Science. Scientific Publishers

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1. [http://nsdl.niscair.res.in/123456789/524 RICE - FORMATTED.pd](http://nsdl.niscair.res.in/123456789/524_RICE_FORMATTED.pdf)  
<http://farmer.gov.in/imagedefault/pestanddiseasescrops/rice.pdf>
2. <http://www.knowledgebank.irri.org/images/docs/12-Steps-Required-for-Successful-Rice-Production.pdf>

### ENT 312 PESTS OF CROPS, STORED PRODUCTS AND THEIR MANAGEMENT (2+1)

#### OBJECTIVE

To study the distribution, bionomics, symptoms of damage and management strategies of pests of crops and storage.

#### Theory

Distribution, Bionomics, Symptoms of damage and Integrated management strategies for insects and non-insect pests such as mites, nematodes, rodents, birds and other vertebrates of the following crops.

#### Unit I: Pests of Cereals, Millets and Pulses

Rice, Wheat, Maize, Sorghum, Cumbu, Ragi, Tenai; Redgram, Greengram, Blackgram, Bengal gram, Cowpea and Soybean

#### Unit II: Pests of Oilseeds, Cotton, Sugarcane, Green manures, Forage crops and Tobacco

Groundnut, Castor, Sesame, Sunflower, Safflower, Linseed, Jatropha, Mustard; Cotton; Sugarcane; Sunhemp, Sesbania, Daincha, Glyricidia; Lucerne, Subabul; Tobacco

#### Unit III: Pests of Vegetables, Tubers, Spices and Plantation crops

Brinjal, Tomato, Bhendi, Crucifers, Cucurbits, Moringa, Amaranthus, Potato, Sweet Potato, Tapioca, Yam; Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, Curry leaf, Cardamom, Pepper and Betel vine; Coconut, Arecanut, Coffee, Tea, Rubber, Cocoa

#### Unit IV: Pests of Fruits and Forest trees

Mango, Sapota, Citrus, Cashew, Banana, Grapevine, Guava, Jack, Custard apple, Pomegranate, Pineapple, Papaya, Aonla, Ber, Tamarind, Apple; Neem, Teak, Sandalwood, Eucalyptus, Casuarina

#### Unit V: Pests of Flower crops, Ornamentals, Medicinal plants and Stored products

Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Greenhouse crops and Mushroom, Lawn and Turf; Gloriosa, Coleus, Phyllanthus, Periwinkle, Aswagantha, Senna; Stored grains, Dry fruits and Nuts; Locusts and their management.

#### Practical

Identification of symptom of damage and life stages of important insect, non-insect pests such as mites, nematodes and rodents, various crops and storage – cereals, millets, pulses, oilseeds, cotton, sugarcane, green manures, forage crops, fruits, forest trees, flower crops, plants, Ornamentals, Lawn Medicinal and Stored products.

#### ASSIGNMENT

- Collection and submission of 25 insect pests of crops and storage.

- Rearing a minimum of 10 insect pests of crops and storage

#### **THEORY LECTURE SCHEDULE**

**Distribution, Bionomics, Symptoms of damage and Integrated management strategies for insect, non-insect pests such as mites, nematodes, rodents, birds and other vertebrate pests of**

1. Rice – Leaf feeders and borers
2. Rice – Sap feeders
3. Wheat, Maize, Sorghum
4. Cumbu, Ragi, Tenai
5. Redgram, Greengram, Blackgram
6. Bengal gram, Cowpea and Soybean
7. Groundnut
8. Castor, Sesame
9. Sunflower, Safflower, Linseed, Jatropha, Mustard
10. Cotton
11. Sugarcane
12. Sunhemp, Sesbania, Daincha, Glyricidia; Lucerne, Subabul; and Tobacco
13. Brinjal, Tomato
14. Bhendi, Crucifers
15. Cucurbits, Moringa and Amaranthus
16. Potato, Sweet Potato, Tapioca, Yam
17. Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, Curry leaf
18. Mid-semester examination
19. Cardamom, Pepper and Betel vine
20. Coconut, Arecanut
21. Coffee
22. Tea, Rubber, Cocoa
23. Mango, Sapota
24. Citrus, Cashew
25. Banana, Grapevine
26. Guava, Jack, Custard apple, Pomegranate, Pineapple
27. Papaya, Aonla, Ber, Tamarind, Apple
28. Neem, Teak, Sandalwood, Eucalyptus, Casuarina
29. Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers
30. Green house crops and Mushroom,
31. Lawn and Turf
32. Gloriosa, Coleus, Phyllanthus, Periwinkle, Aswagantha, Senna
33. Stored grains, Dry fruits and Nuts
34. Locusts and their management

#### **PRACTICAL SCHEDULE**

**Identification of symptoms of damage and life stages of insect, non-insect pests such as mites, nematodes, rodents, birds and other vertebrate pests of**

1. Rice
2. Wheat, Maize, Sorghum, Cumbu, Ragi, Tenai
3. Redgram, Greengram, Blackgram, Bengal gram, Cowpea and Soybean
4. Groundnut, Castor, Sesame, Sunflower, Safflower, Linseed, Jatropha, Mustard
5. Cotton
6. Sugarcane, Sunhemp, Sesbania, Daincha, Glyricidia; Lucerne, Subabul; and Tobacco
7. Brinjal, Tomato, Bhendi,
8. Crucifers, Cucurbits, Moringa and Amaranthus, Potato, Sweet Potato, Tapioca, Yam
9. Mid-semester examination
10. Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, Curry leaf, Cardamom, Pepper and Betel vine
11. Coconut, Arecanut
12. Coffee, Tea, Rubber, Cocoa
13. Mango, Sapota, Citrus, Cashew, Banana, Grapevine
14. Guava, Jack, Custard apple, Pomegranate, Pineapple, Papaya, Aonla, Ber, Tamarind, Apple

15. Neem, Teak, Sandalwood, Eucalyptus, Casuarina, Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers
16. Green house crops and Mushroom, Lawn and Turf, Gloriosa, Coleus, Phyllanthus, Periwinkle, Aswagantha, Senna, Stored grains, Dry fruits and Nuts
17. Orientation for final examination

#### REFERENCE BOOKS

1. Atwal, A.S. and G.S. Dhaliwal. 2003. *Agricultural Pests of South Asia and their Management*, Kalyani Publishers, Ludhiana, 487p.
2. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai. 386p.
3. Awasthi, V.B. 2007. *Agricultural Insect Pests and their Control*, Scientific publishers (India), Jodhpur, 267p.
4. Regupathy, A. and R. Ayyasamy. 2013. *A Guide on Crop Pests*. Namrutha Publications, Chennai, 368p.
5. Parvatha Reddy. 2010. *Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops*. Scientific Publishers, Jodhpur. 384p.
6. Nair, M.R.G.K. 1995. *Insects and Mites of Crops in India*. Indian council of Agricultural Research, New Delhi, 408p.
7. Ayyar, T.V.R. 1963. *Hand Book of Economics Entomology for South India*. Govt. Press Madras.
8. Muthukrishnan, N., N. Ganapathy, R. Nalini and R. Rajendran. 2005. *Pest Management in Horticultural Crops*. New Madura Publishers, Madurai. 325p.

#### e-resources

1. <http://www.ncipm.org.in>
2. <http://agritech.tnau.ac.in/>
3. <http://www.nbaii.res.in/>
4. <http://www.nrcg.res.in/>
5. [ipm.illinois.edu](http://ipm.illinois.edu)

### PAT 313 PRINCIPLES OF PLANT DISEASE MANAGEMENT (1+1)

#### OBJECTIVES

The subject covers the various principles of Plant Pathology and the principles involved in plant disease management. Also classification of fungicides, methods of application of fungicides and various bio-control agents used in the management of crop diseases are taught.

#### THEORY

##### UNIT I: Epidemiology and Diagnosis of Plant Diseases

Classification of plant diseases - Disease triangle, Disease Pyramid - Epidemiology of plant diseases- role of weather factors in disease development and spread- survival and dispersal of plant pathogens- Disease surveillance, assessment and forecasting- Diagnosis of plant diseases- Seed health tests- Chemodiagnosis, Serodiagnosis and Molecular detection of plant pathogens

##### UNIT II: Exclusion and Avoidance

General Principles of Plant Diseases Management- Exclusion- Plant quarantine - Domestic, International and Embargo - Phytosanitary Certificate (PSC) - Quarantine in India. Exotic diseases introduced into India- Role of cultural practices in plant disease management.

##### UNIT III: Eradication

Eradication from Seed and Planting materials - Eradication of diseased plants- Surgery and Rouging - Eradication of Alternate and Collateral host- different methods of eradication- Mechanical, Physical, Chemical and Biological methods.

##### UNIT IV: Protection

Protection of crops from air-borne, seed-borne, soil-borne and vector-borne plant diseases - Physical methods - soil solarization, Hot water treatment, Incineration, Chemical control of plant diseases - fungicides - Different group of fungicides and antibiotics in plant disease management - Biological control of plant diseases - Plant products and Antiviral principles - method of application- plant protection appliances.

## **Unit V: Immunization and Biotechnological approaches**

**Immunization - cross protection and host plant resistance – Types of resistance - vertical and horizontal resistance – Resistant varieties. Mechanism of resistance- structural and bio chemical resistance in plants -Biotechnological approaches for crop disease management.**

### **PRACTICAL**

**Survey and Assessment of important plant diseases- Diagnosis of Plant diseases- Classification and grouping of fungicides- Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), Burgundy mixture and Cheshunt compound - Calculation of fungicides quantity and methods of application of fungicides – Special methods of application. Mass multiplication of *Trichoderma viride*, *Pseudomonas fluorescens* and *Bacillus subtilis* and method of application-Preparation of leaf extracts, oil emulsion of neem and antiviral principles. Cross protection - Tissue culture – meristem tip culture technique. Visit to seed Testing Laboratory and pesticide testing laboratory**

### **THEORY LECTURE SCHEDULE**

- 1. Plant diseases –Classification based on mode of infection, inoculums built up, spread, symptoms, severity and occurrence- Disease triangle- Role of weather factors in plant disease development.**
- 2. Survival and dispersal of Plant Pathogens**
- 3. Disease surveillance –Different methods- surveillance report-Disease surveillance programme in Tamil Nadu. Assessment of Plant Diseases- different methods- Measurement of disease growth rate by Area Under Disease Progressive Curve (AUDPC)**
- 4. Diagnosis of plant diseases-Seed health tests, Chemodiagnosis, Serodiagnosis and Molecular detection of plant pathogens**
- 5. Exclusion- Plant quarantine – Domestic, International and Embargo - Phytosanitary certificate - Quarantine in India. Exotic diseases introduced into India.**
- 6. Role of cultural practices in Plant Disease Management. Different methods of Eradication of Plant Diseases**
- 7. Protection – Physical methods of protection - Chemical fungicides – Definition – Classification- Sulphur and Copper fungicides, Mode of action and Uses**
- 8. Mercury fungicides, Heterocyclic Nitrogen compounds, Organotin, Quinone, Benzene and Miscellaneous compounds , Mode of action and Uses**
- 9. Mid semester examination**
- 10. Systemic fungicides including antibiotics – Classification – Mode of action - Uses. New generation fungicides**
- 11. Methods of application of fungicides: seed treatment, foliar spray, soil drenching and special methods of application**
- 12. Biological control – Definition - mechanism of action – Mass production of *Trichoderma viride*, *Pseudomonas fluorescens* and *Bacillus subtilis* - methods of application - Plant products – Antiviral Principles (AVP) – preparation – methods of application**
- 13. Plant Protection appliances – Duster, Sprayers, Soil injector/Soil gun, Granular applicator and slurry seed treater**
- 14. Disease Resistance – Types - Resistant varieties. Methods of developing resistant varieties**
- 15. Mechanisms of resistance- structural and bio chemical resistance in plants**
- 16. Immunization technique- Cross protection against viral and bacterial diseases.**
- 17. Biotechnological approaches in plant diseases management: Tissue culture techniques- meristem tip culture, somoclonal variation and transgenic plant production by genetic engineering.**

### **PRACTICAL SCHEDULE**

- 1. Survey and Assessment of important plant diseases**
- 2. Diagnosis of Plant diseases: Tetrazolium test, Iodine test and ELISA test**
- 3. Seed health tests for diagnosis of seed borne pathogens - dry seed examination, seed washing, Blotter test and ELISA.**
- 4. Classification and grouping of fungicides.**



5. Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), Burgundy mixture, Chaubattia paste and Cheshunt compound.
6. Calculation of fungicides quantity and methods of application of fungicides – Seed (wet and dry) soil, foliar and post harvest dipping.
7. Special methods of application: swabbing, acid delinting, pseudostem injection, capsule application
8. Special methods of application: Corm injection, Paring and Pralinage, root feeding and trunk injection.
9. Mass multiplication of *Trichoderma viride* and method of application
10. Mass multiplication of *Pseudomonas fluorescens* and method of application
11. Mass multiplication of *Bacillus subtilis* and method of application
12. Preparation of leaf extracts, oil emulsion of neem and antiviral principles.
13. Cross protection: production of pre immunized citrus seedlings against *Tresteza* virus.
14. Tissue culture – Production of virus free plants through meristem tip culture technique.
15. Seed Testing Laboratory equipments
16. Pesticide testing laboratory equipments
17. Record certification

#### REFERENCE BOOKS

1. Agrios, G. N. 2005. Plant Pathology, 5<sup>th</sup> edition, Academic Press, New York. 922 p.
2. Chaube, H.S. and Pundhir, V.S. 2005. Crop Diseases and their Management. PHI Learning pvt., Ltd., New Delhi. 703 p.
3. Dale Walters. 2009. Disease Control in Crops, Biological and Environmentally - Friendly Approaches. Wiley – Blackwell. 266 p.
4. Kapoor, A.S. and Banyal, D.K. 2012. Plant Disease Epidemiology and Management. Narendra Publishing House, New Delhi. 162 p.
5. Lainsbury, M.A. 2016. The UK Pesticide Guide 2016. BCPC and CAB International. 767 p.
6. Narayanasamy, P. 2001. Plant Pathogens Detection and Disease Diagnosis. Marcel Dekker, Inc, New York. 544 p.
7. Nene, Y.L. and Thapliyal, P.N. 1993 (Reprinted in 2011). Fungicides in Plant Disease Control. 3<sup>rd</sup> edition. Oxford and IBH Publishing Co. Ltd., New Delhi. 691 p.
8. Oliver, R.P. and Hewitt, H.G. 2014. Fungicides in Crop Protection. 2<sup>nd</sup> edition. CAB International, U.K. 190 p.
9. Sharma, P.D. 2016. Plant Pathology. Second edition. Rastogi Publications, New Delhi. 616 p.
10. Singh, R.S. 2001. Plant Disease Management. Oxford and IBH Publishing Co. Pvt., Ltd., 238p.

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2. Ebbels, D.L. 2003. Principles of Plant Health and Quarantine. CABI. 302 p.
3. Heather, N.W. and Hallman, G.J. 2008. Pest Management and Phytosanitary Trade Barriers. CABI. 257 p.
4. J.M. Waller, J.M. Lenné and S.J. Waller 2002. Plant Pathologist's Pocket book. 3<sup>rd</sup> Edition, CABI Publishing, U.K.
5. Pal, K. K. and B. McSpadden Gardener, 2006. Biological Control of Plant Pathogens. *The Plant Health Instructor* DOI: 10.1094/PHI-A-2006-1117-02. APS Net

#### e- references

1. [www.apsnet.org/educenter/illglossary/pages/default.aspx](http://www.apsnet.org/educenter/illglossary/pages/default.aspx) - APS Education center
2. [www.croplife.org](http://www.croplife.org)
3. [www.plantdisease.com](http://www.plantdisease.com)
4. [www.cropprotection.html](http://www.cropprotection.html)

#### AGM 314 ENVIRONMENTAL SCIENCE (2+1)

#### OBJECTIVES

- Imparting basic knowledge about the environment and ecology.
- Developing an attitude of concern for the environment.

- Motivating the students to participate in environment protection and environment improvement.

#### Unit I - Ecology and Ecosystems

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

#### Unit II - Natural Resources and Biodiversity

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

#### Unit III- Environmental pollution

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

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

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

#### Unit V- Environmental Protection

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

#### PRACTICAL

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

#### THEORY LECTURE SCHEDULE

1. Ecology, Environment , Ecosystem and its components
2. Terrestrial biomes (Forest, Desert, etc..)
3. Aquatic biomes (Pond, River, Estuaries and Ocean)
4. Energy flow, Food Chain, Food Web and Ecological pyramids
5. Species interactions
6. Succession and adaptations
7. Natural and Energy resources: Land, Water, Air, Forest, Minerals
8. Energy resources - Renewable and Non-renewable
9. Sustainable Management and Conservation of natural resources
10. Biodiversity: Types, National and Global Status, importance, Hotspots and Threats
11. Conservation of Biodiversity: *In-situ and Ex-situ* - Biosphere Reserves - National parks, Wildlife Sanctuaries, Botanical Garden, etc..
12. Environmental pollution- types and sources
13. Soil pollution sources, effects
14. Fate of soil pollutants – management – bio and phyto remediation of soil pollutants
15. Water pollution sources and types of waste water
16. Waste water – impact on ecosystems- eutrophication, bio magnification , water borne diseases
17. Air pollution sources effects and control measures
18. Mid-semester examination

19. Air pollution indicators, episodes and monitoring
20. Noise pollution sources effects and control measures
21. Radioactive, heavy metal and thermal pollution sources effects and control measures
22. Green House Gases-Global warming- Climate change-Impact on agriculture and other natural resources
23. Types of wastes –industrial waste, agricultural wastes, domestic waste-characteristic and environmental impact
24. Solid waste management techniques- physical methods
25. Solid waste management techniques- composting and Vermicomposting
26. Waste water treatment methods –physical, chemical and biological methods.
27. Waste water recycling and Standards for waste water disposal
28. Global treaties and Conventions for Environmental Protection
29. National and state level organizations: CPCB, TNPCB, etc..
30. Environmental impact assessment- stages and monitoring.
31. Environmental Education
32. Environmental Laws and Acts
33. Afforestation
34. Role of information technology on environment.

#### **PRACTICAL SCHEDULE**

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

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1. P.D. Sharma, 2009, Ecology and Environment, Rastogi Publications, Meerat, India
2. Subba Rao,N.S.1999. Soil Microorganisms and plant Growth. Oxford and IBH, New Delhi
3. Rosenberg , E .1993 . Microorganism to combat pollution Kluwer Academic publishers . London
4. Rangaswamy,G.and Bagyaraj, D.J. 1992. Agricultural Microbiology, Asia Publishing House, New Delhi.
5. Purohit and Agarwal 2007 Ecology and Environmental Biology Student Edition , Jodhpur
6. D.K.Asthana and Meera Asthana 2006 A textbook of Environmental Studies , S.Chand and Company lit, New Delhi

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1. Tyler Miller and Scot Spoolman. 2009. Living in the Environment (*Concepts, Connections, and Solutions*). Brooks/cole, Cengage learning publication, Belmont, USA
2. Mishra , P. C. 1990. Fundamentals of air, water pollution Ashish publishing house. New Delhi
3. Arumugam , N . 1994 . Concepts of Ecology. 7<sup>th</sup> edition. Saras publishers Nagarkoil .India
4. Atlas bartha 2006 , Microbial Ecology, Pearson Education ( Fourth Edition)

5. Raina, M. Maier, Law L. Pepper and Charles P. Guaba 2006 Environmental Microbiology, Academic press (An imprint of Elsevier) USA
6. E-Book: Chiras D.D., 2016. Environmental Science, Tenth Edition. Jones and Bartlett Learning, Burlington, MA. ISBN: 978-1-284-05705-8, 708 Pages.

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

#### **OBJECTIVES**

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

#### **THEORY**

##### **Unit-I-Essential Nutrients**

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

##### **Unit-II- Nutrient Dynamics**

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

##### **Unit-III-Classification of Fertilizers**

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

##### **Unit-IV-Application Methods**

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

##### **Unit-V-Nutrient Management**

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

#### **Practical Syllabus**

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

#### **THEORY LECTURE SCHEDULE**

1. Soil fertility and productivity - essential nutrients- criteria of essentiality - N, P and K nutrients -functions, deficiency and toxicity symptoms
2. Secondary nutrients, micro nutrients and beneficial elements - functions, deficiency and toxicity symptoms.
3. Concepts and approaches of soil fertility evaluation - Liebig's Law, Mitscherlich's law and Bray's nutrient mobility concept. Approaches - Deficiency symptoms, tissue analysis, biological tests and chemical tests
4. Techniques/ methods of soil fertility evaluation - Inductive, deductive, 'A' value technique, crop logging, critical level, DRIS and agronomic approach
5. Sources, forms, mobility, transformation, fixation, losses and availability of nitrogen in soil
6. Sources, forms, mobility, transformation, fixation, losses and availability of phosphorus in soil
7. Sources, forms, mobility, transformation, fixation, losses and availability of potassium in soil

8. Sources, forms, mobility, transformation, fixation, losses and availability of calcium magnesium and sulphur in soil
9. Sources, forms, mobility, transformation, fixation, losses and availability of micro nutrients in soil
- 10 Nutrient interactions in soil
- 11 Fertilizers - Definition, classification of N,P and K fertilizers
- 12 N fertilizers- Urea, ammonium sulphate, ammonium nitrate, CAN, properties and their reactions in soil
- 13 Manufacture of urea and ammonium sulphate
- 14 P fertilizers- Rock phosphate, bone meal, basic slag, single super phosphate, diammonium phosphate, triple super phosphate, properties and their reactions in soil
- 15 Manufacturing of SSP and DAP
- 16 K fertilizers- MOP and SOP- properties and reactions in soil
- 17 Mid Semester Examination
- 18 Synthesis of MOP and SOP
- 19 Complex fertilizers- definition, manufacture of ammonium phosphate, nitro phosphate and N,P,K complexes
- 20 Mixed fertilizers-definition, preparation and compatibility
- 21 Preparation and characteristics and compatibility - Specialty/ Customized fertilizers, Water soluble fertilizers, liquid fertilizers, Micro nutrient mixtures and chelated micronutrients
- 22 Fertilizer Control Order
- 23 Organic manures- Definition, classification and sources- Fortified organics
- 24 Composting techniques- Aerobic and anaerobic (Bangalore and Coimbatore method) enriched FYM and vermicompost. Composting of organic waste- Sugarcane trash and coir waste
- 25 Methods of fertilizer application for different soil types - Fertigation - Definition - water soluble fertilizers
- 26 Types of fertigation - Fertilizer schedule
- 27 Fertilizer application methods - Seed coating, pelletization, seedling dipping - Nutriseed pack - Soil Application - Foliar spray
- 28 Nutrient management concepts - INM, STCR, IPNS, SSNM and RTNM - Tools - DSSIFER and VDK
- 29 Nitrogen use efficiency - Slow release N fertilizers - Significance and enhancement techniques
- 30 Nutrient use efficiency of P, K and micronutrients and their enhancement techniques
- 31 Soil health - Definition - Soil Quality Indices - Physical, chemical and Biological indicators-Soil enzymes
- 32 SOM maintenance - Role of SOM in sustaining soil health
- 33 Precision farming and organic farming - Concepts and applications
- 34 Long term effect of fertilization on soil

#### **PRACTICAL SCHEDULE**

1. Estimation of alkaline  $\text{KMnO}_4$  N in soil
2. Estimation of Olsen P and Bray P in soil
3. Estimation of Neutral Normal  $\text{NH}_4\text{OAc}$  K in soil
4. Estimation of Ca, Mg by versenate method
5. Estimation of sulphur in soil by turbidimetry
6. Estimation of DTPA extractable micronutrients in soil
7. Fertilizer sampling techniques and Estimation of N in urea
8. Estimation of ammoniacal and nitrate N in ammonium nitrate
9. Estimation of water soluble P in SSP
10. Estimation of citric acid soluble P in rock phosphate - Pemberton's method
11. Estimation of K in KCl and  $\text{K}_2\text{SO}_4$
12. Estimation of N in FYM / Compost by Macro Kjeldahl method
13. Preparation of triple acid extract - Estimation of P in FYM / Compost by Vanado molybdate yellow colour method
14. Estimation of K in FYM / Compost by Flame Photometry.

15. Colloquium on establishment of soil testing laboratories -Fertilizer calculations- Soil test based fertilizer prescription
16. Visit to STL and FTL, Visit to fertilizer manufacturing / mixing unit
17. Practical Examination.

#### REFERENCE BOOKS

1. John L. Havlin, James D. Beaton, Samuel L. Tisdale and Werner L. Nelson.2011. Soil Fertility and Fertilizers- An Introduction to Nutrient Management. PHL Learning Pvt. Ltd., New Delhi
  2. Gupta, P. K. 2012. A Handbook of Soil, Fertilizer and Manure. Agrobios (India), Jodhpur.
  3. Ramesh Chandra and S. K. Singh. 2009. Fundamental and Management of soil quality. Westville Publishing House, New Delhi.
  4. Dilip Kumar Das, 2007. Micronutrients: Their Behavior in soils and plants. Kalyani Publishers, New Delhi.
  5. Mengel, K., E.A. Kirkby, H.Kosegarten and T.Apple. 2006. Principles of Plant Nutrition, 5<sup>th</sup> ed. Springer International.
  6. Sree Ramulu, U.S. 2003. Principles in the quantitative analysis of waters, fertilizers, plants and soil. Scientific Publishers, Jodhpur
  7. Kolay, A.K 2007. Manures and Fertilizers.Atlantic Publishers and Distributon(P) Ltd. New Delhi
  8. Shivanand Tolanur, 2006. Soil Fertility, Fertilizers and Integrated Nutrient Management. International Book Distribution, Lucknow  
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  2. [www.springerlink.com/index/IQ11256h8t325054.pdf](http://www.springerlink.com/index/IQ11256h8t325054.pdf)

### GPB 316 PLANT BIOTECHNOLOGY (2+1)

#### OBJECTIVES

To impart knowledge on basic and applied aspects of plant biotechnology.

#### THEORY

##### Unit I : Basics of Plant Tissue Culture

Principles in plant tissue culture, Historical achievements, Nutrient media and its composition, Plant growth regulators, Tissue culture techniques-callus culture, suspension culture, anther and ovule culture, embryo culture, meristem tip culture, protoplast culture and somatic hybridization, Regeneration methods - organogenesis and embryogenesis, Synthetic seeds, somaclonal variation, secondary metabolite production, germplasm conservation and application of plant tissue culture in crop improvement.

##### UNIT II : Basic Molecular Biology

Milestone in DNA research- Structure of nucleic acids, DNA, RNA and its types - Central dogma of life - DNA replication, genetic codes and amino acids, palindrome sequence, shine-dalorgano sequence, transcription, translation or protein biosynthesis, Structure of a gene-Lac Operon concept

##### Unit-III: Gene cloning

DNA manipulation enzymes - nucleases, ligases, polymerases, modifying enzymes and topoisomerases, Vectors – plasmids and its classifications, Bacteriophage, phagemids, cosmids, BAC, YAC and HAC, Construction of recombinant DNA molecules and Bacterial transformation.

##### Unit IV : Techniques and analysis of gene expression

Genetic engineering methods- Direct and Indirect methods of gene transfer - *Agrobacterium* mediated and particle bombardment-Transgenic plants-herbicide, pest and disease resistant, abiotic stress resistant, nutritional enhancement and improved quality, Molecular detection of transgenics-Polymerase chain reaction (PCR) - Real Time PCR, Reverse transcription-PCR (RT-PCR), Hybridization and Blotting-Southern, Northern and Western – ELISA, DNA sequencing methods.

##### Unit-V: Molecular markers

DNA markers – different kinds – Hybridization based marker-RFLP, PCR based markers – AFLP, RAPD, SSR and SNPs – DNA finger printing of varieties-Development

of mapping populations- linkage and QTL analysis- principles, methods and applications of Marker Assisted Selection in crop improvement- Genomic and proteomic databases for marker analysis – Gene editing tools.

#### **PRACTICAL**

Biotech Laboratory organization, safety regulations – basics of reagents and solution preparation- Plant tissue culture media preparation- shoot tip culture (rose) - Meristem culture (tapioca)- Micro propagation of banana - Callus culture – Culturing of E.coli and determination of growth curve- Isolation of bacterial plasmid DNA- Restriction Digestion and Ligation- Competent cell preparation and Bacterial transformation – confirmation of transformation through colony screening - DNA extraction from plants- Quantification of DNA and quality check through Agarose gel electrophoresis - Molecular marker analysis- DNA fingerprinting using RAPD/SSR markers - NTSys- analysis of diversity in crop plants- Visit to tissue culture units /biotech labs in seed industry/Bt cotton field/tissue culture banana fields

#### **THEORY LECTURE SCHEDULE**

1. Plant tissue culture: Basic principles, Concepts, historical achievements
2. Plant nutrient media and its composition, Plant growth regulators
3. Culture types - callus culture and cell suspension culture
4. Meristem tip culture (virus free plants)
5. Protoplast isolation and fusion, somatic hybridization
6. Regeneration methods - organogenesis and embryogenesis
7. Synthetic seeds, somaclonal variation and secondary metabolite production
8. In vitro germplasm conservation
9. Application of plant tissue culture in crop improvement.
10. Milestone in DNA Research
11. Structure of nucleic acids
12. Central dogma of life- DNA replication
13. Aminoacids and their classification and genetic codes, transcription
14. Translation and protein synthesis
15. Structure of a gene
16. Structure of gene and Lac Operon
17. DNA manipulation enzymes: Polymerases, restriction endonucleases and ligases
18. Mid semester Examination
19. Different types of vectors: plasmids, phagemids, cosmids
20. BAC, YAC and HAC
21. Construction of recombinant DNA molecules- Bacterial transformation
22. Direct and indirect gene transfer methods in plants-particle bombardment
23. *Agrobacterium* mediated gene transfer method
24. Transgenic plants: herbicide, pest and disease resistant, abiotic stress resistant,
25. Transgenic plants: nutritional enhancement and traits for improved quality
26. Molecular detection of Transgenics- Polymerase chain reaction RT-PCR
27. Hybridization and Blotting and ELISA techniques
28. DNA sequencing methods
29. DNA markers - hybridization based markers (RFLP) - PCR based markers: RAPD, SSR, AFLP, and SNPs
30. DNA fingerprinting of crop varieties
31. Development of mapping populations
32. Linkage and QTL analysis
33. Principles, methods and applications of Marker Assisted Selection in crop improvement
34. Applications of Plant Genomics and genome databases

#### **PRACTICAL SCHEDULE**

1. Biotech Laboratory organization, safety regulations
2. Instrumentation in DNA laboratory and
3. Units and formula, reagents and solution preparation
4. Plant tissue culture media preparation
5. Meristem culture
6. Micro propagation of banana
7. Isolation of bacterial plasmid DNA
8. Restriction Digestion and Ligation

9. Competent cell preparation and Bacterial transformation
10. DNA extraction from plants
11. Quantification of DNA and quality check through Agarose gel electrophoresis
12. PCR and DNA fingerprinting using SSR markers
13. Blotting techniques in molecular biology
14. Biolistic and *Agrobacterium* mediated genetic transformation in plants
15. NTSys- analysis of diversity in crop plants
16. Visit to tissue culture units /biotech lab in seed industry/Bt cotton field/tissue culture banana field
17. Orientation for final examination

#### REFERENCE BOOKS

1. Primrose, S.B. and Twyman, R.M. 2006. Principles of Gene Manipulation and Genomics, 7th Edition. Blackwell Publishing Company.
2. James D. Watson, Micheal Gilman, Mark Zoller, 2001. Recombinant DNA Second Edition - W.H. Freeman and Company, New York.
3. Chawla, H.S.. 1998. Biotechnology in crop improvement. International Book Distributing Company.
4. Satyanarayana, U.. 2005. Biotechnology. Books and Allied (p) Ltd.
5. Dubey, R.C.. 2005. A Text Book of Biotechnology. S. Chand and Co Ltd, New Delhi.
6. Chawla. H S. 2009. Introduction to Plant Biotechnology (3/e). CRC Press, London. 730 P ISBN 9781578086368.
7. George, E.F, Hall M. A. and Geert-Jan De Klerk. 2009. Plant Propagation by Tissue Culture, 3rd Edition, Springer, The Netherlands. 501p.
8. Nelson, D.S. and M.M. Cox. 2012. Lehninger's Principles of Biochemistry. Sixth edition. Chapters- 1,3,8,9,25,26,28 (weblinks, tutorials and lecture companion art) W.H. Freeman and Company.
9. Brown, T. A. 2010. Gene Cloning and DNA Analysis: An Introduction, 6th Edition, Wiley-Blackwell- Companion site (Chapters 1 to 12 and 15)

e-resource

<http://www.isaaa.org/india/> - Briefs

#### HOR 317 PRODUCTION TECHNOLOGY OF FRUITS AND PLANTATION CROPS (2+1)

**OBJECTIVES :** The students will be educated on the cultivation aspects of major fruit crops grown in tropical, sub - tropical and temperate regions and also about the plantation crops.

#### THEORY

##### Unit-I : Crop production techniques in fruit crops - I

Scope and importance of fruits – classification of fruits – area – production and export potential – nutritive value - importance of GAP and organic fruit production. Climate and soil requirements – varieties – propagation – planting density and systems – cropping systems – after care – training and pruning – water, nutrient and weed management – special horticultural techniques – plant growth regulation – Important disorders – maturity indices and harvest – post harvest management of following crops: mango, banana, papaya, sapota and guava.

##### Unit-II : Crop production techniques in fruit crops - II

grapes, citrus (sweet orange, mandarin and acid lime), pineapple, jack, pomegranate

##### Unit-III : Crop production techniques in fruit crops - III

apple, pear, plum and peach.

##### Unit-IV : Crop production techniques in plantation crops - I

Scope and importance of plantation crops – area and production – export potential – importance of GAP and organic plantation production. Climate and soil requirements – varieties – propagation – planting density and systems of planting – cropping systems – after care – training and pruning – water, nutrient and weed management – shade management – intercropping – maturity indices and harvest – post harvest management and processing of following crops: Tea, coffee and rubber

##### Unit-V : Crop production techniques in plantation crops - II

Cocoa, cashew, coconut, arecanut, oil palm and palmyrah.



## **PRACTICAL**

Propagation techniques, selection of planting material, varieties, important practices for the fruit crops : mango, banana, grapes, citrus (sweet orange, mandarin, acid lime), papaya, sapota and guava – visit to commercial orchards located at different horticultural cropping zones, post harvest handling of important tropical crops. propagation techniques, selection of planting material, varieties, important practices for the plantation crops: tea, coffee, rubber, cocoa, cashew, coconut, arecanut and oilpalm, study of post harvest handling of important plantation crops and visit to plantation and processing units.

## **THEORY LECTURE SCHEDULE**

1. Scope and importance of fruits – global and national scenario of fruits – classification of fruits –
2. Area, production, export potential and nutritive value
3. Importance of GAP and organic fruit production
4. Climate and soil – varieties – propagation methods – Planting and cropping systems – after care – training and pruning – water, nutrient and weed management – Special horticultural techniques – plant growth regulation – Important disorders – Maturity indices and harvest – post harvest management of mango
5. – do – banana
6. – do – papaya
7. – do – sapota
8. – do – guava
9. – do – grapes
10. – do – citrus (sweet orange, mandarin and acid lime)
11. – do – pineapple
12. – do – jack and pomegranate
13. – do – custard apple and aonla
14. – do – apple
15. – do – pear
16. – do – plum and peach
17. Scope and importance – status of national and International scenario – area – production – productivity – export potential – Importance of GAP and Organic production of plantation crops
18. Mid Semester examination
19. Production technology of Tea – soil, climate, varieties, nursery and planting, training and pruning
20. Production technology of Tea – water, weed and nutrient management – canopy management and shade regulation – harvest, processing, grading, packing and storage of Tea
21. Production technology of Coffee – soil, climate, varieties, nursery and planting, training and pruning
22. Production technology of Coffee – water, weed and nutrient management – canopy management and shade regulation – intercropping, harvest, processing, grading, packing and storage of coffee
23. Production technology of Rubber – soil, climate, varieties, nursery and planting, training and pruning
24. Production technology of Rubber – water, weed and nutrient management – Canopy management and shade regulation – Intercropping, harvest, processing, grading, packing and storage of Rubber
25. Production technology of Cocoa – soil, climate, varieties, nursery and planting, training and pruning
26. Production technology of Cocoa – water, weed and nutrient management – Canopy management and shade regulation – harvest, processing, grading, packing and storage of cocoa
27. Production technology of Cashew – Soil, climate, varieties, nursery and planting, training and pruning
28. Production technology of Cashew – water, weed and nutrient management – canopy management – intercropping, harvest, processing, grading, packing and storage of Cashew
29. Production technology of Coconut – soil, climate, varieties, nursery and planting

30. Production technology of Coconut – water, weed and nutrient management, intercropping, harvest and post harvest handling
31. Production technology of Arecanut – soil, climate, varieties, nursery and planting, water, weed and nutrient management, intercropping, harvest and post harvest handling
32. Production technology of oil palm – soil, climate, varieties, nursery and planting, training and pruning, water, weed and nutrient management, intercropping, harvest, post harvest handling and processing
33. Production technology of Palmyrah – soil, climate, varieties, nursery, planting, nutrient management – canopy management – harvest and processing

#### 34. Value addition in plantation crops

#### PRACTICAL SCHEDULE

1. Mango – varietal identification, selection of planting material and important cultural practices viz., training and pruning
2. Sapota – varietal identification, selection of planting material and important cultural practices viz., training and pruning
3. Banana – Varietal identification, selection of planting material and important intercultural practices viz., desuckering and propping
4. Grapes – Varietal identification, selection of planting material and important cultural practices viz., training and pruning practices
5. Citrus – Varietal identification and sub groups in citrus and important cultural practices viz., training and pruning practices
6. Papaya and guava – Varietal identification and important cultural practices
7. Visit to commercial orchards located at different horticultural cropping zones
8. Post harvest handling practices of important tropical fruit crops.
9. Tea – Identification of species and varieties – nursery practices – training and pruning – processing
10. Coffee – Identification of species and varieties – nursery practices – training and pruning – Processing
11. Rubber – Identification of varieties – Bud wood nursery practices – training – Processing
12. Cocoa – Identification of types – Clonal nursery practices – training and pruning – Processing
13. Cashew – identification of varieties – propagation techniques – grafting – top working – Processing
14. Coconut – identification of varieties – mother palm and seed nut selection – nursery practices – management of nutrient deficiencies – processing
15. Arecanut and oil palm – identification of varieties – mother palm and seed nut selection – Nursery practices – management of nutrient deficiencies – processing
16. Visit to commercial plantations and processing industries
17. Orientation for final examination

#### REFERENCE BOOKS

1. Veeraragavathatham, D., M. Jawaharlal, S. Jeeva, R.Rabindran and G. Umapathy. 2004. Scientific Fruit Culture. Suri Associates, Coimbatore – 2.
2. Chattopadhyay, T.K. 2001. A Text Book on Pomology (4 volumes). Kalyani Publishers, Ludhiana.
3. Radha, T. and L. Mathew. 2007. Fruit Crops (Horticultural Science Series Vol. III), New India Publishers, New Delhi.
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5. Shanmugavelu, K.G., N. Kumar and K.V. Peter. 2005. Production Technology of Spices and Plantation Crops. Agrobios, Jodhpur.
6. Peter, K.V. 2002, Plantation crops, National Book trust, India
7. Bose, T.K, S.K.Mitra and D.S.Rathouse 1998, Temperate fruits, Nayaorakash culcutta.

## **AEC 318 AGRI BUSINESS MANAGEMENT AND ENTREPRENEURSHIP (1+1)**

### **OBJECTIVE**

The objective of this course is to impart skill, training, proficiency in decision making and enhance ability, to direct, to coordinate and control the work at all levels of management for the farm graduates. The course is designed so that the student would use the knowledge and skill gained for starting new agribusiness and managing the business.

### **THEORY**

#### **Unit I: Agri Business Management**

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

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

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

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

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

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

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

#### **Unit V: Entrepreneurship**

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

### **PRACTICAL**

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

### **THEORY LECTURE SCHEDULE**

- 1. Management - Definition and concepts - Approaches.**
- 2. Principles of Management.**
- 3. Agri Business Management - Meaning and definition - Scope characteristics.**
- 4. Forms of agri business firms - Sale, partnership, joint stock, cooperative and state enterprises - Small, medium, tiny and micro enterprises - Importance.**
- 5. Management Functions: Planning, organizing, staffing, directing, controlling. Planning: Meaning, objective, steps – Types and importance.**
- 6. Organizing - Meaning - Structure - Types - Departmentation - Importance.**
- 7. Staffing - Meaning - Nature and importance HRM - Job analysis - Recruitment and selection.**

8. Directing - Principles - Techniques - Importance.
9. Mid semester examination.
10. Co-ordination and control - Objectives steps - Methods - Importance.
11. Production operations management – Planning and scheduling - Inventory - Materials management - Supply chain management.
12. Financial management - Concept and financial planning for agri business.
13. Marketing management - Market environment - Market segmentation.
14. Marketing mix, market promotion - Promotion mix – Consumer buying behavior.
15. Entrepreneur - Agripreneurs - Agripreneurship - Types, characteristics and process. Innovation, business incubation.
16. EDP - Programmes government schemes and incentives - Government Policy.
17. Agri Clinics and Agri Business Consortium (ACABC).

#### **PRACTICAL SCHEDULE**

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

#### **REFERENCE BOOKS**

1. Amarnath, J.S. and Samvel, A.P.V., 2008. *Agri-Business Management*, Satish Serial Publishing House, New Delhi.
2. Aswathappa, K. 2008. *Human Resource Management: Text and Cases*, Tata McGraw Hill Pub. Co. Ltd., New Delhi.
3. Broadway, A.C. and Broadway, Arif, A. 2002. *Kalyani Publishers*, New Delhi.
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 McGraw Hill Publishing Company Limited, New Delhi.

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

#### **OBJECTIVE**

To impart the basics of soil and water conservation engineering to the undergraduate students

#### **THEORY**

##### **Unit I : Surveying**

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

## **Unit II : Soil erosion**

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

## **Unit III : Soil conservation and watershed management**

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

## **Unit IV : Irrigation and drainage**

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

## **Unit V : Wells and Pumps**

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

### **PRACTICAL**

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

### **THEORY LECTURE SCHEDULE**

- 1. Introduction - land surveying - uses in agriculture.**
- 2. Chain cross staff and compass surveying - computation of angles.**
- 3. Radiation, intersection and traversing.**
- 4. Dumpy level - setting, observation and tabulation of readings - computation of land slope - difference in elevation.**
- 5. Computation of area and volume – Simpson’s rule and Trapezoidal rule.**
- 6. Soil Erosion – causes and evil effects of soil erosion – geologic and accelerated erosion**
- 7. Water erosion - causes - erosivity and erodibility - mechanics of water erosion**
- 8. Splash, sheet, rill and gully erosion - ravines - land slides**
- 9. Wind erosion - factors influencing wind erosion - mechanics of wind erosion – suspension, saltation, surface creep**
- 10. Effects of water and wind erosion**
- 11. Erosion control measures for agricultural lands – biological measures – contour cultivation – strip cropping - Cropping systems – vegetative barriers - Windbreaks and shelterbelts - shifting cultivation**
- 12. Mechanical measures – contour bund – graded bund - Broad beds and furrows – basin listing – random tie ridging**
- 13. Mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall**
- 14. Rain water harvesting – insitu soil moisture conservation – Runoff Computation - runoff water harvesting**

15. Farm ponds and percolation ponds - storage and its use for domestic and ground water recharge
16. Gully control structures - Check dams – Temporary and permanent
17. Watershed concept – Integrated approach and management
18. Mid semester examination.
19. Irrigation - measurement of flow in open channels - velocity area method
20. Rectangular weir - Cippoletti weir - V notch
21. Orifices - Parshall flume
22. Duty of water - irrigation efficiencies
23. Conveyance of irrigation water - canal lining
24. Underground pipe line system
25. Surface irrigation methods - borders, furrows and check basins
26. Components of drip and sprinkler irrigation system
27. Agricultural drainage – need - surface drainage systems
28. Surface drainage systems - drainage coefficient
29. Groundwater occurrence – aquifers types
30. Types of wells and sizes
31. Pump types – reciprocating pumps – centrifugal pumps
32. Turbine pumps – submersible pumps
33. Jet pumps – Airlift pumps
34. Selection of pumps – operation and their maintenance.

#### **PRACTICAL SCHEDULE**

1. Study of survey instruments - chains - compass - plane table - dumpy level.
2. Chains and cross staff surveying - linear measurement - plotting and finding areas.
3. Compass survey - observation of bearings - computation of angles.
4. Compass - radiation, intersection.
5. Levelling – fly levels – determination of difference in elevation.
6. Computation of area
7. Computation of volume
8. Contouring – Block contouring
9. Design of contour bund and graded bund.
10. Drip Irrigation systems.
11. Sprinkler irrigation system
12. Problems on water measurement.
13. Problems on duty of water, irrigation efficiencies.
14. Problems on water requirement - agricultural drainage.
15. Study of different types of wells and its selection.
16. Study of pumps and Selection of pumps.
17. Orientation for final examination.

#### **REFERENCE BOOKS**

1. Basak, N.N. 2008. Surveying and Levelling. 25th reprint. Tata Mc-Graw Hill Publishing Company Ltd
2. Michael, A.M. and Ojha, T.P. 2008. Irrigation Theory and Practice. Second Edition. Vikas Publication House, New Delhi
3. Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers and Distributors, New Delhi.
4. Gunshyam Das. 2005, Hydrology and Soil Conservation Engineering, Prentice-Hall of India Pvt. Ltd., New Delhi.

#### **e-resources**

- <http://nptel.ac.in/courses/105107122/13>
- <http://soilwater.okstate.edu/courses/lectures-powerpoint>

### **VI SEMESTER**

#### **AGR 320 – FARMING SYSTEM AND ORGANIC AGRICULTURE (2+1)**

#### **OBJECTIVES**

Learning the concept of cropping and farming systems as vital tool in enhancing agricultural productivity and intensive farming. Aims at incurring knowledge on various aspects of organic farming and its importance in present world scenario and its impact on environment and soil health.

## **THEORY**

### **Unit -I: Cropping system**

**Cropping system – Definition – principles – concepts – various types of cropping systems – advantage of various cropping systems – criteria for selection of intercrops – crop rotation – principles – Advantages – Intensive cropping systems in India and Tamil Nadu – Interactions between different cropping systems - Cropping scheme – determinants – principles - preparation of cropping schemes. Agronomic requirements in management of cropping systems.**

### **Unit - II: Farming System**

**Farming system - Definition - Principles - Concepts – Factors influencing enterprises selection - Management - Interaction between different enterprises with cropping - scope and advantages of Integrated Farming system - Integrated farming system models for different agro eco-systems – wetland, irrigated upland and dryland. Indices for evaluation of cropping and farming systems – Land use, yield advantages and economic evaluation.**

### **Unit - III: Organic farming for sustainable Agriculture**

**Organic farming: Definition - Scope - principles and concepts - history of organic farming - global scenario - pre requisites for Organic farming. Organic sources of nutrients - manures and other inputs - on farm and off farm sources - organic waste recycling methods. Indigenous Technical Knowledge (ITK) in organic agriculture. Bio-intensive nutrient management – Nutrient rich organic manures – EMI – Organic Crop Production and Protection methods.**

### **Unit - IV: Organic Certification and labelling**

**Organic certification - NPOP guidelines - Certification agencies in India - crop production standards - Quality considerations - labelling and accreditation process - marketing and export opportunities - Organic enterprises. Non chemical management methods for weeds, insects and diseases.**

### **Unit – V: Resource management**

**LEIA and HEIA Concepts and principles – Basic ecological principles of LEISA – Promising LEISA techniques – resource management under constraint situations – Cost reduction strategies in crop production – Non-monetary inputs and low cost technologies – Labour management. Crop residue management. Conservation agriculture and its impact on Agriculture.**

## **PRACTICAL**

**Preparation of cropping scheme - working out input requirements for crops, cropping systems - preparation of calendar of operations for wetland, irrigated upland and dry land cropping system - visit to cropping system experiments - working out indices for evaluation of cropping systems - visit to different units: dairy, goat, poultry and biogas. Preparation of integrated farming system models for different eco-systems. Experiencing organic farming practice. Hands on experience of composting technologies. ITK based biological preparations. Bio – inoculants. Quality aspects of inputs and products - grading, packaging. Visit to organic farms, market outlets and organic certification. Cost of production for organic cultivation of important field crops.**

## **THEORY LECTURE SCHEDULE**

- 1. Cropping system: Definition, Principles and basic concepts , types of cropping systems - Mono cropping, intensive cropping, multiple cropping, intercropping.**
- 2. Advantages and disadvantages of various cropping systems – criteria for selection of intercrops**
- 3. Crop rotation, principles and Advantages, major cropping systems prevailing in India and Tamil Nadu for different agro eco-systems.**
- 4. Cropping scheme , principles and factors influencing in cropping scheme, preparation of cropping schemes.**
- 5. Complementary and competitive interaction in different cropping system - light, nutrient, water and weed.**
- 6. Allelopathy, legume effect - effect of preceding and associated crops.**
- 7. Agronomic requirement for crops and cropping system in inter cropping.**
- 8. Agronomic requirement for crops and cropping system in sequential cropping.**
- 9. Farming system: definition, principles and concepts and advantages of farming**

- system.
10. **Factors influencing choice and size of enterprises.**
  11. **Integrated farming system - Scope and advantages.**
  12. **Allied enterprises for wetland, irrigated upland and dryland and their interactions.**
  13. **Management of agricultural allied enterprises and crops in IFS models.**
  14. **Integrated farming system - models for wetland,**
  15. **Integrated farming system - irrigated upland and dryland eco-system.**
  16. **Indices used to evaluate land use efficiency in multiple cropping.**
  17. **Indices used to evaluate yield advantages and economic viability in multiple cropping.**
  18. **Mid semester examination**
  19. **Organic farming; definition - prospects - principles and concepts - History and genesis of organic farming in World and India: Present status in World, India and Tamil Nadu.**
  20. **Pre-requisites and basic steps for organic farming; conversion to organic farming - planning and processes in practices.**
  21. **Sources of organic manures - plant, animal and microbial origin - on - farm resources; FYM, green manures, crop residues, poultry manure, sheep and goat manures, biogas slurry and vermicompost.**
  22. **Off-farm resources; coir pith, press mud, oilcakes, flyash, bio compost, minerals, bone meal, bio fertilizers, traditional preparations.**
  23. **Organic waste recycling methods and techniques - composting, vermicomposting, *in situ* composting - system approach and Indigenous technical knowledge (ITK) in organic agriculture –importance.**
  24. **Organic certification - procedures - certification agencies in India and labelling and accreditation processes.**
  25. **Crop production standards - NPOP guidelines - principles, recommendations and standards and Organic farming; Promotional activities; role of government and NGO's - action plan - policy considerations.**
  26. **Quality considerations - assessment methods - premium and export opportunities. Good crop husbandry practices for important field crops**
  27. **Non - chemical weed management methods; preventive, physical, cultural, use of tools and implements and biological measures**
  28. **Organic pests and diseases management practices - bio control agents, bio rational pesticides; minerals, botanicals, soaps, trap crops, bird perches, and traditional preparations - sanitation.**
  29. **Resource management under constraint situation.**
  30. **Cost reduction technologies and non monetary inputs in cropping and farming system.**
  31. **LEISA and HEIA - principles and concepts - Basic ecological principles of LEISA and Promising LEISA techniques**
  32. **Labour management in cropping and farming system.**
  33. **Crop residues management (CRM) for sustainable Agriculture**
  34. **Conservation agriculture (CA), scope, advantages and CA technology for sustainable Agriculture.**

#### **PRACTICAL SCHEDULE**

1. **Visit to cropping system experiments in wetland, irrigated upland and dryland.**
2. **Preparation of cropping scheme for wetland and working out input requirement.**
3. **Preparation of cropping scheme for irrigated upland and working out input requirement.**
4. **Calendar of operations for wet land and irrigated upland cropping system.**
5. **Working out indices for evaluating the cropping system - land use, yield advantage, Economics, sustainability.**
6. **Preparation of integrated farming system models : wetland eco-system, Irrigated upland and dryland eco systems.**
7. **Resources Inventory of Organic Farming.**
8. **Study on green manures and raising of green manures (Sunnhemp / Daincha / Fodder cowpea).**
9. **Indigenous practices in - seed treatment and raising of field crop (Rice / Maize /**



- Cowpea / Cotton / Sugarcane).
10. Hands on experience in recycling techniques - composting and vermicomposting, Production techniques – Grading, Packaging and Post harvest management.
  11. Application methods of manures and bio-fertilizers.
  12. Acquiring skills in quality aspects of inputs and products , grading and packaging.
  13. ITK based preparations (Panchakavya, Dasakavya, Amirthakaraisal, fish amino acids)
  14. Exposure visit to organic farm market out lets and organic certification agencies.
  15. Exposure visit to bio-control agent units and bio-fertilizer production units.
  16. Cost of production for organic cultivation of important field crops.
  17. Orientation for final examination

#### REFERENCE BOOKS

1. Palaniappan, SP and K. Sivaraman.1996. Cropping systems in the tropics Principles and management. New Age International (P) Ltd., New Delhi.
2. Jayanthi, C. Devasenapathy, P and C. Vennila. 2007. Farming Systems. Principles and practices. Satish Serial Publishing House. Delhi.
3. S.C. Panda. 2003. Cropping and Farming Systems. Agrobios Publishers. Jodhpur.
4. Dahama, A.K.2009. Organic farming for sustainable agriculture, Agrobros publishers.
5. SP. Palaniappan and K Annadurai. 2008. Organic Farming: Theory and Practice. 2008. Scientific Publishers.

#### e-resources

1. <http://www.fao.org/docrep/016/i2718e/i2718e.pdf>
2. [http://www.fao.org/fileadmin/templates/nr/sustainability\\_pathways/docs/Compilation\\_techniques\\_organic\\_agriculture\\_rev.pdf](http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Compilation_techniques_organic_agriculture_rev.pdf)
3. [http://www.navdanya.org/attachments/Organic\\_Farming3.pdf](http://www.navdanya.org/attachments/Organic_Farming3.pdf)
4. <http://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDF-downloads/TOFG-all.pdf>
5. <http://nsdl.niscair.res.in/123456789/670> Revised Organic farming.pdf  
<http://nsdl.niscair.res.in/123456789/671> Revised farming system.pdf

### AGR 321 CROP PRODUCTION- II (0+1)

#### OBJECTIVES

This course is designed to impart practical aspects of scientific cultivation of any upland crop (maize / sorghum / pearl millet / finger millet / cotton / sunflower / groundnut /sesame) to the students and to acquire sound knowledge in detailed aspects of cultivation and to make them competent to suggest appropriate technology to the farmers based on the varying soil and climatic conditions. Each student will be allotted a minimum land area and he / she will do all field operations in the allotted land from field preparation to harvest and processing.

#### IRRIGATED DRY CROP

Ecosystem - Climate and weather - Seasons and varieties of Tamil Nadu, Growth stages of crop. Selection of field - Main field preparation - seed treatment - Application of manures and fertilizers - Sowing – practicing pre- emergence application of herbicides-- Thinning and gap filling - Estimation of seed rate and plant population - Top dressing - Weed management - Water management – Pest and disease management - Observation on nutrient deficiency - Recording growth, yield attributes and yield .Harvesting, threshing and cleaning the produce - Cost of cultivation and economics

#### PRACTICAL SCHEDULE

1. Study of ecosystems, climate, weather, seasons and varieties of Tamil Nadu
2. Growth stages of crop and selection of field for crop cultivation.
3. Acquiring skill in seed treatment practices.
4. Study and Practice of main field preparation.
5. Practicing of application of manures and fertilizers and fertilizer calculations.
6. Practicing sowing methods and acquiring skill in pre-emergence application of herbicides.

7. Estimation of seed rate and plant population
8. Acquiring skill in gap filling ,thinning and recording bio metric observations
9. Mid semester examination
10. Study of weeds and weed management.
11. Observation of nutritional deficiency symptoms and corrective measures.
12. Study of water management practices.
13. Observation of insect pests and diseases and their management
14. Estimation of yield and yield parameters
15. Harvesting, threshing and cleaning of the produce.
16. Working out cost of cultivation and economics.
17. Orientation for final examination

e-resource

<http://nsdl.niscair.res.in/123456789/532Cotton - Formatted.pdf>

## **PAT 322 DISEASES OF FIELD CROPS AND THEIR MANAGEMENT (2+1)**

### **OBJECTIVE**

- The subject covers etiology, symptoms, epidemiology, mode of spread, survival and integrated management of important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non-parasitic causes of the following crops.

### **THEORY**

#### **UNIT I : Diseases of Cereals and Millets**

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non-parasitic causes of Rice, Wheat, Barley, Oats, Sorghum, Maize, Bajra, Ragi and Small Millets.

#### **UNIT II : Diseases of Pulses**

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of important diseases of Redgram, Blackgram, Greengram, Bengalgram, Soybeans, Cowpea , Lablab and Horse gram.

#### **UNIT III : Diseases of Oil Seeds**

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of important diseases of Coconut, Groundnut, Sesame, Sunflower, Castor, Mustard, Safflower, Linseed, Niger and *Jatropha*

#### **UNIT IV : Diseases of Cash Crops**

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of important diseases of Cotton, Jute, Sugarcane, Sugar beet, Tobacco and Mulberry

#### **UNIT V: Post-harvest Spoilage of Grains**

Post harvest spoilage of grains during storage and their management.

### **PRACTICAL**

Study of symptoms, host-parasite relationship of important diseases of cereals, pulses, oilseeds, cash crops, post harvest diseases of grains and their management. Herbarium collection (50 numbers).

### **THEORY LECTURE SCHEDULE**

1. Introduction to field crop diseases and their significance
2. Fungal diseases of rice
3. Bacterial diseases of rice
4. Viral, Phytoplasma and deficiency disorders of rice.
5. Diseases of wheat
6. Diseases of wheat
7. Diseases of barley and oats
8. Diseases of sorghum
9. Diseases of sorghum
10. Diseases of maize and pearl millet
11. Diseases of ragi (finger millet), small millets
12. Diseases of ragi (finger millet), small millets
13. Diseases of pulses (Redgram)
14. Diseases of pulses (Blackgram, Greengram)

15. Diseases of pulses – chickpea, soybean,
16. Diseases of pulses - cow pea, lablab and horse gram
17. Diseases of coconut
18. Mid semester examination
19. Diseases of groundnut,
20. Diseases of coconut
21. Diseases of sesame and sunflower
22. Diseases of safflower and castor
23. Diseases of mustard, niger, linseed and *Jatropha*
24. Diseases of cotton
25. Diseases of cotton and jute
26. Diseases of sugarcane
27. Diseases of sugarcane
28. Diseases of sugar beet.
29. Diseases of tobacco and mulberry
30. Post-harvest spoilage of grains by field fungi, mycotoxin and their management
31. Post-harvest spoilage of grains during storage and their management.
32. Integrated management of post-harvest diseases

#### **PRACTICAL SCHEDULE**

Study of symptoms and host-parasite relationship of:

1. Rice- fungal diseases
2. Rice - Bacterial, viral and phytoplasma diseases.
3. Diseases of wheat, barley and oats
4. Diseases of sorghum
5. Diseases of maize and pearl millet
6. Diseases of ragi and small millets
7. Diseases of redgram, blackgram, greengram
8. Diseases of chickpea, soybean, cow pea and lablab
9. Diseases of groundnut and coconut
10. Diseases of Sesame, sunflower and castor
11. Diseases of linseed, safflower, niger and mustard
12. Diseases of cotton and jute
13. Diseases of sugarcane and sugar beet
14. Diseases of tobacco, mulberry and *Jatropha*
15. Fungal spoilage of grains during storage and management.
16. Field visit, FCI warehouse visit
17. Orientation for final examination

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

#### **REFERENCE BOOKS**

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e- resources

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2. [www.ictv.org](http://www.ictv.org)
3. [www.vivo.library.cornell.edu](http://www.vivo.library.cornell.edu)
4. [agridr.in/tnauEAgri/eagri50/PATH272/index.html](http://agridr.in/tnauEAgri/eagri50/PATH272/index.html)

## **SAC 323 CROPS AND PESTICIDES CHEMISTRY AND NANOTECHNOLOGY (2+1)**

### **OBJECTIVES**

This course will impart knowledge on the chemistry and nutritional significance of various field and horticultural crops, as well as on different pesticides, their nature and, mode of action and their fate in soil so as to monitor their effect on the environment. This course will also through some light on application of nanotechnology in agriculture.

### **THEORY**

#### **Unit-I Chemistry of Agricultural Crops**

Chemical constituents of plants - Proximate and ultimate constituents - Chemical composition and nutritional quality of cereals, pulses, fibre and forage crops. Chemical composition and nutritional quality of oilseeds and sugarcane. Post harvest changes in Sugarcane.

#### **Unit-II Chemistry of Horticultural Crops, alkaloids and Essential oils**

Chemical composition and nutritional quality of fruits, vegetables, spices, condiments, narcotics and beverages. Post harvest changes in fruits. Chemistry of essential oils and alkaloids - Medicinal and aromatic plants.

#### **Unit -III Pesticide and its Formulations, Insecticides and Rodenticides**

Pesticides - Definition - classifications - Trends in pesticide use. Pesticide formulations - dusts, wettable powders, emulsifiable concentrate, granules. Insecticides - classification-. Characteristics, Mode of action and use of organochlorine compounds- Organophosphates - Carbamates - Pyrethroids, Botanicals, Microbial Insecticides, Insect Growth Regulators and Newer insecticides. Rhodenticides- Zinc phosphide - Aluminium phosphide - Bromodiolone

#### **UNIT IV - Fungicides, Herbicides, PGRs and Pesticides and Environment**

Fungicides - classification of fungicides - properties, mode of action of inorganic, organic and systemic fungicides - Herbicides - classification - properties - mode of action of inorganic and organic herbicides like phenoxy compounds, substituted ureas, amides, thiocarbamates, triazines, pyridines, imidazolines and sulphonyl ureas. Insecticide Act and Insecticide Rules - Fate of pesticides in soil- Impact of pesticides on environment.

#### **Unit-V Nanomaterials- Synthesis, Properties and applications in Agriculture**

Nano materials synthesis -Top-down and bottom-up approaches - Physical, Mechanical, Chemical and Biological methods of synthesis of nanomaterials. Physical, Mechanical, optical, magnetic, thermal and electrical properties - Characterization - SEM, TEM, AFM, FT-IR, XRD. Applications of Nanotechnology in Agriculture.

### **PRACTICAL**

Estimation of moisture, ash, crude protein, P, K and crude fibre and crude fat in plant samples - Determination of reducing and non-reducing sugars in jaggery. Estimation of total solids, ascorbic acid, titratable acidity in fruits. Analysis of pesticides - Physical tests - Bulk density, wettability, suspensibility - Chemical test - Acidity and Alkalinity - Estimation of pesticide residues in soil and pesticidal calculations Visit to pesticide formulation unit and pesticide testing laboratory

### **THEORY LECTURE SCHEDULE**

1. Proximate and ultimate constituents of plants.
2. Chemical composition and nutritional quality of cereals - Rice, wheat, maize, sorghum, ragi and pearl millet. Synthesis of starch
3. Chemical composition and nutritional quality of pulses - Red gram, blackgram, greengram, cowpea, lablab and soybean-Protein synthesis
4. Chemical composition and nutritional quality of oil seed crops - Groundnut, sesame, sunflower, castor, coconut and palm.
5. Chemical composition and nutritional quality of fibre (Cotton, jute, sunhemp and mesta) and forage crops

6. Chemical composition and nutritional quality of sugar crops- sugarcane and sugar beet -Sucrose synthesis - Post harvest changes in sugarcane
7. Chemical composition and nutritional quality of fruits - Mango, banana, papaya, grapes, guava, sapota, citrus, amla, apple and pomegranate.
8. Chemistry of post harvest changes in fruits.
9. Chemical composition and nutritional quality of vegetables -Tomato, bhendi, brinjal, moringa, gourds and greens.
10. Chemical composition and nutritional quality of cabbage, cauliflower, potato, radish and peas.
11. Chemical composition of spices and condiments - Turmeric, chillies, pepper, ginger, onion, garlic, coriander and fenugreek.
12. Chemical composition of Narcotics - Tobacco, arecanut, cocoa and opium - Beverages - Tea and coffee.
13. Essential oils in aromatic plants- Geranium, eucalyptus and Alkaloids in medicinal plants - Cinchona, gloriosa, coleus and aloe vera
14. Pesticides - Definition - classifications-Trends in pesticide use.
15. Pesticide formulations - dusts - wettable powders flowables sprays, granules, fumigants and aerosols - manufacture, characteristics and uses.
16. Pesticide formulations – sprays – emulsion concentrates – water soluble liquids- manufacture, characteristics and uses.
17. Mid semester examination
18. Characteristics, Mode of action and use of Carbamates - Carbaryl, carbofuran, carbosulfan and aldicarb.
19. Characteristics, Mode of action and use of synthetic pyrethroids - Deltamethrin, Fenvalerate, Cypermethrin and Lambda-cyhalothrin
20. Characteristics, Mode of action and use of Botanicals - nicotine pyrethrum, neem Rotenoids, Insecticide butyl amides - Characteristics, Mode of action and use of Insect Growth Regulators -Novaluron, Buprobasin and GABA inhibitors.
21. Microbial Insecticides - NPV, *Bacillus thuringiensis*, Spinosad and Protozoan insecticides. Characteristics, Mode of action and use of newer insecticides - Neonicotinoids - Imidachloprid, Thiachloprid, Acetamiprid, Flupendiamide, Fipronil, Emamectin, Thiomethoxam, Indoxacarb, Chlorantraniliprole
22. Fungicides - Classification - Inorganics - Characteristics, Mode of action and use of sulfur and copper - Wettable sulphur and Lime sulphur - Bordeaux mixture and copper oxychloride / copper hydroxide.
23. Organic fungicides - Dithiocarbamates - Characteristics, Mode of action and use of Mancozeb, Chlorobenzene and Chlorothalnil.
24. Systemic fungicides - Characteristics, Mode of action and use of Benomyl, Carbendazim, Metalaxyl, Quinones, Diclonex, Dicarboximides - vincosolin
25. Rodenticides - Characteristics, mode of action and use of Zinc phosphide - Aluminium phosphide -Bromodiolone
26. Herbicides - Classification of herbicides - Characteristics, Mode of action and use of 2, 4-D, Sulfonyl ureas - Metsulfuron, Pyrosulfuron, Imidazoline.
27. Characteristics, Mode of action and use of Alachlor, Butachlor, Oxyfluorfen, Fulchloralin, Pendimethalin, Atrazine, Paraquat and Glyphosate. PGRS- Auxins, Gibberellins, cytokinins, ABA, Ethylene and brassinosteroids
28. Highlights of Insecticide Act -1968 and Insecticide Rules -1971.
29. Fate of pesticides in soil-Impact of pesticides on the environment.
30. Top down and Bottom up approaches - Physical method, Physical Vapour Deposition (PVD), Etching - Molecular Beam Epitaxy – Sputtering – Lithography -Mechanical synthesis - Ball milling – Types - Mechanical alloying.
31. Chemical synthesis – Sol-gel Method – Chemical Vapour Deposition (CVD) – electro-deposition- thin film. Biological synthesis using Microorganisms and Plants
32. Chemical Vapour Deposition (CVD) – electro-deposition- thin film. Mechanical, magnetic and thermal properties of nanomaterials.
33. Nano-fertilizers– Nano-herbicides– Nano- pesticides – Seed technology Nanotechnology in Food Systems.

#### **PRACTICAL SCHEDULE**

1. Sampling, processing and storage of plant materials for chemical analysis
2. Estimation of moisture and ash content

3. Preparation of di and tri acid extracts of plant samples
4. Estimation of P and K in triple acid extract
5. Estimation of crude protein
6. Estimation of crude fibre
7. Estimation of crude fat
8. Estimation of reducing and non-reducing sugars in jaggery
9. Estimation of total solids and titrable acidity in fruit samples
10. Colloquium on-Safe handling and use of pesticide - label - storage - mixing - application methods
11. Determination of particle size (sieve test), bulk density in dust formulation, Wettability and suspensibility test in wettable powder formulations
12. Estimation of emulsion stability in EC formulation and acidity or alkalinity of pesticides
13. Estimation of purity of Phosphamidon by Iodometry method
14. Estimation of copper content in copper oxychloride
15. Visit to Pesticide Testing Laboratory, Manufacturing unit and Nanotechnology Laboratory
16. Pesticide residue analysis in soil and pesticide requirement calculations
17. Record certification

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2. Handa, S, K,2004. Principles of Pesticides Chemistry, Agrobios (INDIA), Jodhpur.
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2. [www.intechopen.com/.../pesticides-in-the-modern-world-trends-in-pestic...](http://www.intechopen.com/.../pesticides-in-the-modern-world-trends-in-pestic...)

### GPB 324 BREEDING OF FIELD AND HORTICULTURAL CROPS (2+1)

#### OBJECTIVES

Knowledge about the breeding of field and horticultural crops will be exposed to the students

#### THEORY

Place of origin – putative parents – related wild species – classification – objectives of breeding – methods of breeding – quantity – Quality – stress – conventional – innovative – heterosis breeding – distant hybridization and important varieties in following crops:

#### Unit I: Cereals and Millets

Cereals: Rice, Wheat, Grain and fodder Maize, Grain and fodder Sorghum, Pearl millet, Finger millet, Foxtail millet, Kodo millet, Little millet, Proso millet and Barn yard millet.

#### Unit II: Pulses, Oilseeds

Pulses: Red gram , Bengal gram, Green gram, Black gram, Grain and fodder Cowpea, Soybean, Horse gram and lab-lab ; Oilseeds: Groundnut, Sesame, Mustard, Castor, Sunflower, Safflower, Niger, Coconut and Oilpalm.

#### Unit III; Fibres, Sugars, Starch.

Fibres: Cotton, Jute and Mesta ; Sugars: Sugarcane, Sugar beet; Starch: Potato, Tapioca.

#### Unit IV: Forages, Fumitories, Masticatories and Green manures

**Forages:** Guinea grass, Napier, Pearl millet – Napier, *Cenchrus sp.*, Paragrass; **Forage legumes:** Lucerne, *Stylosanthes*, Desmanthus, Desmodium, Siratro, Subabul  
**Fumitories:** Tobacco, Masticatories; **Betelvine;** **Green manures:** Daincha, Sunnhemp,

**Unit V: Horticultural crops**

**Vegetables:** Bhendi, tomato, chilli, Brinjal, **Fruits:** Papaya, Banana, Mango, **Flowers:** Rose, Jasmine, Chrysanthimum.

#### **PRACTICAL**

**Observation on floral biology – anthesis and pollination – selfing and crossing techniques – observation on wild species – maintenance of crossing ledger – pedigree record – in following crops.**

1. **Cereals:** Rice, Wheat, Maize, Sorghum, Pearl millet, Finger millet, Little millet, Kodo millet, Barn yard millet, Proso millet and Foxtail millet.
2. **Pulses:** Redgram and Bengal gram, Green gram, Black gram and Cowpea; Soybean, Horse gram and Lab-lab.
3. **Oilseeds:** Groundnut, Sesame, Sunflower, Safflower, Niger, Mustard. Castor, Coconut and Oilpalm
4. **Fibres:** Cotton, Jute and Mesta
5. **Sugars:** Sugarcane and sugar beet
6. **Starch:** Potato and tapioca
7. **Narcotics:** Fumitories - Tobacco
8. **Masticatories :** Betel vine
9. **Forages:** Guinea grass, fodder Sorghum, fodder maize fodder pearl millet, Pearl millet – Napier hybrids, *Cenchrus*, Lucerne, fodder cowpea, *Desmanthus*, desmodium, *Stylosanthes*, siratro, subabul
10. **Green manures –** Daincha, sunnhemp.
11. **horticultural crops:** Chillies, bhendi, brinjal , tomato, papaya
12. **horticultural crops:** Banana, Mango, Rose, Jasmine ,Chrysanthimum

#### **THEORY LECTURE SCHEDULE**

**Place of origin – putative parents – related wild species – classification – objectives of breeding – methods of breeding – quantity – Quality – stress – conventional – innovative – heterosis breeding – distant hybridization and important varieties in following crops:**

1. **Cereals:** Rice.
2. **Cereals:** Rice.
3. **Cereals:** Rice.
4. **Cereals:** Wheat
5. **Cereals :** Grain and fodder Maize
6. **Cereals:** Grain and fodder Sorghum, Pearl millet.
7. **Cereals:** Finger millet, Foxtail millet, Kodo millet,
8. **Cereals:** Little millet, Proso millet and Barn yard millet.
9. **Pulses:** Redgram , Bengal gram
10. **Pulses:** Greengram, Blackgram, Grain and fodder Cowpea
11. **Pulses:** Soybean, Horsegram, lab-lab
12. **Oilseeds:** Groundnut
13. **Oilseeds:** Gingelly and Mustard
14. **Oilseeds:** Castor
15. **Oilseeds:** Sunflower
16. **Oilseeds:** Safflower, Niger
17. **Oilseeds:** Coconut and Oilpalm
18. **Mid Semester Examination.**
19. **Fibres:** Cotton
20. **Fibres:** Jute, Mesta
21. **Sugars:** Sugarcane, Sugar beet
22. **Starch:** Potato, Tapioca
23. **Fumitories:** Tobacco, Masticatories - Betelvine
24. **Forage grasses:** Guinea grass, Napier, Pearl millet – Napier, *Cenchrus sp.*, Paragrass
25. **Forage legumes:** Lucerne, *Stylosanthes*, Desmanthus,
26. **Forage legumes:** Desmodium, Siratro, Subabul
27. **Green manures and green leaf manures:** Daincha, Sunnhemp,

28. Vegetables: Bhendi,
29. Vegetables: Tomato
30. Vegetables: Brinjal,
31. Vegetables : Chilli
32. Fruits: Papaya, Banana
33. Fruits: Mango.
34. Flowers: Rose, Jasmine, Chrysanthimum

#### **PRACTICAL SCHEDULE**

Observation on floral biology – anthesis and pollination – selfing – crossing techniques – observation on wild species – maintenance of crossing ledger – pedigree record – in following crops.

1. Rice
2. Wheat and Maize.
3. Sorghum and Pearl millet. Finger millet, Little millet, Kodo millet, Barn yard millet, proso millet and Foxtail millet.
4. Redgram and Bengal gram
5. Green gram, Black gram and Cowpea; Soybean, Horse gram and Lab-lab.
6. Groundnut, Sesame and Sunflower.
7. Safflower, Niger, Mustard. Castor, Coconut and Oilpalm
8. Cotton, Jute and Mesta.
9. Sugarcane, sugar beet, potato, tapioca, tobacco and betel vine.
10. Guinea grass, fodder Sorghum, fodder maize,
11. Fodder pearl millet, Pearl millet – Napier hybrids, *Cenchrus*.
12. Lucerne, fodder cowpea, *Desmanthus*
13. Desmodium, stylo, siratro, subabul
14. Green manures – daincha, sunnhemp.
15. Chillies, bhendi, brinjal, tomato, papaya, mango, banana
16. Rose, jasmine, chrysanthemum
17. Orientation for final examination

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**HOR -325-PRODUCTION TECHNOLOGY OF VEGETABLES, SPICES, MEDICINAL  
AND AROMATIC PLANTS ( 2+1)**

**OBJECTIVES**

The students will be educated on the cultivation aspects of major Vegetables, Spices, Medicinal and Aromatic Plants

**THEORY**

**Unit I: Crop production techniques in vegetable crops - I**

Scope importance and constraints of vegetable growing –area and production of vegetables in India and Tamil Nadu-Nutritive value of vegetables –Classification of vegetables –Types of vegetable growing –Vegetable forcing – Precision farming in vegetable cultivation. Climate and soil – varieties and hybrids – seeds and sowing – nutrient management – irrigation and fertigation management – weed management- use of plant growth regulators – cropping systems in vegetable crops - vegetable production under protected structures – maturity indices - post harvest handling and seed production techniques in the following crops. Tomato, Chilli, Brinjal, Bhendi.

**Unit II: Crop production techniques in vegetable crops - II**

Cucurbits, Cabbage, Cauliflower, Dolichos bean, French bean, Peas, Onion, Potato.

**Unit III: Crop production techniques in vegetable crops - III**

Carrot, Beet root, Radish, Tapioca, Elephant foot yam, Moringa, Amaranthus.

**Unit IV: Crop production techniques in spice crops**

Spices - scope and importance – current status of area and production – classification of spices – soil and climate - varieties and related species – propagation and planting – Special horticultural techniques -weed and water management – nutrient management including drip and fertigation – harvesting methods- processing and post harvest handling of the following crops. Black pepper, Cardamom, Turmeric, Ginger, Seed spices Tree spices

**Unit V: Crop production techniques in medicinal and aromatic crops**

Medicinal and aromatic crops- importance and scope – current status - GAP and organic production. soil and climate – varieties – propagation– planting methods – nutrient, water and weed management – harvest – post-harvest handling of the following crops: Medicinal crops - Senna, Periwinkle, Glory Lily, Ashwagandha, Aloe vera. Aromatic crops- Ocimum, Mint, Lemon grass, Vettiver

**PRACTICAL**

Preparation of nursery bed, seed treatment and sowing – preparation of main field and sowing transplanting – laying out of kitchen garden - manures and manuring – irrigation methods - practices in use of plant growth regulators - identification of physiological disorders - identification of varieties and hybrids. Identification of spices, medicinal and aromatic crops – propagation - seed treatment – sowing - planting - training and pruning – fixing maturity standards – harvesting - visit to spice gardens. Study of post harvest handling, processing and value addition of spices- Post harvest handling and extraction of secondary metabolites in medicinal plants. Post harvest handling and extraction of essential oils in aromatic plants

**THEORY LECTURE SCHEDULE**

1. Classification of vegetables
2. Scope importance and constraints of vegetable growing in India and Tamil Nadu
3. Types of vegetable growing and cropping systems.
4. Climate and soil –varieties and hybrids –seeds and sowing – nutrient management –irrigation and fertigation management – weed management – maturity indices – harvesting and post harvest management of Tomato
5. Brinjal
6. Chillies
7. Bhendi
8. Cucurbits – Pumpkin, Ashgourd, bottle gourd.
9. Cucurbits – Snake gourd, Ribbed gourd and Bitter gourd
10. Cabbage
11. Cauliflower
12. Dolichos bean and French bean
13. Peas

14. Onion.
15. Potato
16. Precession farming in vegetable cultivation
17. Carrot, beetroot and radish
18. Mid semester examination
19. Tapioca
20. Elephant foot yam
21. Moringa
22. Amaranthus
23. Soil and climate- varieties and related species – propagation and planting – training and pruning practices - weed and water management – Nutrient management- drip and fertigation and Post harvest handling of Pepper
24. Cardamom
25. Turmeric
26. Ginger
27. Seed spices – Coriander and cumin
28. Seed spices – Fenugreek and fennel
29. Trees spices – Clove, nutmeg and cinnamon
30. Varieties -- soil and climate – propagation- sowing and planting, nutrient, water and weed management - harvest and processing – post harvest handling of Senna, Periwinkle
31. Glory lily and Ashwagandha,
32. Medicinal coleus and Aloe vera
33. Ocimum and Mint
34. Lemon grass and Vettiver

#### **PRACTICAL SCHEDULE**

1. Identification and description of varieties of solanaceous vegetables, bhendi and cucurbits
2. Identification and description of varieties of cole crops, roots and tuber crops
3. Nursery management of vegetable crops
4. Layout of kitchen garden.
5. Practices in manuring, fertilizer application and irrigation in vegetables.
6. Practices in use of plant growth regulators
7. Identification of physiological disorders in vegetable crops and remedial measures
8. Study of maturity standards and harvesting of vegetables.
9. Seed production techniques in vegetable crops
10. Project preparation for commercial production of vegetables
11. Identification and description of varieties in spices
12. Propagation techniques in spices
13. Processing and value addition in spices
14. Identification and description of medicinal and aromatic plants and propagation techniques of medicinal and aromatic plants.
15. Extraction of secondary metabolites from medicinal plants
16. Extraction of essential oils from aromatic plants
17. Orientation for final examination

#### **REFERENCE BOOKS**

1. Arumugam shakila and A.Anburani 2013- Production Technology of spices – Agrobios – India.
2. Farooqi, M., M. M. Khan and M. Vasundhara. 2004. Production technology of medicinal and aromatic crops. Natural Remedies Pvt. Ltd., Bangalore – 561229.
3. Gopalakrishnan, T.R. (2007). Vegetable Crops. Horticultural Science Series (Series Editor K.V.Peter). New India Publishing Agency, New Delhi
4. Kader Mohideen, Arumugam Shakila and A.Anburani 2011- Production technology of medicinal and Aromatic crops – Agrobios.India
5. Kumar, N. Introduction to Horticulture. (2010). Oxford and IBH Publications, New Delhi.
6. Kumar, N. Md. Abdul Khader, P.Rangasamy, and I. Irulappan, (2001). Spices, Plantation Crops, Medicinal and Aromatic Plants, Rajalakshmi Publications, Nagercoil.

7. Mandal, R.C. (2006). Tropical root and tuber crops. Agrobios (India)-Muzzafar nagar
8. Mini, C. and Krishnakumar, K. (2004). Leaf Vegetables. Agro tech Publishing Academy, Udaipur
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10. Ravindrasharma (2004) Agro techniques of Medicinal plants. Daya publishing, New Delhi.
11. Singh, P.K., S.K. Dasgupta and S.K. Tripathi, (2006). Hybrid Vegetable Development. International Book Distributing Co.
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13. Trivedi, P.C. (2004) Medicinal Plants: Utilization and Conservation, Aavishkar Publisher, Distributors, Jaipur.

**e-references**

1. [http:// www. Sus-veg-thai-de/](http://www.Sus-veg-thai-de/)
2. [http:// www. Spices .rec.in](http://www.Spices .rec.in)
3. [www.iisr.org](http://www.iisr.org)

**AEC 326 AGRICULTURAL FINANCE, BANKING AND CO-OPERATION (1+1)**

**OBJECTIVES**

This course aims at imparting knowledge on principles of finance, banking and cooperation, and farm financial analyses. This course will also help the Under Graduate students in understanding the functions of various institutions involved in farm financing and different crop insurance products implemented in India.

**THEORY**

**Unit 1: Agricultural Finance – Nature and Scope**

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

**Unit 2: Farm Financial Analysis**

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

**Unit 3: Financial Institutions**

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

**Unit 4: Banking and Insurance**

**Negotiable Instruments: Meaning - Importance and Types - Central bank: RBI - functions - Credit control - Objectives - CRR, SLR and Repo rate - Credit rationing - Dear money and cheap money. Financial inclusion and exclusion: Credit widening and credit deepening monetary policies. New generation private sector banks. Credit gap: Factors influencing credit gap. Non- Banking Financial Institutions (NBFI). Assessment of crop losses - Determination of compensation - Crop Insurance: Schemes - Coverage - Advantages and limitations in implementation - Estimation of crop yields - Livestock**

insurance schemes - Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.

#### **Unit 5: Cooperation**

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

#### **PRACTICAL**

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

#### **THEORY LECTURE SCHEDULE**

- 1. Agricultural Finance: Definition - Importance - Nature and scope. Agricultural credit: Meaning - Definition - Need and classification.**
- 2. Sources of credit. Role of institutional and non - institutional agencies: Types - Roles - Advantages and disadvantages. Rural indebtedness: Consequences and control measures of rural indebtedness - History and development of rural credit in India.**
- 3. Principles of credit - 5C's, 3R's and 7 P's of credit, Project cycle and management. Preparation of bankable projects / Farm credit proposals - Feasibility.**
- 4. Time value of money: Compounding and discounting - Appraisal of farm credit proposals - Undiscounted and discounted measures.**
- 5. Repayment plans. Farm financial statements: Balance sheet - Income statement - Cash flow statement - Financial ratio analysis.**
- 6. Institutional lending agencies - Commercial banks: Nationalization - Agricultural development branches - Area approach - Priority sector lending - Regional Rural Banks.**
- 7. Lead bank: Role and functions - Preparation of district annual credit plan and scale of finance - Kisan Credit Card (KCC) Scheme and Know Your Customer (KYC). Rural credit policies followed by State and Central Government - Subsidized farm credit, Differential Interest Rate (DIR) Scheme - Relief measures and Loan Waiver Scheme.**
- 8. Higher financial institutions: RBI, NABARD, AFC, ADB, World Bank and Deposit Insurance and Credit Guarantee Corporation of India - Role and their functions in rural credit.**
- 9. Mid Semester Examination**
- 10. Microfinance: Definition and its role in poverty alleviation - Self-Help Groups: Characteristics, role, functions, growth and development in India - Role of Non-Governmental Organizations in promoting SHGs.**

11. **Negotiable Instruments: Meaning - Importance and Types - Central bank: RBI - functions - Credit control - Objectives - CRR, SLR and Repo rate - Credit rationing - Dear money and cheap money.**
12. **Financial inclusion and exclusion: Credit widening and credit deepening monetary policies. New generation private sector banks. Credit gap: Factors influencing credit gap. Non- Banking Financial Institutions (NBFI).**
13. **Assessment of crop losses - Determination of compensation - Crop Insurance: Schemes - Coverage - Advantages and limitations in implementation - Estimation of crop yields - Livestock insurance schemes - Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.**
14. **Cooperation: Philosophy and Principles - History of Indian co-operative credit movement: Pre and Post - Independence periods and cooperation in different plan periods.**
15. **Cooperative credit institutions: Two tier and three tier structure - Functions: provision of short term and long term credit - Strength and weakness of cooperative credit system.**
16. **Policies for revitalizing co-operative credit: Salient features of Vaithyanathan Committee - Report on revival of rural cooperative credit institutions - Reorganization of cooperative credit structure in India and single window system.**
17. **Special Co-operatives: LAMPS, FSS, National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd. (NAFSCOB): Objectives, role and functions.**

#### **PRACTICAL SCHEDULE**

1. **Visit to a farm to study the credit needs, problems and suggestions in the use of farm credit.**
2. **Preparation of Bankable Projects / Farm Credit Proposals.**
3. **Project preparation and appraisal - Undiscounted methods.**
4. **Project preparation and appraisal - Discounted methods.**
5. **Preparation of Balance Sheet and Income Statement.**
6. **Preparation of Cash flow Statement and Exercise on preparation of Repayment plans.**
7. **Exercise on financial ratio analysis.**
8. **Appraisal of farm credit proposals.**
9. **Visit to Commercial Bank / Lead Bank to study its role and functions.**
10. **Visit to NABARD to study its role and functions.**
11. **Visit to Regional Rural Bank to study its role and functions.**
12. **Visit to Primary Agricultural Co-operative Bank (PACB) to study its role, functions and procedures for availing loan.**
13. **Visit to District Central Cooperative Bank (DCCB) to study its role, functions and procedures for availing loan - Fixation of Scale of Finance.**
14. **Visit to Cooperative Agricultural and Rural Development Bank (Land Development Bank) to study procedures for availing long term credit.**
15. **Visit to Self-Help Group to study its characteristics, roles and functions.**
16. **Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.**
17. **Orientation for final examination**

#### **REFERENCE BOOKS**

1. **Muniraj, R. 1987. Farm Finance for Development. Oxford and IBH. New Delhi.**
2. **Subba Reddy, S and P. Raghu Ram. 2011. Agricultural Finance and Management. Oxford and IBH. New Delhi.**
3. **Lee, W.F., M.D. Boehlje, A.G. Nelson and W.G. Murray. 1998. Agricultural Finance. Kalyani Publishers. New Delhi.**
4. **Mammoria, C.B. and R.D. Saxena. 1973. Cooperation in India. Kitab Mahal. Allahabad.**
5. **Patnaik, V.E. and A.K. Roy. 1988. Cooperation and Cooperative Management. Kalyani Publishers. Ludhiana.**
6. **Sreekantaradhya B.S. 2004. Banking and Finance, Deep and Deep Publications Pvt. Ltd., New Delhi.**

**AEX 327 EXTENSION METHODOLOGIES AND TRANSFER OF  
AGRICULTURAL TECHNOLOGY (1+1)**

**OBJECTIVE**

To impart knowledge to the students on different extension methods and approaches used for transfer of agricultural technology. The course will also enable to develop practical skills on preparation of different extension teaching methods.

**THEORY**

**Unit I : Extension Education and Transfer of Technology**

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

**Unit II : Communication**

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

**Unit III : Extension Teaching Methods**

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

**Unit IV : e-Extension and Agricultural journalism**

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

**Unit V : Diffusion of Innovations**

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

**PRACTICAL**

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

**THEORY LECTURE SCHEDULE**

1. Extension Education - Meaning, definition and importance, Agricultural Extension – Meaning, definition. Linkage between Research, Extension and Clientele systems
2. TOT- Meaning and definition, components of TOT, models and approaches of TOT – Importance of TOT in Agricultural Extension
3. Communication – meaning, definition, types and modules communication (Aristotle Shanon and Weaver, Berlo, Schramm, Leagans, Rogers and Shoemaker)
4. Elements of communication and their characteristics - Barriers of communication.
5. Extension teaching methods – Meaning, definition, functions and classification. Individual contact methods – Farm and home visit, Farmers call, Personal letter, Result demonstration.
6. Group contact methods – Method demonstration, group meeting, small group training, field day or farmers' day, study tour, lecture, debate, workshop,

- seminar, forum, conference, symposium, panel discussion brainstorming, buzz session.
7. Mass contact methods – Campaign, Exhibition, Farmers Day, Field trips, Radio, Television Farm publications – Circular letter, Leaflet, Folder, Pamphlet, Newsletter, Newspaper.
  8. Audio aids, Visual aids, Audio-Visual aids – Definitions, classification, Factors influencing selection and use of audio visual aids.
  9. Mid semester Examination.
  10. e-Extension-Internet, video and teleconferencing, Interactive Multimedia Compact disc (IMCD)
  11. Agri portals, Information kiosks, Kisan Call Centre (KCC)
  12. Mobile phone, Expert System, Village Knowledge Centre (VKC), DEMIC
  13. Agricultural journalism (Print media) – Definition, principles, importance, ABC of news, types of news.
  14. Participatory Extension Approaches - Meaning, Definition, Importance, Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA) – Resource Mapping, Transect Walk, Matrix ranking, Venn diagram, Seasonal calendar.
  15. Participatory Technology Development – Meaning and steps
  16. Diffusion of Innovations – Definition, elements; Innovation – definition, attributes. Adoption – meaning, steps in adoption process, Innovation Decision process.
  17. Adopter categories - Factors influencing adoption of innovations - Consequences of innovations.

#### **PRACTICAL SCHEDULE**

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

#### **REFERENCE BOOKS**

1. Chauhan Nikulsingh. 2013. Use of ICTs in Agricultural Extension, Biotech Books.
2. Indu Grover, Sushma Kaushik, Lalit, Yadav and S.K. Varma, 2002. Communication and Instructional Technology, Agrotech Publishing Academy, Udaipur.
3. Narayanasamy, N. 2009. Participatory Rural Appraisal: Principles, Methods and Application, Sage Publications India Pvt. Ltd., New Delhi.
4. Pandey, V.C. 2003. Information Communication Technology and Education (The Changing World ICT Governance), Isha Publishers.
5. Ray, G.L and Sagar Mandal. 2010. Journalism, Farm Journalism and Communication skills. Kalyani publishers, Calcutta.
6. Ray, G.L. 2012. Extension Communication and Management, Kalyani publishers, Naya Prakash, 2006, Bidhan Sarani, Calcutta.
7. Reddy Adivi, A. 1993. Extension Education, Shree Lakshmi Press, Bapatla, Andhra Pradesh.

8. Rogers, E.M. 2003. Diffusion of Innovations, The Free Press, New York.
  9. Santha Govind, Tamilselvi, G and J. Meenambigai. 2011 Extension Education and Rural Development, Agrobios (India), Jodhpur.
  10. Saravanan, R. 2010. (Ed.) ICTs for Agricultural Extension: Global Experiments, Innovations and Experiences, New India publishing Agency (NIPA), New Delhi.
- e- resources
- [www.i4d.com](http://www.i4d.com)
  - [www.panasia.org](http://www.panasia.org)
  - [www.joe.org](http://www.joe.org)

## AEG 328 POST HARVEST AND FOOD ENGINEERING (1+1)

### THEORY

#### Unit I: Post harvest losses, moisture content and properties

Post harvest losses – causes and estimates – unit operations of crop processing – moisture content – methods of estimation - engineering properties of grains – mass, volume, density, porosity, sphericity – Thermal properties- applications .

#### Unit II: Threshing, cleaning and grading

Threshing – threshers for different crops - parts, terminology – operational safety and maintenance - winnowing – manual and power operated winnowers- cleaning, grading and sorting - types of screens - air screen cleaners- construction and operation-care and maintenance –Screen effectiveness-construction and working principles of spiral separator, magnetic separator, specific gravity separator, colour sorter and inclined belt separator.

#### Unit III: Shelling, drying and storage

Shelling equipments - maize sheller, husker sheller, hand and power operated groundnut decorticator - construction and working – performance evaluation - grain drying – principles - advantages - types - batch and continuous, mixing and non mixing – LSU drier – construction and operation - performance of dryers - storage of food grains – factors affecting storage, traditional and improved methods - modified atmosphere storage.

#### Unit IV: Cereals, pulses and oilseed processing

Rice processing – Parboiling- traditional and modern methods - , modern rice milling –Size reduction – principles- equipment used- wheat milling – process flow chart – roller flour mill - construction and operation - pulse milling - wet, dry and CFTRI methods of pulse milling – equipment – construction and operation - oilseed processing – methods and machineries used – ghani, rotary and expeller - filter press – construction and operation – solvent extraction process.

#### Unit V: Material handling and Food Plant layout

Material handling equipments – bucket elevator, screw conveyor, belt conveyor – construction and operation –Food plant location – selection- layout-types- Food Packaging- requirements- types- Packaging of raw and processed foods.

### PRACTICAL

Determination of moisture content - study of threshers, winnowers and graders – components, operations, adjustment and performance - determination of efficiency of maize shellers, groundnut decorticators, cleaners and graders, rice milling and pulse milling - experiments on tray and thin layer drier- experiments on screw conveyor and bucket elevator, study of improved grain storage structures – Study of packaging machine – visit to food processing industry.

### THEORY LECTURE SCHEDULE

1. Post harvest losses – causes and estimates – unit operations of crop processing – moisture content – methods of estimation – direct and indirect methods – wet basis and dry basis.
2. Engineering properties of grains – mass, volume, density, bulk density, true density, porosity, surface area and sphericity– Thermal properties-applications.
3. Threshing – threshers for different crops - parts, terminology - operational safety and maintenance.
4. Winnowing – winnowers- cleaning, grading and sorting- Types of screens - air screen cleaners- construction and operation- screen effectiveness
5. Construction and working principles of spiral separator, magnetic separator, specific gravity separator, colour sorter and inclined belt separator



6. Construction and working of maize sheller, husker sheller, hand and power operated groundnut decorticator - care and maintenance.
7. Grain drying – principles - advantages - types - batch and continuous, mixing and non mixing – LSU drier – construction and operation - heat sources - performance of dryers.
8. Storage of food grains – factors affecting storage, traditional methods - types - bag and bulk storage - CA and MA storage.
9. Mid Semester Examination
10. Rice processing – Parboiling- traditional and modern methods -modern rice milling - layout of modern rice mills.
11. Size reduction – principles- laws in size reduction- equipment used.
12. Wheat milling – process flow chart – roller flour mill - important machineries used in wheat milling – construction and operation.
13. Pulse milling - wet, dry and CFTRI methods of pulse milling – equipment – construction and operation.
14. Oilseed processing – methods and machineries used – ghani, rotary and expeller - filter press – construction and operation – solvent extraction process.
15. Material handling equipments – bucket elevator, screw conveyor, belt conveyor – construction and operation.
16. Introduction to food plant design – selection of plant location - layout – types.
17. Food Packaging – requirements-types- packaging of raw and processed foods..

#### **PRACTICAL SCHEDULE**

1. Determination of moisture content by direct and indirect methods
2. Study of types of thresher and components.
3. Performance evaluation of grain winnower.
4. Performance evaluation of grader.
5. Study of maize sheller / husker sheller for maize.
6. Study of groundnut decorticator.
7. Performance evaluation of cleaner cum grader.
8. Study on paddy parboiling .
9. Study of shelling equipment for paddy .
10. Study of pulse milling equipment.
11. Experiment on tray dryer / thin layer dryer to determine drying characteristics.
12. Performance evaluation of screw conveyor
13. Performance evaluation of bucket elevator
14. Study of improved grain storage structures
15. Study of packaging machine
16. Visit to modern rice mill / oil mill / pulse mill.
17. Orientation for final examination.

#### **REFERENCE BOOKS**

1. Chakraverty,A. 2000. Third Edition. Post Harvest Technology of cereals, pulses and oilseeds. Oxford and IBH publishing and Co. Pvt. Ltd., New Delhi.
2. Sahay. K.M. and Singh,K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd. New Delhi.

#### **e-resources**

1. [www.foodnetbase.com](http://www.foodnetbase.com)
2. [www.fao.org](http://www.fao.org)
3. [food.oregonstate.edu/security/preserve.html](http://food.oregonstate.edu/security/preserve.html)
4. [www.postharvest.ucdavis.edu](http://www.postharvest.ucdavis.edu).

### EXP 329 EXPERIENTIAL LEARNING I

Sl. No.	Course No.	LIST OF COURSES	Credits	Department offering the course
1	EXP AGR 329	Design and Operation of Pressurized Irrigation	0 + 6	Agronomy
2	EXP ENT 329	Apiculture and Sericulture Technology	0 + 6	Entomology
3	EXP PAT 329	Mushroom Culture	0 + 6	Plant Pathology
4	EXP AGM 329	Microbial Inoculants Production and Quality Control	0 + 6	Agri. Microbiology
5	EXP SAC 329	Soil and plant judging for sustainable Agriculture	0 + 6	Soil Science and Agri. Chemistry
6	EXP GEN 329	Commercial Seed Production	0 + 6	Genetics and Plant Breeding
7.	EXP HOR 329	Protected Cultivation Of High Value Vegetable Crops	0 + 6	Horticulture
8.	EXP AEC 329	Basic Analytical Tools For Agri Business	0 + 6	Agri. Economics
9.	EXP AEX 329	Extension And Communication Skills	0 + 6	Agri. Extension
10.	EXP AHS 329	Broiler and Layer Management	0 + 6	Division of Animal Husbandry

#### **EXP AGR 329 DESIGN AND OPERATION OF PRESSURIZED IRRIGATION (0+6) OBJECTIVES**

- To acquire skill in handling micro irrigation system related to cost effective layout, designing, maintenance and operation.
- To establish and evaluate cost effective pressurized irrigation design for major field crops.

#### **PRACTICAL**

Participatory approach in pressurized irrigation (drip / sprinkler) - concept of pressurized irrigation - types of pressurized irrigation - selection of suitable layout - system design criteria and layout - Installation of drip / sprinkler system - irrigation scheduling - Operations of the system. Maintenance of pressurized irrigation system - maintenance of main and sub main pipe lines, laterals and emitters / nozzles - management of clogging and chlorination - super chlorination and acid treatment. Fertigation - concept of fertigation - water soluble fertilizers - water use efficiency - crop response and economic evaluation - periodical observation should be taken throughout the crop period. System as a whole analysis - project preparation for a given resource situation with its economics.

#### **EXP ENT 329 - APICULTURE AND SERICULTURE TECHNOLOGY (0+6) OBJECTIVES**

- To study the rearing techniques of honey bees and practicing the techniques of production of various bee products
- To study the cultivation practice of mulberry plant and rearing techniques of mulberry and eri silkworm

#### **PRACTICAL**

Identification, morphology and structural adaptations in honey bees. Biology and castes of honey bee. Bee keeping appliance- Handling. Site selection and seasonal management of apiary-dearth and honey flow season, Identification of bee pasturage or forage plants. Identification of pests and diseases of honey bees and Handling of bee

colonies. Practicing artificial queen rearing technique. Dividing and uniting colonies. Practicing Royal jelly production technique, pollen collecting technique and venom collecting technique. Morphology of mulberry plants – Identification of popular mulberry genotypes – Nursery bed and main field preparation – planting methods – Identification of nutrient deficiency symptoms – pruning and harvesting methods – Identification of pests, diseases and nematodes of mulberry. Morphology of silkworm – Identification of races – Dissection of mouth parts and silk glands – Practicing disinfection techniques- rearing method for mulberry silkworm- chawki rearing and various methods of late age rearing- rearing facilities – feeding, cleaning and spacing – Identification of pests and diseases of silkworm . Visit to grainage, cocoon market, sericulture farms and silk reeling centre – Non-mulberry silkworms – Tasar silkworms and muga silkworm – food plants – rearing methods. Eri silkworm - Morphology of castor plants, cultivation of castor – Identification of pests, diseases and Practicing Eri silkworm rearing method

#### **EXP PAT 329 MUSHROOM CULTURE (0+6)**

##### **OBJECTIVES**

To give practical exposure to the students in various technologies in seed production.

##### **PRACTICAL**

Mushroom science and mushroom technology – Mushroom biotechnology- challenges and opportunities in food and healthcare industry – Media preparation – pure culture techniques and long term preservation of mushroom cultures – Mushroom tissue culture techniques – Mushroom spawn – types-techniques in commercial spawn production – Mother spawn preparation techniques – Bed spawn preparation techniques – Spawn lab layout designing – exposure on the creation of infrastructure and machinery – Cultivation techniques of mushrooms *Agaricus* spp, *Pleurotus* spp, *Calocybe* spp and *Volvariella* spp – Button mushroom, Oyster mushroom, Milky mushroom and Paddy straw mushroom farm layout design – assignment – Guidelines on harvesting, grading, packaging and post harvest storage of mushrooms – Preparation of value added mushroom products – Problem solving-Identification of key pests and formulating management strategies – Problem solving – weed moulds and abiotic disorders – formulating management strategies – Commercial importance of spent mushroom substrate – vermicomposting and coir pith/waste composting – Mushroom business planning – project preparation and cost analysis

#### **EXP AGM 329 MICROBIAL INOCULANTS PRODUCTION AND QUALITY CONTROL (0+6)**

##### **OBJECTIVES**

To study in detail about the microbial inoculants in Agriculture viz., isolation of bacterial fungal inoculants their mass production and quality control.

##### **PRACTICAL**

Isolation and screening method- Selection suitable strain – Strain improvement of different types of inoculants. *Rhizobium*, *Azotobacter*, *phosphobacteria* Mycorrhiza *Bacillus thuringiensis* *Pseudomonas*, *Trichoderma*, *Beauvaria*, *Verticillium* and *Metarrhizium* etc Testing the efficiency of microbial inoculants mass production of Bacterial inoculants ,Mycorrhizal inoculants algal inoculants - Quality control methods shelf life - Method of inoculation.

#### **EXP SAC 329 - SOIL AND PLANT JUDGING FOR SUSTAINABLE AGRICULTURE (0 +6)**

##### **OBJECTIVES**

The students get familiarised with factors affecting soil quality and also understands how to interpret soil and plant data in relation to status of plant condition and develop suitable fertilizer program for individual crops through need based preparation of fertilizer formulation

## **PRACTICAL**

**Soil Judging-** measuring soil and land properties in the field -the soil resources evaluation- soil quality assessment frame work- soil quality indicators- physical, chemical and biological

**Plant Judging-** Plant nutrition diagnosis techniques- Soil test, tissue test, plant analysis- visual- nutrient deficiency symptoms, DRIS, Critical value and sufficiency value approach- determining nutritional problems- deficiency or toxicity and evaluating fertilizer program-fertilizer prescription based on STCR approach add Mitcherlich Bray approach

**Corrective measures:** Techniques for the development of commercial fertilizer formulation-fertilizer mixtures- macro and micronutrient mixture – crop based nutrient mixture

### **EXP GEN 329 COMMERCIAL SEED PRODUCTION (0+6)**

## **OBJECTIVES**

To give practical exposure to the students in various techniques in seed production.

## **PRACTICAL**

Floral biology - Pollination behavior - Seed development and maturation - Techniques of seed production - Emasculation and pollination - Detasseling, male sterility – types - Self incompatibility-seed production principles – Classes of seed - Generation system of seed multiplication - Seed rate - Seed treatment-isolation distance – Planting ratio - Border row- planting design - Field inspection - Nutrient, irrigation and weed management - Plant protection-Physiological and Harvestable maturity – Harvesting methods - Processing techniques – Storage and marketing – Seed certification and Seed Standards.

### **EXP HOR 329 - PROTECTED CULTIVATION OF HIGH VALUE VEGETABLE CROPS (1+1)**

## **OBJECTIVES**

Understanding the principles, theoretical aspects and developing skills in protected cultivation of high value vegetable crops.

## **PRACTICAL**

Types of protected structures – Greenhouses, poly houses, shade houses, rain shelters etc., Designing and erection of protected structures; Low cost/Medium cost/High cost structures – Location specific designs; Containers and substrates, Structural components; Suitable vegetable crops for protected cultivation – Green house automation - control systems – sensors – decision support systems for vegetable production in green house- Cucumber, tomato, capsicum, chillies, etc.)- Management of hi-tech nursery for vegetable seedlings- water and nutrient management, weed management, physiological disorders, IPM and IDM. Harvest indices, harvesting techniques, post-harvest handling techniques, Pre cooling, sorting, grading, packing, storage, quality standards and marketing - calculation of cost economics including project preparation.

### **EXP AEC 329 - BASIC ANALYTICAL TOOLS FOR AGRI BUSINESS (0+6)**

## **OBJECTIVE**

The objective of the course is to impart practical exposure to the students on the basic financial and managerial tools which are relevant to agri-business.

## **PRACTICAL**

Identification of agri business units - production, processing and marketing units - Balance Sheet – Income Statement - Cash flow Statement - Time value of money - Investment Analysis: Discounted measures - Assessment of NPV, BCR, IRR - Sensitivity Analysis - Undiscounted measures - Ranking by inspection - Payback period - Proceeds per rupee of outlay - Average annual proceeds per rupee outlay - Appraisal of farm credit proposals - Loan repayment schedule - Estimation of Break even quantity - Inventory Management - Economic Order Quantity (EOQ) - Reorder point-SWOT analysis – Identification of marketing strategies and marketing channels.

## **EXP AEX 329- EXTENSION AND COMMUNICATION SKILLS (0+6)**

### **OBJECTIVES**

- To inculcate a superior level of knowledge and Extension and Communication skills through Experiential Learning.
- To train the students on different behavioural skills that would help to improve their employability as successful extension workers.

### **PRACTICAL**

Introduction to Behavioural Skills – practicing assessment of skills using Johari’s Window, Life Skills- types of Attitude, Communication-concept, models, feedback, mass communication, interpersonal communication, non-verbal communication, networking skills, Group Approaches – practicing lecture, brainstorming, buzz session, demonstration, folk media. Communication Behaviour of Farmers – survey and presentation, Decision Making -survey to study the decision making behaviour of farmers, Interactive Skills- types, importance, exercises on questioning, interviewing and group discussion. Leadership – concept, types, qualities, methods of identifying leaders – village visit to conduct sociometry, Team Building-concept, principles, exercises on team work, exercises on tower building, Formation of groups – concept, types of farmers organizations, interaction with successful farmers organization and SHG, Participatory Rural Appraisal (PRA) – Practicing PRA exercises in a village, Public Relations- concept, principles, practice on art of public speaking

## **EXP AHS 329 - BROILER AND LAYER MANAGEMENT (0+6)**

### **OBJECTIVES**

- The course aims to provide a comprehensive knowledge about the scientific rearing of the broiler and layer birds.
- To enable the students to acquire practical knowledge to manage a profitable small scale, commercial poultry enterprise.
- To impart the “cutting edge” technologies used in poultry industries which will reinforce the students entrepreneurship.

### **PRACTICAL**

Introduction - Housing management - Cleaning and disinfection-Farm equipments- Brooder management - Grower and Layer management - Litter management - Nutrition- Lighting management – Moulting - Summer management - Management of desi birds - Dressing of chicken - Value added poultry Products – Debeaking - Deworming and delousing- Vaccination schedule for broiler and layer - Preparation of project reports - Visit to broiler and layer farms.

## **VII SEMESTER**

### **RURAL AWARENESS WORK EXPERIENCE (RAWE)/ AGRO INDUSTRIAL ATTACHMENT (AIA)**

#### **A. Village Stay Attachment**

##### **Guidance to students**

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

It will consist of general orientation by different faculties for one week followed by village attachment. The students would be required to record their observations in field on daily basis and will prepare their project report based on these observations.

The detailed outline of the work to be carried in each subject during Village stay period is as follows:

**RAWE AEX 410 Extension programme (0 + 5)**

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

**RAWE AGR 411 Field Crop Production (0 + 3)**

- The student will involve themselves in actual day-to-day Agricultural operations along with their adopted farmers.
- A calendar of operations for the entire semester will be prepared in consultation with the host farmer , course teacher and Programme Officer.
- The course teacher will provide the recommendations for major crops grown in the village and in turn the students will compare these with farmer's practice and get opinion about improved technology.
- The students will maintain a record of daily work done in the prescribed proforma..
- Each student shall cover a minimum of three crops, preferable from among cereals, oilseeds and pulse crops.
- If such crop diversification is not available, the student shall collect information on any three crops either with the host farmer or other farmer in or near by village.
- Observation on crop growth and yield attributes shall be recorded as per the proforma.

**RAWE HOR-412 Horticultural Crop Production (0 + 2)**

- The student will involve themselves in actual day-to-day horticultural operations along with their adopted farmers.
- For this purpose, a calendar of operations for the entire semester will be prepared in consultation with the adopted farmer and the member of the advisory committee.
- The advisory committee will provide the recommendations for major horticultural crops grown in the village and the turn the student compare these with farmer's practice and get opinion about improved horticultural technology.
- The students shall maintain a record d of daily work done in the Performa given to them by the department of Horticulture.
- Each student shall cultivate/plant a minimum of three crops, preferable one from fruits like Mango, Papaya , Lime , Guava and two from vegetables like Cabbage / Cauliflower / tomato / brinjal/Chilli or any other seasonal vegetables.

**RAWE CPT-413 Crop Protection: Entomology and Plant Pathology (0 + 4)**

The students get an opportunity to work with the farmers in the field and acquainted with various plant protection problems of the standing crops.

- They collect data on pest damage every week.
- They shall maintain record of plant protection work undertaken in the prescribed Performa given to them by the Department of Entomology and Plant Pathology for this purpose.

- The student will also conduct a survey on adoption of recommended plant protection measures and the incidence/occurrence of different diseases and insect pests on different crops in the village.
- Students shall submit 15 herbarium specimens each of insect damage and plant disease symptoms for any of the crops grown in the village.
- Information on other plant disorders, nematode problems, bird and rodent damage if any, shall also be mentioned in the plant protection recorded separately.
- The students will also demonstrate preparation of fungicidal / insecticide spray fluids for important plant protection measures.

## **B. Agro Industrial Attachment**

### **Guidance to students**

For each batch of students, there will be a designated AIA teacher from the Department of Agricultural Economics, who will continuously guide, supervise and monitor the work of students during their placements in the Agro based Industries. The designated teachers will visit and guide the students on technical aspects and to solve the problems, which are beyond the competence of students as well as to, evaluate the performance of the students.

It will consist of general orientation for a week followed by Agro-Industrial attachment. The students will be attached with the agro-industries to get an experience of the industrial environment and working. The students would be required to record their observations on daily basis and will prepare their project report based on these observations.

The detailed outline of the work to be carried in Agro Industrial attachment period is as follows:

### **AIA AEC 415 Rural Economics and Agro Industrial Attachment (0 + 6)**

#### **Rural Economics**

- Each student will take up an agro-economic survey of a village as per questionnaire issued for this purpose by the Department of Agrl. Economics.
- Each students shall collect data on economic conditions of the village, population, vital statistics cropping patterns, irrigation facilities, resource endowments and its utilization, labour problems and employment and other economic aspects covered in the schedule/questionnaire. The student will also conduct a farm holding survey as per proforma given to the student.
- Students has to work out the cost of cultivation of principal crops grown in the village.
- Students has to develop alternative farm plans in consultation with farmers and extension staff for re organization of the farm business for higher income.
- Identification of various marketing constraints of agricultural produces.
- The students shall record family budgets of the farmers in the village

#### **Attachment with Agro-based Industries**

- The students will be attached to any of the following industries/units depending upon the availability of facilities.
- Seed production farms/ Processing units
- Bio technological industries (Tissue Culture Labs)
- Bio pesticides/ fertilizer industries
- Commercial Nurseries of Horticulture / Forest Department
- Food processing units
- Sugar factories/Rice mills/Daal mills
- Dairy/Poultry / Fishery units
- Agri-Clinic and Agri- Business Cell/ Agro-Service Center
- Cool chain / Storage units
- Agricultural finance institutions / Banks / Credit Societies etc
- Non- Government organizations related to agriculture and rural development
- During the attachment of students to the identified agro-based industries, the students are given an opportunity to acquaint themselves with the

organizational set up, functioning, infrastructure available, records maintained and financial, technical and marketing aspects. The students must record all the items of work either carried out by them/ shown to them during the period of attachment to the Agro-based Industries.

- At the end of the attachment period, the students shall submit a project report which includes all the aspects pertaining to the infrastructure facilities, organizational set up, financial and technical aspects.
- In addition, the students shall also describe in their report the operational and market constraints/ problems faced by the Industry.

#### **AEX 414 -ALL INDIA TOUR (0+1)**

#### **OBJECTIVES**

The course will provide an opportunity to the students to study the functioning of important national institutes related to agriculture and allied fields.

#### **SYLLABUS**

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

#### **VIII SEMESTER**

#### **AGR 420 - AGROFORESTRY AND DRY FARMING (2+1)**

#### **OBJECTIVES**

To impart knowledge on Agroforestry systems and dryland technologies

#### **THEORY**

##### **Unit – I : Forests and its importance**

Forest - Role of forests – Status of forests - Global forests scenario – Indian forests – National forest policies. Agro forestry – Concept – Definition – Benefits – Components – Social forestry- concepts – definition – SF projects - Joint Forest management (JFM). Afforestation – definition – methods - Afforestation Projects – Agroforestry – Classification – Tree species suitable for agro forestry in soil and water conservation.

##### **Unit – II : Agronomy of tree species and wasteland management**

Silviculture practices for important agroforestry species viz., Teak, Casuarina, Eucalyptus, Subabul, Tamarind, Ailanthus, Pungam, Neem, Acacia spp and Bamboos – Wastelands – definition – Classification – Suitable tree species – planting techniques for wastelands – Agroforestry systems for different types of problem soils and wastelands.

##### **Unit - III: Dry Farming**

Dryfarming – definition- classification. Major crops of Dryfarming in India and Tamil Nadu. History, Significance, Characteristics and constraints of dryfarming. Indices of aridity. Rainfall climatology - Length of growing period. Distribution of Arid and semiarid regions in World, India and Tamil Nadu.

##### **Unit - IV: Drought and Contingent crop planning**

Drought - Definition - Types and effects of drought on crop production - Mechanism of drought tolerance in plants - Drought management - Contingent crop planning and Mid season corrections. Soil moisture conservation approaches - Integrated dryfarming technologies and Mechanization.

##### **Unit - V: Watershed management**

Watershed management – definition – concepts – scope and importance. *In-situ* water harvesting, storage and recycling. Water harvesting - farm pond, percolation pond. Alternate land use systems in different watershed. Role of institutions - Government policies in promoting watershed programme.

#### **PRACTICAL**

Identification of trees, seeds and seedlings of important Agroforestry species – Forest nursery – types – layout – nursery technology for important tree species – visit to different agroforestry systems – visit to social forestry plantations – economics –



assessing fodder and fuel requirements of a village. Zonation of Dry farming regions of Tamil Nadu, India and World - Characteristics of ACZs of Tamil Nadu and cropping pattern - Rainfall analysis and crop planning - Study of tools, implements and machineries for tillage, sowing and after cultivation. Seed treatment technologies for dryfarming. Working out LGP. Preparation of contingency crop plan to mitigate aberrant rainfall situations - Visit to watershed.

#### **THEORY LECTURE SCHEDULE**

1. Role of forest – global and Indian forest status – National forest policy.
2. Social forestry and Agro forestry – definition – concepts – Agroforestry Vs social forestry
3. Social forestry phase I and II Projects – Achievements
4. Joint forest management – Tamilnadu Afforestation programme.
5. Agroforestry – Subsystems slitting cultivation – Taungya cultivation – Alley cropping – importance.
6. Agroforestry – components benefits – classification – primary systems – Agrisilviculture – silvipasture – agri silvipasture
7. Agroforestry - Subsystem – Home garden - Multitier cropping – wind break and shelter belts – design of shelter belts and species composition
8. Role of agroforestry in soil, water and ecological conservation – industrial Agroforestry – constraints merits.
9. Silviculture practices for Teak – Casuarina – Eucalyptus
10. Silviculture practices for Tamarind – Neem – Acacia – Prosopis.
11. Silviculture practices for pungam – Ailanthus – Bamboo
12. Waste land – Definition – Classification – suitable tree species
13. Agroforestry systems for different problem soils and waste lands
14. Planting techniques and afforestation for wastelands.
15. Significance and scope of dry farming in India and history of dryland agriculture.
16. Dry farming and rainfed farming: Definition and Characteristics.
17. Distribution of arid and semi-arid regions in World, India and Tamil Nadu.
18. Mid - Semester Examination
19. Major crops of dryland in India and Tamil Nadu.
20. Characteristics of dryland farming and major constraints for crop production.
21. Rainfall climatology – length of growing period - Drought: definition and types.
22. Effects of drought on crop production - Drought management strategies and contingent crop planning
23. Mid season correction – mulching - thinning - anti transpirants – anti evaporants.
24. *In-situ* soil moisture conservation techniques and approaches – Agronomical measures
25. *In-situ* moisture conservation – Mechanical – Biological measures
26. Water harvesting, storage and recycling.
27. Integrated dryland technologies and farm mechanization.
28. Mechanization in dryland farming.
29. Resource management under constraint situations for irrigated and rainfed farming
30. Cost reduction strategies in crop production Non-monetary inputs and low cost technologies for crop production - cropping and farming system in dry region.
31. Tillage – Summer tillage – Pre monsoon sowing
32. Watershed: definition, principles, classification and management.
33. Alternate land use systems in dryland – Agro forestry systems.
34. Role of institutions – Government policies for promotion of drylands.

#### **PRACTICAL SCHEDULE**

1. Identification and description of seeds and seedlings of Teak, Casuarina, Eucalyptus, Tamarind, Ailanthus, Pungam, Neem, Acacia, prosopis and bamboo.
2. Production of pre sprouted seeds in Pungam, Neem, Acacia, prosopis and bamboo.

3. Identification and description of fuel, fodder and green manure trees in the locality.
4. Nursery techniques for eucalyptus – casuarinas – production of stump for Teak – seedling Production for various tree species.
5. Visit to woodlots of casuarinas, eucalyptus, Neem, Tamarind, Teak – observing spacing, height, girth and calculating tree volume using the formula.
6. Working out economics of cultivation of tree species like Teak, casuarina, and eucalyptus.
7. Visit to nearby village and assessing the needs of fodder, fuel and greenmanue.
8. Agroclimatic, Agro ecological zones and characteristics. Zonation of dry farming regions of Tamil Nadu, India and World.
9. Characteristics of ACZs of Tamil Nadu and cropping pattern. Cropping and farming systems in dryland.
10. Rain fall analysis and crop planning
11. Soil erosion and soil conservation practices. Water harvesting structure and their use.
12. Study of tools, implements, and machineries for tillage, sowing and after cultivation and assessing their efficiencies.
13. Indices in dry farming - working out LGP and planning for cropping system.
14. Drought management technologies to mitigate drought in dryfarming agriculture.
15. Preparation of contingency crop plan for aberrant rainfall situations.
16. Visit to watershed area to study the impact of various soil and moisture conservation methods.
17. Orientation for final examination

#### REFERENCE BOOKS

1. Govindan, K. and V. Thirumurugan. 2003. Principles and practice of Dryland Agriculture, Kalyani Publishers, Chennai.
2. Thanunathan. K. and V. Imayavaramban. 2011, Agroforestry and Agronomy of Multipurpose Trees. SCITECH Publication (India) Pvt. Ltd. Chennai – 56  
E.mail : scitech@airtelmail.in
3. Nair, P.K.R. 1993. Introduction to Agroforestry. Kluwer Academic Publishers, Dordrecht, The Netherlands, 499 P
4. Negi, S.S. 1986. A hand book of Social Forestry. International book Distributors, Dehra Dun.177 P
5. Rengasamy, P. 1990. Dry farming Technology in India. Agri publishing Academy, New Delhi.
6. Singh, R.P. 1996 Sustainable development of dryland Agriculture in India. Scientific Publishers, New Delhi.

#### e-resources

1. <http://nsdl.niscair.res.in/jspui/bitstream/123456789/656/1/revised%20agroforestry.pdf>
2. <http://cropsfordrylands.com/wp-content/uploads/Dryland-Farming-Crops-Tech-for-Arid-Regions.pdf>
3. [ftp://ftp.fao.org/ag/agp/ca/CA\\_CoP\\_Jun14/CA\\_with\\_trees.pdf](ftp://ftp.fao.org/ag/agp/ca/CA_CoP_Jun14/CA_with_trees.pdf)

### GPB 421 PRINCIPLES OF SEED PRODUCTION, SEED QUALITY REGULATION AND STORAGE (2+1)

#### OBJECTIVE

To make the students understand the importance and principles involved in Quality seed production.

#### THEORY

##### Unit I - Introduction to seed and seed quality

Seed - definition - Seed structure - Seed development and maturation - Germination -phases of seed germination - Dormancy - types of seed dormancy - breaking treatments- Seed quality characteristics - significance - Causes of varietal deterioration and maintenance - Genetic and agronomic principles of seed production - Factors affecting quality seed production. Classes of seed - Generation system of seed

**multiplication in seed supply chain. Seed replacement rate and varietal replacement - Seed Multiplication Ratio - Seed renewal period**

**Unit II - Seed production techniques of Agricultural and Horticultural crops**

**Methods of seed production of varieties and hybrids - seed production techniques of rice, sorghum, maize and bajra varieties and hybrids – redgram, black gram varieties and hybrids - blackgram and greengram varieties - groundnut and sesame varieties - sunflower, castor and cotton varieties and hybrids. seed production techniques of tomato, chillies, brinjal, bhendi, onion, snakegourd, bittergourd, pumpkin, ashgourd, ribbedgourd and bottlegourd varieties and hybrids.**

**Unit III - Post harvest seed handling techniques**

**Threshing - methods - Drying - methods of seed drying - advantages and disadvantages -Seed processing – definition - importance - Seed cleaning and grading - upgrading - equipments - working principles - Seed treatments and containers - Mid storage treatments. - importance - types - Seed invigouration techniques - seed hardening - seed fortification - seed priming - Seed enhancement techniques - seed coating - seed pelleting.**

**Unit IV - Seed Legislation and certification**

**Introduction and importance of seed quality regulation. The Seeds Act and Rules - Seeds (Control) Order 1983 and labeling- seed standards - PPVand FRA 2001- National Seed Policy 2002- Salient features of Seed Bill 2004. Seed certification - definition - phases - procedures - Field inspection, field counts, field and seed standards - LFR- Downgrading - Post harvest inspection and seed quality assurance - Processing, bagging and tagging - Assigning of seed lot number - Validity period - Revalidation.**

**Unit -V - Seed quality testing, Storage and Marketing**

**Seed testing - importance - seed sampling - mixing and dividing - seed quality assessment (seed moisture content, physical purity, ODV, seed germination test, quick viability test, vigour tests and seed health test) - Pre and post quality regulation system (grow out test - molecular markers). seed storage - stages - factors affecting seed longevity - Types of seed storage. Seed marketing- Seed demand forecasting - Marketing organization - structure - pricing policy, factors influencing seed marketing**

**PRACTICAL**

**Study of seed structure of agricultural and horticultural crops - Seed invigouration techniques - hardening and priming - Seed enhancement techniques - seed coating and pelleting - Seed upgradation technique in rice- Acid delinting in cotton - Hybrid seed production techniques - Detasseling in maize - emasculation and dusting in cotton and vegetables - supplementary pollination in rice and sunflower - Physiological and harvestable maturity indices - Fruit grading - Seed extraction methods in vegetables - tomato, brinjal, chillies, bhendi and cucurbits - Seed cleaning and grading techniques - Detection of seed mechanical injury - Seed sampling - Types of sample (service sample - certified sample - official sample) - seed sampling procedures - mixing and dividing - Seed moisture content estimation - Physical purity analysis - Seed germination test - Seedling evaluation - Viability test - Vigour tests - Seed health - Grow out tests.**

**THEORY LECTURE SCHEDULE**

- 1. Seed - definition - seed structure - Seed development and maturation**
- 2. Germination - phases of seed germination – Factors affecting seed germination.**
- 3. Dormancy - types of seed dormancy – dormancy breaking treatments.**
- 4. Seed quality characteristics – significance- Factors affecting quality seed production**
- 5. Causes of varietal deterioration and maintenance - Genetic and agronomic principles of seed production.**
- 6. Classes of seed - Generation system of seed multiplication in supply chain - Seed replacement rate and varietal replacement - Seed Multiplication Ratio - Seed renewal period**
- 7. Methods of seed production of varieties and hybrids of rice and bajra**
- 8. Methods of seed production of varieties and hybrids of sorghum and maize**
- 9. Methods of seed production of varieties and hybrids of redgram and black gram**
- 10. Methods of seed production of varieties and hybrids of groundnut and sesame.**
- 11. Methods of seed production of varieties and hybrids of sunflower and castor.**
- 12. Methods of seed production of varieties and hybrids of cotton**

13. Methods of seed production of varieties and hybrids – tomato, brinjal and chillies.
14. Methods of seed production of varieties and hybrids – bhendi and onion
15. Methods of seed production of varieties and hybrids - snakegourd, bittergourd, pumpkin.
16. Methods of seed production of varieties and hybrids - ashgourd, ribbedgourd and bottlegourd.
17. Mid semester examination
18. Post harvest handling of seeds - Threshing - methods - Drying - methods of seed drying - advantages and disadvantages.
19. Seed processing - definition - importance - sequence - seed cleaning and grading - equipments (cleaner cum grader)
20. Seed upgrading - equipments (colour sorter, Indented cylinder separator, specific gravity separator, spiral separator, magnetic separator -working principles
21. Seed treatment - importance - types.
22. Seed invigouration techniques - seed hardening - seed fortification - seed priming - Seed enhancement techniques - seed coating - seed pelleting.
23. Introduction and importance of seed quality regulation - The Seeds Act and Rules
24. Seeds (Control) Order 1983 and labeling- seed standards – PPVandFRA 2001- National Seed Policy 2002 - salient features of Seed Bill 2004.
25. Seed certification - definition - phases - procedures.
26. Field inspection, field counts, field and seed standards- LFR- Downgrading- Post harvest inspection and seed quality assurance.
27. Seed testing - importance - Seed sampling procedures - mixing and dividing.
28. Seed quality assessment (seed moisture content, physical purity, ODV).
29. Seed germination test and quick viability test.
30. Vigour tests and seed health test.
31. Pre and post quality regulation system (grow out test).
32. Seed treatments and containers - Mid storage treatments -Storage godown sanitation
33. Advances in seed storage techniques - ultra dry storage, modified atmospheric seed storage and cryopreservation.
34. Seed marketing- seed demand forecasting- marketing organization- structure- pricing policy.

#### **PRACTICAL SCHEDULE**

1. Study of seed structure of agricultural and horticultural crops.
2. Practicing seed invigouration techniques - seed hardening and seed priming seed coating and seed pelleting
3. Seed upgradation technique in rice- Acid delinting in cotton.
4. Detasseling techniques for hybrid seed production in maize.
5. Emasculation and dusting techniques for hybrid seed production in cotton and vegetables.
6. Hybrid seed production techniques - supplementary pollination in rice and sunflower.
7. Determination of physiological and harvestable maturity indices.
8. Fruit grading and seed extraction methods in vegetables - tomato, brinjal, chillies, bhendi and cucurbits.
9. Seed cleaning and grading techniques and detection of seed mechanical injury.
10. Seed sampling -types of sample - service sample-certified sample- official sample- sampling - mixing and dividing.
11. Seed moisture content estimation.
12. Physical purity analysis.
13. Seed germination test and seedling evaluation.
14. Practicing viability test and vigour tests
15. Seed health assessment test.
16. Grow out test
17. Orientation for final examination

## REFERENCE BOOKS

### Text books

1. Agrawal, R.L. 1996. Seed Technology, Oxford and IBH Publishing Co., New Delhi.
2. Bhaskaran, M. *et al.*, 2004. Principles of seed production. Scientific Publishers, Ludhiana.

### Online references

1. [www.fao.org](http://www.fao.org)
2. [www.seednet.gov.in](http://www.seednet.gov.in)
3. [www.agricoop.nic.in](http://www.agricoop.nic.in)
4. [www.online.library.wiley.com](http://www.online.library.wiley.com)
5. [www.sciencedirect.com](http://www.sciencedirect.com)

### e-journals

1. Seed Science Research ([www.jgateplus.com](http://www.jgateplus.com))
2. Seed Science and Technology ([www.jgateplus.com](http://www.jgateplus.com))

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1. "Seeds", Baskin, Carol. Academic Press. (Elsevier e-books) (ISBN No. 9780124166776).
2. "Seeds" Derek Bewley, Kent. (Springer e-books) ([www.link-springer.com](http://www.link-springer.com)) (ISBN NO. 978-1-4614-4693-4)

## PAT 422 DISEASES OF HORTICULTURAL CROPS AND THEIR MANAGEMENT (2+1)

### OBJECTIVE

The subject covers 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 following crops.

### THEORY

#### UNIT I : Diseases of fruit crops

Mango, banana, citrus, grapevine, guava, sapota, pomegranate, annona, papaya, jack, pineapple, ber, aonla, apple, pear, peach, plum, cashew, fig, avocado and litchi

#### UNIT II : Diseases of vegetable crops

Brinjal, tomato, bhendi, cucurbits, crucifers, beans, peas, potato, sweet potato, beet root, raddish, carrot, cassava, yam, lettuce and colacasia, Post-harvest disease of fruits and vegetables.

#### UNIT III : Diseases of spices and condiments

Chillies, cardamom, turmeric, ginger, onion, garlic, pepper, betel vine, fenugreek, coriander, clove, nutmeg and cinnamon

#### UNIT IV : Diseases of Plantation crops

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

#### UNIT V : Diseases of flower crops, medicinal plants and mushroom cultivation

Flower crops: Jasmine, rose, crossandra, chrysanthemum, tuberose, carnation, liliun, gladiolus and marigold; Medicinal plants : Gloriosa, stevia, coleus, aloe. Mushroom cultivation : Cultivation of oyster mushroom, milky mushroom, button mushroom and paddy straw mushroom.

### THEORY LECTURE SCHEDULE

Etiology, symptoms, Mode of spread, survival, Epidemiology and management of diseases of the following crops.

1. Mango
2. Banana
3. Citrus and grapevine
4. Guava, sapota, pomegranate, annona and jack.
5. Papaya, pineapple, ber, aonla.
6. Apple, pear, plum, peach, cashew, fig, avocado and litchi
7. Post-harvest diseases – Apple, mango, banana, citrus, grapes, papaya
8. Brinjal and bhendi
9. Tomato
10. Cucurbits
11. Cabbage, cauliflower, radish and beetroot

12. Potato, sweet potato and cassava
13. Yam, colacasia, bean, peas and lettuce
14. Onion and garlic
15. Post harvest diseases – Tomato, potato, carrot and onion
16. Chillies
17. Mid semester examination
18. Pepper and Betelvine
19. Fenugreek, cinnamon, nutmeg, clove and coriander
20. Turmeric and ginger.
21. Tea
22. Coffee
23. Coconut and areca nut
24. Rubber
25. Cocoa , vanilla and cardamom
26. Jasmine and rose
27. Crossandra, gladiolus and chrysanthemum.
28. Marigold, carnation, liliun and tuberose
29. Medicinal plants – *Gloriosa*, *Stevia*
30. *Coleus* and *Aloe*
31. Mushroom cultivation : *Agaricus*
32. Mushroom cultivation : *Pleurotus* and *Calocybe*
33. Mushroom cultivation : *Volvariella*
34. Biotic and abiotic stresses of mushroom

#### **PRACTICAL SCHEDULE**

Study of symptoms and host parasite relationship of:

1. Diseases of mango and banana
2. Diseases of citrus and grapevine
3. Diseases of guava, sapota, pomegranate, annona, jack, papaya, pineapple, ber and aonla.
4. Diseases of apple, pear, plum, peach
5. Diseases of tomato and brinjal
6. Diseases of cucurbits and crucifers
7. Diseases of bean, peas and potato
8. Diseases of cassava, sweet potato, yam and colacasia
9. Diseases of onion, garlic, chillies, pepper and betel vine
10. Diseases of turmeric, ginger, cardamom, fenugreek, coriander, clove, nutmeg and cinnamon
11. Diseases of tea, coffee and rubber.
12. Diseases of coconut, arecanut and vanilla.
13. Diseases of rose, jasmine, crossandra, chrysanthemum, tuberose, marigold, liliun and carnation
14. Diseases of medicinal plants : *Coleus*, *gloriosa*, *stevia* and *aloe*
15. Mushroom cultivation: *Agaricus*, *Pleurotus*, *Calocybe* and *Volvariella*
16. Field visit
17. Orientation for final examination

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

#### **REFERENCE BOOKS**

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3. Arjunan. G. Karthikeyan, G, Dinakaran, D. Raguchander, T. 1999. Diseases of Horticultural Crops, A.E. Publications, Coimbatore.
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5. Cook, A.A, 1981. Diseases of Tropical and Subtropical Field, Fiber and Oil palms, Mac. Millan Publishing Co. New York
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12. Sohi, H.S, 1992. Diseases of Ornamental Plants in India, ICAR Publications, New Delhi.
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1. Agrios, G.N. 2008. Plant Pathology, Academic Press, New York.

**e-references**

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

**HOR 423 COMMERCIAL FLORICULTURE AND LANDSCAPE GARDENING (2+1)  
OBJECTIVES**

This course provides the basic knowledge and state of the art information on the commercial flower crops and landscape gardening, which aims to develop a strong foundation for careers in the floriculture and landscape industry to meet the needs of an ever changing world.

**Unit-I: Production technology of loose flowers**

Scope, importance and constraints of commercial floriculture industry – Area and production – Export potential – Cultivation of Loose flowers – Soil and climate – Varieties – Propagation – Nursery practices – Planting methods – Nutrient and water management – Role of growth regulators – Special practices- Harvesting – Post-harvest management – Grading and packaging of jasmine, rose, chrysanthemum, tuberose, crossandra and marigold.

**Unit-II: Production technology of cut flowers**

Cut flowers – Protected cultivation of cut flowers – Soil and climate – Varieties – Propagation – Nursery practices – Planting methods – Nutrient, water and weed management – Fertigation – Role of growth regulators-Special practices – Harvesting – Post harvest management – Grading and packaging – Export standards of cut rose, gladiolus, carnation, cut chrysanthemum, gerbera, anthurium, lilies and tropical orchids.

**Unit-III: Landscape gardening**

Landscape gardening – Definitions, scope, importance and opportunities – History of gardening in India– Types of gardens- Hindu, Buddhist, Persian, Mughal, Japanese, Italian, French and English garden - Styles of garden - formal, informal and picturesque gardens.

**Unit-IV: Garden components**

Softscape elements in garden – Ornamental trees, shrubs, climbers and creepers, annuals, biennials, herbaceous perennials, palms and cycads, Cacti and succulents, indoor plants, hedges, edges, topiary, trophy, carpet beds – Turf – establishment and maintenance. Hardscape elements in Garden - their position, materials required, establishment and maintenance – Planter boxes, arches, pergolas, pavements, decks, garden benches, fountains, cascades, gazebo, statues, bird bath, fences- light and lamb posts- plant, water and rock

**Unit-V: Principles and designing of Landscape gardens**

Elements and Principles of landscape design — site analysis and plants adaptability for different locations- Preparation and drawing of site plan – Garden designing softwares and tools - Landscaping for specific areas - institutions, industries,

residents, hospitals, theme parks, IT parks, corporates, high way, traffic islands, dam sites and play grounds - Special types of gardens - Xeriscaping - Bonsai culture-Terrarium.

#### **PRACTICAL**

Description and identification of species and varieties in jasmine, rose, chrysanthemum, tuberose, crossandra, marigold, cut rose, gladiolus, carnation, cut chrysanthemum, gerbera, lilies, anthurium and orchids - 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 cultivation practices in rose, jasmine, chrysanthemum, marigold - harvesting, postharvest handling and storage - visit to commercial fields and preparation of project reports for fresh flower production.

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.

#### **THEORY LECTURE SCHEDULE**

1. Importance, scope and constrains of commercial floriculture industry
2. Area, production and Export potential of commercial flowers
3. Soil and climate - Varieties - Planting - Pruning methods - Special horticultural practices - Nutritional management - Role of growth regulators - Harvesting - Post harvest management - Grading and packing of following flower crops: Jasmine
4. Rose
5. Chrysanthemum
6. Tuberose
7. Crossandra
8. Marigold
9. Protected cultivation structure - Growing media and climatic requirements - Varieties - Planting - Pruning methods - Special horticultural practices - nutritional management - Role of growth regulators - Harvesting - Post harvest management - Grading and packing of following flower crops: Cut rose
10. Gladiolus
11. Carnation
12. Cut Chrysanthemum
13. Gerbera
14. Anthurium
15. Lilies
15. Tropical orchids
16. Landscape gardening - Definitions, scope, importance and opportunities
17. History of gardening in India
18. Mid Semester Examination
19. Styles and Types of gardening
20. Growth habit, foliage and flower features, pruning, training and growth regulation of softscape elements - Ornamental trees, shrubs, hedges and edges
21. Growth habit, foliage and flower features, pruning, training and growth regulation of softscape elements - Creepers, climbers, annuals, topiary, trophy and carpet beds
22. Growth habit, foliage and flower features, pruning, training and growth regulation of softscape elements - Indoor plants and plants for special purposes - palms, Cacti, succulents, ferns and rosarium
23. Turf management - Functional utility in garden, turf grasses, establishment and maintenance



24. Different hardscape elements in gardens and their position, establishment, materials required and maintenance – Planter boxes, pavements, decks, garden benches and fences
25. Different hardscape elements in gardens and their position, establishment, materials required and maintenance – Fountains, cascades, jacuzzi, gazebo, statues and birds bath and water proofing techniques
26. Principles and elements of landscape design and Concepts in landscape designing
27. Assessing site and plants adaptability for different locations - client preference in landscape design planning
28. Garden plan – Elevation diagram – Perspective diagram – Layout of garden designs – Matching the plant materials to design criteria - Symbols in garden designing - Garden designing softwares and tools
29. Landscape design for specific areas – institutions, industries, residents, hospitals, theme parks, IT parks and corporates
30. Landscape design for specific areas – Planting avenues, high way, traffic islands, dam sites and play grounds
31. Special types of garden
32. Xeriscaping
33. Bonsai making and terrarium

#### **PRACTICAL SCHEDULE**

1. Identification and description of species and varieties in jasmine, tuberose and marigold.
2. Identification and description of species and varieties of rose, chrysanthemum and crossandra.
3. Study of propagation and pruning of jasmine and loose rose
4. Identification and description of species and varieties of cut rose, gladiolus, carnation and cut chrysanthemum.
5. Identification and description of species and varieties of gerbera, lilies, anthurium and tropical orchids.
6. Media preparation and potting of cut flowers
7. Working out benefit cost ratio for loose and cut flowers.
8. Garden components, basic functions and utility
9. Identification and description of softscape elements.
10. House plant and indoor gardening
11. Turf-Establishment and maintenance
12. Basic function, utility, fabrication and maintenance of nonliving components
13. Description and designing of hardscape elements
14. Principles of landscape drawing and fundamentals of manual drawing- Plan view, elevation and perspective diagram
15. Computer aided designing in landscaping of different areas.
16. Bonsai culture and terrarium
17. Orientation for final examination.

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2. Bose, T.K. and D. Mukherjee. 1977. Gardening in India. Oxford and IBH Publication Co., Kolkata.
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4. Chadha, K.L. 1986. Ornamental Horticulture in India. ICAR. KrishiBhavan, New Delhi.
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6. Hari Krishna Paliwal. 2009. Ornamental Gardening. National Book Trust, New Delhi, India.
7. Karuppaiah, P. and K. Manivannan. 2016. Ornamental Horticulture. Agrobios (India), Jodhpur
8. Nambisan, K.M.P. 1992. Design Elements of Landscape Gardening, Oxford and IBH Publications Co.(P) Ltd., Kolkata.
9. Randhawa, G.S. 1973. Ornamental Horticulture in India. Today and Tomorrow's printers and publishers, New Delhi.

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1. [www.gardenadorment.com](http://www.gardenadorment.com)

2. [www.toptropicals.com](http://www.toptropicals.com)

3. [www.bestgarden.net](http://www.bestgarden.net)

#### EXP 424 EXPERIENTIAL LEARNING – II

Sl. No.	Course No.	LIST OF COURSES	Credits	Department offering the course
1	EXP AGR 424	Integrated Farming Systems	0 + 6	Agronomy
2	EXP ENT 424	Bio Pesticides And Biocontrol Agents Production Technology	0 + 6	Entomology
3	EXP PAT 424	Biological Control of Plant Diseases	0 + 6	Plant Pathology
4	EXP AGM 424	Composting Technologies For Sustainable Agriculture	0 + 6	Agrl. Microbiology
5	EXP SAC 424	Soil constraints and its management for sustainable crop productivity	0 + 6	Soil Science and Agrl.Chemistry
6	EXP GPB 424	Hybrid Seed Production In Techniques in Rice	0 + 6	Genetics and Plant Breeding
7.	EXP HOR 424	Commercial Landscape Gardening	0 + 6	Horticulture
8.	EXP AEC 424	Farm Business Analysis	0 + 6	Agrl. Economics
9.	EXP AEX 424	Entrepreneurial and Managerial Skills	0 + 6	Agrl. Extension
10.	EXP AHS 424	Sheep And Goat Management	0 + 6	Animal Husbandry

#### EXP AGR 424 INTEGRATED FARMING SYSTEMS (0+6)

##### OBJECTIVES

- To understand the existing system and formulating new IFS model as location specific innovation
- To establish irrigated upland IFS model and wetland model
- To evaluate the IFS model established based on productivity, profitability, employment and resource utilization as holistic farming

##### Practical

Introduction and concept of farming systems - resource inventory and participatory analysis - selection of crops and raising of selected crops - nursery raising and excavation of trenches for fishes. Installation of allied enterprises - fertilizer management and transplanting / sowing of crop - intercultural operations - water management - plant protection measures - introducing allied enterprises .Observations on crops and allied activates - quantification of residues from crop components and allied enterprises. Compost making from crop residues and wastes - Harvesting yield and economic evaluation of IFS -

Recording cumulative output and income from IFS- Value addition and marketing of produces nutrient inflow / out flow. Report preparation, analysis and presentation of project outcome.

#### EXP ENT 424 BIO PESTICIDES AND BIOCONTROL AGENTS PRODUCTION TECHNOLOGY (0+6)

##### OBJECTIVES

- To study the plants of insecticidal value and practicing various extraction methods.
- To study the mass production techniques of various biocontrol agents.

##### PRACTICAL

Collection and Identification of plants of insecticidal value - Neem, Pungam, Vitex, Acorus, Ocimum, Garlic, Onion, Turmeric, Adathoda etc. Preparation of plant products - various extraction procedures - Bioassays and Formulation of natural products - Field application - Impact on crop and storage pest control. Safety to non target organisms. Collection, preservation and Identification of important predators and parasitoids. Mass production techniques of predators - *Cryptolaemus*, *Cyrtorhinus* and *Chrysopa*, parasitoids - Trichogrammatids, Chalcids, Bethyids, Ichneumonids, Braconids. Field release technique of

parasitoids and predators. Identification of important entomopathogens. Mass production of white and green muscardine fungi – Bt, NPV, EPN. Facilities and equipments required for mass multiplication. Diagnosis of insect diseases (fungal, bacterial and viral). Identification of important spider groups. Bioassay to test the efficacy entomopathogens and haemocytometer techniques to standardize the microbial load in a formulation. Visit to commercial biocontrol laboratories

#### **EXP PAT 424 BIOLOGICAL CONTROL OF PLANT DISEASES (0+6)**

##### **OBJECTIVES**

To study the significance of biological agents, methods of isolation of the antagonistic organisms and mechanisms of action involved in disease suppression. Also the subject covers the mass multiplication methods, bio-formulation development and delivery methods.

##### **PRACTICAL**

Safety procedures for handling equipments – Preparation of culture media – PDA, Kings B and NA – Isolation of *Trichoderma* from soil – Cultural characteristics of *Trichoderma* – Assessment of *in vitro* efficacy of *Trichoderma* isolates – Mass production of *Trichoderma viride* – small and large scale – Development of formulations and quality parameters of *Trichoderma* – Packing and storage of *Trichoderma* formulations – Fermentation technology – Isolation of PGPR from soil – Cultural characteristics of PGPR – Assessment of *in vitro* efficacy of PGPR isolates – Mass production of PGPR – small and large scale – Development of formulations and quality parameters of PGPR – Packing and storage of PGPR formulations – Delivery system

#### **EXP AGM 424 COMPOSTING TECHNOLOGIES FOR SUSTAINABLE AGRICULTURE (0+6)**

##### **OBJECTIVES**

- To study the nature of different type of wastes and different techniques of preparing enriched composts
- To know the role of microorganism in composting techniques
- To study the quality standards of compost and its role in sustainable agriculture

##### **PRACTICAL**

Characterization of waste material – Physical characterization of waste materials- Chemicals characterization of waste materials - method of composting – Aerobic method of composting- Anaerobic method of composting- Vermicomposting Physical vermicomposting – qualitative analysis- estimation of microbial load assessment of maturity of compost by physical and chemical test -quantitative assay – Quantitative estimation of micronutrient N,P and K- Dehydrogenase activity of nature compost –field visit to compost yard

#### **EXP SAC 424 SOIL CONSTRAINTS AND ITS MANAGEMENT FOR SUSTAINABLE CROP PRODUCTIVITY ( 0+6)**

##### **OBJECTIVES**

Students understand the methodology that allows soil constraints to be identified systematically from basic soil attributes. Inferences are then drawn about how individual soils should be managed to maximise their productive potential.

##### **PRACTICAL**

Analysis of constraints on agricultural production- physical and chemical constraint

Physical constraints- types- identification- field diagnosis ( visual) and Laboratory diagnosis( Soil analysis) and modern tools like satellite imageries an aerial photograph – Assessment of soil physical health- LIC, Storie index, productivity rating index and soil physical rating index – management options for amelioration of soil physical fertility

Chemical constraints- types- assessment - field (visual) and laboratory (soil test) and modern tools like satellite imageries an aerial photograph of acid soil and salt affected soils- methods of reclamation measures of problem soils; management options – agronomic and integrated soil fertility management for higher crop productivity ,SSNM approach, use of decision support system

Quality of irrigation water- assessment, development of quality indices and judgment on its profitable use

#### **EXP GPB 424 HYBRID SEED PRODUCTION IN TECHNIQUES IN RICE (0+6)**

##### **OBJECTIVES**

To give practical exposure to the students in hybrid seed production in rice.

##### **PRACTICAL**

Floral biology of rice, emasculation and pollination techniques - Male sterile lines in rice - morphological characterization : observations of sterility : inducing sterility - Supplementary pollination - Planting ratio - Planting methods - Recommended package of practices for hybrid rice seed production - Estimation of various types of heterosis in rice - Hybrid seed production in rice - an account on the released rice hybrids; their potential; problems and ways of overcoming it.

#### **EXP HOR 424 COMMERCIAL LANDSCAPE GARDENING (0+6)**

##### **OBJECTIVES**

To enable students to gain hands experience in landscape designing and execution and to develop entrepreneurial skills and confidence among students to develop their own landscape company.

##### **PRACTICAL**

Site analysis- Assessing client preference - Design components for landscape gardening- Planning and manual designing of different types of location specific gardens e.g. home garden, institutional garden, public garden, corporate and factory garden - Computer aided designing process- execution of softscape elements - execution of hardscape elements - measurements and materials for landscape project - pricing and cost estimates -Bidding for landscape contracts- Preparation of landscape company profile.

#### **EXP AEC 424 FARM BUSINESS ANALYSIS (0+6)**

##### **OBJECTIVE**

The objective of the course is to impart practical exposure to the students on the basic financial and managerial tools which are relevant to farm business.

##### **PRACTICAL**

Farm survey - Methods of data collection - Farm records and maintenance - Estimation of cost of cultivation of annual and perennial crops - Estimation of cost of production of milk, egg, broiler, fish - Farm financial statements - Balance Sheet - Income Statement - Cash flow Statement - Valuation of farm assets - Depreciation of farm assets - Budgeting - Complete budgeting and Partial budgeting - Market survey - Study on agricultural input firms seeds, fertilizers, pesticides, implements - Input data collection - Estimation of producer's surplus - Estimation of price spread and market margin - Estimation of price indices.

#### **EXP AEX 424 ENTREPRENEURIAL AND MANAGERIAL SKILLS (0+6)**

##### **OBJECTIVES**

To inculcate a superior level of knowledge on entrepreneurial managerial skills through Experiential Learning.

To train the students on different behavioural skills that would help to improve their employability as successful managers or entrepreneurs.

##### **PRACTICAL**

Motivation -concept, Maslow's hierarchy of needs, exercises on motivational techniques, visit to a firm to study the motivation techniques adopted, Decision Making & Support- concept, principles, tools / methods, Decision support system - importance, methodology, hands on experience, Managerial Skills -concept, types of managerial skills, Transactional Analysis (TA), Survey to study the managerial skills of extension personnel of state department of agriculture, Creativity- concept, types, exercises on improving, Entrepreneurial skills- Concept, Interaction with a leading agripreneur and entrepreneur, Time Management- concept, problems in managing Time, Time management techniques - survey to study the time utilization pattern of farmers and farm women, HRD- concept, principles, types of training, visit to a firm to learn about HRD practices, Delegation- concept, principles, methodology, exercise on delegation, visit to a firm to study the existing

pattern of delegation, Analytical skills– reasoning, breaking down problems, exercises on problem solving, Conflict Management– concept, reactions to conflict, visit to a firm and NGO to study conflict management techniques, Negotiation–concept, types, exercise on improving negotiation skills, meeting association leaders to study their negotiation skills, Stress Management– concept, types and causes of stress, general adaptation syndrome, practicing coping strategies, visit to a firm to study coping mechanisms to manage stress, Emotional Intelligence– concept, Emotional Quotient (EQ) – practice to assess EQ, Project Proposal– preparation and presentation

#### **EXP AHS 424 SHEEP AND GOAT MANAGEMENT (0+6)**

##### **OBJECTIVES:**

- To impregnate the students with holistic knowledge of commercial rearing of sheep and goats.
- To cater “hand on” experience so that students have the opportunity to start their own business to achieve optimum utilization of the livestock resources.

##### **PRACTICAL**

Introduction - Housing management – Pen and Run Housing - All slat system -Farming practices - Economic traits - Care and management of young and adult animals – Nutrition – Flushing Vs Steaming up - General farm practices - Breeding Management – Artificial Insemination – Pregnancy Diagnosis - Vaccination schedule - Preparation of project reports - Visit to sheep and goat farms.

#### **APW 425 PROJECT WORK (0+2)**

##### **PRACTICAL**

The students will work on a specified topic suggested by the course teachers appointed for that purpose on various aspects of Agri-Hortibusiness, economics of precision farming, feasibility of establishing a small and cottage industry related to agriculture and allied sciences and cooperative firms engaged in dealing with agricultural input or outputs. The group of students is expected to submit the project report in the prescribed format given in the annexure and the same should be submitted within a period of two semesters.

##### **Detailed program of project work**

- Identification of thrust area in agriculture and allied sciences
- Selection of topic and delineation of objectives to fulfill the core area of the subject
- Mobilization of resources needed for accomplishing the research project
- Review of literature in the subject area selected and finalizing the project proposal
- Finalization of research methods/methodology/design of experiments to be initiated by the group of student researchers
- Design and layout finalization – laying of experiments at field – preparation of questionnaire for the survey – testing the questionnaire and conduct of field survey
- Analysis of data – tabulation and finalization of research data
- Report writing and submission of draft report to the course teacher/guide concerned
- Identifying the user groups and dissemination of the findings emanated
- Conducting final evaluation and assessment of performance of students in various aspects of research project implementation

##### **Format of Research Project to be executed by the Student Researcher**

- Cover page
- Certificate page duly signed by the student and the guide/course Teacher
- Acknowledgement to be given by the student
- Contents highlighting the name of the Chapters
- Contents highlighting the list of tables
- Contents highlighting the list of plates/figures
- Abstract along with key words to be annexed in a single page
- Interleaf pages for Chapters
- Chapter – I Introduction – Dedicated to highlight the national, regional and societal importance, Scope of the study and limitations of the study along with the objectives
- Chapter – II Review of Literature – It should focus on the concepts used, concepts derived and literature reviewed towards each and every objective chosen in the study and a

- summary of literature to orient towards the subject chosen
- Chapter – III Methodology/Design of the study – It should focus on the methods of conduct of study, tools used for analysis and Statistical Significance related are to be discussed
  - Chapter – IV Description of the Study – It should address on the place in which the research was conducted, its topographical, climatic and geographical and socio economic features
  - Chapter – V Results/Results and Discussion – Presentation of the findings with tabular, diagrammatic evidence to prove the data and discussion in liaison with the literature reviewed towards each and every objective of the study
  - Chapter – VI Summary and conclusions – This chapter can present the summary of data and its important findings and if need be related policies for alleviating the constraints in the farm and the firm.
  - References – Books; Journals; Periodicals; Theses/Dissertations; Web References.

#### OPC 426 OPTIONAL COURSES

Sl. No.	Course No.	OPTIONAL COURSE	Credit	Department offering the course
1	OPC AGR 426	Indigenous Technology in Agricultural Production	1 +1	Agronomy
2	OPC ENT 426	Emerging Trends in Insect Pest Suppression	1 +1	Entomology
3	OPC PAT 426	Emerging Trends In Plant Disease Management	1 +1	Plant Pathology
4	OPC AGM 426	Advanced Microbial Biotechnology	1 +1	Agri. Microbiology
5	OPC SAC 426	Farm Advisory on Soil Health, Water quality and Plant Nutrition	1 +1	Soil Science and Agri.Chemistry
6	OPC GPB 426	Plant Tissue Culture	1 +1	Genetics and Plant Breeding
7.	OPC HOR 426	Supply Chain Management, Processing And Value Addition In Horticultural Crops	1 +1	Horticulture
8.	OPC AEC 426	Agricultural Project Management	1 +1	Agri. Economics
9.	OPC AEX 426	Entrepreneurship Development	1 +1	Agri. Extension
10.	OPC AHS 426	Technology Of Dairy and Poultry Products	1 +1	Animal Husbandry

#### OPC AGR 426 INDIGENOUS TECHNOLOGY IN AGRICULTURE (1+1)

##### OBJECTIVES

Aims at incurring indigenous knowledge and experiencing ITK technologies for various field crops. To provide experience on ITK's based biological preparations. To cover various aspects of indigenous technologies with relevance to its advantages, importance in the present world scenario and its impact on soil and environment.

##### THEORY

##### Unit – I Concept of ITK's

ITK – Definition — Concept - Need - Importance – Types of ITK's – ITK belief – Centre disseminating ITK's – International, National and State level. ITK practices followed in different parts of Tamil Nadu and India.

##### Unit – II ITK's Technology

ITK in predicting rainfall – Water source identification - Preparatory cultivation. ITK practices – Seeds - Seed treatment - Sowing methods – Manuring - Weed management, soil and water management - Pest and disease management.

##### Unit – III ITK's in Sustainable Agriculture

**ITKs and their role in sustainable Agriculture – ITK's in growth promoters – Biofortified Farming Systems - Analysis, implication and issues – Indigenous Post harvest processing.**

**Unit – IV ITK's Conceptual Model**

**Sources of ITK, special features of ITK, ITK in organic farming – Conceptual model for farming with local knowledge and modern technology – Good Agricultural practices (GAP) – Concept and prospects.**

**Unit – V ITK's Crop Production Technology**

**ITK technologies for important crops – rice, maize, millets, pulses, groundnut, gingelly, sunflower, cotton and sugarcane. Traditional crop varieties – salient features.**

**PRACTICAL**

**Collection and study of traditional crop varieties – Collection of indigenous technologies – Preparation of indigenous technologies for various field crops – Methods of predicting rainfall and wind – Indigenous tools and implements – Indigenous farming system practices – Soil fertility management, weed management, pest and disease management. ITK for identification of water resources – ITK's technology for storage of food grains – ITK's in growth promoters – ITK preparation for seed treatment – ITK's technology for improving soil fertility – ITK technologies for recycling of Agricultural wastes – Visit to nearby farmers field and ITK's centers.**

**THEORY LECTURE SCHEDULE**

1. ITK – Definition, concept, need and Importance
2. Types of ITK's – ITK belief – Centre disseminating ITK's
3. International, National and State level. ITK practices followed in different parts of Tamil Nadu.
4. ITK in predicting rainfall
5. ITK in predicting water source identification, preparatory cultivation.
6. ITK practices in seeds and seed treatment
7. ITK practices in sowing methods – Manuring - Weed management, soil and water management - Pest and disease management.
8. ITK's and their role in sustainable Agriculture
9. Mid semester examinations
10. ITK's in growth promoters, biofortified Farming Systems
11. ITK's analysis, implication and issues - Post harvest processing.
12. Sources of ITK, special features of ITK, ITK in organic farming
13. Conceptual model for farming with local knowledge and modern technology
14. Good Agricultural practices (GAP), Concept and prospects.
15. ITK technologies for important crops Rice, Maize, Millets and Pulses
16. ITK technologies for groundnut, gingelly, sunflower, cotton and sugarcane.
17. Traditional varieties and salient features.

**PRACTICAL SCHEDULE**

1. Collection and study of traditional crop varieties
2. Collection of indigenous technologies
3. Preparation of indigenous technologies for various field crops
4. Methods of predicting rainfall and wind
5. Indigenous tools and implements
6. Indigenous farming system practices
7. Developing a biofortified farming model
8. ITK's for improving soil fertility
9. ITK's weed management
10. ITK's pest and disease management
11. ITK for identification of water resources
12. ITK's in growth promoters
13. ITK's for seed treatment
14. ITK's technology for storage of food grains
15. ITK's technologies for recycling of Agricultural wastes
16. Visit to nearby farmers field and ITK's centers
17. Record

**REFERENCE BOOKS**

**Rathakrishnan. T, N. Anandaraja, Ramasubramanian. M and L. Nirmala, 2009. Traditional Agricultural Practices. New India Publishing Agency, New Delhi.**

**OBJECTIVES**

To impart knowledge on the novel approaches and recent developments in Insect pest suppression.

**THEORY**

**Unit-I: Industrial perspective of Insecticide development – Past, Present and Future**

Indian and Global insecticide industry - Changing scenario in the last two decades – its future direction – Difficulties in new molecule identification and development - Steps in insecticide development – Role of natural active molecules as cue for novel insecticide development - Successful examples which mimic natural active molecules - Carbamates, pyrethroids, nicotinoids, Anticoagulants, Nereistoxin analogues - Their synthesis – Importance of Structure activity relationship – Role and scope of Research and Development in insecticide development.

**Unit-II: Improvements in various pest management components**

Novel Pheromone application technology - Sprayable pheromone formulations – different types of dispensers – Role in mating disruption of crop and stored product pests – Successful examples. Push – Pull technology – Principles – components – Examples. Host plant Resistance – Induced resistance. Novel insecticides –Insect growth regulators, Feeding blockers, ryanodine receptor blockers. Improved formulations of insecticides – Advantages. Nano technology in formulations. Storage Entomology - Issues in methyl bromide and phosphine fumigation - Hermetic control of stored product pests.

**Unit-III : Biotechnology in Insect Pest Management**

Genetic improvement of natural enemies – *In vitro* Mass production of Entomopathogens using cell lines – Genetic Engineering with baculoviruses – Transgenic plants with Bt toxin genes – Gene pyramiding – Resistance development – Scope and future of second and third generation transgenic crops - assessing risks and benefits of transgenic crops - Host plant resistance – Molecular breeding and Marker assisted selection – Techniques and Advantages.

**Unit IV: Urban and Quarantine Entomology**

Public health pests – problems and challenges. Mosquitoes – species – biology - Mosquitoes as vectors. House flies – species – biology. Cockroaches – species – biology. Rodents – species – biology and damages. Minor pests in human habitations - Sand flies, bed bugs, human lice and fleas. Termites – Species - biology and problems to buildings and furniture. Bees, ants and wasp colonies. Principles and methods of pest management in residential places and public buildings. Insecticides for domestic use and their safety. Quarantine entomology - Domestic and international quarantine - case histories of exotic insect pests and their status. Related Acts – Techniques - fumigation, VHT and other safer techniques of disinfestations - Phytosanitary certificate.

**Unit V: Veterinary Entomology**

Major insect, mite, and tick vectors of domestic animals - Their life cycle, morphology, and behavior – Detection, Evaluation and monitoring the infestation - Classes of insecticides and acaricides used in Livestock pest management – Special formulations - Methods of application – Dipping vats, Rub on pads etc., Traditional practices of utilizing plants in livestock pest management - Integrated control methods.

**THEORY LECTURE SCHEDULE**

1. Indian and Global insecticide industry. Changing scenario in the last two decades – its future direction – Difficulties in new molecule identification and development - Steps in insecticide development
2. Role of natural active molecules as cue for novel insecticide development - Successful examples which mimic natural active molecules and their synthesis
3. Importance of Structure activity relationship – Role and scope of Research and Development in insecticide development.
4. Novel Pheromone application technology - Sprayable pheromone formulations – different types of dispensers – Role in mating disruption of crop and stored product pests – Successful examples. Push – Pull technology – Principles – components – Examples.
5. Host plant Resistance – Induced resistance. Novel insecticides –Insect growth regulators, Feeding blockers, ryanodine receptor blockers.
6. Improved formulations of insecticides – Advantages. Nano technology in formulations. Storage Entomology - Issues in methyl bromide and phosphine fumigation - Hermetic control of stored product pests.



7. Genetic improvement of natural enemies – *In vitro* Mass production of Entomopathogens using cell lines – Genetic Engineering with baculoviruses
8. Transgenic plants with Bt toxin genes – Gene pyramiding – Resistance development – Scope and future of second and third generation transgenic crops - assessing risks and benefits of transgenic crops
9. Mid semester examination
10. Host plant resistance – Molecular breeding and Marker assisted selection – Techniques and Advantages.
11. Public health pests – problems and challenges. Mosquitoes – species – biology - Mosquitoes as vectors. House flies – species – biology. Cockroaches – species – biology. Rodents – species – biology and damages. Minor pests in human habitations - Sand flies, bed bugs, human lice and fleas.
12. Termites – Species - biology and problems to buildings and furniture. Bees, ants and wasp colonies.
13. Principles and methods of pest management in residential places and public buildings. Insecticides for domestic use and their safety.
14. Quarantine entomology - Domestic and international quarantine - case histories of exotic insect pests and their status. Related Acts
15. Techniques - fumigation, VHT and other safer techniques of disinfestations - Phytosanitary certificate.
16. Major insect, mite, and tick vectors of domestic animals - Their life cycle, morphology, and behavior – Detection, Evaluation and monitoring the infestation
17. Classes of insecticides and acaricides used in Livestock pest management – Methods of application – Dipping vats, Rub on pads etc., - Integrated control methods.

#### **PRACTICAL**

Rearing of Test insect *Viz.*, Housefly, Spodoptera, Aphids and Bioassay techniques for screening of insecticides. Understanding the working principle of IR, UV, MS and NMR and their utility in structure determination. Studies on effect of pheromones on mating disruption. Studying the effect of nutrition on induced resistance of crops and Identification and Studies on high performance novel formulations. Evaluation of Bt cotton transgenics in comparison with non – Bt cotton. Identification of various species of Mosquitoes, House flies, Cockroaches, Rodents, bed bugs, human lice and fleas, Termites, Bees, ants and wasp and their management. Techniques of clearing infestation in quarantine stations. Identification of various livestock pests and their management.

#### **PRACTICAL SCHEDULE**

1. Rearing of Test insect *Viz.*, Housefly, Spodoptera, Aphids
2. Bioassay techniques for screening of insecticides
3. Determination of Median Lethal Dose (LD<sub>50</sub>)
4. Understanding the working principle of IR, UV, MS and NMR and their utility in structure determination
5. Studies on effect of pheromones on mating disruption
6. Studying the effect of nutrition on induced resistance of crops
7. Identification and Studies on high performance novel formulations
8. Preparation of silver nano particle mediated nano formulation of botanicals
9. Studies on the effect of CO<sub>2</sub> on stored product pest under air tight conditions
10. Evaluation of Bt cotton transgenics in comparison with non – Bt cotton
11. Identification of various species of Mosquitoes, House flies, Cockroaches, Rodents, bed bugs, human lice and fleas, Termites, Bees, ants and wasp.
12. Practicing methods of pest management in residential places and public buildings.
13. Techniques of clearing infestation in quarantine stations
14. Techniques of fumigants usage in quarantine
15. Identification of various livestock pests
16. Management techniques of livestock pests
17. Orientation for final examination

#### **REFERENCE BOOKS**

1. Dubey N K, 2011. Natural Products in Plant Pest Management. CAB International, USA. 312 p.
2. Dudani, 2003. Alternatives to Pesticides in Tropical Countries: Sustainable Agriculture -

- Food Security With Food Safety. Vigyan Prasar Publication. 360 p.
3. Dhang, P. 2011. Urban Pest Management an Environmental Perspective. CAB. International, Wallingford, UK, 280 p.
  4. Robinson, W. H. 2005. Urban Insects and Arachnids - A Handbook of Urban Entomology. Cambridge university press, Cambridge, England. 480p
  5. Rajeev K and Mukherjee RC. 1996. Role of Plant Quarantine in IPM. Aditya Books, New delhi. 295p.

**OPC PAT 426 EMERGING TRENDS IN PLANT DISEASE MANAGEMENT (1+1)**

**OBJECTIVES**

To study the novel approaches and recent developments in crop disease management

**THEORY**

**Unit I: Conventional Plant Disease Management**

Identification of plant diseases – symptoms, biochemical and molecular methods. Cultural and physical methods of disease management prophylaxis, avoidance, exclusion, eradication, protection, Quarantine legislation - Plant quarantine order 2003 – APEDA, seed act – SPS under WTO and TRIPS, ISTA, EPPO, OECD – Disease resistance.

**Unit – II : New generation chemical/fungicides**

New generation chemicals/ fungicides – characteristics of an ideal fungicide – antibiotics – formulations – Role of stickers, adjuvants and spreaders – methods of application. Good laboratory practices for agrochemical laboratories – Fungicide resistance in plant pathogens and its management – FRAC – SBI, MBI fungicides.

**Unit – III : Biological approaches in Plant Disease Management**

Biological control – fungal and bacterial bio-formulations – mass multiplication – methods of applications – compatibility with other agrochemicals – Biological control of post harvest diseases of fruits and vegetables – Suppressive soil – Biochemical changes as induced by biological products

**Unit IV – Biotechnological approaches for plant disease management**

Immunity – resistance – Host defense mechanism – Types of resistance –Biotechnological tools – Resistance genes in plants – molecular approach for plant disease management – Tissue culture –Cross protection – Genetic recombination –Transgenic plants – Basic concepts of bio safety and bio security. Genetic resistance of crops – Cotton, rice, maize and tomato – GM crops – Definition – Significance – Special emphasis on cotton, maize, tomato.

**Unit V – Botanicals in plant disease management**

Botanicals with antimicrobial properties – AVP – improved extraction methods, characterization and synthesis of secondary plant compounds – Bioassay for antifungal, antibacterial property of botanicals – Biochemical changes as induced by plant products

**PRACTICAL**

Identification of plant diseases – Symptoms, biochemical and molecular methods - Diagnostic tests for identification of plant diseases - Cultural and physical methods – plant quarantine - New generation fungicides- Antibiotics – methods of applications - Good laboratory practices for agrochemical laboratories - Bio agents- formulations and methods of applications – mass multiplication of *Trichoderma viride*, *Pseudomonas fluorescens*, *Bacillus subtilis* - Molecular approach for plant disease management - Biotechnological tools - Meristem tip culture – Botanicals - extraction methods – techniques in isolation of secondary plant compounds – bioassay to study mode of action of botanicals.

**THEORY LECTURE SCHEDULE**

1. Identification of plant diseases – symptoms, biochemical and molecular
2. Cultural and physical methods of disease management
3. Prophylaxis, avoidance, exclusion, eradication, protection and resistance
4. Quarantine legislation - Plant quarantine order 2003 – APEDA, seed act – SPS under WTO and TRIPS, ISTA, EPPO, OECD
5. New generation chemical/fungicides
6. Characteristics of an ideal fungicide, Antibiotics – mode of action- Biochemical changes as induced by chemical fungicides
7. Fungicide formulations – Role of stickers, adjuvants and spreaders
8. Fungicide resistance in plant pathogens and its management – FRAC – SBI, MBI fungicides
9. Mid semester examination
10. Biological control – fungal and bacterial bio-formulations – mode of action- Biochemical

- changes as induced by bioagents
11. Compatibility with other agrochemicals – Biological control of post harvest diseases of fruits and vegetables – Suppressive soil
  12. Immunity – resistance – Host defense mechanism – Types of resistance, resistance genes in plants
  13. Biotechnological tools – molecular approach for plant disease management – Meristem tip culture – Cross protection
  14. Transgenic plants– GM crops
  15. Botanicals with antimicrobial properties – AVP
  16. Improved extraction methods of botanicals, characterization and synthesis of secondary plant compounds
  17. Characterization and synthesis of secondary metabolites – Bioassay to study mode of action of metabolites - Biochemical changes as induced by plant products

#### **PRACTICAL SCHEDULE**

1. Study of Symptoms, biochemical and molecular methods to identify the plant diseases
2. Diagnostic tests for identification of plant diseases
3. Disease management using Cultural and physical methods
4. New generation fungicides – Fungicide formulations, methods of applications
5. Antibiotics – Phytotoxicity and compatibility of fungicides and methods of application
6. Bio agents – formulations, methods of applications
7. Mass multiplication of *Trichoderma viride*
8. Mass multiplication of *Pseudomonas fluorescens* and *Bacillus subtilis*
9. Good laboratory practices for agrochemical laboratories
10. Molecular approach for plant disease management - Biotechnological tools –
11. Meristem tip culture
12. Botanicals - extraction methods - AVP preparation
13. Techniques in isolation of secondary plant compounds – bioassay to study mode of action/ antimicrobial properties of botanicals.
14. Field / laboratory visit
15. Biochemical changes as induced by biological agents/products and botanicals
16. Biochemical changes as induced by chemical fungicides
17. Orientation for final examination

#### **REFERENCE BOOKS**

1. Ravichandra, N.G. 2016. *Frontiers in Phytopathology*. I.k. International Publishing house. 1040p.
2. Pradeep kumar, Gupta, V.K., Tiwari, A.K. and Kamle, M. 2016. *Current trends in Plant disease diagnostics and management practices (Fungal Biology)*. Springer Publications. 469p.
3. Chand, G. and Santosh kumar. 2016. *Crop diseases and their management*. CRC Press. 295p.
4. Awasthi, L. 2015. *Recent Advances in the diagnostics and management of plant diseases*. Springer Publications. 294p.
5. Meghvansi, M.K. and Ajit verma. 2015. *Organic amendments and soil suppressiveness in plant disease management*. Springer Publications. 531p.
6. Gupta, S.K. 2014. *Approaches and Trends in plant disease management*. Scientific publishers. Jodhpur.
7. Narayanasamy, P. 2011. *Crop diseases management: Principles and practices*. New India Publishing agency. 366p.
8. Chaube and Pundhir. 2005. *Crop diseases and their management*. Prentice Hall India Learning Private Limited. 724p.
9. Chakraborty, B. 2015. *Recent trends in plant pathology*. Scientific publishers, Jodhpur.
10. Gisi, U., Chet, I. and Gullino, M.L. 2009. *Recent developments in Management of plant disease. (Plant Pathology in 21<sup>st</sup> Century)*. Springer Publications. 378p.

#### **OPC AGM 426 ADVANCED MICROBIAL BIOTECHNOLOGY(1+1)**

#### **OBJECTIVES**

The subject is designed to impart knowledge on

1. The fermentation concepts and types
2. Industrial production of microbial inoculants and dairy products
3. Utilization of microorganisms for bioremediation and waste water treatment

## **THEORY**

### **Unit-I**

**Brief history of fermentation - General concepts and Types. Applications of fermentation; Range of fermentation process- Microbial biomass, enzymes, metabolites, recombinant products, transformation process; Culture media - types, components and formulations. Sterilization: Batch and continuous sterilization.**

### **Unit-II**

**Microbial cells as products for commercial use; Selection and Improvement of Strains for biomass production; Single cell protein – microorganisms and raw materials used as substrate; nutritive value and uses of SCP.**

### **Unit-III**

**Microbial inoculants - Production of Rhizobium, Azotobacter, Azospirillum and cyanobacteria Phosphate solubilizing bacteria; mycorrhiza; plant growth promoting rhizobacteria(PGPR); Quality control of bio inoculants; Cyanobacterial and algal fuels;**

### **Unit-IV**

**History and scope of fermented foods; Fermented foods of vegetables and fruits- Cereal and legume based fermented products. Microbiology of Fermented Dairy Products Buttermilk; Yogurt (probiotics, prebiotics, synbiotics); Properties and beneficial effects of probiotic and prebiotic. Fermented meat and fish products; Fermented beverages**

### **Unit-V**

**Bioremediation - process and organisms involved; Water treatment- primary and secondary waste water treatments; Composting of solid wastes, Aerobic and anaerobic digesters: Microbial leaching of ores. A brief account of biodegradable plastics and super bug**

### **PRACTICAL**

**Design and Preparation of Media for Bioprocesses; Isolation of industrially important microorganism from different sources using specific substrates; Production of ethanol from sucrose by yeast; To study the design of fermenter and its working; Production of extracellular enzymes; Ethanol production using immobilized yeast culture.**

**Isolations of nitrogen fixing bacteria; nitrogen fixing activity, indole acetic acid (IAA), siderophore production etc; Bioinoculant production and quality control. Isolation of xenobiotic degrading microorganisms, Anaerobic waste water treatment of industrial dyes and effluent; Estimation of BOD and COD levels of different water systems; Bacteriological analysis of water by presumptive, confirmatory and completed tests.**

### **THEORY LECTURE SCHEDULE**

- 1. History of fermentation and general concepts. Types of fermentations- Aerobic and anaerobic fermentation, Submerged and solid state fermentation; Factors affecting submerged and solid state fermentation; Substrates used in SSF and its advantages;**
- 2. Applications of fermentation; Range of fermentation process- Microbial biomass, enzymes, metabolites-Primary and Secondary, recombinant products, transformation process;**
- 3. Microbial cells as products for commercial use; Bacterial culture (lactic acid cultures; propionic acid culture; acetic acid bacteria);**
- 4. Selection and Improvement of Strains for biomass production;**
- 5. Single cell protein: microorganisms used; raw material used as substrate; condition for growth and production; nutritive value and uses of SCP and Baker's yeast;**
- 6. Microbial inoculants- Selection and establishment of nitrogen fixing bacteria. Phosphate solubilizing bacteria; mycorrhiza; plant growth promoting rhizobacteria (PGPR);**
- 7. Mass Production of bio inoculants(bacterial and mycorrhizal biofertilizers)**
- 8. Quality control of bio inoculants;**
- 9. Cyanobacterial and algal fuels;**
- 10. History and scope of fermented foods; Importance of fermented foods; health aspects of fermented foods. Organisms used for production of fermented food products; Fermented foods of vegetables and fruits- sauerkraut, pickles, Kimchi; and Cereal and legume based fermented products- bread, Soya Sauce, Koji, Tempeh, Miso, Natto, Tofu, Angkkak; Indian products like Idly, Dosa, Vada.**

- 11. Microbiology of Fermented Dairy Products (Product Characteristics, Processing, Starter**

- culture, Growth, Genetics). Buttermilk; Yogurt (probiotics, prebiotics, synbiotics); Acidophilus Milk; Bifidus Milk, Bulgarian milk; acidophilus milk; Kefir; Kumiss; Cheeses;
12. Fermented meat and fish products;
  13. Fermented beverages- Microbial fermentation of tea, coffee and cacao. Production of different types of wine and beer;
  14. Bioremediation- process and organisms involved; Microbes involved in aerobic and anaerobic processes in nature;
  15. Water treatment Primary and secondary waste water treatments
  16. Composting of solid wastes,
  17. Microbial leaching of ores- process, microorganism's involved and metal recovery with special reference to copper and iron. A brief account of biodegradable plastics and super bug.

#### **PRACTICAL SCHEDULE**

1. Isolation and characterization (morphological and biochemical) of Lactic Acid Bacteria (LAB)
2. Thermal Death rate and Thermal Death time
3. Mass production of bacterial bio inoculants
4. Mass production of algal bio inoculants
5. Mass production of mycorrhizal biofertilizers
6. Screening of microbes for production of industrially important antibiotics
7. Purification of antimicrobial metabolites from a microbe
8. Yoghurt Fermentation
9. Cheese Fermentation
10. Production of alcoholic beverages
11. Production and characterization of emulsifiers by microbes
12. To study the various methods of biomass measurement
13. Bio hydrogen production
14. Production of extracellular enzymes

#### **REFERENCE BOOKS**

1. Stanbury, P. F., Whitaker and Hall, A. S. J., Principles of Fermentation Technology. Butterworth-Heinemann.
2. Shuler, M.L. and Karg, I F., Bioprocess Engineering Basic Concepts , Prentice Hall.
3. Vogel, H.C. Todaro, C.L. and Todaro C.C., Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment, Noyes Data Corporation/ Noyes Publications.
4. Crueger W. and Crueger, A., Biotechnology. A Textbook of Industrial Microbiology, Sinauer Associates.
5. Reed, G., Prescott and Dunn's Industrial Microbiology, AVI publication
6. Casida L. E. J. R., Industrial Microbiology, New Age (1968)
7. Robert A Andersen. 2005. *Algal Culturing Techniques*. Academic Press.
8. L. M. Prescott, J. P. Harley and D. A. Klein. Microbiology-, McGraw Hill
9. N. J. Pelczar, S. Chand, R. Krieg. Microbiology- Tata McGraw Hill
10. Frazier, Food microbiology. W.C. Tata McGraw Hill.
11. Carr NG and Whitton BA. 1982. The Biology of Cyanobacteria. Blackwell.
11. Bergerson F J. 1980. Methods for Evaluating Biological Nitrogen Fixation. John Wiley and Sons.
12. Pandey A, Lasroche C, Soccol C. R and Dussop C. G. Advances in Fermentation technology (2008). Asiatech publishers Inc.
13. Mathuriya A. S. Industrial Biotechnology (2009) Ane Books Pvt. Ltd.

### **OPC SAC 426 FARM ADVISORY ON SOIL HEALTH, WATER QUALITY AND PLANT NUTRITION (1+1)**

#### **OBJECTIVES**

The major objective of this course is to impart practical knowledge on soil related constraints, irrigation water quality appraisal guidelines and their efficient management, diagnosis of plant nutrient related problems, soil and water pollution and their impact on crop production and techniques for development of commercial fertilizer formulations and organic preparations.

## **THEORY**

### **UNIT – I : Soil related constraints and their management**

Soil related constraints in crop production – Physical, Chemical and Biological constraints – Identification, extent, causes and measures to combat the constraints.

### **UNIT – II : Irrigation water quality appraisal and its management**

Irrigation water – Ground water – Characteristics, problems due to use of poor quality water – water quality guidelines – Management of poor quality water.

### **UNIT – III : Diagnostic Techniques for nutrient disorders**

Diagnosis of nutrient related problems in crop plants – Deficiency and Toxicity, Diagnostic key for identifying nutrient deficiency. Plant sampling for diagnosis of nutritional disorders – Tissue analysis and total analysis.

### **UNIT –IV : Prescription for nutrient disorders**

Differentiating criteria for nutrient deficiency symptoms from insect and disease attack – Prescription – DRIS – Interpretation of plant analytical results.

### **UNIT –V : Soil and water pollution**

Soil and water pollution – Impact on crop production-Management of polluted soils and water. Minespoils – Strategies for Rehabilitation of minespoils.

## **PRACTICAL**

Identification of physical and chemical constraints – Techniques for reclamation of acid, sodic and saline soils. Methods of fertilizer application for different crops. Assessing nutrient efficiency in problem soils. Analysis of irrigation water for its quality and interpretation. Diagnosis of crop plant for nutrient deficiency, toxicity and physiological disorders. Plant tissue tests. Analysis of polluted soils and waters. Preparation of composts, enriched organic manures. Formulation of micronutrient mixtures – Nutrient mixtures for foliar nutrition.

## **THEORY LECTURE SCHEDULE**

1. Soil constraints – extent and types
2. Physical constraints – Identification, types and causes
3. Management of soil physical constraints
4. Chemical constraints – Identification, Types, causes (Acid soil, salt affected soils)
5. Management of chemical constraints -Acid soils and(Salt affected soils)
6. Irrigation water resources – Groundwater potential and utilisation
7. Irrigation water characteristics and problems arising due to poor quality water
8. Water quality guidelines and their management
9. Mid-semester examination
10. Diagnostic key for identifying nutrient deficiency and toxicity
11. Plant sampling for diagnosing nutrient disorders for field crops
12. Plant sampling for diagnosing nutrient disorders for Horticultural crops
13. Establishment of DRIS
14. Interpretation and reporting of results of plant analysis
15. Pollution, types and extent of pollution
16. Remediation of polluted soils
17. Mine spoils – Mining industries and their ill effects and Rehabilitation

## **PRACTICAL SCHEDULE**

1. Key to identify physical constraints (Soil aggregate analysis, Shear strength)
2. Key to identify chemical constraints I(EC, pH)
3. Key to identify chemical constraints II (ESP, SAR, CaCO<sub>3</sub>)
4. Techniques for Reclamation of Acid soil (Lime Requirement)
5. Techniques for Reclamation of Sodic soil (Gypsum requirement)
6. Techniques for Reclamation of Saline soil (leaching requirement)
7. Methods of fertilizer application ( for different crops and problems)
8. Assessing nutrient efficiency for enhanced productivity in acid soils
9. Assessing nutrient efficiency for enhanced productivity in salt affected soils
10. Interpretation of irrigation water quality I (pH, EC, SAR, RSC)
11. Interpretation of irrigation water quality II(Potential salinity and Potential alkalinity hazards)
12. Diagnosis of plant nutrient deficiency symptoms

13. Diagnosis of plant nutrient Toxicity symptoms
14. Diagnosis of physiological disorders in crop plants
15. Quick test / Tissue test for plant nutrient status and prescription.
16. Analysis of polluted soils and waters for heavy metals
1. Orientation for final examination

#### **REFERENCE BOOKS**

1. Das, P.C. 1993. Manures and Fertilizers. Kalyani Publishers, New Delhi
2. Indian Society of Soil Science 1991. Soil-related Constraints in Crop Production. Bulletin No.15. ISSS, New Delhi
3. Indian Society of Soil Science. 1996. Soil Management in Relation to Land Degradation and Environment, Bulletin No:17. ISSS. New Delhi
4. Palaniappan, S.P. and Annadurai, K. 1999. Organic Farming, Theory and Practice. Scientific Publishers (India), Jodhpur
5. Ranjan Kumar Basak. 2000. Soil Testing and Recommendation. Kalyani Publishers, New Delhi
6. Tandon, H.L.S. 1994. Fertilizers, Organic Manures, Recyclable wastes and Biofertilizers. Fertilizer Development and Consultation Organisation, New Delhi
7. Tandon, H.L.S. 1995. Recycling of crop, Animal, Human and Industrial wastes in Agriculture. Fertilizer Development and Consultation Organisation. New Delhi

### **OPC GPB 426 PLANT TISSUE CULTURE (1+1)**

#### **OBJECTIVES**

- To teach various methods in in-vitro culture of plants
- To teach commercial application of tissue culture techniques

#### **THEORY**

##### **Unit I**

Introduction-Historical achievements in plant tissue culture – Fundamental principles in plant tissue culture- Totipotency, dedifferentiation, competency-different sterilization methods – Terminology-Explants and its types, cyto differentiation in plant tissue culture-Application of plant tissue culture

##### **Unit II**

Plant nutrient media- types of nutrient media- MS, B5, SH, WPM and N6 media- functions of different elements in plant tissue culture- Nutritional requirements of a plant tissue culture medium- Gelling agents- classes of plant growth regulators in plant tissue culture

##### **Unit III**

Types of in vitro cultures in plants-Callus, cell suspension cultures, single cell culture cell viability test- Haploid production – Anther culture, ovary and ovule culture-Doubled haploids- Embryo culture – embryo rescue technique – endosperm culture

##### **Unit IV**

Micropropagation and its Stages-Techniques in micropropagation -Multiplication via axillary bud- organogenesis- Embryogenesis- somatic embryos-somatic embryogenesis- Micropropagation in Banana and Rose.Factors affecting plant tissue culture.

##### **Unit V**

Meristem tip culture for virus free production-Protoplast fusion and somatic hybridization- cybrids- germplasm conservation- synthetic seeds-somaclonal variation and its applications in crop improvement.

#### **PRACTICAL**

Tissue culture laboratory and equipment needs -Sterilization techniques-Preparation of culture medium-Cell suspension culture and callus induction-Somatic embryogenesis-Synthetic seeds-Anther and pollen culture-Ovary and ovule culture-Embryo rescue techniques -Embryo culture-Endosperm culture-Meristem culture-Protoplast culture and somatic hybridization -Micro propagation in banana-Cryopreservation of plant parts – visit to commercial tissue culture laboratory.

#### **THEORY LECTURE SCHEDULE**

Introduction-Historical achievements in plant tissue culture – Fundamental principles in plant tissue culture- Totipotency, dedifferentiation, competency-different sterilization methods – Terminology-Explants and its types, cyto differentiation in plant tissue culture-Application of plant tissue culture

1. Historical achievements in plant tissue culture .
2. Totipotency, dedifferentiation, competency.
3. Sterilization techniques and methods.
4. Explants and its types, cyto differentiation in plant tissue culture.
5. Plant nutrient media and its types.
6. Composition of tissue culture medium and preparation.
7. Plant growth regulators and its role in culture medium.
8. Callus culture and callus induction. Isolation of single cell and cell suspension culture.
9. Mid-Semester Examination.
10. Embryo culture and its application. Embryo rescue techniques.
11. Micropropagation and its stages, Shoot multiplication via auxillary bud as explants.
12. Anther culture, Ovary culture and its application.
13. Organogenesis and somatic embryogenesis.
14. Micropropagation in banana and rose.
15. Meristem tip culture and Somatic hybridization
16. Synthetic seeds and germplasm conservation.
17. Somaclonal variation and its applications in crop improvement.

#### **PRACTICAL SCHEDULE**

2. Tissue culture laboratory and equipment needs.
3. Machines and equipments used in plant tissue culture laboratory.
4. Sterilization techniques.
5. Preparation of MS stock solutions.
6. Preparation of growth regulator stock solutions.
7. Preparation of MS culture medium.
8. Meristem tip culture.
9. Micro propagation in banana.
10. Regeneration via direct organogenesis pathway.
11. Regeneration via indirect organogenesis pathway.
12. Regeneration via direct somatic embryogenesis pathway.
13. Regeneration via indirect somatic embryogenesis pathway.
14. Synthetic seeds.
15. Production of Haploids.
16. Embryo culture.
17. visit to commercial tissue culture laboratory
18. Orientation for final examination

#### **REFERENCE BOOKS**

1. Bhojwani, S.S. and Razdan, M.K. 2006. Plant Tissue Culture Studies – Theory and Practice, Elsevier Publication.
2. Gupta, P.K. 2005. Elements of Biotechnology. Rastogi Publication, India.
3. Singh, B.D. 2004. Frontier areas in Biotechnology. Kalyani Publications, New Delhi.

### **OPC HOR 426 SUPPLY CHAIN MANAGEMENT, PROCESSING AND VALUE ADDITION IN HORTICULTURAL CROPS (1+1)**

#### **OBJECTIVES**

To enable students to gain hands on experience in commercial production of value added products and to train the students in establishing a commercial processing unit and to impart knowledge on value chain management of horticultural commodities.

#### **THEORY**

**Unit-I: Principles of post harvest technology**

Importance and scope of post harvest technology and causes of post harvest losses – Maturity indices and time of harvesting – pre and post harvest physiological changes in Horticultural produce.

**Unit-II : Post harvest handling and storage**

Handling methods – pre –cooling-cooling methods-- washing and grading – waxing – vapour heat treatment – fumigation –ripening methods-. storage methods –low temperature storage-refrigerated storage-storage using evaporative coolers- hypobaric , controlled and modified atmospheric storage techniques – storage disorders – handling of vegetables – shelf life extension.

**Unit-III: Packaging of Horticultural produce**



**Packaging of horticultural produce – type of containers and cushioning materials – methods of packing – controlled and modified atmospheric packaging – vacuum, edible packaging.**

#### **Unit-IV: Methods of preservation**

**Principles of preservation – Preservation with sugar, salt – preservatives-drying and dehydration-types of driers-canning-preparation of canned products and fermented beverages. Minimal processing of fruits and vegetables-techniques–Fresh cut- processing by irradiation-principle ,method,suitability-application of irradiation in food processing-waste and by product utilization from processing industry .**

#### **Unit -V: Quality standards and certification**

**FPO- Fssai standards – Agmark standards- Indian and International standards for preservatives- HACCP regulation WTO guidelines for export of horticultural produce- CODEX standards and export standards for major fruits and vegetables -food safety standards.**

#### **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. Project preparation and working out cost economics.**

#### **THEORY LECTURE SCHEDULE**

- 1) Importance and scope of post harvest technology and causes of post harvest losses .
- 2) Maturity indices and time of harvesting in fruits and vegetables
- 3) Pre and post harvest physiological changes in Horticultural produce.
- 4) Handling methods of fruits and vegetables: pre –cooling , washing and grading
- 5) Handling methods of fruits and vegetables: waxing, vapour heat treatment and fumigation
- 6) Ripening and Storage methods of fruits and vegetables: low temperature storage-refrigerated storage-storage using evaporative coolers
- 7) Hypobaric, controlled and modified atmospheric storage techniques – storage disorders.
- 8) Packaging of horticultural produce : type of containers and cushioning materials
- 9) Mid-semester.
- 10) Methods of packing: controlled and modified atmospheric packaging – vacuum, edible packaging.
- 11) Principles of preservation – Preservation with sugar, salt – preservatives
- 12) Drying, dehydration and canning and preparation of canned products and fermented beverages.
- 13) Minimal processing of fruits and vegetables: processing by Fresh cut
- 14) Minimal processing of fruits and vegetables: irradiation- principle ,method, suitability
- 15) Waste and by product utilization from processing industry .
- 16) FPO- Fssai standards
- 17) Agmark standards- Indian and International standards for preservatives-
- 18) HACCP regulation WTO guidelines for export of horticultural produce-
- 19) CODEX standards and export standards for major fruits and vegetables -food safety standards.

#### **PRACTICAL SCHEDULE**

- 1) Practice in Judging the maturity of horticultural produce.
- 2) Pre harvest treatments to enhance the post harvest life.
- 3) Assessment of physical, physiological and biochemical changes during ripening.
- 4) Determination of physiological loss in weight and quality.
- 5) Preharvest treatments to enhance the post harvest life.
- 6) Storage studies.
- 7) Packaging studies for fruits and vegetables.
- 8) Packaging studies for cut flowers and dry flowers.
- 9) Waxing.
- 10) Identification and study of working of equipments used in processing units.
- 11) Preparation of squash, RTS and syrup.
- 12) Preparation of Jam.
- 13) Preparation of Jelly and marmalade.
- 14) Preparation of sauce and ketch-up.
- 15) Preparation of pickles and dehydrated products.
- 16) Preparation of fresh cut vegetables and fruits.

17) Visit to food processing units.

18) Orientation for final examination

#### REFERENCE BOOKS

1. Giridharilal, Siddappa, G.S. and Tondon, G.L. 1986. Presentation of Fruits and Vegetables. Publications and Information Division, Indian Council of Agricultural Research, New Delhi.
2. Desrosier, N.W. and Desrosier, J.N. 1987. The technology of food preservation. CBS publishers and distributors, New Delhi.
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4. Srivastava, R.P. and Sanjeev Kumar. 1998. Fruits and Vegetable preservation principles and practices. International Book distributing Co. Chaman studio building 2nd floor, Charbagh Lucknow, UP.
5. Vennila, P. and S.Kanchana. 2003. Principles and preservation of fruits and vegetables. Ratna Publications, Madurai.
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#### OPC AEC 426 AGRICULTURAL PROJECT MANAGEMENT (1+1)

##### OBJECTIVES

The objective of this course is to provide knowledge to the students on project selection, formulation, financial feasibility analysis, monitoring and evaluation techniques with reference to agricultural sector.

##### THEORY

###### Unit I: Introduction to Project Management

Project - definition - characteristics - project cycle - classification, identification, formulation. Feasibility study - economic and market analysis - Environmental impact study - Financial analysis - Risk and uncertainty - project appraisal - detailed project report.

###### Unit II: Human Resource in Project Management

Project Organization design - Human resource management - Role management - team building - Communication - Motivation - Decision making - Leadership.

###### Units III: Project Management Techniques

Project management - Bar chart - Milestone chart - Gantt chart - Networks - PERT - Network diagram - Computation of EST and LST - Network analysis - CPM - Time cost relationship of an activity - Project crashing - Project Control.

###### Unit IV: Monitoring

Monitoring - Introduction, basic elements, importance - Monitoring and progress reporting - Monitoring techniques - Indicators for monitoring - Types of monitoring - Monitoring risk and uncertainties.

###### Unit V: Evaluation

Evaluation - Definition, introduction, features, importance - Comparison of appraisal, monitoring and evaluation - Types of evaluation - Designing monitoring and evaluation system - Salient aspects of evaluation - Quantitative and qualitative approaches - Participatory monitoring and evaluation - Social audit - Evaluation report.

##### PRACTICAL

Developing skills in identification of projects - Formulation of projects - Measuring of cost and benefit of projects - Appraisal of project using undiscounted and discounted techniques - Use of sensitivity analysis - Selection methods among mutually exclusive projects - Preparation of case studies - Social cost benefit analysis - Developing network techniques for project management - PERT, CPM - Time cost relationship of an activity - Use of management tools in project monitoring - Analyzing risk in projects - Environmental Impact Assessment.

##### THEORY LECTURE SCHEDULE

1. Introduction - Project definition
2. Project characteristics - Project performance dimensions
3. Project cycle, conceptualization, planning, execution phases
4. Project classification
5. Project identification - Formulation
6. Feasibility study - Economic and market analysis
7. Environmental impact study
8. Financial analysis - Pay back period, ROI, NPV, BCR, IRR

9. Risk and uncertainty - Economic benefit – Management aspects
10. Project appraisal – Market, Technical, Economic appraisal
11. Detailed project report
12. Project organization design
13. Human resource management
14. Role management - Team building
15. Communication
16. Motivation - Decision making leadership
17. Mid semester examination
18. Project management - Bar chart - Milestone chart - Networks - PERT - Network diagram
19. Computation of EST and LST - Network analysis - CPM
20. Time cost relationship of an activity
21. Project crashing - Project control
22. Monitoring – Introduction, basic elements, importance
23. Monitoring and progress reporting - Monitoring techniques
24. Indicators for monitoring - Types of monitoring
25. Monitoring risk and uncertainties
26. Evaluation – Definition, introduction, features, importance
27. Comparison of appraisal, monitoring and evaluation
28. Types of evaluation
29. Designing monitoring and evaluation system
30. Salient aspects of evaluation
31. Quantitative and qualitative approaches
32. Participatory monitoring and evaluation
33. Social audit
34. Evaluation report

#### **PRACTICAL SCHEDULE**

1. Development skills in identification of projects
2. Formulation of projects
3. Measuring of cost and benefit of projects
4. Appraisal of project using undiscounted techniques
5. Appraisal of project using discounted techniques
6. Use of sensitivity analysis
7. Selection methods among mutually exclusive projects
8. Preparation of case studies
9. Preparation of case studies
10. Social cost benefit analysis
11. Networks - PERT - Network diagram
12. PERT - CPM analysis
13. Time cost relationships of an activity
14. Developing network techniques for project management
15. Use of management tools in project monitoring
16. Analyzing risk in projects and environmental impact assessment
17. Orientation for final examination

#### **REFERENCE BOOKS**

1. Chalmers, James, 2002. How to Manage Project, Jaico Publishing House, Mumbai.
2. Chandra, Prasanna, 1995. Projects: Preparation, Appraisal, Budgeting and Implementation, Tata McGraw Hill Publications, New Delhi.
3. Gittinger, Price J. 1982. Economics Analysis of Agricultural Projects, The John Hopkins University Press, London.
4. Goel, B.B. 1989. Project Management, Deep and Deep Publications, New Delhi.
5. Little I.M.D. and Mirelees, J.A. 1974. Project Appraisal and Planning for Developing Countries, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

#### **OPC AEX 426 ENTREPRENEURSHIP DEVELOPMENT (1+1)**

#### **OBJECTIVES**

1. To learn the concepts of entrepreneur, entrepreneurship and dimensions of entrepreneurship development.
2. To learn the elements of marketing and training programmes for entrepreneurship

development.

3. To gain experience in formulation of projects and working out BCR, Break even analysis and financial ratios
4. To visit various small scale agro – based enterprises so as to gain knowledge on their establishment and management

## **THEORY**

### **Unit I : Concept of Entrepreneurship**

Entrepreneur and Entrepreneurship – definition, meaning, characteristics of ideal entrepreneur – types of entrepreneurs

### **Unit II: Enterprise**

Entrepreneurship and Entrepreneurial motivation – Motivational factors for entrepreneurship – Enterprise – Meaning, definition, characteristics and types of enterprises.

### **Unit III: Setting up Small Scale Enterprises**

Steps in setting up small enterprises – product idea – sources for product ideas, methods and techniques to generate product ideas – SWOT analysis. Importance of technology for an enterprise – Identification and accessing of technology.

### **Unit IV: Marketing and Record Keeping**

Marketing - Elements - Market segmentation, market positioning, marketing mix and product mix. Types of capital – Fixed capital - technology fee, land and building, plant and machinery, connection for utilities, office furniture and operative expenses - Working capital – raw materials, other expenses, circulation of cash, Machine utilization and costs and contingency - Record keeping- purpose and importance, Types of business records.

### **Unit V: Entrepreneurial Training**

Entrepreneurship Development Training Programme (EDTPs) — Objectives, Importance and models of EDTPs - Organizations in the service of entrepreneurs –Entrepreneurship development programmes for women entrepreneurs, Problems of women entrepreneurs - EDTP for women entrepreneurs.

## **PRACTICAL**

Formulation of project proposal– working out benefit cost ratio – break even analysis – capital budgeting – preparation of balance sheet. Preparation of project profiles for agro based enterprises - visit to agro based industries – practicing entrepreneurial games – evaluation of women owned enterprises and visit to entrepreneurship support agency.

## **THEORY LECTURE SCHEDULE**

1. Entrepreneur and Entrepreneurship – definition, meaning and importance of entrepreneurship in agriculture
2. Characteristics of ideal entrepreneurs, Types of entrepreneurs
3. Entrepreneurial motivation – Definition, motivational factors for entrepreneurship, importance of entrepreneurial motivation
4. Enterprise – Meaning, definition, characteristics of enterprises and types of enterprises.
5. Steps in setting up small scale enterprises
6. Product idea – characteristics of good product idea, sources for product ideas
7. Methods and techniques to generate product ideas, Assessing product ideas – factors in assessing product ideas
8. SWOT analysis-Concept, meaning, advantages, SWOT analysis for agro based industries and products
9. Mid-Semester Examination
10. Technology – Definition, characteristics, Importance of technology for an enterprise, Identification and accessing of technology.
11. Marketing – Concept – elements - orientation, Market segmentation, Market positioning, Marketing mix and Product mix.
12. Types of capital – Fixed capital - Technology fee, land and building, plant and machinery, connection for utilities, office furniture and operative expenses
13. Working capital – raw materials, circulation of cash, Machine utilization costs, contingency and other expenses.
14. Record keeping –Purpose and importance, Types of business records
15. Entrepreneurship Development Training Programme (EDTPs) – Importance and models of EDTPs
16. Organizations in the service of entrepreneurs, Organizations for women entrepreneurs

**17. Entrepreneurship development programmes for women entrepreneurs, problems of women entrepreneurs.**

**PRACTICAL SCHEDULE**

1. Formulation of a project proposal
2. Working out benefit – cost ratio for any agro - based project
3. Working out break – even analysis
4. Working out financial ratio
5. Cost of production of agro - based product
6. Capital budgeting for any agro-based project
7. Preparation of balance sheet
8. Preparation of sample project profile for mushroom rearing
9. Preparation of sample project profile for dairy farming
10. Visit to agro based industry I
11. Visit to agro based industry II
12. Practicing tower building
13. Practicing test for achievement planning
14. Case study of successful women entrepreneurs.
15. Visit to entrepreneurship support agency.
16. Preparation of project report of any agro based Industry
17. Orientation for final examination

**REFERENCE BOOKS**

1. Dhillon, P.K. 1993. Women Entrepreneurs – problems and prospects. New Delhi, Blaze Publishers and Distributors Pvt. Ltd.
2. Sivakamasundari, S. 1995. Entrepreneurship Development for Rural Women. New Delhi. Asia and Pacific Centre for Transfer of Technology, Vol.I.
3. Sagar Mondal and G.L Ray. 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.

**OPC AHS 426 TECHNOLOGY OF DAIRY AND POULTRY PRODUCTS (1+1)**

**OBJECTIVES**

- To impart the comprehensive idea of the existing technologies and practices for augmenting milk and poultry products.
- To give “hands on” experience with the different technologies used in dairy and poultry products to develop entrepreneurship skills among the students.

**THEORY**

**Introduction - Composition and processing of milk - Fat rich dairy products - Indigenous milk products - Dairy byproducts- Composition of meat - Slaughtering techniques of poultry - Composition, grading, preservation and value addition of eggs.**

**Unit – I - Milk Composition**

**Milk – Composition of milk – Factors influencing composition of milk – Types of milk – Homogenization – Pasteurization of milk.**

**Unit – II - Dairy Products – I**

**Fat rich Dairy products – Preparation of Cream, Butter, Ghee – Preparation of Ice cream**

**Unit – III - Dairy Products – II**

**Indigenous milk products – Preparation of Khoa, Paneer, Channa – Dairy by products - Skim milk – Whey – Ghee residue.**

**Unit – IV - Poultry Meat**

**Slaughtering techniques of Poultry – Preparation of cut-up parts – Inspection and grading of poultry meat.**

**Unit – V - Egg and Egg products**

**Composition of egg – Grading of egg – Factors affecting egg quality – Preservation of egg – Value added egg products**

**PRACTICAL**

**Platform tests for milk- Specific gravity, fat percentage, total solids and acidity in milk- Adulterants in milk - Preparation of Cream, Ghee, Paneer, Channa and Ice cream – Utilization of Dairy byproducts- Preparation of flavoured milk and whey drink -Dressing of Poultry - Cut up parts - Value added poultry meat products – Candling, grading and preservation of eggs.**

**THEORY LECTURE SCHEDULE**

1. Introduction to Dairy and Poultry Industry.
2. Definition and Composition of milk – factors influencing composition of milk.
3. Types of milk.
4. Pasteurization and Homogenization of milk.
5. Preparation of Cream.
6. Preparation of Butter and Ghee.
7. Preparation of Ice cream.
8. Preparation of Khoa, Paneer and Channa, Dairy byproducts – Skim milk –Whey – Ghee residue.
9. Mid Semester Examination.
10. Slaughtering techniques of poultry.
11. Preparation of cut up parts.
12. Inspection and grading of poultry meat.
13. Composition and nutritive value of egg.
14. Factors affecting egg quality.
15. Grading of eggs.
16. Preservation of egg.
17. Value added egg products.

**PRACTICAL SCHEDULE**

1. Platform test for milk.
2. Determination of Specific Gravity of milk.
3. Estimation of fat percentage and total solids in cow's milk.
4. Determination of acidity in milk.
5. Detection of adulterants in milk.
6. Demonstration of cream separation.
7. Preparation of Ghee.
8. Preparation of Paneer and Channa.
9. Preparation of Ice cream and judging its quality.
10. Preparation of flavoured milk.
11. Preparation of Whey drink.
12. Dressing of Poultry.
13. Preparation of cut up parts of poultry meat.
14. Preparation of value added poultry meat products.
15. Candling and grading of eggs.
16. Preservation and value addition of eggs.
17. Orientation for final examination

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1. Ralph Early (2014). Technology Of Dairy Products (Vol I and II), 2nd Edition. SPRINGER (SIE.) 11 West 42th street, 15<sup>th</sup> Floor, New York, USA.
2. Analysis of Milk and Its Products: A Lab Manual 2nd edn (2012). Milk Industry Foundation. Daya Publishing House, 4760-61/23, Ansari Road, Darya Ganj, New Delhi.
3. Hui Y. H (2014). Dairy Science and Technology Handbook: Product manufacturing.. Wiley India 4435-36/7, Ansari Road, Daryaganj ,New Delhi .
4. Handbook of Milk Processing, Dairy Products and Packaging Technology (2012). E I R I Board. Engineers India Research Institute, 4449 Nai Sarak, Delhi-6.

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