



**ANNAMALAI UNIVERSITY**

(Accredited with 'A' grade by NAAC)



**FACULTY OF AGRICULTURE**

(Accredited by ICAR)

**Academic regulations and Syllabus**

**BACHELOR OF SCIENCE (HONOURS)  
IN AGRICULTURE**

**(Semesters 1- 8)**

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

**2018-19 Onwards**

**(Revised)**

**ANNAMALAI UNIVERSITY**  
**FACULTY OF AGRICULTURE**  
**ACADEMIC REGULATIONS AND SYLLABUS**  
**B.Sc. (HONS.) (AGRICULTURE)**  
**(2018-19 ONWARDS)**

**1. Title and Scope**

**1.1.** These academic Regulations shall be called “Annamalai University Faculty of Agriculture B.Sc. (Hons.) Agriculture Academic Regulations 2018” 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 2018-19 onwards.

**2. Definitions**

**2.1. University:** University means Annamalai University, Annamalainagar, Tamil Nadu.

**2.2. State Government:** State Government means the Government of Tamil Nadu.

**2.3. Academic 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 up to second decimal place.

**2.10. Credit point:** A credit point is a product of grade point obtained by a student and number of credits in a course.

**2.11. Grade Point Average (GPA):** It is 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)/ “Cumulative Grade Point Average” (CGPA):** 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**

1.	Total credit hours till the end of last semester	18
2.	Total credit points till the end of last semester	140.50
3.	Total credit hours in the current semester	22
4.	Total credit points obtained in the current semester	156
5.	Total credit hours including the current semester	$(18+22) = 40$
6.	Total credit points including the current semester	$140.50 + 156 = 296.50$
7.	Overall Grade Point Average	$(296.50/40) = 7.412$
8.	Corrected to two decimals	$7.41 / 10.00$

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

**3. Admission**

**3.1.** Admission of the student to B.Sc. (Hons.) Agriculture programme in the Faculty of Agriculture shall be on the basis of merit and in accordance with the policy and guidelines of the state government and the University. The minimum admission requirement shall be decided by the University and issued from time to time. 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. (Hons.) Agriculture	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
	<b>Total</b>	<b>100</b>
9.2.	Course with only Theory / Practical*	Marks
I.	Mid Semester Examination	40
II.	Final Semester Examination	60
	<b>Total</b>	<b>100</b>
*The modality of evaluation of various courses with only practical is given in regulation 9.4		

9.3. **Evaluation of course work:** The results of the course shall be indicated by grade points ranging from 0 to 10.0. 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 practical 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 ( $10 \times 2 = 20$ ) PART - B Five Marks Questions 2 out of 3 ( $2 \times 5 = 10$ ) PART - C Ten Marks Questions 1 out of 2 ( $1 \times 10 = 10$ )	40
2	Yoga Practical Examination	30
3	Viva - Voce Examination	10
4	Record	20
<b>Total</b>		<b>100</b>

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

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

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

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

S. No.	Particulars	Marks
1	NSS Regular Programme (15 +15 +15 +15)	60
2	NSS Special camp not exceeding 10 days duration (Attendance-30 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	<i>Viva Voce</i>	-	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	<i>Viva-Voce</i>	-	5
	<b>Total</b>	<b>40</b>	<b>60</b>

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

**RAWE AEX 410 Village Attachment and Technology Transfer (0+5), RAWE AGR 411 (0+3), RAWE HOR 412 (0+2) and RAWE CPT 413 (0+4)**

Course on Rural Agricultural Work Experience will be offered in the VII Semester for eleven weeks. The village attachment will be organized by the Department of Agricultural Extension.

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.

Orientation programme will be organized by different departments during the first week of the semester 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 final examination will be conducted separately at the end of the semester by the University. The marks will be awarded as detailed below.

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

#### G. Educational Tours: AGR 221 (0+1) and AEX 414 (0+1)

Educational tour courses AGR 221 Study tour-I and AEX 414 All India Tour (0+1) 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>	

#### H. AIA AEC 415 Agroindustrial Attachment (0 + 6)

Course on Agro Industrial attachment will be offered in the VII Semester for five 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 1<sup>st</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>	

## I. Experiential learning

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

Periodical evaluation of the above course will be done by the course teacher during different stages of work. Final evaluation of the above course will be done by the teacher in charge and another staff member appointed as examiner by the Head of the Department. The final examination will be conducted by the University before the commencement of regular final semester examinations.

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

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

**10.1.** Writing the mid-semester examination is a pre-requisite for writing the final theory and practical examinations. If a student does not appear for MSE, he/she is not eligible to appear for the final examinations. Such 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.

	<b>Model</b>	<b>Marks</b>
1.	Objective type @ ½ a mark for 10 questions out of 12	5
2.	Definition/description @ 1 mark for 5 questions out of 7	5
3.	Short answers @ 2½ marks for 2 questions out of 3	5
4.	Essay type @ 5 marks for 1 question out of 2	5
	<b>Total</b>	<b>20</b>

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

	<b>Model</b>	<b>Marks</b>
1.	Objective @ 1 mark for 10 questions out of 12	10
2.	Definition/description @ 2 marks for 5 questions out of 7	10
3.	Short answers @ 3 marks for 5 questions out of 7	15
4.	Essay type @ 5 marks for 1 question out of 2	5
	<b>Total</b>	<b>40</b>

**10.5.** If the student is not able to write the MSE due to deputation by the University, he/she may be permitted to take up 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.

	<b>Model</b>	<b>Marks</b>
1.	Objective type @ ½ mark for 10 questions out of 12	5
2.	Definition/description @ 1 mark for 5 questions out of 7	5
3.	Short answers @ 2½ marks for 2 questions out of 3	5
4.	Essay type @ 5 marks for 5 questions (either or pattern from each Unit)	25
	<b>Total</b>	<b>40</b>

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

	<b>Model</b>	<b>Marks</b>
1.	Objective type @ 1 mark for 10 questions out of 12	10
2.	Definition/description @ 2 marks for 5 questions out of 7	10
3.	Short answers @ 3 marks for 5 questions out of 7	15
4.	Essay type @ 5 marks for 5 questions (either or pattern from each Unit)	25
	<b>Total</b>	<b>60</b>

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

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

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

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

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

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

**12.3.** 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 re-appearance examination at a time. The candidate who has completed the tenure of four years in the B.Sc. (Hons.) Agriculture Degree Programme (private candidate) cannot appear for more than 16 subjects in the re-appearance examination at a time.

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

## **13. Malpractices in examinations**

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

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



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

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

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

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

**14.3 Ragging-An offence:** Extract of Tamil Nadu Government Gazette - Extra ordinary dt. 29.01.1997 (Tamil Nadu Prohibition of Ragging Act, 1997). In this Act, unless the context otherwise requires, "Ragging" means display of noisy, disorderly conduct, doing any act which causes or is likely to cause physical or psychological harm or raises apprehension or fear or shame or embarrassment to a student in any educational Institution and includes: teasing, abusing or playing practical jokes on or causing hurt to such student or asking the student to so any act or perform something which such student will not, in the ordinary course willingly act or perform. Ragging within or outside any educational institution is prohibited. Whoever directly or indirectly commits, participates in, abets or propagates "Ragging" within or outside any educational institution, shall be punished with imprisonment for a term which may extend to two years and shall also be liable to fine which may extend to ten thousand rupees.

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

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

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

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

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

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

The candidates should have undergone successfully the prescribed course of study in the University. They shall further be required to have completed and passed 180 course credits and shall have earned an overall grade point average (OGPA) of 6.50 out of 10 for all courses completed in B.Sc. (Hons.) Agriculture

degree programme. In addition to the above, students shall in the judgment of the Faculty, possess good conduct and character.

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

#### **15.1. Class ranking**

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

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

#### **16. Transitory Regulations**

Separate time table of course work under old semester system will be arranged by the 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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## PROGRAMME OUTCOMES

### GGEN42 B.Sc. (Hons) Agriculture

<p><b>1.</b> Graduate will acquire detailed basic and applied knowledge on crop cultivation, crop improvement, seed production, management of abiotic-stress, soil reclamation, plant protection, farm machinery, renewable energy, livestock production and allied socioeconomic aspects concerned with field and horticultural crops and necessary skills and hands-on experience for entrepreneurship venture, higher studies and research in all frontier areas of agriculture.</p>
<p><b>2.</b> Graduate will be able to develop expertise in the various techniques and illustrate efficiency in identifying soil types, weeds, crops and varieties, seeds, fertilizers, pesticides, disease symptoms and insect pests and proposing farm budgeting, and irrigation and nutrient schedules.</p>
<p><b>3.</b> Graduates will be the successful professionals in agro-industries with problem solving skills, critical thinking, market intelligence and decision-making and will be able to organize, facilitate and participate effectively and demonstrate innovativeness and creativity.</p>
<p><b>4.</b> Graduates will function as an effective member or leader in diverse teams of knowledge dissemination regarding various farming techniques and commercial aspects of agriculture.</p>
<p><b>5.</b> Graduates will learn appropriate traditional/Indigenous and modern techniques and understand the current problems which are necessary for future goals in agriculture. Further, they will have absolute idea about energy flow, waste management, environment related enforcements and eco system management.</p>
<p><b>6.</b> Graduate will gain accurate and relevant analytical skills of problems and will have capacity to interpret information, analyze data and draw appropriate statistical conclusions, respond and adapt to changing situations and to understand the ethical standards.</p>

### PO and Co Mapping Matrix

AFFINITY LEVELS	
1	Low
2	Moderate/ Medium
3	Substantial/High

### Abstract of Distribution Pattern of Courses and Credit

Semester	Number of Courses	Credit
I	9	6+9 = 15
II	9	12+9 = 21
III	9	16+9 = 25
IV	10	14+10 = 24
V	10	17+10 = 27
VI	11	18+9 = 27
VII	6	0 +21 = 21
VIII	2	0+20 = 20
<b>Total</b>		<b>83+97 = 180</b>

## Semester-wise Distribution of Courses and Credit

### I Semester

S. 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; ntshz;ika[k; mwptpay; jkpH;g; gad;ghLk; (OR) Development Education	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 (or) NCC 118	National Service Scheme (OR) National Cadet Corps	0+1
<b>Total</b>			<b>6+9=15</b>

### II Semester

S. No.	Course code	Title	Credit
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

S. No.	Course code	Title	Credit
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

S. No.	Course code	Title	Credit
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

S. No.	Course code	Title	Credit
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

S. No.	Course code	Title	Credit
1.	AGR 310	Farming System, Organic Agriculture, Agroforestry and Dry Farming	3+1
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>17+ 10=27</b>

#### VI Semester

S. No.	Course code	Title	Credit
1.	AGR 320	Climate Change and Disaster Management	1+0
2.	AGR 321	Crop Production-II	0+1
3.	AEG 322	Post Harvest Technology and Value Addition of Field Crops	2+0
4.	PAT 323	Diseases of Field and Horticultural Crops and Their Management	3+1
5.	SAC 324	Crops and Pesticide Chemistry and Nanotechnology	2+1
6.	GPB 325	Breeding of Field and Horticultural Crops	2+1
7.	HOR 326	Production Technology of Vegetables, Spices, Flowers and Landscape Gardening	3+1
8.	AEC 327	Agricultural Finance, Banking and Co-operation	1+1
9.	AEX 328	Extension Methodologies and Transfer of Agricultural Technology	1+1
10.	GPB 329	Principles of Seed Production, Seed Quality Regulation and Storage	2+1
11.	OPC XXX 001	Optional Course*	1+1
<b>Total</b>			<b>18+9=27</b>

#### VII Semester

S. No.	Course code	Title	Credit
1.	RAWE AEX 410	Village attachment and Technology Transfer	0+5
2.	RAWE AGR 411	Agronomical Interventions	0+3

S. No.	Course code	Title	Credit
3.	RAWE HOR 412	Horticultural Interventions	0+2
4.	RAWE CPT 413	Crop Protection Interventions (Entomology and Plant Pathology)	0+4
5.	AEX 414	All India Tour	0+1
6.	AIA AEC 415	Agro Industrial Attachment	0+6
<b>Total</b>			<b>0+21= 21</b>

### VIII Semester

S. No.	Course code	Title	Credit
1.	EXP XXX 42X	Experiential Learning I <sup>#</sup>	0+10
2.	EXP XXX42X	Experiential Learning II <sup>#</sup>	0+10
<b>Total</b>			<b>0+20=20</b>

### \*Registration of Optional Courses OPC XXX 001

The optional courses are to be registered by B.Sc. (Hons.) Agriculture students. A student can select one optional course during VI semester from the list of optional courses offered as detailed below. If more number of students opts for a particular optional course then OGPA of the student is to be considered.

Sl. No.	Course No.	Optional Course	Credit	Department offering the course
1.	OPC AGR 001	Indigenous Technology in Agricultural Production	1+1	Agronomy
2.	OPC ENT 001	Industrial Entomology	1+1	Entomology
3.	OPC PAT 001	Emerging Trends in Plant Disease Management	1 +1	Plant Pathology
4.	OPC AGM 001	Advanced Microbial Biotechnology	1+1	Microbiology
5.	OPC SAC 001	Farm Advisory on Soil Health, Water Quality and Plant Nutrition	1+1	Soil Science and Agrl. Chemistry
6.	OPC GPB 001	Plant tissue culture	1+1	Genetics and Plant Breeding
7.	OPC HOR 001	Supply Chain Management, processing and Value Addition in Horticulture Crops	1+1	Horticulture
8.	OPC AEC 001	Agricultural Project Management	1+1	Agri. Economics
9.	OPC AEX 001	Advertising Technology	1+1	Agri. Extension
10.	OPC AHS 001	Goat Rearing and Management	1+1	Animal Husbandry

**#Registration of Experiential Learning EXP XXX 42X**

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

S. No.	Course No.	Title	Credit
1.	EXP AGR 421	Production of Liquid Organic Formulations	0+10
2.	EXP AGR 422	Seed Production of Legumes/Green Manure/Fodder	0+10
3.	EXP ENT 421	Bio Pesticides and Biocontrol Agents Production Technology	0+10
4.	EXP ENT 422	Commercial Apiculture	0+10
5.	EXP ENT 423	Commercial Sericulture	0+10
6.	EXP PAT 421	Mushroom Culture	0+10
7.	EXP PAT 422	Biological Control of Plant Diseases	0+10
8.	EXP AGM 421	Microbial Inoculants Production and Quality Control	0+10
9.	EXP AGM 422	Composting Technologies for Sustainable Agriculture	0+10
10.	EXP SAC 421	Hands on Training for Soil, Water and Plant Analysis	0+10
11.	EXP SAC 422	Hands on Training on Soil Constraints and Its Management for Sustainable Crop Productivity	0+10
12.	EXP GPB 421	Commercial Seed Production in Vegetable Crops	0+10
13.	EXP GPB 422	Seed Production Techniques in Field Crops	
14.	EXP HOR 421	Organic Vegetable Production	0+10
15.	EXP HOR 422	Commercial Horticultural Nursery	0+10
16.	EXP HOR 423	Commercial Landscaping	0+10
17.	EXP HOR 424	Processing and Value Addition of Horticultural Crops	0+10
18.	EXP AEC 421	Marketing Skills for Agri Professionals	0+10
19.	EXP AEC 422	Managerial Skills for Agripreneurs	0+10
20.	EXP AEX 421	Extension and Communication Skills	0+10
21.	EXP AEX 422	Transformation through Extension Programme Planning	0+10
22.	EXP AHS 421	Broiler Production	0+10
23.	EXP AHS 422	Japanese Quail Production	0+10
24.	EXP AHS 423	Technology of Value-added Milk Products	0+10



### Abstract of Department-wise Credit

Departments/Division	Credit hours		
Agronomy	15 +	13	= 28
Entomology	8 +	6	= 14
Plant Pathology	6 +	5	= 11
Microbiology	6 +	3	= 9
Soil Science and Agricultural Chemistry	11 +	6	= 17
Genetics and Plant Breeding	13 +	7	= 20
Horticulture	7 +	5	= 12
Agricultural Economics	5 +	11	= 16
Agricultural Extension	3 +	9	= 12
Animal Husbandry	2 +	1	= 3
Statistics	1 +	1	= 2
Engineering	5 +	3	= 8
Languages (Tamil, English)	0 +	3	= 3
Common Courses	1 +	24	= 25
<b>Total</b>	<b>83 +</b>	<b>97</b>	<b>= 180</b>

### List of Courses Offered (Department-wise) Department of 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	Farming System, Organic Agriculture, Agro forestry and Dry farming	3+1
9.	V	AGR 311	Crop Production-I	0+1
10.	VI	AGR 320	Climate Change and Disaster Management	1+0
11.	VI	AGR 321	Crop Production-II	0+1
12.	VI	AGR 322	Post Harvest Technology and Value addition of Field Crops	2+0
13.	VII	RAWE AGR 411	Agronomical Interventions	0+3
<b>Total</b>				<b>15+13= 28</b>

### Department of 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>

### Department of 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 323	Diseases of Field and Horticultural Crops and their Management	3+1
4.	VII	RAWE CPT 413	Crop Protection (Entomology and Plant Pathology)	0+2
<b>Total</b>				<b>6+5=11</b>

### Department of Agricultural Microbiology

S. 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>

### Department of Soil Science and Agricultural Chemistry

S. 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 324	Crop and Pesticide Chemistry and Nanotechnology	2+1
<b>Total</b>				<b>11+6 =17</b>

### Department of Genetics and Plant Breeding

S. 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 325	Breeding of Field and Horticultural Crops	2+1
7.	VI	GPB 329	Principles of Seed Production, Seed Quality Regulation and Storage	2+1
<b>Total</b>				<b>13+7=20</b>

### Department of Horticulture

S. 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 326	Production Technology of Vegetables, Spices, Flowers and Landscape Gardening	3+1
4.	VII	RAWE HOR 412	Horticultural Interventions	0+2
<b>Total</b>				<b>7+5=12</b>

### Department of Agricultural Economics

S. 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 327	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>

### Department of Agricultural Extension

S. 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 328	Extension Methodologies and Transfer of Agricultural Technology	1+1
4.	VII	RAWE AEX 410	Village attachment and Technology Transfer	0+5
5.	VII	AEX 414	All India Study Tour	0+1
<b>Total</b>				<b>3+9=12</b>

### Division of Animal Husbandry

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

### Department of Statistics

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

### Division of Computer Science & Information Science (Faculty of Engineering)

S. No.	Semester	Course code	Title	Credit
1.	I	COM 128	Fundamentals of Information Technology	1+1

### Department of Mechanical Engineering (Faculty of Engineering)

S. No.	Semester	Course code	Title	Credit
1.	IV	AEG 229	Farm Power, Machinery and Renewable Energy	2+1

### Department of Civil Engineering (Faculty of Engineering)

S. No.	Semester	Course code	Title	Credit
1.	V	AEG 319	Fundamentals of Soil and Water Conservation Engineering	2+ 1
<b>Total</b>				<b>5+3=08</b>

**Faculty of Indian Languages**

**(Department of Tamil Studies & Research and Department of English)**

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

**Common Courses**

S. 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	OPC XXX 001	Optional Course	1+1
5.	VIII	EXP 424	Experiential Learning - I	0+10
6.	VIII	EXP 424	Experiential Learning - I	0+10
<b>Total</b>				<b>1+24=25</b>

## SYLLABI

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

#### LEARNING OBJECTIVES:

- To know about the basic principles and practices of crop production
- To gain knowledge on various agricultural development from ancient to modern age
- To understand about various factors affecting crop production
- To acquire knowledge on basic agricultural operations *viz.*, seeds and sowing, after cultivation practices, irrigation and nutrient management
- To obtain awareness on harvesting, cleaning and storage of agricultural products.

#### 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 Arthashastra - Thirukural - Sangam literature - IITK -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 socioeconomic 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. **Current stream of developments**

#### 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- IITK
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**

#### **COURSE OUTCOMES:**

- CO 1:** To understand the basic principles and practices of crop production
- CO 2:** To gain knowledge on various agricultural development from ancient to modern age
- CO 3:** To critically assess the inter relationship between crop production and different factors affecting the production of crops
- CO 4:** To construct skills on basic agricultural operations viz., seeds and sowing, after cultivation practices, irrigation and nutrient management
- CO 5:** To understand about harvesting, cleaning and storage of agricultural products.

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

	<b>PO 1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3	-	2	-	1	-
<b>CO2</b>	3	-	2	-	-	-
<b>CO3</b>	3	2	1	1	2	-
<b>CO4</b>	3	1	-	-	-	-
<b>CO5</b>	1	-	-	-	2	-

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1. Balasubramaniyan, P. and SP.Palaniappan. 2010. Principles and Practices of Agronomy. Agrobios. Jodhpur - 342 002.
2. Sudhagar Rao, G.B., M. Thiruppathi., 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 SankaraReddi, G.H. 2010. Principles of Agronomy. Kalyani Publishers, New Delhi.

#### **E-RESOURCES**

1. [http://www.hillagric.ac.in/edu/coa/agronomy/lect/Teaching\\_Manual\\_on\\_Intrductory\\_Crop\\_Production.pdf](http://www.hillagric.ac.in/edu/coa/agronomy/lect/Teaching_Manual_on_Intrductory_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>

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

### LEARNING OBJECTIVES:

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

### THEORY

#### Unit -I: Introduction to Meteorology

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

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

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

#### Unit- III: Atmospheric pressure

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

#### Unit -IV: Clouds and Precipitation

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

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

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

### 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  $ET_o$  - Definition and their importance in agricultural production.
12. Weather forecasting / Warming - Types, importance, Agro Advisory Services, Agromet services for India
13. Agro climatic zones of Tamil Nadu - Agro climatic normals for field crops.
14. Synoptic chart
15. Crop weather calendar.
16. Remote sensing and its application on crop production.
17. Effect of weather and climate on crop production, soil fertility and incidence of pest and diseases.

#### **PRACTICAL SCHEDULE**

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

#### **COURSE OUTCOMES**

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

- CO 2:** To construct information about effect of solar radiation, temperature and relative humidity on crop production
- CO 3:** To comprehend knowledge with cyclones, EL Nino and La Nino
- CO 4:** To create awareness on cloud types, precipitation, drought, flood and evapotranspiration.
- CO 5:** To formulate cropping pattern for different Agro climatic zones of India and Tamil Nadu, importance of weather forecasting and remote sensing.

#### CO-PO MAPPING MATRIX

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

#### REFERENCES

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-RESOURCES

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)

#### LEARNING OBJECTIVES:

- To familiarize with the basic principles of Analytical Chemistry and instrumentation techniques.
- 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. **Current stream of developments.**

## **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  $\text{KMnO}_4$
6. Dichrometry – Standardization of Ferrous Sulphate
7. Iodimetry – Estimation of Copper
8. Complexometry – Estimation of Calcium and Magnesium
9. Principles of Gravimetry – Moisture Estimation
10. Potentiometry and Conductometry – Determination of pH and EC
11. Spectrophotometry – Determination of phosphorus
12. Turbidimetry – Estimation of Sulphur
13. Flame Photometry – Estimation of Potassium
14. Absorption spectrophotometry – Estimation of Fe / Zn / Mn / Cu
15. Identification of sub atomic particles, calculation of Half life and Activity Constant
16. Identification of types of radioactive decay
17. **Orientation for final examination**

## COURSE OUTCOMES

- CO 1:** Students gain knowledge on basic principles of analytical chemistry
- CO 2:** Students learn the techniques of standard preparations and various methods of qualitative and quantitative analysis
- CO3:** Students develop a conceptual understanding on the principles of different instrumental techniques followed for soil and plant analysis.

## CO-PO MAPPING MATRIX

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

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1. Sharma BK. 2012. Instrumental methods of chemical analysis, Goel Publishing House Meerut, 27<sup>th</sup> edition
2. Gary.O.Christian. 2007. Analytical Chemistry, Wiley Publication.
3. R.M.Verma. 2007. Analytical Chemistry, Theory and Practical, CBS Publisher.
4. Gurdeep R.Chatwal. 2015. Analytical Chemistry, Himalaya Publishing House.
5. Kirupadanam.G.L.D. Vijaya Prasad, O.Varaprasad. 2001. Analytical Chemistry, University Press
6. S.M.Khopkar. 2009. Basic concepts of Analytical Chemistry, New Age International Pvt. Ltd.
7. David Kealey. 2002. Bios instant notes in analytical chemistry, Taylor & Francis Publisher.
8. R.Gopalan, K.Rengarajan, P.S.Subramanian. Elements of analytical chemistry, Sultan Chand & Sons Publisher.

## E-RESOURCES

1. [http://en.wikipedia.org/wiki/Analytical\\_chemistry](http://en.wikipedia.org/wiki/Analytical_chemistry)
2. <http://www.scribd.com/doc/30296831/Instant-Notes-in-Analytical-Chemistry>



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

### LEARNING OBJECTIVES:

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

### THEORY

#### Unit I: Plant Water Relations

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

#### Unit II: Plant Mineral Nutrition

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

#### Unit III: Photosynthesis and Respiration

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

#### Unit IV: Growth and Development

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

#### Unit V: Stress Physiology

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

### 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**

#### **COURSE OUTCOMES:**

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

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

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

#### **REFERENCES**

1. Boominathan, P., R. Sivakumar, A. Senthil, and D. Vijayalakshmi. 2014. Introduction to Plant Physiology, A.E. Publications. Coimbatore
2. Jain, V.K. 2007. Fundamentals of plant physiology, S.Chand and Company Ltd., New Delhi.
3. Taiz. L. and Zeiger. E., 2010 (Fifth edition). Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

## E-RESOURCES

1. <http://www.plantphys.org>
2. <http://www.Biologie.Uni-hamburg.de/b-online>
3. <http://4e.plantphys.net>
4. [www.plantphysiol.org](http://www.plantphysiol.org)

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

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

### bra;Kiwg; gapw;rpfs;

1. bjhy;fhg;gpak; fhl;Lk; Kjw;bgHUs;/ fUg;bgHUs; tHpnTshz; kug[fismwpy;
2. r';f ,yf;fpaj;jpy; ntshz; bjhHpy; El;g';fs; - (vl;Lj;bjhif/ gj;Jg;ghl;L)
3. gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ikmwptpay;
4. gs;S ,yf;fpa';fs;/ VbuGgJ – cHth; thH;tpay; bewpKiwfSk; ntshz;ikj; bjhHpy; El;g';fSk;
5. ,yf;fpaj;jpy; ntshz; bgHwpapay; - njhl;ltpay; - tdtpay; - kidapay; - NHypay;
6. ntshz;ikg; gHbkhHpfs; - cHt[ tpijmwptpay; - ehw;WeLjy; - vU ,Ljy; - ePh;g;ghrdk; - fisnkyhz;ik – gap;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;wpvGJk; Kiwfs; - vGj;Jg; gpiHfs; - brhw;gpiHfs; - brhw; gphpg;g[g;gpiH – thf;fpag;gpiH – bka;g;gj; jpUj;jk;
11. ,yf;fpaj;jpy; bkd;jpwd;fs; - jiyikg;gz;g[ - fhynkyhz;ik
12. MSikg;gz;g[ nkk;ghL – kdpj cwt[j;jpwd;fs; tsh;j;jy;
13. mwptpay; jkpH; tsh;r;rpepiyfs;/ ntshz; E}y;fs;/ ntshz; ,jH;fs;
14. fiyr;brhy;yhf;fk; - ntshz; fiyr; brhw;fiscUthf;Fk; Kiw – jug;gLj;Jjy; - ,yf;fpantshz; fiyr;brhw;fs;/ tl;lhuntshz;iktHf;Fr; brhw;fs; - mfuhjpapay;
15. bkhHpbgah;g;g[ - Kf;fpapjpf; - goepiyfs; - bkhHpbgah;ghshpd; ,d;wpaikahg; gz;g[fs; - ntshz; bra;jpfisbkhHpbgah;j;jy;
16. Ml;rpj; jkpH; - murhizfs; mYtyf; foj';fs; - cHth;fSf;fhdmwptpg;g[f;fiSBtspapLjy; - fl;Liur; RUf;fk; vGJjy;
17. fZpdpcyfp; jkpH; - xU';FFwpaPLgapw;Wtpj;jy; - tiyg; g{f;fs; - tpf;fpgPoah – ntshz; bra;jpfisg; gjpntw;wk; bra;jy; - ntshz; bra;jpfis ,izajstHpmwpy;

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

- CO1: gz;ilaf; fhye;bjhl;L ,yf;fpa';fspy; fhzg;gLk; ntshz;ik Fwpj;j bra;jpfis mwpe;J bfhs;tu;/ mjd;tHp jw;fhy ntshz;ikf;fhd jPu;t[fs; fpilf;Fk;/
- CO2: gHbkhHpfs;. kug[j; bjhlu;fs; tHp ntshz;ik rhu;ej bra;jpfis mwpa[k; jpwd; bgw;wpUg;gu;/
- CO3: fiyr;brhw;fSf;fhd bgHuis mwpe;J bfhs;tjnhL. gpw bkhHpapypUe;J jkpGf;F ntshz;ik rhu;ej fiyr;brhw;fis cUthf;Fk; jpwd; khztu;fSf;F Vw;gLk;/
- CO4: ntshz;ik rhu;ej fl;Liufs; vGJtjw;fhd gapw;rp bfhl;fg;gLtjhy;. gpiHapd; El;gkhd tifapy; fl;Liufs; vGJtu;/
- CO5: ngr;Rg; gapw;rp mspf;fg;gLtjhy;. tptrhak; rhu;ej bra;jpfis Clf';fSf;F tpsf;fpf; TWk; mDgtk; Vw;gLfpwJ/

## CO-PO MAPPING MATRIX

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

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

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

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

### LEARNING OBJECTIVES:

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

### LECTURE SCHEDULE

1. Basic principles of learning. Binary terms viz - growth and development, education - for - life and life - long education, motivation and morale -
2. Occupation and profession, training and education, lateral thinking and convergent thinking, teaching and learning - discussion.
3. Bloom's classification of educational objectives - Cognitive, Affective, Psychomotor domain(s)
4. Career development - opportunity for graduates of agriculture and allied sciences - discussion
5. Success story of a farmer / entrepreneur - factors involved - role - play
6. Brainstorming - Demonstration
7. Simulation - Educational Simulation-Interactive Teaching - Business Simulation - Company's annual report for analysis
8. Interpersonal communication - Transactional communication - ice breaker
9. **Mid semester examination**

10. The conduct of a symposium
11. Conferencing – the concept and presentation of a paper
12. Scientific Article Writing and Editing
13. Popular Article Writing, Editing and Blogging
14. Project proposal
15. Project Report – writing
16. Entrepreneur – intrapreneur – Managing an intrapreneur – motivation and entrepreneurship development – planning, monitoring and evaluation.
17. **Orientation for final examination**

### **COURSE OUTCOME**

The student will be able to

- CO1:** Understand the basic principles of learning
- CO2:** Have carrier development either in agriculture or allied sciences
- CO3:** Write edit and blog scientific articles
- CO4:** Have ideas to prepare project
- CO5:** Have a knowledge of Entrepreneurship and intrapreneurship

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

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

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3. Day, A Robert 1993. "How to Write and Publish a Scientific Paper" CUP.
4. Hariharan.S. 1995. "Brainstorming and Interactive Learning" Research Quarterly, ADU, Coimbatore.
5. Krishna Mohan and Meera Banerji, 1990. "Developing Communication Skills", Macmillan Pub. Co., Ch.6, 9, 10, 13 and 15.
6. Mathew.M. Monipally. 1997. "The craft of Business Letter Writing". Tata McGraw Hill Pup., Ch. 10 and Appendix – I.
7. Seely John. 1988. "Communicating in Everyday Life". The Oxford Guide to Writing and Speaking, OUP. P.1-79.
8. Sudarsanam.R 1985. "Development Education" Chapter 1,2.
9. Taneja.R.P. 1991. Dictionary of Education, Anmol Pub., New Delhi, India.
10. Wallace, L.Michael 1998. "Study Skills in English" CUP Unit.4.

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

#### **LEARNING OBJECTIVES:**

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

- To impart effective and flawless writing skills to the students.
- To cultivate the students with good receptive, reading and productive skills.

### **Unit I - LISTENING**

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

### **Unit II - SPEAKING**

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

### **Unit III - READING**

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

### **Unit IV - WRITING**

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

### **Unit V**

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

## **PRACTICAL SCHEDULE**

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

16. Text conversion- Interpreting charts, graphs diagrams into text - Poster making - Essay writing ( types of essays)

**17. Orientation for final examination**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

- CO1:** Understand the nuances of the language skills.
- CO2:** Read different texts with improved skill
- CO3:** Speak and write in English effectively and flawlessly
- CO4:** Take part in group discussion activities with confidence
- CO5:** Face the challenging interviews with confidence. Become competent with effective communication skills.

**CO-PO MAPPING MATRIX**

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

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14. Team of authors - Cambridge BEC Vantage, 2005, Cambridge University.
15. Team of authors - Cambridge IELTS Books 1 to 5, 2006, Cambridge University.
16. Team of authors - Objective IELTS, 2006, Intermediate and Advanced, Cambridge University.
17. Team of authors -TOEFL ibt-2007-Barron.



## E-RESOURCES

1. [www.esl--lab.com](http://www.esl--lab.com)
2. [www.webenglishteacher.com](http://www.webenglishteacher.com)
3. [www.eflweb.com](http://www.eflweb.com)
4. [www.softskills.com](http://www.softskills.com)
5. [www.teachingenglish.org.uk](http://www.teachingenglish.org.uk)
6. [www.reportingskills.com](http://www.reportingskills.com)
7. [www.essays.com](http://www.essays.com)
8. [www.writing-skills.com](http://www.writing-skills.com)
9. [www.onestopenglish.com](http://www.onestopenglish.com)
10. [www.negotiation.com](http://www.negotiation.com)
11. [www.tealit.com](http://www.tealit.com)
12. [www.businessballs.com](http://www.businessballs.com)
13. [www.eltweb.com](http://www.eltweb.com)
14. [www.study-habits.com](http://www.study-habits.com)
15. [www.angelfire.com](http://www.angelfire.com)
16. [www.timethoughts.com](http://www.timethoughts.com)
17. [www.primesl.com](http://www.primesl.com)
18. [www.appliesl.com](http://www.appliesl.com)
19. [www.learnbusinessEnglish.com](http://www.learnbusinessEnglish.com)
20. [www.teachersdesk.com](http://www.teachersdesk.com)
21. [www.bogglesworld.com](http://www.bogglesworld.com)
22. [www.flexbilelearning.net.au](http://www.flexbilelearning.net.au)

## PED 116 PHYSICAL EDUCATION (0+1)

### LEARNING OBJECTIVES:

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

### SKILL DEVELOPMENT IN ANYONE OF THE FOLLOWING GAMES

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

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

**Volley Ball:** Fingering, under arm pass, over head pass, setting, spiking, back pass, jump pass, stunts, elementary dive, 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 paryobrine, 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.

#### Current stream of developments.

#### COURSE OUTCOMES

- CO 1:** Physical education encourage through games and sports sportsmanship, Co-operation loyalty, sociality, self-control, leadership, patriotism, friendship, kindness, sympathy, tolerance, forgiveness and other similar qualities.
- CO 2:** Physical Education helps to improve one's ability for work and self expression in the competitive condition of our modern life.
- CO 3:** Physical fitness is the combination of strength, flexibility, agility, power, speed, muscular endurance and cardio vascular endurance. It is the ability to enjoy our life and to achieve our goals without undue fatigue or stress. It is the production against the degenerative diseases and feeling of youthfulness, even when we are growing old.

#### CO-PO MAPPING MATRIX

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

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

### LEARNING OBJECTIVES:

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

### PRINCIPLES (20 hrs)

#### UNIT I

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

#### UNIT II

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

#### UNIT III

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

#### UNIT IV

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

#### UNIT V

Meditation and relaxation techniques: Meditation: Introduction - Meaning - Definition - Techniques -Obstacles - Benefits ; Relaxation techniques: IRT - QRT - DRT - Psychic sleep. **Current stream of developments.**

### PRACTICAL SCHEDULE (40 hrs)

1. Prayer - Starting and closing
2. Breathing practices for awareness : Hands in and out breathing,-Hand stretch breathing- Ankle breathing
3. Preparatory practices: Loosening practices- Forward and backward bending - Lateral bending-Alternate toe touching-spinal twisting; Jogging-Forward-Backward and Sideward
4. Suryanamaskar - Start with prayer/mantra - 12 poses
5. Asana: Standing -Periyaasana, Padhastasana, Trikonasana; Siting - Vajrasana,Paschimotasana, Ushtrasana, Vakrasana; Prone - Makrasana; Bhujangasana, Shalabasana, Dhanurasana; Supine - Uttanapadasana, Sarvangasana, Matyasana, Halasana, Chakrasana, Savasana
6. Pranayama -Kapalabathi,Sectional Breathing, NadiShuddhi, Sitkari, Sadanta, Nada-Anu-Sandana
7. Mudra - Chin mudra, Chinmaya mudra, Adhi mudra, Brahma mudra, Namaskara mudra, Maha mudra, Vishnu mudra/Nasiga mudra, Yoga mudra
8. Bandha -Jalandra Bandha, Uddiyana Bandha, Moola Bandha
9. Kriya -Kapalpathi, Trataka-Jothi trataka, Jatrutrataka; Neti-Jalaneti, Sutra neti; Dhouti -Vamana dhouti
10. Dhayana practice - Meditation
11. Relaxation -Instant relaxation technique (IRT); Quick relaxation technique (QRT); Deep relaxation technique (DRT)
12. Practical record preparation

## COURSE OUTCOMES

**CO 1:** Knowledge of Yoga Philosophy.

**CO 2:** Ability to establish the personal health and social health skills to apply.

**CO 3:** Appropriate application with practice of Asanas, Pranayama, Meditation and relaxation.

## CO-PO MAPPING MATRIX

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

## REFERENCES

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2. ShivanandaSaraswati, Yoga Therapy, Bihar School of yoga, Munger,1998
3. Swami SatyanandaSaraswati, Asana, Pranayama, Mudra and Bandha, Bihar School of Yoga , Munger, 2002
4. Swami Vishnu Devananda, Mantra and Meditation, International Sivananada Yoga centre, 2002
5. Hatha yoga Pradipika, Swami SatyanandaSaraswati, Bihar School of Yoga , Munger, 2004

## NSS/NCC 118 NATIONAL SERVICE SCHEME / NATIONAL CADET CORPS (0+1)

### 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. 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)**

#### **LEARNING OBJECTIVES:**

- The students will know basic understanding on the biology and ecology of weeds.
- The students will equip with the concepts and principles of weed control and its management.
- The students will learn about various herbicides, formulations and adjuvant.
- The students will attain information on mechanism and mode of action of herbicides, persistence of herbicides.
- The students will be trained to manage the weeds of field crops, aquatic and problematic weeds.

#### **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. **Current stream of developments.**

#### **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**

#### **COURSE OUTCOMES:**

- CO 1:** To create knowledge on facts and information from different sources, pertaining to weed biology and management and be able to explain how they are interrelated; demonstrated through successful completion of assignments.
- CO 2:** To critically assess different weed management strategies
- CO 3:** To synthesise idea about various herbicides, formulations and adjuvants
- CO 4:** To understand about mechanism and action of herbicides, persistence of herbicides.
- CO 5:** To construct information regarding management of weeds of field crops, horticultural crops, aquatic and problematic weeds.

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

	<b>PO 1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	2	2	2	1	1	-
<b>CO2</b>	3	2	2	-	-	-
<b>CO3</b>	-	-	2	-	2	-
<b>CO4</b>	-	-	-	-	2	-
<b>CO5</b>	2	1	2	1	2	2

#### **REFERENCES**

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/123456789/568Weeds and their control methods - Formatted.pdf](http://nsdl.niscair.res.in/123456789/568Weeds%20and%20their%20control%20methods%20-%20Formatted.pdf)

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

### **LEARNING OBJECTIVES:**

- The students will study the basic principles and practices of irrigation.
- The students will gain clear scientific knowledge on soil water plant relationship.
- The students will acquire knowledge on water requirement for various field crops.
- The students will learn about various methods of irrigation and improve irrigation efficiency.
- The students will study and understand how to use poor quality water for irrigation and importance of drainage.

### **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. **Current stream of developments.**

### **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**

#### **COURSE OUTCOMES:**

- CO 1:** To understand basic principles and practices of irrigation.
- CO 2:** To formulate ideas pertaining to soil water plant relationship.
- CO 3:** To evaluate water requirement for various field crops.
- CO 4:** To gain skill development on layout of different methods of irrigation and ways to improve irrigation efficiency.
- CO 5:** To analyse the quality of water for irrigation and formulate different drainage methods.

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

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

#### **REFERENCES**

1. Michael, A.M. 1997. Irrigation: Theory and Practice Vikas Publishers, 1997, New Delhi.
2. Thirupathi, M and R.Rex Immanuel. 2012. Irrigation and dry farming technology. Sri VelanPathippagam, 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, Ludhiyana.
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.

#### **E-RESOURCES**

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)**

#### **LEARNING OBJECTIVES:**

- To identify and distinguish insects from other closely related taxa
- To study about the relative position of insects in animal kingdom

- To explore the external morphology, anatomy, physiology and behaviour of insects
- To understand the classification of insects and to identify different groups of insects
- To study different methods of collection and preservation of insects

## **THEORY**

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

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

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

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

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

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

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

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

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

Distinguishing characters of agriculturally important orders of Endopterygota – Neuroptera (Chrysopidae, Myrmeleontidae, Mantispidae, Ascalaphidae), Megaloptera, Raphidioptera, Coleoptera (Cicindellidae, Carabidae, Dytiscidae, Curculionidae, Apionidae, Staphylinidae, Coccinellidae, Lampyriidae, Hydrophilidae, Scarabaeidae, Dynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae, Meloidae, 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, Cochliidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae, Metarbelidae and Hesperidae) and Hymenoptera (Tenthredinidae, Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Ichneumonidae, Braconidae, Platygasteridae, Bethyloidea, Evaniidae, Chalcididae, Encyrtidae, Eulophidae and Trichogrammatidae).

**Current stream of development in Morphology, Physiology and Taxonomy.**

## PRACTICAL

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

### Assignment:

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

## THEORY LECTURE SCHEDULE

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

20. Elementary knowledge on nerve impulse conduction – axonic and synaptic transmissions
21. Elementary knowledge on male and female reproductive systems in insects – structure and modifications. Spermatogenesis and Oogenesis. Structure of male and female genitalia
22. Types of reproduction – oviparous, viviparous, paedogenesis, polyembryony, ovoviviparous and parthenogenesis
23. Elementary knowledge on structure and functions of Exocrine and Endocrine glands
24. Structure of sense organs – types of sensilla – photoreceptors, chemoreceptors and mechanoreceptors
25. Taxonomy and systematics – Definition, importance and binomial nomenclature. Classification of insects – Apterygota, Pterygota, Endopterygota with examples
26. Distinguishing characters of orders Collembola, Protura, Diplura, Archaeognatha and Zygentoma.
27. Distinguishing characters of Paleoptera orders– Ephemeroptera and Odonata.
28. Distinguishing characters of Neoptera orders – Polyneoptera – Plecoptera, Dermaptera, Embioptera, Zoraptera, Orthoptera,
29. Distinguishing characters of orders Phasmatodea, Grylloblattodea and Mantophasmatodea, (Mantodea, Blattodea (Cockroach), Blattodea (Termites)
30. Distinguishing characters of Paraneoptera orders – Psocodea (free living), Psocodea (parasitic), Thysanoptera and Hemiptera
31. Distinguishing characters of order Endopterygotes – Neuroptera, Megaloptera, Raphidioptera, Coleoptera and families of agricultural importance
32. Distinguishing characters of order Strepsiptera, Mecoptera, Siphonaptera, Trichoptera and Diptera and their families of agricultural importance
33. Distinguishing characters of order Lepidoptera and families of agricultural importance
34. Distinguishing characters of order Hymenoptera and families of agricultural importance.

#### **PRACTICAL SCHEDULE**

1. Observations on segmentation and external features of grasshopper/cockroach/blister beetle
2. Practicing the methods of collection, killing, pinning, labelling, display and preservation of insects including immature stages. Preparation of riker mount.
3. Observations on various types of insect head orientation and antennae
4. Demonstration of mouth parts of cockroach and plant bug and study of mouth parts of female mosquito, honeybee, thrips, antlion grub, house fly and butterfly
5. Observations on the modifications in legs and wings (wing venation, regions, angles and wing coupling)
6. Observations on various types of abdominal appendages
7. Studies on the types of metamorphosis. Observations on immature stages of insects – Eggs, larvae and pupae
8. Demonstration of digestive system and male and female reproductive systems (grasshopper/cockroach)
9. Observation on distinguishing characters of Collembola, Protura, Diplura and Archaeognatha, Zygentoma, Ephemeroptera and Odonata. Plecoptera, Dermaptera, Embioptera, Zoraptera and Orthoptera (Acrididae, Tettiigonidae, Gryllidae and Gryllotalpidae).



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

#### **COURSE OUTCOMES:**

- CO1:** Describe characters of Arthropoda and Insecta, and their relationship and reasons for insect dominance
- CO2:** Explain morphology of insects, its appendages, their modifications, growth and development (metamorphosis) and behaviour
- CO3:** Describe anatomy and physiology of various systems of insects
- CO4:** Identify different orders of insects based on their diagnostic characters up to family level
- CO5:** Demonstrate different collection and preservation techniques of insects

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

	<b>PO 1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	2	2	3	2	2	2
<b>CO2</b>	2	2	1	2	3	2
<b>CO3</b>	3	3	2	3	2	1
<b>CO4</b>	2	3	3	1	2	3
<b>CO5</b>	3	3	1	1	2	3

#### **REFERENCES**

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2. Norman F. Johnson, Charles A. Triple Horn. 2004. *Borror and DeLong's Introduction to the Study of Insects* (VII Edition). Thomson Publication, New York. 888p.



3. Richards O.W. and R.G. Davies. 1977. *Imm's General Text Book of Entomology*, Vol. I and II. Chapman and Hall Publication, London. 692p.
4. Gullen, P.J. and P.S. Cranston. 2011. *The Insects – An Outline of Entomology* (IV Edition). Wiley- Blackwell. UK. 565p.
5. Selvanarayanan, V. and S. Arivudainambi. 2004. *Introductory Entomology*. Manivasagar Padhippagam, Chennai. 262p.

## E-RESOURCES

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

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

### LEARNING OBJECTIVES:

- To enable better understanding of students about the microscopic world around them
- To acquaint students with the basic laboratory techniques and tools of microbiology
- To introduce the fundamentals characteristics of various microorganisms
- To develop experimental skills, such as handling, various microorganisms, culturing & maintenance of Microorganisms

### THEORY

#### Unit I. History of Microbiology

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

#### Unit II. Microbiological Techniques

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

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

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

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

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

## Unit V. Viruses, Bacterial Genetics and Immunology

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

### PRACTICAL

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

### THEORY LECTURE SCHEDULE

1. Definition and scope of microbiology - Development of microbiology as science
2. Biogenesis and a biogenesis theory. Contributions by Antonie Van Leeuwenhoek, Louis Pasteur
3. Contributions of John Tyndall, Joseph Lister, Edward Jenner, Robert Koch, Alexander Fleming and Waksman. Germ theory of fermentation and disease
4. Microscopy; principles - resolving power and magnification. Light microscopy
5. Different types of microscopes - UV, Dark Field, Phase Contrast, Fluorescence and Electron Microscopes; Atomic and Confocal Scanning Laser Microscopy
6. Staining techniques - principle and types of stains staining techniques- simple, negative, differential and structural staining methods
7. Sterilization - principle - physical agents and chemical methods
8. Isolation and enrichment culture techniques; preservation techniques
9. Evolutionary relationship - Position of microbes in living world - concepts and developments in classification of microorganisms
10. Groups of microorganisms prokaryotes and eukaryotes
11. Archaea - ecology; differences among archaea, eubacteria and eukaryotes
12. Systematic bacteriology Bergey's manual of systematic bacteriology - outline only
13. Cell biology; size, shape, structure and arrangement of cells
14. External structures in bacteria and their functionality
15. Functional anatomy and reproduction in bacteria
16. Morphology of fungi - economic importance
17. Morphology of algae - economic importance
18. **Mid Semester Examination**
19. Bacterial growth population growth and growth cycle - continuous culture - chemostat and turbidostat; synchronous culture
20. Conditions for growth temperature requirements aerobes and anaerobes - factors influencing growth and methods of assessment of growth
21. Nutritional types of bacteria; energetic in bacteria. Metabolic diversity/ pathways specific to bacteria
22. Microbial metabolism- Energy generation by substrate level phosphorylation, oxidative and Photo phosphorylation
23. Aerobic respiration and anaerobic respiration
24. Fermentative mode of respiration
25. Viruses and their properties; types of viruses
26. Bacteriophages - lytic and lysogenic and temperate phages

27. Mutation in bacteria – principles and types
28. Mutagens – physical, chemical and biological
29. Genetic recombination – competency transformation
30. Genetic recombination by Conjugation – concept of Hfr
31. Genetic recombination by Transduction – generalized and specialized
32. Basic concepts of Immunology
33. Immunology – principles – specific and non specific defense
34. Antigen – antibody reactions – vaccines applications

### **PRACTICAL SCHEDULE**

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

### **COURSE OUTCOMES:**

- CO 1:** Students gained knowledge on the basic and applied aspects of understanding and exploitation of microorganisms for the welfare of human kind.
- CO 2:** Students gained knowledge on the historical developments and contributions of some scientist in the field of microbiology.
- CO 3:** Students exposed practical hands on experience in the basic skills employed in microbiological laboratories, which will equal them to carryout independent research in microbiological/ biotechnology in feature.
- CO 4:** Students thoroughly exposed to modern approaches in classification, nutrition, cytology, cultivation, purification and preservation of microorganisms.
- CO 5:** Students gained knowledge on biotechnological principle like genetic recombination, Immunological science and vaccines.

### **CO – PO MAPPING MATRIX**

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

## REFERENCES

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.
5. Prescott, Harley and Klein, 2013. Microbiology, 9<sup>th</sup> edition, McGraw Hill Publishing
6. Michael J. Pelczar, JR., E.C.S. Chan, Noel R.Krieg, 2005. Microbiology

## E-RESOURCES

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

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

### LEARNING OBJECTIVES:

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

### THEORY

#### Unit I- Carbohydrates

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

#### 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. **Current stream of developments.**

### **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. **Mid Semester Examination**
18. Physical and chemical constants of oils. Rancidity of oils.
19. Carbohydrate metabolism - breakdown of starch by amylases
20. Glycolysis - Reactions and bioenergetics.
21. TCA cycle - Reactions and bioenergetics.
22. Pentose phosphate pathway - Reactions.
23. Respiration - electron transport chain and oxidative phosphorylation.
24. Lipid metabolism - lipases and phospholipases.
25. Beta-oxidation of fatty acids and bioenergetics.
26. Biosynthesis of fatty acids and triacylglycerol.
27. Transamination, deamination and decarboxylation of amino acids.
28. Ammonia assimilating enzymes - GS, GOGAT and GDH.
29. Metabolic inter-relationship.
30. Secondary metabolites - occurrence, classification and functions of phenolics.
31. Occurrence, classification and functions of terpenes and alkaloids.
32. Vitamins - Definition - general characteristics and classification.
33. Plant Hormones - definitions - Roll of Auxins, Gibberellins in plants.
34. Cytokinins and other natural growth hormones and inhibitors in plants.

### **PRACTICAL SCHEDULE**

#### **I. Qualitative tests for carbohydrates**

1. Identification of glucose and fructose

2. Identification of sucrose and maltose
3. Identification of lactose
4. Identification of dextrin
5. Identification of starch
6. Scheme for identification of unknown carbohydrates

## II. Quantitative analysis of carbohydrates

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

## III. Analysis of proteins

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

## IV. Analysis of lipids

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

## V. Vitamins

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

### COURSE OUTCOMES :

- CO 1:** Students gain knowledge about the biochemistry of amino acids, proteins, sugars, carbohydrates, and lipids.
- CO 2:** Students develop a conceptual understanding of different biochemical processes and metabolic pathways specific to plants
- CO 3:** Students learn about the various quantitative aspects of biochemistry including enzyme kinetics, protein ligand binding, analytical techniques, and bioenergetics.

### CO-PO MAPPING MATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	-	-	-	-
CO2	1	-	-	-	1	-
CO3	1	-	-	-	-	-

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

#### LEARNING OBJECTIVES:

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

#### 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, Areaceae 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; Areaceae: 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. **Current stream of developments.**

#### 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
2. nomenclature and its major guidelines - author citation - Agricultural classification of crops
3. General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf
4. Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation , types of fruits.
5. List of cultivated crops, economic parts, chromosome number and family description of Poaceae; Key botanical features of Rice and Wheat.
6. Key botanical features of sorghum, maize, pearl millet and finger millet. List of small millets
7. Key botanical features of Guinea grass, Napier grass, *Cenchrus* and sugarcane.
8. List of cultivated crops, economic parts, chromosome number and family description of (Papilionaceae) Key botanical features of Red gram, Bengal gram and Soybean
9. Key botanical features of Black gram, Green gram, Cowpea, Lab lab, Horse gram and Groundnut.
10. **Mid Semester Examination**
11. Key botanical features of Lucerne, *Stylosanthes*, Clitoria, Agathi, and Sunnhemp.
12. List of cultivated crops, economic parts, chromosome number and family description of Pedaliaceae and Asteraceae: Key botanical features of Gingelly, Sunflower, Safflower.
13. 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
14. 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.
15. List of cultivated crops, economic parts, chromosome number and family description of Tiliaceae, Piperaceae and Chenopodiaceae; Key botanical features of Jute, Betelvine, Sugar beet.
16. 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
17. 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
18. 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.

## COURSE OUTCOMES

- CO 1:** The student will be able to characterize crops based on its anatomical characters such as root, shoot, leaf venation etc.
- CO 2:** Will be able to classify the plant species based on its economic importance
- CO 3:** The student will be able to identify the family to which a particular crop belongs to.
- CO 4:** Botanical features and economic importance of different crop plants belonging to 20 families will be exposed.

## CO-PO MAPPING MATRIX

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

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2. Sambamurthy, V.S. and N.S. Subramanian, 1989. Text Book of Economic Botany, Wiley Eastern, New Delhi

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2. Society and Longman Co., Singapore
3. Purse glow. 1988. Tropical Crops - Dicotyledons. The English language book Society and Longman Co., Singapore.
4. Albert F. Hill and O.P. Sharma, 1996. Economic Botany. Tata McGraw - Hill Publishing Co. Ltd., New Delhi.
5. 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)

### LEARNING OBJECTIVES

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

### THEORY

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

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

#### Unit II: Theory of Consumption

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

#### Unit III: Theory of Production

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

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

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

#### Unit V: Macroeconomic Concepts

Macroeconomics: Definition and subject matter - National income: Concepts - GNP, GDP, NNP, disposable income and per capita income. Money: Definition, types and functions of money. Inflation: Meaning - Types of inflation. Public finance: Meaning

- Principles - Public revenue: Meaning - Classification of taxes - Canons of taxation - Public expenditure: Principles. Welfare Economics - Meaning. **Current stream of developments.**

### **PRACTICAL**

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

### **THEORY LECTURE SCHEDULE**

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

- GNP, GDP, NNP, disposable income and per capita income - Money: Definition, Types and functions of money - Inflation: Meaning and Types of inflation.
17. Public Finance: Meaning, Principles - Public revenue: Meaning, Classification of taxes - Canons of taxation - Public expenditure: Principles. Welfare Economics: Meaning.

### **PRACTICAL SCHEDULE**

1. Exercise on Law of Diminishing Marginal Utility.
2. Exercise on Law of Equi-Marginal Utility.
3. Indifference curve analysis and consumer equilibrium.
4. Law of Demand, demand schedule - Graphical derivation of individual and market demand.
5. Estimation of own price, income and cross price elasticities of demand.
6. Estimation of Consumer surplus.
7. Illustration on Engel's Law of Family Expenditure.
8. Law of supply - Estimation of supply elasticity.
9. Equilibrium price determination.
10. Types and functions of money.
11. Inflation: Analysis of causes of inflation and control measures.
12. Approaches to computation of national income.
13. Study of structural changes in the economy.
14. Food grain production in India - Growth rate analysis.
15. Study of demographic changes in India.
16. Measures of human development: Welfare indicators - Human Development Index (HDI) and Physical Quality of Life Index (PQLI).
17. **Orientation for final examination**

### **COURSE OUTCOMES:**

At the end of the course students will be able to

- CO 1:** Understand the important concepts on micro and macro economics.
- CO 2:** To know the principles of economics, concepts like GDP, GNP, Inflation.
- CO 3:** To acquire the practical exposure on application of economic principles related to agriculture.
- CO 4:** To work out the measurement of Human Development Index, welfare indicators.

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

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

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

### **LEARNING OBJECTIVES:**

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

- Basics concepts related to rural sociology
- Basics concepts related to educational psychology.
- 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.

#### **Current stream of developments.**

### **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).
- 11 and 12.Processing of data and presentation of reports.
- 13 and 14.Practicing Personality measurement techniques (Group exercise).
- 15 and 16.Practicing Intelligence measurement techniques (Group exercise).

### **17.Orientation for final examination**

#### **COURSE OUTCOMES :**

**At the end of the course students will be able to**

- CO 1:** Understand basics concepts related to rural sociology and educational psychology.  
**CO 2:** Gain expertise on practical applications of sociological and psychological concepts.  
**CO 3:** Gain expertise on application of various psychological tests.  
**CO 4:** Develop Leadership skills

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

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

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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**

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

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

#### **LEARNING OBJECTIVES**

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

#### **THEORY**

##### **UNIT I: COMPUTER BASICS**

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

##### **UNIT II: OPERATING SYSTEM AND SOFTWARE**

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

##### **UNIT III: COMPUTER NETWORKS AND INTERNET**

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

##### **UNIT IV: COMPUTER PROGRAMMING AND LANGUAGES**

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

##### **UNIT V: DATABASE MANAGEMENT SYSTEMS**

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

### **THEORY LECTURE SCHEDULE**

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

### **PRACTICAL SCHEDULE**

- 1 Working with basic Computer Hardware
- 2 Number System conversion : Decimal, Binary, Octal, Hexa Decimal, Binary addition and subtraction.
- 3 Conversion between bits, bytes, kilobits, kilobytes, megabits, megabytes, gigabits, gigabytes.
- 4 Working with MS DOS commands
- 5 Working with Windows Operating system
- 6 Working with Linux Operating System
- 7 Working with Word Processing Software
- 8 Working with Presentation Software
- 9 Working with Spreadsheet Software
- 10 Working with Image Editing Software

- 11 Working with basic networking commands
- 12 Working with Web Browsers and Search Engines
- 13 Working with Emails
- 14 Working with Programming basics : Algorithm, Flowchart, Pseudo Code and Coding
- 15 Working with DBMS softwares
- 16 Working with SQL commands
- 17 Orientation for final examination

#### **COURSE OUTCOMES:**

**At the end of the course students will be able to**

- Co1:** Know the basic components of the computer and working of each device  
**Co2:** Understand the representation of data in computer.  
**Co3:** Know the fundamentals of Computer Networking and Database.  
**Co4:** Performing common basic functions like editing, formatting, printing, scanning etc using tools.

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

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

#### **REFERENCES**

1. Pearson , Introduction to Information Technology, 2013 Second Edition, ITL Education Solutions Limited.
2. Pearson , Express Learning: Introduction to Information Technology, 2012 Edition, ITL Education Solutions Limited.

#### **E-RESOURCES**

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

### **III SEMESTER**

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

#### **LEARNING OBJECTIVES:**

- The students will gain knowledge about economic importance, origin, soil and climatic requirement of cereals viz.,Rice, Wheat, Maize, Barley, Oat, Rye and Triticale
- The students will acquire knowledge about importance of minor millets and its cultivation practices
- The students will learn about various constraints of pulse production and production technologies for various pulse crops
- the students will acquire knowledge on agronomical aspects of cereals, legume and perennial fodders and its preservation
- The students will be familiar with importance and cultivation aspects of green and green leaf manures

#### **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, Pearl millet, Forage crops: Guinea grass, Cumbu - Napier, Water grass, Buffalo grass, Elephant grass, Kolukkattai grass, Lucerne, Berseem, Desmanthus, Stylosanthes 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, Kalinga, Glyricidia, Subabul, Pungam, Poovarasu and Neem - Origin, economic importance, soil and climatic requirement, Varieties, cultural practices and yield. *In situ* incorporation of green manures. **Current stream of developments.**

### **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, Guinea grass and water grass - Economic importance, soil and climatic requirement, varieties, cultural practices and yield.
  28. Forage crops - Buffalo grass, Elephant grass, Kolukkattaigrass - 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. *In situ* 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.**

## COURSE OUTCOMES:

- CO 1:** To understand the importance of food grain requirement and cultivation of major cereal crops
- CO 2:** To gain knowledge about importance of minor millets and its cultivation practices
- CO 3:** To formulate legume based cropping system and production technologies for various pulse crops
- CO 4:** To construct idea regarding knowledge on growing of legume and perennial fodders and its preservation
- CO 5:** To create awareness about role of green manures in soil fertility

## CO-PO MAPPING MATRIX

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

## REFERENCES

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

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

### LEARNING OBJECTIVES:

- To explain species, morphology, anatomy and biology of bees and silkworms
- To understand the rearing techniques of honey bees, silkworm, and lac insects.
- To discuss about minor productive insects and their uses.
- To describe helpful insects and their services, injurious insects and their impacts
- To study the basic morphology, biology and extraction techniques of important plant parasitic nematodes.

### THEORY

#### Unit-I: Apiculture

Economic classification of insects. Importance and history of apiculture, species of bees, morphology, anatomy–structural adaptations. Colony organization and life history – bee castes, duties, social behaviour, bee pasturage, bee foraging, communication, swarming. Apiary –selection of site-bee-keeping 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.

### **Current trends in Apiculture, Sericulture, Lac culture and Nematology.**

#### **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 flotation 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 –

12. Nursery preparation – Main field preparation – Methods of planting – Nutritional requirements – Water management – Pruning methods – Methods of harvesting – preservation of leaves – Pests of mulberry plants.
13. Mulberry silk worm rearing – rearing house – room and bed disinfectants – grainage.
14. Chawki rearing – feeding, cleaning and spacing, Rearing of late age worms – feeding, cleaning, spacing.
15. 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.
16. Pests and diseases of silkworm – symptoms – management practices.
17. Importance and history of Lac culture. Species of Lac insect.
- 18. Mid Semester Examination.**
19. Morphology, biology and secretion of lac.
20. Host plants of lac insect – maintenance of host plants. Inoculation of Lacinsect and Yield. Enemies of lac insect.
21. Lac processing – Seed lac – Button lac – Shellac. Lac products – Uses of lac.
22. Minor productive insects –Cochineal insect, Gall insect. Aesthetic, Scientific and Medicinal value of insects
23. Forensic entomology – Definition - insects used in criminal investigations-salient examples – their biology. Entomophagy – Definition – Edible insects and advantages. Insects as animal feed.
24. Helpful insects - Parasitoids, Predators, difference between predators and parasitoids, Types of parasitoids and parasitism.
25. Weed killers, pollinators, scavengers and soil builders.
26. Injurious insects – identification of insects injurious to human beings, cattle and poultry.
27. Identification and management of house hold insects
28. Nematology – Introduction – Brief history and development in India – Position of nematodes in animal kingdom.
29. Importance of plant parasitic nematodes and entomophilic nematodes –Economic loss in crop plants.
30. Elementary knowledge on morphology of nematode – cuticle, segmentation, cephalic regions.
31. Elementary knowledge on alimentary, excretory, reproductive systems, nervous system and sense organs.
32. Classification based on feeding habits and ecology. Taxonomy of important plant parasitic nematodes.
33. Biology and ecology of important plant parasitic nematodes – *Meloidogyne*, *Heterodera*, *Globodera*, *Tylenchulus*, *Hoplolaimus*, *Aphelenchoides*, *Xiphinema*
34. Biology and ecology of important plant parasitic nematodes – *Pratylenchus*, *Rotylenchulus*, *Radopholus* and *Ditylenchus*.
35. 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.

#### **COURSE OUTCOMES:**

- CO 1:** Discuss bee morphology, biology, behaviour and describe apiary selection, bee pasturage and management of bee colony (Apiculture)
- CO 2:** Explain silkworm types, voltinism, biology and define mulberry cultivation, rearing techniques of silkworms and cocoon harvesting and processing of silk (Sericulture).
- CO 3:** Describe biology, strains and cultivation of lac and depict minor productive insects and their uses
- CO 4:** Compare and contrast predators and parasitoids, express other helpful insects, their uses . Discuss insects injurious to humans, farm animals and other house hold insects and their menace
- CO 5:** Explain basic morphology and anatomy of nematodes and describe biology of major plant parasitic nematodes

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

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

#### **REFERENCES**

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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.

4. David, B.V. and Ramamurthy, V.V. 2010. *Elements of Economic Entomology* (Revised Edition). Namurtha Publications, Chennai. 624p.
5. Hariprasad, Y, R.Veeravel and R. Kannan. 2006. *Basics of Plant Nematodes*. Sowmi Publications. Chidambaram. 205p.
6. Jonathan, E.I. 2010. *Fundamentals of Plant Nematology*, Devi Publications, Triruchirapalli. 232p.
7. MujeeburRahmankhan and Shamim Jairajpuri, M. 2012. *Nematode Infestations - Part III: Horticultural Crops*, The National Academy of Sciences, India. 613p.

#### E- RESOURCES

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2. <http://www.agrimoon.com/agriculture-icar-ecourse-pdf-book/>
3. <http://nematologia.com.br/wp-content/uploads/2012/12/ifasfree.pdf>
4. <http://www.csb.gov.in/publications/books/>
5. <http://ilri.ernet.in/~iinrg/>
6. <http://www.agrimoon.com/agriculture-icar-ecourse-pdf-book/>
7. <http://nematologia.com.br/wp-content/uploads/2012/12/ifasfree.pdf>
8. Ronald N. Perry and Maurice Moens. 2006. *Plant Nematology*. CABI Publishing. 463 pages.

### PAT 212 FUNDAMENTALS OF PLANT PATHOLOGY (2+1)

#### LEARNING OBJECTIVES:

- To study the basic concepts of Plant Pathology and causes of plant diseases
- To know about pathogenesis and plant defense mechanisms
- To study the general characters and classification of fungal kingdom Protozoa
- To study the general characters and classification of Phylum Ascomycota and Basidiomycota
- Study of general characters of bacteria, virus, virusoids, algae

#### 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 (Euriotiales), Leotiomyces

(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. **Current Streams of developments.**

**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* (*Pestalotia*), *Pyricularia* (*Magnoportha*), *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*, *Peronospora*, *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 bunchy top
15. Phanerogamic parasites and non-parasitic diseases
16. Field visit
17. **Orientation for final examination**
18. Assignment: Students should submit 50 well-preserved disease specimens.

#### **COURSE OUTCOMES:**

**CO 1:** Aware of basic principles of Plant Pathology, causes and importance of crop diseases

**CO 2:** Having knowledge of pathogenesis and plant defense mechanisms

**CO 3:** Having in depth knowledge of fungal kingdom Protozoa

**CO 4:** Having in depth knowledge of Phylum Ascomycota and Basidiomycota

**CO 5:** Knowing the general characters of bacteria, virus, virusoids, algae

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

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

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1. Agrios, G.N. 2005. Plant Pathology – (5<sup>th</sup> Edition). Academic Press, New York.
2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2010. Introductory Mycology. John Wiley and Sons Ltd., New York.
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5. Dube, H.C. 2009. A Text Book of Fungi, Bacteria and Viruses, Vikas Publishing House Pvt., Ltd., New Delhi.
6. Mehrotra, R.S. and Aneja, K.R. 1990. An Introduction to Mycology, Wiley E. Ltd., New Delhi.
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#### **E-BOOKS**

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.

#### **E-RESOURCES**



1. [www.mycobank.org](http://www.mycobank.org)
2. [www.mycology.net](http://www.mycology.net)
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)**

#### **LEARNING OBJECTIVES:**

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

#### **THEORY**

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

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

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

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

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

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

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

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

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

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

#### **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-1I
- 9 Determination of particle size analysis- Bouyoucos Hydrometer
- 10 Determination of soil colour using Munsell color chart
- 11 Estimation of pH and EC in soil
- 12 Estimation of soil organic carbon
- 13 Estimation of CEC in soil
- 14 Estimation of exchangeable cations in soil- calcium and magnesium
- 15 Estimation of exchangeable cations- Potassium and Sodium
- 16 Determination of base saturation and interpretation
- 17 Record certification

### COURSE OUTCOMES:

**CO 1:** Students gain the knowledge origin of earth, weathering of rocks and minerals

**CO 2:** Students learn to explain soil formation and different soil forming processes.

**CO 3:** Students develop individual skills and ability to analysis the soil for Physical and Chemical properties.

### CO-PO MAPPING MATRIX

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

### REFERENCES

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

### E-RESOURCES

1. <http://www.sciencedirect.com/science/books>
2. [http://ftp.wcc.nrcs.usda.gov/H...soil order/soil-USDA-textural-class.pdf](http://ftp.wcc.nrcs.usda.gov/H...soil%20order/soil-USDA-textural-class.pdf)

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

### LEARNING OBJECTIVES:

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

### THEORY

#### Unit I: Cytology

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

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

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

## **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).
15. iv.) Duplicate dominant epistasis (15:1)
16. v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); Summary of epistatic ratios (i) to (vi).
17. Lethal genes, Pleiotrophy, penetrance and expressivity, phenocopy: Multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles.
- 18. Mid Semester Examination**
19. 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.
20. Structure of DNA – Watson and Crick model – Central dogma of life
21. Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication.
22. RNA types - mRNA, tRNA, rRNA; genetic code, protein synthesis - transcription. Translation
23. Regulation of gene expression – operon model of Jacob and Monad; Structural genes and regulator genes. Cistron, muton and recon;



24. Complementation test; exons, introns - split genes - Transposable genetic elements - Ac - Ds system in maize - Functional genomics, Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics
25. Mutation - characteristics of mutation - micro and macro mutation - CIB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.
26. Quantitative inheritance - Multiple factor hypothesis - Nilsson Ehle experiment on wheat kernel colour.
27. Polygenes - transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits.
28. Linkage - coupling and repulsion; Experiment on Bateson and Punnett - Chromosomal theory of linkage of Morgan - Complete and incomplete linkage, Linkage group.
29. Crossing over - significance of crossing over; cytological proof for crossing over - Stern's experiment; Factors controlling crossing over.
30. Strength of linkage and recombination; Two point and three point test cross.
31. Double cross over, interference and coincidence; genetic map, physical map.
32. 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.
33. Genic balance theory of Bridges, quantitative theory, hormonal theory, barr bodies, metabolic differentiation theory; Gynandromorphs - sex reversal in chicken
34. Sex linked inheritance - criss cross inheritance - reciprocal difference; holandric genes; sex influenced and sex limited inheritance.
35. 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**

#### COURSE OUTCOMES:

- CO 1:** The student will have knowledge in the basic principles of inheritance  
**CO 2:** Will be able to understand the modern concepts of genetics  
**CO 3:** Will have the capacity to work out the various classical examples in genetics, crossing over and their interactions  
**CO 4:** The student will be able to carryout cytological analysis in breeding populations

#### CO-PO MAPPING MATRIX

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

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4. Pundhansingh. 2014. Elements of Genetics. Kalyani Publishers  
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5. Benjamin Lewin. 2005. Genes IX Oxford University Press, Oxford.
6. Russel, P.J. 2000. Fundamentals of genetics. Addition Wesley Longman Publishers, USA
7. Daniel Sundararaj, G. Thulasidas and M.StephenDorairaj, 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai -15.
8. Strickberger. M.W. 1996. Genetics. Prentice-Hall of India Pvt. Ltd. New Delhi.
9. Singh, B.D. 2004. Fundamentals of Genetics, Kalyani Publishers, Chennai.

#### E-RESOURCES

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

### HOR 215 BASIC HORTICULTURE AND PLANT PROPAGATION (2+ 1)

#### LEARNING OBJECTIVES:

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

#### THEORY

##### Unit-I: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. **Current Streams of thought.**

## **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 - multil-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**

1. Visit to Orchard and study of different features of an orchard
2. Planning, layout and planting of horticultural crops
3. Machineries, tools and implements used for various horticultural operations
4. Media and containers for propagation of plants
5. Preparation of potting mixture, potting and repotting of plants
6. Seed treatment techniques
7. Preparation of nursery beds for raising rootstocks and seedlings
8. Demonstration of propagation through cutting
9. Demonstration of propagation through layering
10. Demonstration of propagation through grafting and top working
11. Demonstration of propagation through budding
12. Propagation through specialized plant parts
13. Bearing habits of horticultural crops
14. Special training and pruning practices followed in horticultural crops
15. Preparation of plant growth regulators and methods of application in horticultural crops
16. Visit to tissue culture laboratory and study of micropropagation protocols and hardening
17. Plant propagation structures including mist chamber, shade net, glass houses and poly houses and Orientation for final examination

#### **COURSE OUTCOMES**

**CO 1:** The student will be able to understand basics of plant propagation and nursery management techniques.

**CO 2:** Can demonstrate advanced propagation methods of horticultural crops.

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

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	2	2	1
CO2	2	3	2	2	2	3

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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)**

#### **LEARNING OBJECTIVES:**

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

#### **THEORY**

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

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

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

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

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

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

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

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

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

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

#### **PRACTICAL**

Problems on factor - product relationship - Determination of least cost combination - Determination of optimum product combination - Computation of cost concepts - Cost of cultivation and cost of production of agricultural crops, horticultural and livestock products - Methods of calculation of depreciation - Farm records and

accounts: Analysis of farm records and accounts - Farm inventory analysis: Valuation of farm assets - Net worth statement - Profit and loss statement - Cash flow statement - Preparation of complete and partial budgets - Preparation of farm plan - Graphical solution to linear programming problem.

#### **THEORY LECTURE SCHEDULE**

1. Production Economics: Definition and nature and scope - Farm Management: Definition - Objectives - Scope of farm management - Farm management decisions.
2. Production Economics Vs Farm Management - Basic terms and concepts: Resources - Fixed, variable, flow and stock resources - Choice indicator.
3. Factors of production - Types/Forms of production function - Linear, quadratic and cobb-douglas.
4. Factor - Product relationship: Meaning - Agricultural production function: Meaning, definition - Laws of Returns: Law of constant, increasing and decreasing returns.
5. Law of Diminishing Marginal Returns - Relationship between total, average and marginal products - Three stages of production function.
6. Elasticity of production - Determination of optimum input and output - Physical and economic optimum.
7. Cost principles and cost curves.
8. Economies of scale - Economies of size - Factor - Factor relationship: Meaning - isoquant: Definition - Types.
9. **Mid-Semester Examination**
10. Isoquant map - characteristics / properties - Factor intensity.
11. Marginal rate of technical substitution - Elasticity of factor substitution - Iso-cost line - Principles of cost minimization / Least cost combination of inputs.
12. Isoclines, ridgelines and expansion path - Effect of input price changes on the least cost combination - Returns to scale.
13. Product - Product relationship - Meaning - Production possibility curve - Marginal rate of product substitution.
14. Enterprise relationship: Joint products, complementary, competitive and supplementary products - Iso-revenue line - Optimum product combination - Principle of equi-marginal returns - Opportunity cost principle - Principle of comparative advantage - Minimum loss principle.
15. Farm planning: Meaning - Types - Elements - Farm planning procedure - Characteristics of good farm plan - Farm budgeting: Definition and types - Partial budgeting - Complete budgeting and cash flow budgeting - Limitations.
16. Types and systems of farming: Types - Specialized, diversified, and mixed farming - Systems of farming: Co-operative, collective, capitalist, state and peasant farming.
17. Risk and Uncertainty: Definition - Types of risk and uncertainty - safeguards against risk and uncertainty.

#### **PRACTICAL SCHEDULE**

1. Estimation of optimum input and output combination.
2. Computation of cost concepts
3. Determination of least cost combination.
4. Determination of optimum product combination
5. Cost of cultivation and cost of production of agricultural crops
6. Cost of cultivation and cost of production of horticultural crops
7. Cost of production of livestock products.
8. Depreciation: Methods of calculating depreciation.
9. Visit to private agricultural farm to collect data/ information on farm business.

10. Farm records and accounts: Analysis of farm records and accounts - types.
11. Farm inventory analysis – Methods of valuation of assets
12. Net worth statement - Profit and loss statement
13. Preparation of cash flow statement.
14. Preparation of complete and partial budgets
15. Preparation of farm plan.
16. Graphical solution to linear programming problem.
17. **Orientation for final examination**

#### **COURSE OUTCOMES:**

At the end of the course students will be able to

**CO 1:** Understand the concepts, nature and Scope of farm management

**CO 2:** Know the importance of farm planning and budgeting.

**CO 3:** Work out the cost of cultivation for different crops

**CO 4:** Importance of farm records and accounts and farm business analysis

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

#### **REFERENCES**

1. Doll, J.P. and F. Orazem, 1983. Theory of Production Economics with Applications to Agriculture, John Wiley, New York.
2. Johl, S.S. and Kapoor, T.R., 2000. Fundamentals of Farm Business Management, Kalyani Publications, India.
3. Panda, S.C., 2007. Farm Management and Agricultural Marketing, Kalyani Publications, Ludhiana, India.
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)**

##### **LEARNING OBJECTIVES:**

**To enable the students to learn about**

- Fundamentals of extension education.
- Extension systems in India.
- Programme planning and rural development.
- Extension activities of different organizations

##### **THEORY**

##### **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. **Current Streams of thought.**

### **PRACTICAL**

Visit to District Rural Development Agency (DRDA) to study the organizational set up and rural development programmes; Visit to Panchayat Union office to learn their functions; Exposure to 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 ShahariRozgar 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), MahilaSamridhi 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)
12. Visit to a village to collect data (Group exercise).
13. Visit to a village to collect data (Group exercise).
14. Visit to a village to collect data (Group exercise).
15. Preparation of report.
16. Preparation of report.

#### **COURSE OUTCOMES :**

At the end of the course students will be able to

- CO 1: Understand fundamentals of extension education.  
 CO 2: Understand extension systems in India.  
 CO 3: Gain expertise on various rural development programme.  
 CO4: Expose on Extension activities of different organizations.

#### CO-PO MAPPING MATRIX

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

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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.
7. Sanjay Prakash Sharma. 2006. Panchayat Raj, Vista International Publishing House, New Delhi.
8. Van den Ban, A.W and H.S. Hawkins. 2002. Agricultural Extension, CBS Publishers and Distributors, New Delhi.
9. Viswanathan Maithili. 1994. Women in Agriculture and Rural Development, Printwell, Jaipur.

#### E-RESOURCES

1. rural.nic.in
2. www.panchayat .gov.in
3. wcd.nic.in
4. moud.nic.in
5. mhupa.gov.in

### AHS 218 LIVESTOCK AND POULTRY MANAGEMENT (2+1)

#### LEARNING OBJECTIVES:

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

#### THEORY

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

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

##### Unit II: Dairy Cattle Management

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

### **Unit III: Sheep and Goat Management**

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

### **Unit IV: Swine Management**

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

### **Unit V: Poultry Management**

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

### **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**

### COURSE OUTCOMES:

- CO 1: Basic management practices of different livestock enterprises such as cattle, sheep, goat, pig and poultry..
- CO 2: Clean milk production and its impact on the society.
- CO 3: Modern rearing practices of sheep and goat for meat and milk production.
- CO 4: Management practices of swine, broiler and layer farming for egg and meat production
- CO 5: Integrated farming system (IFS) along with plantation and horticultural crops for income generation and entrepreneurship skill development.

### CO-PO MAPPING MATRIX

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

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9. Radostitis.O.M.,Gray,C.C.,Blood,D.C.andHinchcliff,K.W. 2000. A text book of the diseases of Cattle, Sheep, Pigs , Goats and Horses. IX edition,Book Power WB Saunders,London.
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### E-RESOURCES

1. [www.sciencecentral.com](http://www.sciencecentral.com)
2. [www.ansci.umn.edu/poultry/resources/layermgmt.htm](http://www.ansci.umn.edu/poultry/resources/layermgmt.htm)
3. [www.armsd.com/](http://www.armsd.com/)
4. [www.animalwebsites.co.uk](http://www.animalwebsites.co.uk)
5. [www.intervet.com/species/pigs/websites.aspx](http://www.intervet.com/species/pigs/websites.aspx)
6. [www.britishangoragoats.org.uk/management.htm](http://www.britishangoragoats.org.uk/management.htm)
7. [www.indiagoatfarm.com](http://www.indiagoatfarm.com)
8. [www.indiadairy.com](http://www.indiadairy.com)
9. [www.indiagronet.com](http://www.indiagronet.com)
- 10.[www.foodsci.uoguelph.ca](http://www.foodsci.uoguelph.ca)

## IV SEMESTER

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

#### LEARNING OBJECTIVES:

- The students will acquire the basic knowledge of scientific crop production of major oilseed crops.
- The students will gain knowledge about economic importance, origin, soil and climatic requirement of sugar crops viz., Sugarcane, Sugarbeet and Sweet sorghum
- The students will acquire knowledge about importance of fibre crops and its cultivation practices
- The students will learn about various production technologies for various tuber crops
- The students will be familiar with importance and cultivation aspects of Tobacco and Betelvine

#### 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. **Current Streams of thought.**

#### 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 harvestmanagement 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**

#### **COURSE OUTCOMES :**

- CO1: To understand the importance of oil seed production and cultivation of major oil seed crops
- CO2: To gain knowledge about importance of sugar crops and its cultivation practices
- CO3: To formulate different cropping system and production technologies for various fibre crops
- CO4: To construct idea regarding knowledge on growing of tuber crops
- CO5: To create awareness about narcotics crops and its production technologies

## CO-PO MAPPING MATRIX

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

## REFERENCES

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.

## E- RESOURCES

1. <http://nsdl.niscair.res.in/123456789/532Cotton - Formatted.pdf>
2. <http://nsdl.niscair.res.in/123456789/509LINSEED - FORMATTED.pdf>
3. <http://nsdl.niscair.res.in/123456789/512SUNFLOWER - FORMATTED.pdf>
4. <http://nsdl.niscair.res.in/123456789/511NIGER - FORMATTED.pdf>
5. <http://nsdl.niscair.res.in/123456789/513SUGARCANE - Formatted.pdf>

## AGR 221 – STUDY TOUR (0+1)

### LEARNING OBJECTIVES:

- The students will undertake tour to learn different soil types in various regions
- The students will gain knowledge about the cropping pattern for major crops in different agro ecosystem.
- The students will visit important Agricultural research stations and institutions.
- The students will familiar with various agro based industries and its operation
- The students will understand the practical constraints in production technologies and post harvest management for various crops in farmers field

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.

### COURSE OUTCOMES :

- CO 1: To gain knowledge about various soil types presented in different regions
- CO 2: To formulate different cropping systems followed in various agro climatic regions
- CO 3: To understand information pertaining to the different crops and their cultivation methods.
- CO 4: To create awareness about different agro based industries
- CO 5: To apply new post harvest management technologies and value addition of crops

## CO-PO MAPPING MATRIX

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

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

- To understand the basic ecological concepts in relation to insects
- To evaluate influence of abiotic and biotic factors in insect population dynamics and its relevance in Integrated Pest Management (IPM)
- To illustrate various components of IPM and their importance
- To discuss ecological perspectives of insecticides
- To illustrate use of sampling and AESA in pest management decision making

### 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. **Current Stream of developments in Insect Ecology and IPM.**

### **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

#### **COURSE OUTCOMES:**

- CO 1:** Depict basic ecological concepts, understand the impact of ecology on the insect population and concepts of IPM, ETL and EIL. To employ AESA and pest survey as pest management decision making tools.
- CO 2:** Explain role of biological pest suppression and mass production of various biocontrol agents.
- CO 3:** Describe non chemical methods of pest management viz., bio rationals and other novel techniques like sterile insect method.
- CO 4:** Discuss classification and formulations of insecticides, their poisoning effects and antidotes.
- CO 5:** Describe ill effects of over use of insecticides and define various IPM modules for different crops.

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

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

#### **REFERENCES**

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.

#### **E-RESOURCES**

1. <http://www.ncipm.org.in/recent-publications.htm>
2. <http://www.ipmnet.org>



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

### LEARNING OBJECTIVES:

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

### THEORY

#### Unit I Introduction to Soil Microbiology

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

#### Unit II Microbial Processes in soil

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 – Xenobiotic degradation

#### Unit III Soil Microorganisms and plants

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

#### Unit IV Microbial inoculants

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

#### Unit V Industrial Microbiology

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

### PRACTICAL

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

### THEORY LECTURE SCHEDULE

1. Introduction and historical developments in soil microbiology. Contributions of Beijerinck, Winogradsky, Fleming and Waksman
2. Diversity of soil microorganisms - culturable and unculturable microbial diversity Metagenomic approach
3. Factors influencing the activities of soil microorganisms

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

#### **PRACTICAL SCHEDULE**

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

16. Methods of application of different bioinoculants
17. Wine fermentation
18. **Orientation for final Examination**

### **COURSE OUTCOMES**

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

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

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

### **REFERENCES**

1. Rangaswamy,G.andBagyaraj, D.J. 1992. Agricultural Microbiology, Asia Publishing House, New Delhi.
2. SubbaRao,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.
4. Alexander, M. 1977. Soil Microbiology. John Wiley and Sons. New York
5. Waiter.M.J.,N.L.Morgan,J.S.Rocky and G.Higton.1999. Industrial Microbiology - An Introduction. Blackwell Scientific

### **E-RESOURCES**

1. [fire.biol.wvu.edu/hooper/416\\_05Ncycle1.ppt](http://fire.biol.wvu.edu/hooper/416_05Ncycle1.ppt)
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)**

#### **LEARNING OBJECTIVES:**

- To impart proficiency to the students in exploring the problems and potentials of soil and water
- 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. **Current Streams of thought.**

## **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
28. crusting, sub soil hard pan, fluffy paddy soil, shallow soil - Characteristics and
29. management
30. Aeolian , ill drained and polluted soils- Characteristics and their management
31. Acid soil and Acid sulphate soils - Genesis and characteristics.
32. Lime requirement of acid soil, liming materials and reclamation of acid soil
33. Genesis and classification of salt affected soils - Effect of saline soils on plant growth and their management
34. Genesis and classification sodic and saline sodic soil - characteristics and their management
35. Quality of irrigation waters - quality criteria and appraisal- USSL and other systems
35. 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

#### **COURSE OUTCOMES:**

- CO 1:** Basic contents of soil survey and soil taxonomy would enhance competence and provide knowledge of soil present in all over the world.
- CO 2:** The modern tools (remote Sensing, GIS and GPS) used in soil survey in order to enhance in better understanding of land use planning of the soil.

- CO 3:** Understanding the physical, chemical constraints would enhance the knowledge of the soil and sustainable agriculture production.
- CO 4:** Sound knowledge about quality of irrigation and influence would increase the high land use to increase the agricultural production using poor quality irrigation water.

#### CO-PO MAPPING MATRIX

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

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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.ScientificPublishers.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. SreeRamulu, U.S. 2003. Principles in the quantitative analysis of waters, fertilizers, plants and soil. Scientific Publishers.

#### E-RESOURCES

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)

#### LEARNING OBJECTIVES:

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

#### THEORY

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

Objectives and role of plant breeding - historical perspective - activities in Plant Breeding. Centres of origin - contribution of Vavilov, Harlan, 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. **Current Streams of thought.**

## PRACTICAL

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

## THEORY LECTURE SCHEDULE

1. Objectives and role of plant breeding - historical perspective - activities in Plant Breeding.
2. Centres of origin - contribution of Vavilov, Harlan, 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**

#### **COURSE OUTCOMES:**

- CO 1:** The student will have the gist of the various self and cross pollinated crops.
- CO 2:** Will be able to develop expertise in the various crossing and emasculation techniques in various crops
- CO 3:** Students will develop the capacity to carry out independent plant breeding experiments
- CO 4:** The students will be able to multiply and modify the vegetatively propagated crops.

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

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

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2. Allard, R. 1989. Principles of Plant breeding. John Wiley and Sons, New Delhi.
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### **AEC 226 AGRICULTURAL MARKETING, TRADE AND PRICES (1+1)**

#### **LEARNING OBJECTIVES:**

- To give exposure to the Under Graduate students on market concepts
- To understand domestic and export trade
- To study risk in agricultural marketing, marketing institutions involved, price dynamics and the role of government in regulation of markets

#### **THEORY**

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

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

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

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

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

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

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

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

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

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

### **PRACTICAL**

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

### **THEORY LECTURE SCHEDULE**

1. Market and marketing - Definition. Agricultural marketing - Concepts, scope and subject matter. Classification of markets.

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

#### **9. Mid Semester Examination**

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

#### **PRACTICAL SCHEDULE**

1. Market survey
2. Estimation of marketable and marketed surplus
3. Identification of marketing channels and estimation of price spread for agricultural products.
4. Identification of marketing channels and estimation of price spread for horticultural products.
5. Visit to Regulated market.
6. Visit to Cooperative marketing society
7. Visit to Farmers' market and shandy.
8. Visit to FCI, CWC and TNCSC



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

#### **COURSE OUTCOMES:**

At the end of the course students will be able to

- CO 1:** To understand the marketing channels of different commodities.
- CO 2:** To gain the practical knowledge of price spread and its implications.
- CO 3:** To know the role of marketing institutions and trade in agricultural products like WTO and APEDA.
- CO 4:** Gain practical knowledge on FCI, CWC and regulated market activities.
- CO 5:** Role of CACP for price fixation, and price stabilization measures.

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

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

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2. Jhingan, M.L., 2011, International Economics, Vrinda Publications (P) Ltd., New Delhi.
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### **STA 227 AGRICULTURAL STATISTICS (1+1)**

#### **LEARNING OBJECTIVES:**

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

#### **THEORY**

##### **Unit I: Descriptive Statistics**

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

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

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). **Current Streams of thought.**

## **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  
Latin Square Design (LSD). TBI 315 – 320

## PRACTICAL SCHEDULE

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

## COURSE OUTCOME

**CO1:** Understand fundamental concept of statistical applications in biology

**CO2:** Application of statistical concepts

**CO3:** Acquire theoretical concept of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.

**CO4:** Practical exposure to concept of descriptive statistics, testing of hypothesis, correlation and regression

**CO5:** Practical exposure to basic design of experiments

## CO/PO MAPPING MATRIX

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

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- 3 Gupta.S.C and V.K.Kapoor. 1977. Fundamentals of Applied Statistics. Sultan Chand and Sons, New Delhi.
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- 9 Kailasam. G and R.Gangaiselvi. 2010. Applied Statistics. Kalyani Publishers. New Delhi.

#### E-RESOURCES

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

### ENG 228 SOFT SKILLS OF EMPLOYABILITY (0+1)

#### LEARNING OBJECTIVES:

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

#### UNIT I : Introduction to Soft Skills

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

#### UNIT II : Life Skills

Attitude - Psychological and sociological definitions - types of attitude - consequences - suggestions to keep good attitude. **Emotional Intelligence** - Introduction to Emotional Intelligence - four branch model of EQ - five point scale to measure EI - suggestions to improve EI. **Interpersonal skills** - Interpersonal Skills - Study of character traits - formal interpersonal skills - greeting, enquiring, answering, complimenting and acknowledging. **Self Development/Empowerment** - Self Development - Empowerment - SWOC Analysis - Goal setting based on the principle of SMART - self motivation strategies.

#### UNIT III:Communication Skills

**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. **Group Dynamics** - Study of affiliation, participation, goal consciousness - Forming, Storming, Norming -Performing. **Kinesics** - Definition - personal appearance, posture, gestures, facial expressions, eye contact and movements.

#### UNIT IV : Employability Skills

**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. **Interview Skills - II** - Telephone interview - Skype interview - Panel Interview -Five stages of interview

-how to answer the questions **Group Discussion** - Definition - contexts - why and how? - techniques and skills.

### **UNIT V : Corporate Skills**

**Leadership qualities** - Definition - basic requirements - (responsibility - self - knowledge - rapport with subordinates- knowledge of the assignment- goal setting- decision making - team work) - leadership and vision. **Negotiation skills** - Select definitions - functions of negotiation - kinds of negotiation - phases of the process - rules - steps to improve negotiation skills. **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. **Stress management** - Definition of stress -kinds - stress at work - causes, effects and solution - stress and stroke - different kinds of stroke - stress in interview. **Current Streams of thought.**

### **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**

### **COURSE OUTCOMES:**

At the end of the course the students will be able to

- CO1:** Understand the values of soft skills
- CO2:** Acquire various soft skills necessary for being good citizens as well as successful employees
- CO3:** Understand the difference between emotional intelligence and intelligence quotient
- CO4:** Shine as effective communicators and successful leaders

**CO5:** Face various kinds of interviews with courage and confidence

### CO/PO Mapping Matrix

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

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2. Beverly Jaeger, *Making Work Work for the Highly Sensitive Person*, Tata McGraw – Hill, USA, 2004.
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4. Gloria. J. Galanes, Kathreine Adams, John. K. and Brillhart, *Effective Group Discussion*, Tata McGraw – Hill, New Delhi, 2004.
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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.
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### Text book

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### E-BOOKS

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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)



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

### **LEARNING OBJECTIVES:**

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

### **THEORY**

#### **UNIT I - Tillage and Tillage Machinery, Sowing, Planting, Intercultural Equipment**

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

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

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

#### **UNIT III - Agriculture Diesel Engine and Tractors**

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

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

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

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

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

### **PRACTICAL**

Study of different components of IC engine, four stroke petrol engine, two stroke petrol engine. Study of MB plough, disc plough, seed-cum-fertiliser drills, their mechanisms. Operation of tractor and implements - operation and maintenance of power tiller - Study of different inter-cultivation equipments - Sprayers and dusters - their operation, repairs

and adjustment - Paddy transplanting. Harvester for paddy, sugarcane, groundnut - horticultural tools .

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

### **THEORY LECTURE SCHEDULE**

1. Farm power in India - human, animal, mechanical and electrical energy sources **TB1: 1-10**
2. Objectives of Primary tillage, mouldboard ,disc plough, chisel plough and subsoiler, components and functions, types, 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**  
**TB1:293-297**
11. Equipment for land development and soil conservation - dozers **TB1:323-327**
12. Equipment for intercultural tools levelers, chisel plough, sub soil plough, Blade harrow and bund former **TB1:185-211**
13. Implements for intercultural operations - cultivators, sweep, junior hoe, Manual weeders and **TB1:213-221**
14. Power operated weeders for wet land and garden land **TB5:216-222**
15. IC engines- working principles, two stroke and four stroke engines, Different systems of IC engine **TB1:22-35**  
**TB2:1-21**
16. Electronic fuel injection system, dual fuel operation engine, Tractors- types and utilities. **TB1:107-117**  
**TB2:313-319**
17. Introduction - Energy crisis - Classification - Availability - Renewable energy sources - significance. **TB3:387-411**
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 andHarvesting Machinery - operation and maintenance
- 9 Study and constructional details of different bio gas plant types
- 10 Study and constructional details of different types Gasifiers and biomass Briquetting
- 11 Study of different types of solar collector.
- 12 Study of working principle of solar water heater and solar air heater.
- 13 Study the Performance of a solar still, solar dryer and solar cooker
- 14 Study the working of solar photovoltaic pumping system and solar street light
- 15 Study the different types of wind mills
- 16 Study the processing of Bio diesel production from Jatropha
- 17 **Orientation for final examination**

### **COURSE OUTCOME**

- CO1:** To Gain knowledge on the various types of IC engines, types and selection of tractors.
- CO2:** To Understand the construction and working of various farm implements like tillage implements, seed drills, transplanters, plant protection and harvesting equipments.
- CO3:** To Gain knowledge on the various renewable energy sources like solar, wind ,biogas and biomass energy.
- CO4:** 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.

### CO/PO Mapping Matrix

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

### 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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9. Biotechnology and other Alternate Technology, Chakravarthy A 1989. Oxford and IBH Publishing Co. Ltd. New Delhi.
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### E-RESOURCES

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2. [www.farmmachineryshow.org](http://www.farmmachineryshow.org)
3. [www.freesolaronline.com](http://www.freesolaronline.com)

### V SEMESTER

### AGR 310: FARMING SYSTEM, ORGANIC AGRICULTURE, AGROFORESTRY AND DRY FARMING (3+1)

### LEARNING 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.
- To impart knowledge on Agroforestry systems and dryland technologies

## **THEORY**

### **Unit-I: Cropping system and Farming System**

Cropping system – Definition – principles – concepts – multiple cropping systems – intercropping – sequential cropping – principles – Advantages – Interactions between different cropping systems – Cropping scheme – Farming system – Definition – Principles – Concepts – Interaction between different enterprises with cropping – scope and advantages of Integrated Farming system – Integrated farming system models for different agro eco – systems . Indices for evaluation of cropping and farming systems – Land use, yield advantages and economic evaluation.

### **Unit-II: Organic farming Practices and Management**

Organic farming ; Definition – Scope – principles and concepts, Organic sources of nutrients – manures – organic waste recycling methods. Bio – intensive nutrient management – Organic Crop Production and Protection methods. Organic certification – NPOP guidelines – Certification agencies in India – crop production standards – Quality considerations – labelling and accreditation process – marketing and export opportunities.

### **Unit-III: LEISA Concepts and Principle**

Basic ecological principles of LEISA – Promising LEISA techniques – resource management under constraint situations – Indigenous Technical Knowledge (ITK) in agriculture. Cost reduction strategies in crop production – Non – monetary inputs and low-cost technologies – Labour management. Conservation agriculture and its impact on agriculture.

### **Unit-IV: Agro forestry**

Forests – Role of forests – types of forest. Agro forestry –definition - concept – Components – benefits. Social forestry – Concepts – Definition. Afforestation – definition – methods – Agroforestry – Classification – Tree species suitable for agro forestry in soil and water conservation – Agroforestry systems for different types of problem soils and wastelands. Silviculture practices for important agroforestry species viz., Teak, Casuarina, Subabul, Tamarind, Ailanthus, Pungam, Neem, Acacia spp and Bamboos

### **Unit-V: Dry Farming**

Dry farming – definition – classification, Characteristics and constraints of dry farming. Indices of aridity. Rainfall climatology. 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 dry farming technologies and Watershed management. In – situ water harvesting, storage and recycling. Alternate land use systems in different watershed. **Current Streams of thought.**

## **PRACTICAL**

Preparation of cropping scheme – working out input requirements for crops, cropping system. 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. Identification of trees, seeds and seedlings of important Agroforestry species –Forest nursery – types – layout – nursery technology for important tree species –Rainfall analysis and crop planning – Preparation of contingency crop plan to mitigate aberrant rainfall situations.

## **THEORY LECTURE SCHEDULE**

1. Cropping system: Definition, Principles and basic concepts, types of cropping systems – multiple cropping system

2. Advantages and disadvantages of various cropping systems - criteria for assessing yield advantages
3. Principles and advantages of cropping system, principles and factors influencing in cropping scheme, preparation of cropping schemes.
4. Complementary and competitive interaction in different cropping system -light, nutrient, water and weed.
5. Allelopathy, legume effect - effect of preceding and associated crops.
6. Agronomic requirement for crops and cropping system in intercropping and sequential cropping.
7. Farming system: definition, principles and concepts and advantages of farming system.
8. Integrated farming system - Scope and advantages - Allied enterprises for wetland, irrigated upland and dryland and their interactions.
9. Integrated farming system - models for wetland, irrigated upland and dryland ecosystem.
10. Indices used to evaluate land use efficiency and yield advantages and economic viability in multiple cropping.
11. Organic farming - definition - principles - concepts - prospects
12. Sources of organic manures - plant, animal and microbial origin, On-farm resources; FYM, poultry manure, sheep and goat manures; green manures, crop residues; biogas slurry and vermicompost.
13. Off-farm resources; coir pith, press mud, oilcakes, fly ash, bio compost, minerals, bone meal, bio fertilizers, traditional preparations.
14. Organic waste recycling methods and techniques - composting, vermicomposting, *in situ* composting -bio intensive nutrient management.
15. Non - chemical weed management methods; preventive, physical, cultural, use of tools and implements and biological measures.
16. Organic pests and diseases management practices - bio control agents, biorational pesticides; minerals, botanicals, soaps, trap crops, bird perches, and traditional preparations - sanitation.
17. Organic certification- procedures - certification agencies in India and labelling and accreditation processes.
18. Crop production standards - NPOP guidelines - principles, standards, recommendations.
19. Quality considerations - assessment methods - premium and export opportunities-
20. Good crop husbandry practices for important field crops.
21. Cost reduction technologies and non-monetary inputs in cropping and farming system.
22. LEISA- principles and concepts - Basic ecological principles of LEISA and promising LEISA techniques.
23. Indigenous technical knowledge (ITK) in organic agriculture - importance.
24. Marketing of organic products-legislation
25. Crop residues management (CRM) for sustainable Agriculture.
26. Mid-semester Examination.
27. Conservation agriculture (CA), scope, advantages and CA technology for sustainable Agriculture.
28. Forests - Role of forest - Status - Types of forests.
29. Agroforestry subsystems - shifting cultivation - Taungya cultivation - Alley cropping - Home garden - Multitier cropping.
30. Agroforestry - components benefits - classification - primary systems - Agri silviculture - silvipasture - Agri silvipasture.



31. Wind break and shelter belts – design of shelter belts and species composition.
32. Role of agroforestry in soil, water and ecological conservation – industrial Agroforestry – constraints and merits.
33. Afforestation – importance - methods
34. Social forestry phase I and II projects – Joint Forest Management and Tamil Nadu Afforestation Programme.
35. Agroforestry systems for different problem soils and tree species suitable for problem soils.
36. Silviculture practices for Teak – Casuarina –Subabul.
37. Silviculture practices for Tamarind – Neem – Acacia – Prosopis.
38. Silviculture practices for Pungam – Ailanthus – Bamboo
39. Dry farming and rainfed farming: Definition and Characteristics.
40. Major constraints in dry farming for crop production
41. Rainfall climatology – length of growing period
42. Drought: definition and types - Effects of drought on crop production
43. Drought management strategies and contingent crop planning
44. Mid-season correction – mulching – thinning – antitranspirants – antievaporants.
45. *In-situ* soil moisture conservation techniques and approaches – Agronomical measures
46. *In-situ* soil moisture conservation – Mechanical – Biological measures
47. Integrated dryland technologies and farm mechanization.
48. Resource management under constraint situations for irrigated and rainfed farming
49. Watershed: definition, principles, classification and management.
50. Water harvesting, storage and recycling.
51. Alternate land use systems in different watershed

#### **PRACTICAL SCHEDULE**

1. Visit to cropping system experiments in wetland, irrigated upland and dryland.
2. Preparation of cropping scheme, inputs and working out various indices
3. Preparation of integrated farming system models for different eco systems
4. Indigenous practices in seed treatment and raising of field crop (Rice / Maize/ Cowpea / Cotton / Sugarcane).
5. Hands-on-experience in recycling techniques–composting and vermicomposting, Production techniques – grading, packaging
6. ITK based preparations (Panchakavya, Dasakavya, Amirthakaraisal, fish amino acids)
7. Manures and bio-fertilizers application methods practical experience
8. Exposure visit to bio – control agent units and bio-fertilizer production units.
9. Working out cost of production for organic cultivation of important field crops.
10. Identification and description of agroforestry tree seeds and seedlings of Teak, Casuarina, Eucalyptus, Tamarind, Ailanthus, Pungam, Neem, Acacia, Prosopis and Bamboo.
11. Identification and description of fuel, fodder and green manure trees in the locality.
12. Nursery techniques for eucalyptus – casuarina – production of stump for Teak – seedling production for various tree species.
13. Rainfall analysis and crop planning
14. Soil erosion and soil conservation practices, water harvesting structure and their use.
15. Drought management technologies to mitigate drought in dry farming agriculture.

16. Preparation of contingency crop plan for aberrant rainfall situations.
17. Orientation for final practical examination

#### **COURSE OUTCOMES:**

- CO 1:** To gain the information and acquire practical knowledge on various types of cropping systems.
- CO 2:** To understand interaction between different farm enterprises and to gain the information about the impact of organic farming and indigenous practices
- CO 3:** To understand the procedure followed for organic certification as per NPOP guidelines and to evaluate different resource management techniques in conservation agriculture.
- CO 4:** To gain the information about forestry and their role on the environment and practicing silviculture.
- CO 5:** To know about integrated dry farming technologies and Watershed management.

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

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

#### **REFERENCE BOOKS**

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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, Agrobiospublishers, Jodhpur
5. SP. Palaniappan and K Annadurai. 2008. Organic Farming: Theory and Practice. 2008. Scientific Publishers.
6. Govindan, K. and V. Thirumurugan. 2003. Principles and practice of Dryland Agriculture, Kalyani Publishers, Chennai.
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#### **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/123456789/670Revised\\_Organic\\_farming.pdf](http://nsdl.niscair.res.in/123456789/670Revised_Organic_farming.pdf)
6. <http://nsdl.niscair.res.in/jspui/bitstream/123456789/656/1/revised%20agroforestry.pdf>
7. <http://cropsfordrylands.com/wp-content/uploads/Dryland - Farming -Crops - Tech - for - Arid - Regions.pdf>

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

### LEARNING OBJECTIVES:

- Students will acquire knowledge about cultivation of rice in different ecosystem
- Students will acquire skill on different nursery techniques
- The students will be trained to treat the seeds with biofertilizers and fungicides
- The students will aware about different methods of planting techniques
- The students will learn about harvesting methods and processing

### 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

### COURSE OUTCOMES

- CO 1: To gain knowledge about cultivation aspects of rice
- CO 2: To understand the different nursery management practices
- CO 3: To apply different seed treatment methods for rice
- CO 4: To evaluate different methods of planting techniques

CO 5: To construct methodologies in harvesting and processing

#### CO-PO MAPPING MATRIX

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

#### REFERENCES

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

#### E-RESOURCES

1. <http://nsdl.niscair.res.in/123456789/524RICE - FORMATTED.pd>  
<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)

#### LEARNING OBJECTIVES:

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

#### 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.

**Current Streams of Thoughts in pest 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**

#### **COURSE OUTCOMES:**

- CO 1:** Define bionomics, symptoms of damage and integrated management strategies for pests of cereals, millets and pulses
- CO 2:** Discuss bionomics, symptoms of damage and integrated management strategies for pests of Oilseeds, Cotton, Sugarcane, Green Manures, Forage Crops and Tobacco
- CO 3:** Explain bionomics, symptoms of damage and integrated management strategies for pests of Vegetables, Tubers, Spices and Plantations
- CO 4:** Define bionomics, symptoms of damage and integrated management strategies for pests of Fruits, Ornamentals and Medicinal Plants
- CO 5:** Discuss bionomics, symptoms of damage and integrated management strategies for pests of Tree, Lawn, Stored Products, Mushroom and green house crops



## CO-PO MAPPING MATRIX

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

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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)

### LEARNING OBJECTIVES:

- To study the classification, disease surveillance and Molecular detection of plant pathogens
- To study the General Principles and legislative method of plant disease management
- To study about methods eradicating disease causing pathogen
- To study about methods of protection the host from disease causing pathogen
- To learn about Biotechnological approaches for crop disease management.
- To learn about biological control of plant diseases

### 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. **Current Streams of thought.**

## **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, inoculum 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

### **COURSE OUTCOMES:**

- CO 1:** Having knowledge of classification, disease surveillance and Molecular detection of plant pathogens
- CO 2:** Having knowledge of general Principles and legislative method of plant disease management
- CO 3:** Trained in eradicating disease causing pathogen and Expertise in protection the host from disease causing pathogen
- CO 4:** Aware of Biotechnological approaches for crop disease management.

## CO 5: Knowing about biological control of plant diseases

### CO - PO MAPPING MATRIX

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

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### E-RESOURCES

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)

### LEARNING OBJECTIVES:

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

### THEORY

#### Unit I - Ecology and Ecosystems

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

#### Unit II - Natural Resources and Biodiversity

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

#### Unit III- Environmental pollution

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

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

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

#### Unit V- Environmental Protection

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

### PRACTICAL

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

### THEORY LECTURE SCHEDULE

1. Ecology, Environment , Ecosystem and its components
2. Terrestrial biomes (Forest, Desert, etc..)
3. Aquatic biomes (Pond, River, Estuaries and Ocean)
4. Energy flow, Food Chain, Food Web and Ecological pyramids
5. Species interactions
6. Succession and adaptations
7. Natural and Energy resources: Land, Water, Air, Forest, Minerals
8. Energy resources - Renewable and Non-renewable
9. Sustainable Management and Conservation of natural resources

10. Biodiversity: Types, National and Global Status, importance, Hotspots and Threats
11. Conservation of Biodiversity: *In-situ and Ex-situ* - Biosphere Reserves - National parks, Wildlife Sanctuaries, Botanical Garden, etc..
12. Environmental pollution- types and sources
13. Soil pollution sources, effects
14. Fate of soil pollutants - management - bio and phyto remediation of soil pollutants
15. Water pollution sources and types of waste water
16. Waste water - impact on ecosystems- eutrophication, bio magnification , water borne diseases
17. Air pollution sources effects and control measures
- 18. Mid-semester examination**
19. Air pollution indicators, episodes and monitoring
20. Noise pollution sources effects and control measures
21. Radioactive, heavy metal and thermal pollution sources effects and control measures
22. Green House Gases-Global warming- Climate change-Impact on agriculture and other natural resources
23. Types of wastes -industrial waste, agricultural wastes, domestic waste-characteristic and environmental impact
24. Solid waste management techniques- physical methods
25. Solid waste management techniques- composting and Vermicomposting
26. Waste water treatment methods -physical, chemical and biological methods.
27. Waste water recycling and Standards for waste water disposal
28. Global treaties and Conventions for Environmental Protection
29. National and state level organizations: CPCB, TNPCB, etc..
30. Environmental impact assessment- stages and monitoring.
31. Environmental Education
32. Environmental Laws and Acts
33. Afforestation
34. Role of information technology on environment.

#### **PRACTICAL SCHEDULE**

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



### COURSE OUTCOMES:

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

### CO - PO MAPPING MATRIX

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

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

### LEARNING OBJECTIVE

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

## **THEORY**

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

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

### **Unit-II- Nutrient Dynamics**

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

### **Unit-III-Classification of Fertilizers**

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

### **Unit-IV-Application Methods**

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

### **Unit-V-Nutrient Management**

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

## **PRACTICAL 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 K<sub>2</sub>SO<sub>4</sub>
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.

#### **COURSE OUTCOMES:**

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

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

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

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8. ShivanandTolanur, 2006. Soil Fertility, Fertilizers and Integrated Nutrient Management. International Book Distribution, Lucknow

#### **E-RESOURCES**

1. [www.fspublishers.org/ijab/past-issues/IJAB Vol\\_5\\_No\\_3/47.pdf](http://www.fspublishers.org/ijab/past-issues/IJAB_Vol_5_No_3/47.pdf)
2. [www.springerlink.com/index/IQ11256h8t325054.pdf](http://www.springerlink.com/index/IQ11256h8t325054.pdf)

## GPB 316 PLANT BIOTECHNOLOGY (2+1)

### LEARNING OBJECTIVES:

- To impart knowledge on basic and applied aspects of plant biotechnology.
- To teach various aspects of plant tissue culture
- To familiarize recent strides in molecular genetics, gene transformation and immunotechnology

### 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. **Current Streams of thought.**

### 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**

#### **COURSE OUTCOMES:**

- CO 1:** The student will have knowledge in the basic biotechnological techniques
- CO 2:** The students will be able to do the various sterilization methods
- CO 3:** Will be able to dissect the mother plant or explants for initiation of tissue culture
- CO 4:** The students will be familiarised with the development of pathogen and virus free plants
- CO 5:** Will be able to do basic research involving DNA and marker based technology

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

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

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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)**

### **LEARNING OBJECTIVES:**

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

### **THEORY**

#### **Unit-I: 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. **Current Streams of thought.**

### **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

### COURSE OUTCOMES:

- CO 1:** Can acquire knowledge on the cultivation aspects of fruits and plantation crops.
- CO 2:** Can demonstrate important production techniques and diagnose problems in cultivation of fruits and plantation crops.

### CO-PO MAPPING MATRIX

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

### REFERENCES

1. Veeraragavathatham, D., M. Jawaharlal, S. Jeeva, R.Rabindran and G. Umopathy. 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.
4. Kumar, N. Md. Abdul Khader, P.Rangasamy, and I. Irulappan, 2001. Spices, Plantation Crops, Medicinal and Aromatic Plants, Rajalakshmi Publications, Nagercoil.
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 AGRIBUSINESS MANAGEMENT AND ENTREPRENEURSHIP (1+1)**

#### **LEARNING OBJECTIVES:**

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

#### **THEORY**

##### **Unit I: Agri Business Management**

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

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

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

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

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

##### **Unit IV: Functional 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). **Current Streams of thought.**

#### **PRACTICAL**

Mapping opportunities in Agribusiness sectors and selecting an agribusiness - Identification of the forms of agri business organization - Guest lecture by entrepreneur - Visit - Understanding functional areas of agribusiness firm - Identifying information needs for business plan preparation - Documenting the procedure for establishing agribusiness firms - guest lecture / visit to District Industries Centre - Exercise on forecasting demand for agricultural products - Preparation of production plans for

agribusiness firm - Exercise on Inventory Management - types, cost and basic EOQ model - Purchase management and Vendor rating methods - Market survey for understanding customer needs and satisfaction - Pricing of products of small agribusiness - Working out cost of production and cost analysis - Preparation of advertisement and sales promotion programs for an agribusiness firm - Financial performance of firm - Balance sheet and Income Statement of agribusiness and Ratio analysis - Assessment of entrepreneurial skill and competency - Presentation of business plan and discussion - Model project discussion.

### **THEORY LECTURE SCHEDULE**

1. Management - Definition and concepts - Approaches.
2. Principles of Management.
3. Agri Business Management - Meaning and definition - Scope characteristics.
4. Forms of agri business firms - Sale, partnership, joint stock, cooperative and state enterprises - Small, medium, tiny and micro enterprises - Importance.
5. Management Functions: Planning, organizing, staffing, directing, controlling. Planning: Meaning, objective, steps - Types and importance.
6. Organizing - Meaning - Structure - Types - Departmentation - Importance.
7. Staffing - Meaning - Nature and importance HRM - Job analysis - Recruitment and selection.
8. Directing - Principles - Techniques - Importance.
- 9. Mid semester examination.**
10. Co-ordination and control - Objectives steps - Methods - Importance.
11. Production operations management - Planning and scheduling - Inventory - Materials management - Supply chain management.
12. Financial management - Concept and financial planning for agri business.
13. Marketing management - Market environment - Market segmentation.
14. Marketing mix, market promotion - Promotion mix - Consumer buying behavior.
15. Entrepreneur - Agripreneurs - Agripreneurship - Types, characteristics and process. Innovation, business incubation.
16. EDP - Programmes government schemes and incentives - Government Policy.
17. Agri Clinics and Agri Business Consortium (ACABC).

### **PRACTICAL SCHEDULE**

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



## 17. Orientation for final examination

### COURSE OUTCOMES:

At the end of the course students will be able to

**CO 1:** To understand the opportunities in agribusiness sectors

**CO 2:** To understand the marketing mix, and supply chain management in agribusiness.

**CO 3:** To know the management functions and how to prepare agribusiness project.

### CO-PO MAPPING MATRIX

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

### REFERENCES

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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)

### Learning Objectives:

- To impart the basics of soil and water conservation engineering to the undergraduate students.

### THEORY

#### Unit I: Surveying

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

#### Unit II: Soil erosion

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

#### Unit III: Soil conservation and watershed management

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

recharge. Gully control structures -Check dams - Temporary and permanent. Watershed concept - Integrated approach and management

#### **Unit IV: Irrigation and drainage**

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

#### **Unit V: Wells and Pumps**

Groundwater occurrence - aquifers - types of wells and sizes - pump types - reciprocating pumps - centrifugal pumps - turbine pumps - submersible pumps - jet pumps - airlift pumps - selection of pumps - operation and their maintenance. **Current Streams of thought.**

#### **PRACTICAL**

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

#### **THEORY LECTURE SCHEDULE**

1. Introduction - land surveying - uses in agriculture.
2. Chain cross staff and compass surveying - computation of angles.
3. Radiation, intersection and traversing.
4. Dumpy level - setting, observation and tabulation of readings - computation of land slope - difference in elevation.
5. Computation of area and volume - Simpson's rule and Trapezoidal rule.
6. Soil Erosion - causes and evil effects of soil erosion - geologic and accelerated erosion
7. Water erosion - causes - erosivity and erodibility - mechanics of water erosion
8. Splash, sheet, rill and gully erosion - ravines - land slides
9. Wind erosion - factors influencing wind erosion - mechanics of wind erosion - suspension, saltation, surface creep
10. Effects of water and wind erosion
11. Erosion control measures for agricultural lands - biological measures - contour cultivation - strip cropping - Cropping systems - vegetative barriers - Windbreaks and shelterbelts - shifting cultivation
12. Mechanical measures - contour bund - graded bund - Broad beds and furrows - basin listing - random tie ridging
13. Mechanical measures for hill slopes - contour trench - bench terrace - contour stone wall
14. Rain water harvesting - insitu soil moisture conservation - Runoff Computation - runoff water harvesting
15. Farm ponds and percolation ponds - storage and its use for domestic and ground water recharge
16. Gully control structures -Check dams - Temporary and permanent
17. Watershed concept - Integrated approach and management
- 18. Mid semester examination.**

19. Irrigation - measurement of flow in open channels - velocity area method
20. Rectangular weir - Cippoletti weir - V notch
21. Orifices - Parshall flume
22. Duty of water - irrigation efficiencies
23. Conveyance of irrigation water - canal lining
24. Underground pipe line system
25. Surface irrigation methods - borders, furrows and check basins
26. Components of drip and sprinkler irrigation system
27. Agricultural drainage - need - surface drainage systems
28. Surface drainage systems - drainage coefficient
29. Groundwater occurrence - aquifers types
30. Types of wells and sizes
31. Pump types - reciprocating pumps - centrifugal pumps
32. Turbine pumps - submersible pumps
33. Jet pumps - Airlift pumps
34. Selection of pumps - operation and their maintenance.

### **PRACTICAL SCHEDULE**

1. Study of survey instruments - chains - compass - plane table - dumpy level.
2. Chains and cross staff surveying - linear measurement - plotting and finding areas.
3. Compass survey - observation of bearings - computation of angles.
4. Compass - radiation, intersection.
5. Levelling - fly levels - determination of difference in elevation.
6. Computation of area
7. Computation of volume
8. Contouring - Block contouring
9. Design of contour bund and graded bund.
10. Drip Irrigation systems.
11. Sprinkler irrigation system
12. Problems on water measurement.
13. Problems on duty of water, irrigation efficiencies.
14. Problems on water requirement - agricultural drainage.
15. Study of different types of wells and its selection.
16. Study of pumps and Selection of pumps.
17. Orientation for final examination.

### **COURSE OUTCOME**

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

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

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

### **REFERENCES**

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

- Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers and Distributors, New Delhi.
- 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 CLIMATE CHANGE AND DISASTER MANAGEMENT (1+0)**

#### **LEARNING OBJECTIVES:**

- The students will gain competence about climate changes, causes and importance of mitigation.
- The students will aware about conservation of various resources and eco system management
- The students will acquire knowledge about natural and manmade disaster management
- The students will know about efforts to mitigate natural disasters
- The students will learn about the disaster rehabilitation

#### **THEORY**

##### **Unit - I : Climate change and its impact**

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

##### **Unit - II : Resource conservation**

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

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

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

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

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

##### **Unit - V : Disaster Rehabilitation**

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

#### **THEORY LECTURE SCHEDULE**

- Climate change – definition – concepts – causes – issues.
- Impact of climate change on Agriculture and mitigation strategies
- Climate change – global warming, sea level rise, ozone layer depletion and acid rain
- Environmental pollution causes, effects and control
- Conservation of resources and remediation measures from different pollutants
- Basic concepts and principles of Agricultural ecology and environment
- Manmade disasters and Nuclear disasters
- Natural disasters – definition – types and effects

9. Mid – semester examination
10. Floods, drought, cyclone, earth quakes and Tsunami
11. Landslides, avalanches, volcanic eruptions, Heat and cold waves
12. Disaster management – efforts to mitigate disasters at national and global levels
13. Disaster response mechanism in India
14. Disaster warning, India’s key hazards, risk and mitigation
15. Financial arrangements – role of NGOs and other organizations.
16. Rehabilitation – Bio shields livelihood options – insurance and compensation
17. Preparedness - EOCs

#### **COURSE OUTCOMES:**

**CO 1:** To gain knowledge about causes of climate change and ways to mitigate it

**CO 2:** To construct different resource conservation and remediation measures

**CO 3:** To understand natural and manmade disasters.

**CO 4:** To apply various mitigation strategies in emergencies

**CO 5:** To formulate various disaster rehabilitation measures.

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

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

#### **REFERENCES**

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/123456789/458global issues -formatted.pdf](http://nsdl.niscair.res.in/123456789/458global%20issues%20-formatted.pdf)
2. <http://nsdl.niscair.res.in/123456789/607Biosafety.pdf>
3. <http://nsdl.niscair.res.in/123456789/1069environments.ppt>

### **AGR 321 CROP PRODUCTION- II (0+1)**

#### **LEARNING OBJECTIVES**

- To impart practical aspects of scientific cultivation of any upland crop (maize / sorghum / pearl millet / finger millet / cotton / sunflower / groundnut / sesame) to the students
- 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.
- To allot 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

#### **COURSE OUTCOMES:**

**CO 1:** To acquire skill in various agronomic practices that can bring improved crop yield.

**CO 2:** To gain hands on experience on cultivation of crops individually.

**CO 3:** To understand the different sowing methods for garden land crops

**CO 4:** To apply different seed treatment techniques

**CO 5:** To evaluate different harvesting methods and processing

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

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

### **AGR 322: POST HARVEST TECHNOLOGY AND VALUE ADDITION OF FIELD CROPS (2+0)**

#### **LEARNING OBJECTIVES**

- To gain knowledge on post-harvest technology and its importance for agricultural crops
- To acquire perception in processing of various agricultural produce
- To understand the basic concepts in value addition and byproducts

#### **THEORY**

##### **Unit-I: Post harvest losses, moisture content and properties**

Post harvest technology – importance-post harvest losses – causes - role of post harvest technology on food security - moisture content – methods of estimation –



physical properties of grains –mass, volume, density, porosity, sphericity – applications and effect of moisture content on properties.

### **Unit-II: Threshing, cleaning and grading**

Threshing – threshers for different crops – components of thresher - combine harvester - paddy baler – factors affecting threshing – winnowing – manual and power operated winnowers –cleaning, grading and sorting – types of screens – air screen cleaners – working principles of spiral separator, magnetic separator, specific gravity separator, colour sorter and inclined belt separator.

### **UNIT-III: Shelling, drying and storage**

Shelling equipment – 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 – 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 – advantages and disadvantages of parboiling-modern rice milling -Wheat milling- principles – equipment used – roller flour mill. Pulse milling – wet, dry and CFTRI methods of pulse milling – equipment. Oilseed processing – methods and machineries used – ghani, rotary and expeller –filter press – solvent extraction process - oil refining.

### **Unit-V: Value addition, byproducts and utilization**

Value addition and by products utilization of cereals – millets – pulses, Oilseeds, fibre, sugar and tuber crops – nutritive value of rice, millets and pulses – fortified food products. **Current Streams of thought.**

#### **THEORY LECTURE SCHEDULE**

1. Post-harvest technology, definition, and importance and value
2. Food Preservation, role of post-harvest technology in food security
3. Post-harvest losses: Quantitative and qualitative, and causes
4. Moisture content and its good and bad effects on storage of food grains.
5. Methods of estimation of moisture content– direct and indirect methods – wet basis and dry basis.
6. Physical properties of grains – mass, volume, density, bulk density, true density, porosity, surface area and sphericity
7. Threshing concepts, methods of threshing and factors affecting threshing
8. Types of threshers for different crops, combine harvester, paddy baler, threshing efficiency of different threshers
9. Winnowing concepts, winnower types, cleaning, grading and sorting methods and its importance in value addition
10. Types of screens –air screen cleaners - rotary - vibratory
11. Working principles of spiral separator, magnetic separator, Specific gravity separator, colour sorter and inclined belt separator
12. Working principles of maize sheller, husker sheller, hand and power operated groundnut decorticator
13. Principle of drying, importance, sun drying, advantages and shortcomings.
14. Different methods of drying- mechanical and chemical methods
15. Grain driers – different types- batch and continuous, Mixing and non-mixing – LSU drier – solar drier
16. Storage of food grains – factors affecting storage
17. **Mid Semester Examination**
18. Fumigation-methods of fumigation-dosage of fumigants
19. Traditional storage methods-advantages-disadvantages over other methods
20. Modern methods of storage –types –Construction-advantages.

21. Food refrigeration and cold storage construction
22. Rice processing - Parboiling - physio-chemical changes -advantages and disadvantages.
23. Traditional and modern methods of rice parboiling and milling.
24. Understanding various types of milling equipment in modern rice mill
25. Wheat milling - concepts - important machineries used in wheat milling.
26. Pulse milling - concepts - wet, dry and CFTRI methods - equipment used
27. Oil seed processing - methods and machineries - groundnut-gingelly-sunflower
28. Oil seed processing - methods and machineries -coconut - mustard - castor - cotton seed
29. Principles and concepts of solvent extraction process in rice bran oil-refining process
30. Value addition and byproducts utilization of rice and maize
31. Value addition and byproducts utilization of millets and pulses
32. Value addition and byproducts utilization of oilseeds and fibres
33. Value addition and byproducts utilization of tuber crops
34. Processing of sugarcane - Extraction of sugar - Jaggery preparation - preservation and storage

### **COURSE OUTCOMES**

- CO1:** Understand the basics of post harvest losses in agriculture.
- CO2:** Understand the threshing, cleaning and grading of processing.
- CO3:** Understand Technologies for Shelling, drying and storage of processed foods.
- CO 4:** Acquire the knowledge on Cereals, pulses and oilseed processing
- CO5:** Understand the Value addition, byproducts and utilization of products

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

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

### **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. Jawahar. S, S. Kandasamy, C. Kalayarasan and K. Suseendran.2018. Post-harvest Management for Agricultural Crops. Manibharathi publishers, Chidambaram, Tamil Nadu, India.
3. Kandasamy, S and G. Murugan. 2014.Post Harvest Technology for Agriculture crops-Manibharathi publishers, Chidambaram, Tamil Nadu, India.
4. Sahay. K.M. and Singh. 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)

## **PAT 323 DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIR MANAGEMENT (3+1)**

### **LEARNING OBJECTIVE**

- To acquire knowledge on 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 field and horticultural crops.

### **THEORY**

#### **UNIT I: Diseases of Cereals and Pulses**

Rice, Wheat, Sorghum, Maize, Bajra, Ragi, Minor Millets, Pulses and Post-harvest spoilage of grains during storage and their management.

#### **UNIT II: Diseases of Oil Seeds and Cash Crops**

Groundnut, Sesame, Sunflower, Castor, Mustard, Cotton, Jute, Sugarcane, Sugar beet, Tobacco and Mulberry

#### **UNIT III: Diseases of fruits & flower crops**

Mango, banana, citrus, grapevine, guava, sapota, pomegranate, papaya, jack, pineapple, apple, peach and Post-harvest disease of fruits, Flower crops: Jasmine, rose, crossandra, chrysanthemum, tuberose, carnation, gladiolus and marigold

#### **UNIT IV: Diseases of vegetables crops**

Brinjal, tomato, bhendi, cucurbits, crucifers, potato, sweet potato, cassava, beet root, radish, carrot and Post-harvest disease of vegetables.

#### **UNIT V: Diseases of Plantation crops, spices and condiments & medicinal plants**

Chillies, cardamom, turmeric, ginger, onion, garlic, pepper, betel vine, Coconut, Tea, coffee, cocoa, rubber and arecanut. Medicinal plants : Gloriosa, stevia, coleus, aloe.

**Current Streams of thought.**

### **PRACTICAL**

Study of symptoms, host-parasite relationship of important diseases of cereals, pulses, oilseeds, cash crops, horticultural crops, post harvest diseases and their management. Herbarium collection (100 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 Cumbu and Sorghum
7. Diseases of Minor millets
8. Diseases of pulses
9. Diseases of pulses
10. Post-harvest spoilage of grains during storage and their management.
11. Diseases of ground nut
12. Diseases of Sesame and Sunflower
13. Diseases of Castor and Mustard
14. Diseases of cotton
15. Diseases of sugarcane
16. Diseases of sugar beet
17. Diseases of Jute and mulberry

18. Diseases of tobacco
19. Diseases of Mango
20. Diseases of Banana
21. Diseases of Citrus
22. Diseases of grapevine
23. Diseases of Guava and sapota
24. Diseases of pomegranate and jack
25. Diseases of Papaya and pineapple
26. Diseases of Apple and Peach
27. Post harvest diseases of fruits
28. Diseases of Jasmine and rose
29. Diseases of Crossandra, chrysanthemum and Carnation
30. Diseases of tuberose, Marigold and gladiolus
- 31. Mid semester examination**
32. Diseases of Brinjal and bhendi
33. Diseases of Tomato
34. Diseases of Cucurbits
35. Diseases of Crucifers
36. Diseases of Potato
37. Diseases of Sweet potato and cassava
38. Diseases of Beet root, carrot and radish
39. Post Harvest diseases of vegetables and their management
40. Diseases of Chillies
41. Diseases of Cardamom and Turmeric
42. Diseases of ginger and onion
43. Diseases of garlic and Pepper
44. Diseases of Betel vine and Coconut
45. Diseases of Tea and Coffee
46. Diseases of Cocoa
47. Diseases of areca nut
48. Diseases of Rubber
49. Diseases of *Gloriosa*
50. Diseases of *Stevia*
51. Diseases of *Coleus*

### **PRACTICAL SCHEDULE**

#### **Study of symptoms and host-parasite relationship of:**

1. Diseases of cereals
2. Diseases of cereals and minor millets
3. Diseases of pulses
4. Diseases of storage grains
5. Diseases of oilseeds
6. Diseases of cash crops
7. Field visit
8. Diseases of fruits
9. Diseases of fruits
10. Diseases of flower crops
11. Diseases of vegetables
12. Diseases of vegetables
13. Post-harvest diseases of vegetables
14. Diseases of plantation crops
15. Diseases of spices and condiments

16. Diseases of medicinal plants
17. Field visit, FCI warehouse visit

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

#### **COURSE OUTCOMES:**

- CO 1:** To acquire the knowledge on about new emerging diseases of Cereals and pulses
- CO 2:** Having expertise in identifying and managing diseases in Oil Seeds and Cash Crops
- CO 3:** Having expertise in identifying and managing diseases in fruits & flower crops
- CO 4:** Having expertise in identifying and managing diseases in vegetables crops
- CO 5:** Trained in identifying and managing disease of Plantation crops, spices and condiments & medicinal plants

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

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

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#### **E- RESOURCES**

1. [www.ucmp.berkeley.edu/fungi](http://www.ucmp.berkeley.edu/fungi)
2. [www.ictv.org](http://www.ictv.org)
3. [www.vivo.library.cornell.edu](http://www.vivo.library.cornell.edu)
4. [agridr.in/tnauEAgri/eagri50/PATH272/index.html](http://agridr.in/tnauEAgri/eagri50/PATH272/index.html)

#### **SAC 324 CROPS AND PESTICIDE CHEMISTRY AND NANOTECHNOLOGY (2+1) LEARNING OBJECTIVES**

- To 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.

- To throw 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. **Current Streams of thought.**

## 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. 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 - vinclozolin
  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

### COURSE OUTCOMES

- CO 1:** Students thoroughly understand the chemistry of agricultural crops.  
**CO 2:** Students gain a comprehensive knowledge of the chemistry of horticultural crops, alkaloids and essential oils.  
**CO 3:** Students gain skills in handling of insecticides and their mode of action.  
**CO 4:** Students have an insight on the fungicides, herbicides and their classification, properties and mode of action  
**CO5:** Acquire information about synthesis of nonmaterial and applications of nanotechnology in agriculture

### PO-CO MAPPING MATRIX

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

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### GPB 325 BREEDING OF FIELD AND HORTICULTURAL CROPS (2+1)

#### LEARNING OBJECTIVES

- To acquire the knowledge about the breeding of field and horticultural crops
- To impart knowledge on specific breeding techniques followed in crop improvement of various Field crops and Horticultural crops.

#### 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. **Current Streams of thought.**

#### 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**

#### **COURSE OUTCOMES:**

**CO 1:** The students will be able to identify putative parents and wild relatives

**CO 2:** Will be able to differentiate the crops based on its floral biology

**CO 3:** The students will be in a position to identify and understand the methodologies employed for self, cross and vegetatively propagated crops

**CO 4:** The students will have enhanced knowledge in the current trends in plant breeding.

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

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

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### HOR 326 PRODUCTION TECHNOLOGY OF VEGETABLES, SPICES, FLOWERS AND LANDSCAPE GARDENING (3+1)

#### LEARNING OBJECTIVES

- To provide knowledge on cultivation of vegetables, spices and flower crops.
- To teach them techniques in precision farming for horticultural crops.
- To enable better understanding of basic principles and practices of landscape gardening.

#### 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, cucurbits, dolichos bean, French bean, peas and onion.

##### **Unit-II: Crop production techniques in vegetable crops - II**

Cabbage, cauliflower, carrot, beet root, radish, tapioca, potato and sweet potato, moringa, amaranthus.

##### **Unit-III: 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, coriander, fenugreek, fennel and clove.

##### **Unit-IV: Crop production techniques in flower crops**

Scope, importance and constraints of commercial floriculture industry - Area and production- 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 - export standards of the following crops: jasmine, rose, chrysanthemum, tuberose, crossandra, marigold and nerium.

##### **Unit - V: Landscape gardening and designing**



Landscape gardening –scope, importance and opportunities – history of gardening in India – elements and principles of landscape design- types of gardens –styles of garden – softscape elements in garden – hardscape elements in garden turf – establishment and maintenance –garden designing softwares and tools – Landscaping for specific areas.

**Current Streams of thought.**

#### **PRACTICAL**

Preparation of nursery bed, seed treatment and sowing – preparation of main field – sowing and transplanting – lay 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 of spices– propagation – description and identification of species and varieties in loose flowers –propagation and planting – seed treatment and sowing – planting of tubers and suckers – layout and planting of rose and jasmine –special practices in rose, jasmine, chrysanthemum and marigold – harvesting, post harvest handling and storage 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, flower beds, foliage beds, climbers and creepers, hedges, edges. evaluation of different garden sites in the campus based on the basic principles – lawn – study of types of grasses – establishment, care and maintenance of lawn – art of topiary – identification, planning and designing of non – living components –preparation of landscape design plan for various sectors.

#### **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 the following crops  
Tomato
5. Brinjal
6. Chillies
7. Bhendi
8. Cucurbits – Pumpkin, ashgourd, bottle gourd, snake gourd, ribbed gourd and bitter gourd
9. Dolichos bean and French bean
10. Peas and onion
11. Potato
12. Sweet Potato
13. Tapioca
14. Moringa
15. Amaranthus
16. Cabbage
17. Cauliflower
18. Carrot, beetroot and radish
19. 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 following crops:  
Black pepper
20. Cardamom
21. Turmeric

## **22. Mid- semester examination**

23. Ginger
24. Seed spices – Coriander
25. Seed spices – Fenugreek, fennel
26. Trees spices – Clove
27. Importance, scope and constraints of commercial floriculture industry
28. Area, production and export potential of commercial flowers
29. 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
30. Rose
31. Chrysanthemum
32. Tuberose and crossandra
33. Nerium and marigold
34. Landscape gardening – Definitions, scope, importance and opportunities – history of gardening
35. Styles and types of gardening
36. Principles and elements of landscape design.
37. Concepts in landscape designing
38. Growth habit, foliage and flower features, pruning, training and growth regulation of softscape elements – ornamental trees, shrubs, hedges and edges
39. Growth habit, foliage and flower features, pruning, training and growth regulation of softscape elements – creepers, climbers, annuals, topiary, trophy and carpet beds – indoor plants and plants for special purposes – palms, cacti, succulents, ferns and rosarium
40. Turf management – functional utility in garden, turf grasses.
41. Turf establishment and maintenance
42. Different hardscape elements in gardens and their position, establishment, materials required and maintenance – planter boxes, pavements, decks, garden benches and fences – fountains, cascades, jacuzzi, gazebo, statues and birds bath and water proofing techniques
43. Garden plan – elevation diagram
44. Garden plan – perspective diagram.
45. Layout of garden designs – matching the plant materials to design criteria – symbols in garden designing – garden designing softwares and tools
46. Landscape design for specific areas – institutions, industries, residents, hospitals, theme parks, IT parks and corporate
47. Landscape design for specific areas – Planting avenues, high way, traffic islands, dam sites and play grounds

## **PRACTICAL SCHEDULE**

1. Identification and description of varieties of vegetables
2. Nursery management of vegetable crops
3. Layout of kitchen garden.
4. Practices in manuring, fertilizer application and irrigation in vegetables.
5. Practices in use of plant growth regulators in vegetables
6. Identification of physiological disorders in vegetable crops and remedial measures
7. Maturity indices of vegetable crops
8. Post harvest handling and seed production techniques in vegetable crops
9. Identification, description of varieties and propagation techniques in spices
10. Identification and description of species and varieties of loose flowers
11. Study of propagation and pruning of flower crops

12. Garden components, basic functions and utility
13. Identification and description of softscape elements
14. Identification and description of hardscape elements
15. Indoor gardening
16. Turf establishment and maintenance
17. Principles of landscape drawing and fundamentals of manual drawing – Plan view, elevation and perspective diagram

#### **COURSE OUTCOMES:**

**CO 1:** Students will be able to understand the production technology of vegetables, spices and flower crops, its advances and precision horticulture.

**CO 2:** The student will gain skill in managing precision horticulture units.

**CO 3:** Acquire information about the gardening and landscaping in urban and semiurban areas.

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

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

#### **REFERENCE BOOKS**

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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. Gopalakrishnan, T.R. 2007. Vegetable Crops. Horticultural Science Series (Series Editor K.V.Peter). New India Publishing Agency, New Delhi.
5. Gopalamylyankar. 1970. Complete Gardening in India. Kalyan Printers, Bangalore.
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.
10. Singh, P.K., S.K. Dasgupta and S.K. Tripathi. 2006. Hybrid Vegetable Development. International Book Distributing Co.
11. Thamburaj, S. and Narendra Singh. 2001. Vegetables, Tuber crops and Spices, Directorate of information and publications of agriculture, ICAR, New Delhi.

#### **E - RESOURCES**

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)
4. [www.gardenadornment.com](http://www.gardenadornment.com)
5. [www.toptropicals.com](http://www.toptropicals.com)
6. [www.bestgarden.net](http://www.bestgarden.net)

## **AEC 327 AGRICULTURAL FINANCE, BANKING AND CO-OPERATION (1+1)**

### **LEARNING OBJECTIVES**

- To aim at imparting knowledge on principles of finance, banking and cooperation, and farm financial analyses.
- To understand the functions of various institutions involved in farm financing and different crop insurance products implemented in India.

### **THEORY**

#### **Unit I: 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 II: 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 III: 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 IV: 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 V: Cooperation**

Cooperation: Philosophy and Principles - History of Indian co-operative credit movement: Pre and Post - Independence periods and co-operation in different plan periods. Co-operative credit institutions: Two tier and three tier structure - Functions: provision of short term and long term credit - Strength and weakness of cooperative credit system - Policies for revitalizing cooperative credit: Salient features of Vaithyanathan Committee - Report on revival of rural co-operative credit institutions -

Reorganization of co-operative credit structure in India and single window system. Special Co-operatives: LAMPS, FSS, National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd. (NAFSCOB): Objectives, role and functions. **Current Streams of thought.**

### **PRACTICAL**

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

### **THEORY LECTURE SCHEDULE**

1. Agricultural Finance: Definition - Importance - Nature and scope. Agricultural credit: Meaning - Definition - Need and classification.
2. Sources of credit. Role of institutional and non - institutional agencies: Types - Roles - Advantages and disadvantages. Rural indebtedness: Consequences and control measures of rural indebtedness - History and development of rural credit in India.
3. Principles of credit - 5C's, 3R's and 7 P's of credit, Project cycle and management. Preparation of bankable projects / Farm credit proposals - Feasibility.
4. Time value of money: Compounding and discounting - Appraisal of farm credit proposals - Undiscounted and discounted measures.
5. Repayment plans. Farm financial statements: Balance sheet - Income statement - Cash flow statement - Financial ratio analysis.
6. Institutional lending agencies - Commercial banks: Nationalization - Agricultural development branches - Area approach - Priority sector lending - Regional Rural Banks.
7. Lead bank: Role and functions - Preparation of district annual credit plan and scale of finance - Kisan Credit Card (KCC) Scheme and Know Your Customer (KYC). Rural credit policies followed by State and Central Government - Subsidized farm credit, Differential Interest Rate (DIR) Scheme - Relief measures and Loan Waiver Scheme.
8. Higher financial institutions: RBI, NABARD, AFC, ADB, World Bank and Deposit Insurance and Credit Guarantee Corporation of India - Role and their functions in rural credit.
9. **Mid Semester Examination**
10. Microfinance: Definition and its role in poverty alleviation - Self-Help Groups: Characteristics, role, functions, growth and development in India - Role of Non-Governmental Organizations in promoting SHGs.
11. Negotiable Instruments: Meaning - Importance and Types - Central bank: RBI - functions - Credit control - Objectives - CRR, SLR and Repo rate - Credit rationing - Dear money and cheap money.

12. Financial inclusion and exclusion: Credit widening and credit deepening monetary policies. New generation private sector banks. Credit gap: Factors influencing credit gap. Non- Banking Financial Institutions (NBFI).
13. Assessment of crop losses - Determination of compensation - Crop Insurance: Schemes - Coverage - Advantages and limitations in implementation - Estimation of crop yields - Livestock insurance schemes - Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.
14. Cooperation: Philosophy and Principles - History of Indian co-operative credit movement: Pre and Post - Independence periods and cooperation in different plan periods.
15. Cooperative credit institutions: Two tier and three tier structure - Functions: provision of short term and long term credit - Strength and weakness of cooperative credit system.
16. Policies for revitalizing co-operative credit: Salient features of Vaithiyanathan Committee - Report on revival of rural cooperative credit institutions - Reorganization of cooperative credit structure in India and single window system.
17. Special Co-operatives: LAMPS, FSS, National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd. (NAFSCOB): Objectives, role and functions.

#### **PRACTICAL SCHEDULE**

1. Visit to a farm to study the credit needs, problems and suggestions in the use of farm credit.
2. Preparation of Bankable Projects / Farm Credit Proposals.
3. Project preparation and appraisal - Undiscounted methods.
4. Project preparation and appraisal - Discounted methods.
5. Preparation of Balance Sheet and Income Statement.
6. Preparation of Cash flow Statement and Exercise on preparation of Repayment plans.
7. Exercise on financial ratio analysis.
8. Appraisal of farm credit proposals.
9. Visit to Commercial Bank / Lead Bank to study its role and functions.
10. Visit to NABARD to study its role and functions.
11. Visit to Regional Rural Bank to study its role and functions.
12. Visit to Primary Agricultural Co-operative Bank (PACB) to study its role, functions and procedures for availing loan.
13. Visit to District Central Cooperative Bank (DCCB) to study its role, functions and procedures for availing loan - Fixation of Scale of Finance.
14. Visit to Cooperative Agricultural and Rural Development Bank (Land Development Bank) to study procedures for availing long term credit.
15. Visit to Self-Help Group to study its characteristics, roles and functions.
16. Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.
17. **Orientation for final examination**

#### **COURSE OUTCOMES:**

- CO1:** To understand the functions of various institutions involved in farm financing.
- CO 2:** To know the principles of credit, 5c's, 3R's and time value of money.
- CO 3:** To gain knowledge on microfinance, role of SHG's, NGO.
- CO 4:** To understand risk mitigating measures like agricultural insurance schemes available for the benefits of famers.



## CO-PO MAPPING MATRIX

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

## REFERENCE BOOKS

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

### LEARNING OBJECTIVES

- To impart knowledge to the students on different extension methods and approaches used for transfer of agricultural technology.
- 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. **Current Streams of thought.**

## PRACTICAL

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

## THEORY LECTURE SCHEDULE

1. Extension Education - Meaning, definition and importance, Agricultural Extension - Meaning, definition. Linkage between Research, Extension and Clientele systems
2. TOT- Meaning and definition, components of TOT, models and approaches of TOT - Importance of TOT in Agricultural Extension
3. Communication - meaning, definition, types and modules communication (Aristotle Shanon and Weaver, Berlo, Schramm, Leagans, Rogers and Shoemaker)
4. Elements of communication and their characteristics - Barriers of communication.
5. Extension teaching methods - Meaning, definition, functions and classification. Individual contact methods - Farm and home visit, Farmers call, Personal letter, Result demonstration.
6. Group contact methods - Method demonstration, group meeting, small group training, field day or farmers' day, study tour, lecture, debate, workshop, seminar, forum, conference, symposium, panel discussion brainstorming, buzz session.
7. Mass contact methods - Campaign, Exhibition, Farmers Day, Field trips, Radio, Television Farm publications - Circular letter, Leaflet, Folder, Pamphlet, Newsletter, Newspaper.
8. Audio aids, Visual aids, Audio-Visual aids - Definitions, classification, Factors influencing selection and use of audio visual aids.
- 9. Mid semester Examination.**
10. e-Extension-Internet, video and teleconferencing, Interactive Multimedia Compact disc (IMCD)
11. Agri portals, Information kiosks, Kisan Call Centre (KCC)
12. Mobile phone, Expert System, Village Knowledge Centre (VKC), DEMIC
13. Agricultural journalism (Print media) - Definition, principles, importance, ABC of news, types of news.
14. Participatory Extension Approaches - Meaning, Definition, Importance, Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA) - Resource Mapping, Transect Walk, Matrix ranking, Venn diagram, Seasonal calendar.
15. Participatory Technology Development - Meaning and steps
16. Diffusion of Innovations - Definition, elements; Innovation - definition, attributes. Adoption - meaning, steps in adoption process, Innovation Decision process.
17. Adopter categories - Factors influencing adoption of innovations - Consequences of innovations.

## PRACTICAL SCHEDULE

1. Understanding the communication methods followed by the State Department of Agriculture for TOT.
2. Planning and preparation of posters and charts.
3. Planning and preparation of flash cards and flannel graph.
4. Planning and preparation of extension literature- leaflet, folder and pamphlet
5. Practice on conduct of method demonstration in a village.
6. Exercise on conducting brain storming.
7. Practice on script writing for Radio.
8. Practice on script writing for television.

9. Practice on script writing for newspapers.
10. Visit to local press (newspaper agency) to study their media activities
11. Practice on handling of digital camera
12. Art of public speaking.
13. Practicing PRA techniques in a village setting.
14. Preparation of interview schedule to study the spread and acceptance of Agricultural technologies
15. Visit to village to study the spread and acceptance of Agricultural technologies
16. Processing of data, preparation and presentation of reports.
17. **Orientation for final examination**

#### **COURSE OUTCOMES:**

At the end of the course students will be able to

- CO 1:** Understand extension methods and approaches used for transfer of agricultural technology.
- CO 2:** Understand various models of communication and communication barriers.
- CO 3:** Gain expertise on e-Extension and Agricultural journalism
- CO 4:** Prepare and use of different extension teaching methods.

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

	<b>PO 1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	1	-	2	2	3	-
<b>CO2</b>	-	3	-	3	-	2
<b>CO3</b>	2	-	2	-	-	3
<b>CO4</b>	-	3	-	-	3	-

#### **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**

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

## GPB 329 PRINCIPLES OF SEED PRODUCTION, SEED QUALITY REGULATION AND STORAGE (2+1)

### LEARNING 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 - PPV and 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. **Current Streams of thought.**

### 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**

#### **COURSE OUTCOMES:**

- CO 1:** Acquire knowledge on Seed quality characteristics, significance and Genetic and agronomic principles of seed production
- CO 2:** Understand the Seed production techniques of Agricultural crops. Post harvest seed handling techniques
- CO 3:** Understand the Seed production techniques of Horticultural crops. Post harvest seed handling techniques
- CO 4:** Understand the Seed Legislation and certification procedures and Seed quality testing, Storage and Marketing

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

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



## OPC 001: OPTIONAL COURSES

### OPC AGR 001: INDIGENOUS TECHNOLOGY IN AGRICULTURAL PRODUCTION (1+1)

#### LEARNING 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.

#### Current Streams of thought.

#### 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 rain fall 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 Certification

**COURSE OUTCOMES**

- CO1:** To execute the concepts, need and importance of indigenous knowledge in agriculture
- CO2:** To learn indigenous knowledge in predicting rainfall, crop production techniques, pest and disease management
- CO3:** To analyse situations to blend indigenous knowledge with modern technologies in farming
- CO4:** To develop sustainable indigenous farming practices with modern technologies
- CO5:** To improvise technology for seed treatment, storage of food grains recycling of agricultural wastes

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

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## OPC ENT 001: INDUSTRIAL ENTOMOLOGY (1+1)

### LEARNING OBJECTIVES

- To practice the students for bee keeping and silkworm rearing
- To formulate biopesticides and marketing strategies
- To impart knowledge on urban pest control and insect farming.

### THEORY

#### Unit - I: Commercial Apiculture

Scope, importance and Benefits of Apiculture -Traditional Beekeeping - Modern Beekeeping - Urban or backyard beekeeping - Role of Central Honey Bee Research & Training Institute - Basic requirements for starting beekeeping - Economics of small scale and large scale beekeeping - Establishment of Apiary - Installation of various hive models usage of various accessories - Value addition Production and Storage of quality honey, wax, pollen and royal jelly - Apitherapy. Marketing of Bee products - Pollination service.

#### Unit - II: Commercial Sericulture

Scope and importance of sericulture and Ericulture as allied industry in India - Cost of production of mulberry for rearing 100 dfls - Non - recurring and recurring expenditure in sericulture - Identifying commercially important silkworm races. Important cocoons markets in Tamilnadu and Karnataka. Evaluation of cocoons in market. Seasonal market variability. Cost Benefit ratio for CB and CSR breeds. By products of seri industry and their marketability. Production and marketing of Eri cocoons.

#### Unit -III: Commercial production of Biopesitocides

Novel methods of collection, preservation and identification of important predator and parasitoids. Commercial production and field release techniques of predators and parasitoids. Identification and commercial production of important entomopathogens -Quality control and formulation of entomopathogens.

#### Unit-IV: Commercial urban pest management

Scope and prospects of Urban Pest Management - Economic and public health importance of pests in residential areas - Commercial management of termites, mosquitoes, house flies, cattle pests and rodents. Essential equipments and their usage in urban pest management. Formulations of pesticides and traps used in urban pest management. Calibration calculations for application of pesticides per unit area. Establishing procedures for commercial Pest control and Fumigation services for employment. Laws and regulations in urban pest management.

#### Unit- V: Commercial Insect Farming

Introduction to edible insects and Promoting Entomophagy - Insect Usage as an Industrial Animal Feed/Feed Ingredient. Successful case histories and their farming-market possibilities. **Current streams of development in Commercial Entomology.**

### THEORY SCHEDULE

1. Scope, importance and Benefits of Apiculture. Traditional, Modern and Urban or backyard Beekeeping. Role of Central Honey Bee Research & Training Institute. Basic requirements for starting beekeeping - Economics of beekeeping- Economics of commercial small scale and large scale beekeeping.
2. Beekeeping Hives, Installation of Hives, Tools - Necessities of honey bee adaptations. Production and Storage of quality honey- Value addition process in Apiculture -Types of value added honey products - Bee therapy.
3. Marketing of Bee products - Marketing Honeycomb and Honey, Honey extraction, Processing, costing, Packaging - Marketing. Bee wax rendering,

purification and Marketing. Marketing of Propolis and Pollen. Royal Jelly extractor, Royal jelly preparation and Marketing - Marketing of Bee venom. Pollination services.

4. Scope and importance of sericulture and Ericulture as allied industry in India - Contribution of Sericulture and Ericulture to rural economy, GDP and Export. Cost of production of mulberry for rearing 100 dfls - Land preparation to harvest and labour requirement per acre.
5. Non - recurring expenditure in initiation of sericulture - Rearing house construction, rearing structures, equipments. Working out differences among Pucca structures and cost effective methods.
6. Recurring expenditures; labour requirement, DFLs, Bed disinfectants. Identifying commercially important silkworm races. Important cocoon markets in Tamil Nadu and Karnataka. Evaluation of cocoons in market - Renditta estimation, Price fixation and auction procedures. Seasonal market variability. Establishment of reeling units - Filature and cottage basin- their economics and minimum requirements.
7. Cost of production of Eri cocoons and its marketing.
8. Novel methods of collection, preservation and identification of important predator, parasitoids and pathogens.

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

10. Novel methods of collection, preservation and identification of important predator, parasitoids and pathogens formulation and marketing.
11. Compatibility of bio pesticides, botanical and chemical pesticides.
12. Bio pesticides for important agricultural and Horticultural crops.
13. Scope and prospects of Urban Pest Management— Economic and public health importance of pests in residential areas. Pests of cattle, poultry, pet animals and their management and Rodents management.
14. Termite proofing in buildings both under construction and existing. Establishing procedures for commercial Pest control and Fumigation services for self employment. Laws and regulations in urban pest control.
15. Introduction to edible insects - History of entomophagy - Edible insects farming and concepts
16. Insect farming for feed and human consumption
17. Food Safety in Insect Based Foods - Insects and their connection to Food Allergy

#### **PRACTICAL SCHEDULE**

1. Installation of Hives - Production and Storage of quality honey
2. Marketing of Bee products and visit to commercial apiculture unit
3. Working out cost benefits ratio of Apiary
4. Preparing bankable bee keeping project.
5. Cost of production of mulberry for rearing 100 dfls
6. Identifying commercially important silkworm races.
7. Working out Cost Benefit ratio for CB, CSR breeds and eri silkworm.
8. Identification Commercial production techniques of important predators and parasitoids.
9. Commercial production of Entomopathogens
10. Quality parameters of Entomopathogen.
11. Establishment of urban pest management Unit
12. Practicing various equipments used for urban pest management and calibration calculation including for termite proofing.
13. Working out cost benefit ratio of urban pest management unit.

14. Establishment of Insect rearing facility – Insect specimen & their requirements
15. Semi-cultivation of edible insects
16. Working out cost benefit ratio in using poultry insects as feed.
17. Visit to commercial Apiculture, Sericulture and Bio-pesticide production units.

#### **COURSE OUTCOMES:**

- CO 1:** Development of Apiary and practice bee keeping
- CO 2:** Practice silk worm rearing and marketing
- CO 3:** Formulate biopesticides and marketing
- CO 4:** Importance of household pest control and using various related techniques
- CO 5:** Understand various techniques for insect farming.

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

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

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## OPC PAT 001 EMERGING TRENDS IN PLANT DISEASE MANAGEMENT (1+1)

### LEARNING OBJECTIVE

- 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.

#### Current Streams of thought.

### 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

#### **COURSE OUTCOMES**

- CO 1:** Understand the conventional methods in Plant Disease Management
- CO 2:** Practice the use of new molecules of fungicides and their action on diseases management.
- CO 3:** Developed the skill on molecular techniques in plant disease management
- CO 4:** Understand the biological and botanical methods and their utilization in plant disease management

## CO - PO MAPPING MATRIX

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

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## OPC AGM 001 ADVANCED MICROBIAL BIOTECHNOLOGY (1+1)

### LEARNING OBJECTIVES

The subject is designed to impart knowledge on

- The fermentation concepts and types
- Industrial production of microbial inoculants and dairy products
- 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. **Current Streams of thought.**

#### **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 mycorrhizhal 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

### **COURSE OUTCOMES:**

- CO 1:** Students gained knowledge on the basic and applied aspects of Fermentor design and operation
- CO 2:** Students gained knowledge on the historical developments and microbial inoculants
- CO 3:** Students exposed to practical hands on experience in the basic skills employed in microbiological laboratories, food and dairy products
- CO 4:** Students thoroughly exposed to modern approaches in bioremediation
- CO 5:** Students gained knowledge on biodegradable plastic and superbugs.

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

	<b>PO 1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3	-	2	3	1	2
<b>CO2</b>	-	3	-	3	2	1
<b>CO3</b>	3	1	-	3	1	3
<b>CO4</b>	3	3	-	1	2	2
<b>CO5</b>	3	-	-	-	2	-

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## OPC SAC 001- FARM ADVISORY ON SOIL HEALTH, WATER QUALITY AND PLANT NUTRITION (1+1)

### LEARNING OBJECTIVES

- To impart practical knowledge on soil related constraints, irrigation water quality appraisal guidelines & their efficient management.
- Diagnosis of plant nutrient related problems, soil & water pollution and their impact on crop production and techniques for development of commercial fertilizer formulations & 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. **Current Streams of thought.**

## PRACTICALS

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.

## 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 & 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 & 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 & 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 & waters for heavy metals
17. Record Certification

## COURSE OUTCOMES:

- CO 1: Understand the Physical, Chemical and Biological constraints in soil  
CO 2: Diagnosed the Irrigation water quality appraisal and its management  
CO 3: Practice the diagnostic techniques for nutrient disorders and nutrient recommendations for reclamation of soil  
CO 4: Identify the Soil and water pollution and its management



## CO - PO MAPPING MATRIX

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

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### OPC GPB 001 PLANT TISSUE CULTURE (1+1)

## LEARNING 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 auxillary 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. **Current Streams of thought.**

## 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**

1. Tissue culture laboratory and equipment needs.
2. Machines and equipments used in plant tissue culture laboratory.
3. Sterilization techniques.
4. Preparation of MS stock solutions.
5. Preparation of growth regulator stock solutions.
6. Preparation of MS culture medium.
7. Meristem tip culture.
8. Micro propagation in banana.
9. Regeneration via direct organogenesis pathway.
10. Regeneration via indirect organogenesis pathway.
11. Regeneration via direct somatic embryogenesis pathway.
12. Regeneration via indirect somatic embryogenesis pathway.
13. Synthetic seeds.
14. Production of Haploids.
15. Embryo culture.
16. visit to commercial tissue culture laboratory
17. **Orientation for final examination**

### **COURSE OUTCOMES:**

**CO 1:** The students will be able to prepare and sterilize growing medium

- CO 2:** Will be able to handle sterile transfer chamber and equipment
- CO 3:** Will be able to excise explants and transfer of plant material to tissue culture medium
- CO 4:** The students will have the ability to do independent tissue culture experiments by testing different growth parameters *invitro*

#### CO-PO MAPPING MATRIX

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

#### REFERENCE BOOKS

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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 001 SUPPLY CHAIN MANAGEMENT, PROCESSING AND VALUE ADDITION IN HORTICULTURAL CROPS (1+1)

#### LEARNING OBJECTIVES

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

#### THEORY

##### Unit-I: Principles of post harvest technology

Importance and scope of post harvest technology and causes of post harvest losses - Maturity indices and time of harvesting - pre and post harvest physiological changes in Horticultural produce.

##### 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. **Current Streams of thought.**

### **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 Examination.**
10. Methods of packing: controlled and modified atmospheric packaging – vaccum, 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**

#### **COURSE OUTCOMES**

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

**CO 2:** Will gain skill in doing post harvest operations pertaining to Horticultural products.

**CO 3:** Will become able to work in post harvest industries

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

	<b>PO 1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3	-	3	2	2	2
<b>CO2</b>	2	-	3	2	3	2
<b>CO3</b>	3	-	2	2	3	2

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2. Desrosier, N.W. and Desrosier, J.N. 1987. The technology of food preservation. CBS publishers and distributors, New Delhi.
3. Cruess, W.V. 1997. Commercial fruit and vegetables products, Agro Botanica, Bikaner, Rajasthan.
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.
6. Vijay Sethi, Shruti Sethi, B.C. Deka and Y.R Meena, 2005. Processing of fruits and vegetables for value addition. Indus Publishing Company.

### **OPC AEC 001: AGRICULTURAL PROJECT MANAGEMENT (1+1)**

#### **LEARNING OBJECTIVES**

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 & 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.

**Current Streams of thought.**

### **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 SCHEDULE**

1. Introduction - Project definition - Project characteristics - Project performance dimensions
2. Project cycle, conceptualization, planning, execution phases - Project classification
3. Project identification - Formulation - Feasibility study - Economic and market analysis
4. Environmental impact study - Financial analysis - Pay back period, ROI, NPV, BCR, IRR
5. Risk and uncertainty - Economic benefit – Management aspects - Project appraisal – Market, Technical, Economic appraisal
6. Detailed project report - Project organization design
7. Human resource management - Role management - Team building
8. Communication - Motivation - Decision making leadership
9. **Mid Semester Examination**
10. Project management - Bar chart - Milestone chart - Networks - PERT - Network diagram - Computation of EST & LST - Network analysis - CPM
11. Time cost relationship of an activity - Project crashing - Project control
12. Monitoring – Introduction, basic elements, importance - Monitoring and progress reporting - Monitoring techniques
13. Indicators for monitoring - Types of monitoring - Monitoring risk and uncertainties
14. Evaluation – Definition, introduction, features, importance - Comparison of appraisal, monitoring and evaluation
15. Types of evaluation - Designing monitoring and evaluation system
16. Salient aspects of evaluation - Quantitative and qualitative approaches
17. Participatory monitoring and evaluation - Social audit - 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. Practical Examination

### **COURSE OUTCOMES:**

At the end of the course students will be able to

**CO 1:** Understand nature and scope of financial management in agribusiness.

**CO 2:** Identify the tools for credit, repayment and down payments.

**CO 3:** Do the appraisal of projects by measurement of costs benefits and sensitivity analysis.

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

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

### **REFERENCES**

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 & 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 001 ADVERTISING TECHNOLOGIES (1+1)**

#### **LEARNING OBJECTIVES**

To enable the students to learn about

- Various formats of advertising
- Elements of graphic design
- Copy writing and designs

#### **THEORY**

##### **Unit I - Advertising: Basics Concepts**

Definition, Nature, Scope, objectives of Advertising - social, economic, ethical and legal issues in advertising.

##### **Unit II - Types and Trends in Advertising**

Advertising based on target audience and geographic area, Components of advertising, outdoor advertising - transit advertising, point of purchase advertising, Latest trends in advertising.

### **Unit III - Media Planning**

Media planning, Media selection, Media scheduling

### **Unit IV - Copy Writing**

Guidelines for Copy writing, writing headlines, Writing slogans, Logos & Trademarks-Copy production and Copy testing.

### **Unit V - Designing of Advertisements**

Conceptualization, Ideation, Visualization, Designing a layout, Typography, making of story board. Measurement of advertising performance. **Current Streams of thought.**

### **PRACTICAL**

Design an advertisement for a consumer product, public service advertisement, testimonial advertisement, comparative advertisement, an advertisement for brand promotion, advertisement with emotional appeal, advertisement with fear appeal, an advertisement with humorous appeal, visual dominant advertisement, souls advertisement, Designing a layout for a print advertisement, Practicing radio commercials, Developing storyboard for a TV commercial, Practicing TV commercials, Visit to an advanced digital studio, Visit to an advertising agency and a corporate to study its advertising strategy

### **LECTURE SCHEDULE**

1. Definition, Nature, Scope and objectives of Advertising
2. Social and economic issues in advertising
3. Legal and ethical issues in advertising.
4. Advertising based on target audience and geographic area
5. Components of advertising
6. Outdoor advertising - transit advertising
7. Point of purchase advertising,
8. Latest trends in advertising.
- 9. Mid-Semester Examination**
10. Media planning, media selection, media scheduling
11. Guidelines for Copy writing,
12. Writing headlines, writing slogans, Logos & Trademarks.
- 13.** Copy production and Copy testing.
14. Conceptualization, Ideation, Visualization
15. Designing a layout, Typography,
16. Making of a Story board.
17. Measurement of advertising performance

### **PRACTICAL SCHEDULE**

1. Design an advertisement for a consumer product
2. Design a public service advertisement
3. Design a testimonial advertisement
4. Design a comparative advertisement
5. Design an advertisement for brand promotion
6. Design an advertisement with emotional appeal
7. Design an advertisement with fear appeal
8. Design an advertisement with humorous appeal
9. Designing a layout for a print advertisement
10. Practicing radio commercials
11. Developing storyboard for a TV commercial

12. Practicing TV commercials
13. Visit to an advanced digital studio
14. Design a visual dominant advertisement
15. Design a souls advertisement
16. Visit to an advertising agency
17. Visit to a corporate to study its advertising strategy

#### **COURSE OUTCOMES:**

At the end of the course students will be able to

- CO1:** Understand the concepts social, economic, ethical and legal issues in advertising.
- CO2:** Evaluate the types and trends in advertising
- CO3:** Understand the media planning and copy righting.
- CO4:** Practice the designing techniques in advertising.

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

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

#### **REFERENCES**

1. Visual Communications, Hasan Siddiqui, Anmol Publications Pvt Ltd, 2011
2. Visual Communications, Paul Martin, Bio Green Books, 2016
3. Practice of Advertising, Adrian R Mackay, Reed Elsevier India Pvt.Ltd, 2005
4. Handbook of Advertising, Christopher Jones, Nabu Press, 2010
5. Advertising Handbook, Alistair Paterson, Routledge, 2002

#### **E- RESOURCES**

1. [www.iadttdesign.com](http://www.iadttdesign.com)
2. [www.pinterest.com](http://www.pinterest.com)
3. [www.vcgcorporate.com](http://www.vcgcorporate.com)
4. [www.blog.bannersnack.com](http://www.blog.bannersnack.com)
5. [www.wordstream.com](http://www.wordstream.com)

#### **OPC- AHS 001 - GOAT REARING AND MANAGEMENT (1+1)**

#### **LEARNING OBJECTIVES**

- To impart the importance of goat rearing in rural farming
- To expose the students to essential goat management skills
- To offer hands on training in various goat rearing practices with emphasis to recent technologies

#### **THEORY**

##### **Unit-1: Introduction**

Introduction- importance of goat farming- Common terminologies - Goat milk and meat: composition - importance in human nutrition.

##### **Unit II: Goat Breeds and Breeding Management**

Breeds- classification of breeds - milk, meat and dual purpose- Breeding management- Estrous cycle - types of mating- Artificial insemination - Controlled breeding.

### **Unit III: Farming Practices**

Goat and its role in integrated farming system - Housing management- systems of housing- slatted, pen and run, concrete - space requirements - Care and management of buck, doe and kids - Daily Farm routines.

### **Unit IV: Nutrition**

Nutrition - Feeding management - Feeds and fodder - Flushing Vs Steaming up - Requirement of nutrients - grazing behavior.

### **Unit- V: Disease Management**

Introduction to goat diseases - Vaccination- Dipping - general control measures of diseases. **Current Streams of thought.**

### **PRACTICALS**

External parts - Restraining methods - Identification Methods - Identification of Goat breeds - Judging - Dentition - Type and design of goat house - Identification of does in oestrous - Artificial Insemination - Control of ecto and endo parasites - Vaccination Schedule - Identification of feed and fodder - Methods of goat feeding - Visit to goat farm.

### **THEORY LECTURE SCHEDULE**

1. Introduction to goat farming.
2. Common terminologies in goat rearing.
3. Composition of goat milk and meat.
4. Importance of milk and meat in human nutrition.
5. Breeds - Classification of goat breeds.
6. Oestrous cycle in goats.
7. Types of mating, Artificial Insemination.
8. Caprine and its role in integrated farming system.
9. **Mid Semester Examination.**
10. Housing management and space requirements.
11. Daily farm routines.
12. Care and management of buck, doe and kids
13. Nutrition and requirements of nutrients.
14. Flushing vs Steaming up.
15. Fodder for goat rearing - grazing behavior of goats.
16. General Disease management its prevention and control measures.
17. Vaccination and dipping.

### **PRACTICAL SCHEDULE**

1. Study of external parts of goats.
2. Restraining methods of goats.
3. Identification methods in goats.
4. Identification of goat breeds.
5. Judging of goats.
6. Dentition in goats.
7. Type and design of goat house.
8. Identification of does in oestrus.
9. Artificial Insemination.
10. Control of ecto and endo parasites.
11. Vaccination protocol.
12. Identification of feed and fodder.
13. Methods of goat feeding.
14. Daily farm operations in goat farm.
15. Maintenance of goat farm records.
16. Visit to goat farms.
17. **Practical Examination.**

### COURSE OUTCOMES:

At the end of the course students will be able to

- CO 1: Understand the importance of goat farming.
- CO 2: Identify the different types of goat breeds and its breeding management
- CO 3: Understand the Housing management- and caring of goats
- CO 4: Acquire knowledge on nutritional requirements and disease management in goats.

### CO - PO MAPPING MATRIX

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

### REFERENCE BOOKS

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2. Hafez,E.S.E 1968 Adaptation of animals, Lea & Febiger, Philadelphia
3. Handbook of Animal husbandry,2002 ICAR, New Delhi
4. Ranjan, S.K., 1990, Agro Industrial by products and Non conventional feeds for livestock feeding , ICAR, New Delhi
5. Sastry, N.S.R, C.K. Thomas and R.A. Singh 1996. Livestock Production Management, Third revised edition, Kalyani Publishers, Rajendra Nagar, Ludhiana

### VII SEMESTER

#### STUDENT READY COMPONENT 1 - RURAL AGRICULTURAL WORK EXPERIENCE (0+20)

#### RAWE AEX 410 Village attachment and Technology Transfer (0 + 5)

#### LEARNING OBJECTIVES:

- 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

#### COURSE OUTCOMES:

At the end of the course students will be able to

- CO 1: Understand rural situation, institutions and organizations.

- CO 2:** Understand customs and value systems of the villagers.  
**CO 3:** Familiarize with cropping pattern and extend of adoption agricultural practices  
**CO 4:** Undertake field visits and agricultural demonstrations.

**CO-PO MAPPING MATRIX**

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

**RAWE AGR 411 Agronomical Interventions (0 + 3)**

**LEARNING OBJECTIVES:**

- 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.

**COURSE OUTCOMES:**

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

**CO-PO MAPPING MATRIX**

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



### RAWE HOR-412 Horticultural Interventions (0 + 2)

#### LEARNING OBJECTIVES

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

#### COURSE OUTCOMES:

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

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

### RAWE CPT-413 Crop Protection Interventions (Entomology and Plant Pathology) (0 + 4)

#### LEARNING OBJECTIVES

- To formulate ideas about on farm pest management situations
- To demonstrate pest management techniques learnt under field situation
- To interact with farmers and get acquainted with field situations
- To understand plant protection problems in standing crops in fields

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.

#### COURSE OUTCOMES:

CO 1: Illustrate identification of pest problems in farmers' fields

CO 2: Analyse various pest management practices practiced by farmers

CO 3: Demonstrate practical applications of pest management techniques learnt

CO 4: Manage real field situations in pest management scenarios

#### CO-PO MAPPING MATRIX

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

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

#### LEARNING OBJECTIVE

- 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.

#### COURSE OUTCOMES:

At the end of the course students will be able to

- CO 1:** Understand the functioning of important national institutes related to agriculture
- CO 2:** Understand the functioning of important national institutes related to allied fields.
- CO 3:** Get exposure on various agro climatic zones and their features.

#### CO-PO MAPPING MATRIX

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

#### STUDENT READY COMPONENT 2 - AIA AEC 415 Agro Industrial Attachment (0 + 6)

#### LEARNING OBJECTIVES

- To develop entrepreneurial skill on agro based industries
- To gain practical knowledge and on field experience to understand economic feasibility of agro based industries

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:

- 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
- 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.

#### **COURSE OUTCOMES:**

At the end of the course students will be able to

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

**CO 2:** Start own business and become an entrepreneur

**CO 3:** Prepare project report

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

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

CO2	-	-	3	3	-	-
CO3	3	-	2	-	-	3

## VIII SEMESTER

### STUDENT READY COMPONENT 3 - EXPERIENTIAL LEARNING/SKILL DEVELOPMENT (0+20)

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

#### EXP AGR 421 PRODUCTION OF LIQUID ORGANIC FORMULATIONS (0+10) LEARNING OBJECTIVE

- To acquire practical experience in preparation and marketing of liquid organic formulations as a business enterprise.

#### WORK PLAN

Students will procure required raw materials for preparation of certain liquid organic formulations viz., *Panchakavya*, *Dasagavya*, *Amirdhakaraisal*, *Jeevamirtham*, *Agniastra*, *Vermiwash*, *Beejamirtha*, *Amrut pani* and other related formulations depending upon the availability and feasibility. On procurement of raw materials and other essentialities the students will prepare the formulation following the scientific procedures he/she learnt in the earlier classes. The final product will be marketed. A balance sheet will be prepared for making out profit and loss account.

#### COURSE OUTCOMES:

- CO1: Student can gain basic knowledge on preparation of certain liquid organic formulations  
 CO2: Can gain skills on scientific procedures  
 CO3: Will become capable of doing marketing of products.

#### CO-PO MAPPING MATRIX

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

#### EXP AGR 422 SEED PRODUCTION OF LEGUMES / GREEN MANURE / FODDER (0+10)

#### LEARNING OBJECTIVE

- To motivate the students in seed production activities as a business enterprise and to gain confidence as a leader in seed production technology.

#### WORK PLAN

Students will procure quality seeds from certified agencies/ Agricultural Universities/ Government seed farms. Depending upon the availability choice of seed will be taken for production. Students will themselves raise the crop till harvest following all scientific principles and approved methods. The seeds harvested will be marketed after following seed legislation. A balance sheet will be prepared for making out profit and loss account.

#### COURSE OUTCOMES

- CO1: Acquire knowledge on production of seeds of legumes and fodders  
 CO2: Develop skills on scientific principles of seed production

CO3: Trained to marketing of produced seeds.

#### CO-PO MAPPING MATRIX

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

#### EXP ENT 421 BIO PESTICIDES AND BIOCONTROL AGENTS PRODUCTION TECHNOLOGY (0+10)

##### LEARNING OBJECTIVES

- Have hands on Experience in production of botanical insecticides and microbial insecticides.
- To understand the economics of bio pesticides production unit.

##### PRACTICAL

Preparation of neem oil and other neem based formulations. Packing and marketing - equipments & facilities needed. Economics of botanical insecticides. Mass production of Beauveria, Metarhizium, Verticilium and Paecilomyces. Fermentors in large scale production. Operating procedures and standardization of parameters. Development of liquids and talc based formulations - Quality parameters - Marketing strategies - Economics of microbial insecticides - Visit to commercial biocontrol laboratories.

##### COURSE OUTCOMES

CO1: Acquire knowledge on production of biopesticides

CO2: Develop skills on bioagents production

CO3: Trained to market of produced biopesticides and biocontrol agents.

#### CO-PO MAPPING MATRIX

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

#### EXP ENT 422 COMMERCIAL APICULTURE (0+10)

##### LEARNING OBJECTIVES

- To have hands on training in apiculture
- To understand the economics of bee keeping and marketing of honey and other by-products

##### PRACTICAL

Hands on experience in establishment of Apiary-Transport of hives, installing hives in Apiary. Maintenance of bee floral garden - identification of nectar and pollen yielding plants - preparation of month wise bee floral calendar. Management of bees during dearth and honey flow period. Swarming and absconding - Detection and management. Pest and disease management in bees- Harvesting of honey - Packing and marketing - Processing bee wax and marketing - Cost benefit ratio of rearing Indian bees.

##### COURSE OUTCOMES

CO1: Acquire knowledge on bee keeping

CO2: Practice bee keeping and handling of bees at Apiary.

CO3: Packing and Marketing of honey.

#### CO-PO MAPPING MATRIX

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

#### EXP ENT 423 COMMERCIAL SERICULTURE (0+10)

#### LEARNING OBJECTIVES

- To have hands on training in sericulture
- To understand the economics and marketing of cocoons

#### PRACTICAL

Hands on experience in Mulberry cultivation – Preparation of land – Practising Row system, Pit system and Tree plantation of mulberry – Maintenance of mulberry garden for chawki and late age rearing. Practicing leaf and shoot harvesting methods. Storage of leaves/shoots. Chopping of leaves for different instars. Identifying various races of mulberry silk worms. Grainage technology –Practicing mother moth examination. Disinfection of rearing house and equipments. Block boxing. Brushing of DFL. Practicing shoot rearing – feeding, bed cleaning and other care – Maintenance of temperature and relative humidity. Silkworm disease management. Mounting matured worms in mountages. Harvesting and deflossing. Transport of cocoons to market. Participation in auction. Working out cost benefit ratio for 100 DFL. Castor cultivation and rearing of eri silkworm. Rearing of eri silkworm – care and management. Economics and marketability of eri cocoon.

1. Training for the raising of Mulberry nursery
2. Hands on training for collection of leaves, chopping, pruning & preservation of leaves –feeding for chawki rearing.
3. Hands on training for late age rearing
4. Disinfection procedures to maintain aseptic condition in sericulture rearing rooms.
5. Care to be taken during moulting
6. Pests and disease management
7. Training on post cocoons technology
8. Importance of silk
9. Hands on training on Ericulture

#### COURSE OUTCOMES

CO1: Acquire knowledge on rearing of chawki and late age worms and also mulberry cultivation

CO2: Develop skills on silkworm rearing techniques

CO3: Practice training to market the cocoons.

#### CO-PO MAPPING MATRIX

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



## EXP PAT 421 MUSHROOM CULTURE (0+10)

### LEARNING OBJECTIVE

- To give practical exposure to the students in various technologies in seed production.

### WORK PLAN

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, *Calocybes*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.

### COURSE OUTCOMES

- CO1: Practice the production of mushrooms
- CO2: Develop skills on handling and creation of infrastructure
- CO3: Trained to plan mushroom business and marketing.

### CO-PO MAPPING MATRIX

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

## EXP PAT 422 BIOLOGICAL CONTROL OF PLANT DISEASES (0+10)

### LEARNING OBJECTIVES

- To study the significance of biological agents, methods of isolation of the antagonistic organisms and mechanisms of action involved in disease suppression.
- To develop mass multiplication methods, bio-formulation development and delivery methods.

### WORK PLAN

Safety procedures for handling equipment - Preparation of culture media-DA, Kings Band 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

## COURSE OUTCOMES

- CO1: Practice the production of *Trichoderma*
- CO2: Improve the skills on development of formulations
- CO3: Trained to sale the produced material commercially.

## CO-PO MAPPING MATRIX

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

### EXP AGM 421 MICROBIAL INOCULANTS PRODUCTION AND QUALITY CONTROL (0+10)

#### LEARNING OBJECTIVE

- To study in detail about the microbial inoculants in Agriculture viz., isolation of bacterial fungal inoculants their mass production and quality control.

#### WORK PLAN

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.

## COURSE OUTCOMES

- CO1: Understand the Isolation and screening of inoculants.
- CO2: Enhancing the skills on development of mass production of Bacterial inoculants, Mycorrhizal and algal inoculants
- CO3: Trained identify the quality and to sale the inoculants.

## CO-PO MAPPING MATRIX

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

### EXP AGM 422 COMPOSTING TECHNOLOGIES FOR SUSTAINABLE AGRICULTURE (0+10)

#### LEARNING OBJECTIVES

- To study the nature of different types 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

#### WORK PLAN

Characterization of waste material – Physical characterization of waste materials- Chemical characterization of waste materials - method of composting – Aerobic method of composting - Anaerobic method of composting-enriched compost-Vermicomposting- qualitative analysis- estimation of microbial load- assessment of maturity of compost by physical and chemical tests – Maturity index -quantitative assay – Quantitative

estimation of N,P, K and micronutrient - Dehydrogenase activity of mature compost - value addition of compost - visit to compost yard.

#### COURSE OUTCOMES

- CO1: Understand the Aerobic and Anaerobic method of composting
- CO2: Enhancing the skills on estimation of microbial load and assessment of maturity of compost by physical and chemical tests.
- CO3: Acquire skills on value addition of compost.

#### CO-PO MAPPING MATRIX

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

### EXP SAC 421 HANDS ON TRAINING FOR SOIL, WATER AND PLANT ANALYSIS (0+10)

#### LEARNING OBJECTIVES

- To train the students to get familiarised with the recent methods adopted in the analysis of soil, water and plants so as to gain knowledge,
- To set up soil, water and plant clinic, to interpret the soil and plant analysis data and to give suitable fertilizer recommendation to the farmers.

#### WORK PLAN

**Soil Analysis:** Collection and Preparation of Soil sample, Analysis of soil sample for pH,EC and available N, P, K, S exchangeable Ca and Mg, available (DTPA extractable Zn,Mn, Fe and Cu and hot water-soluble B.

**Irrigation water Analysis:** Collection of Irrigation water sample in borewell and open well, Analysis of water sample for pH, EC, Cations (Ca<sup>++</sup>, Mg<sup>+</sup>, Na<sup>+</sup> and K<sup>+</sup>)anions (SO<sub>4</sub><sup>2-</sup> Cl<sup>-</sup>·HCO<sub>3</sub><sup>-</sup> CO<sub>3</sub><sup>2-</sup>,NO<sub>3</sub><sup>-</sup>, BO<sub>3</sub><sup>3-</sup> , Calculation of irrigation suitability indices.

**Analysis of plant samples:** Tissue test, plant analysis - visual nutrient deficiency symptoms - collection and preparation of plant sample, preparation of Di/Tri acid extract, Analysis of plant sample for total N,P,K,Ca,Mg,S,Zn,Fe,Mn,Cu,B and Cl. Interpretation of plant analysis data.

#### COURSE OUTCOMES:

- CO1: Improve the knowledge on the recent methods adopted in the analysis of soil, water and plants
- CO2: Able to interpret the soil and plant analysis data and to give suitable fertilizer recommendation to the farmers.

#### CO-PO MAPPING MATRIX

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

### EXP SAC 422 HANDS ON TRAINING ON SOIL CONSTRAINTS AND ITS MANAGEMENT FOR SUSTAINABLE CROP PRODUCTIVITY (0+10)

## LEARNING OBJECTIVE

- To understand the methodology that allows soil constraints to be identified systematically from basic soil attributes. Inferences are then drawn about how individual soil should be managed to maximise their productive potential.

## WORK PLAN

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 and soil photograph – assessment of soil physical health – LOIC, 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 and 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 judgement on its profitable use.

## COURSE OUTCOMES:

- CO1:** Understand the physical and chemical constraint in soil.
- CO2:** Improve the skills on the use of field (visual) and laboratory (soil test) and modern tools like satellite imageries and aerial photograph
- CO3:** Acquire skills on agronomic and integrated soil fertility management for higher crop productivity.

## CO-PO MAPPING MATRIX

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

## EXP GPB 421 COMMERCIAL SEED PRODUCTION IN VEGETABLE CROPS (0+10)

## LEARNING OBJECTIVE

- To give practical exposure to the students in various techniques in seed production of Vegetable crops.

## WORK PLAN

Floral biology - Pollination behaviour - Seed development and maturation - Techniques of seed production - Emasculation and pollination - 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 - Seed extraction - Processing techniques – Storage and marketing – Seed certification and Seed Standards.

## COURSE OUTCOMES

- CO1- Able to produce vegetable seeds on their own.  
 CO2- Improve the skills on the use latest techniques in seed production.  
 CO3- Acquire skills on packing and marketing to farmers and other needy people.

**CO-PO MAPPING MATRIX**

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

**EXP GPB 422 SEED PRODUCTION TECHNIQUES IN FIELD CROPS (0+10)**

**LEARNING OBJECTIVE**

- To give practical exposure to the students in hybrid seed production in Field crops viz., Rice, Maize, Ragi, Minor Millets and Other field crops.

**WORK PLAN**

Floral biology, emasculation and pollination techniques - Male sterile lines - 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 - Hybrid seed production - an account on the released rice hybrids; their potential; problems and ways of overcoming it.

**COURSE OUTCOMES**

- CO1: Learnt about Hybrid seed production in rice, maize and other field crops.  
 CO2: Develop the skills on the problems in hybrid seed production and their commercial marketability.

**CO-PO MAPPING MATRIX**

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

**EXP HOR 421 ORGANIC VEGETABLE PRODUCTION (0+10)**

**LEARNING OBJECTIVES**

- To promote entrepreneurial skills and knowledge through meaningful hands on experience through a business model enterprise.
- To provide skills in various organic production techniques and regulatory practices
- To provide an excellent opportunity to observe, think, analyse, synthesize, evaluate and apply the acquired knowledge with respect to organic vegetable production unit.

**WORK PLAN**

Students shall prepare a plan to start an organic cultivation unit for vegetable crops and analyse its technical and financial viability. Undertake end to end approach to

achieve the objectives of the approved project. Hands-on-training will be given right from project development, execution, procurement of raw materials, preparation of value-added compost, bio stimulants and organic foliar supplements, production, care, marketing, regulatory practices including organic certification, decision-making, individual and team coordination, approach to problem solving, accounting, marketing and resolving conflicts.

#### **COURSE OUTCOMES**

- CO1:** Student can gain basic knowledge on organic farming techniques
- CO2:** Can gain skills required to manage organic farms
- CO3:** Will become capable of managing organic farming and certification process.

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

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

#### **EXP HOR 422 COMMERCIAL HORTICULTURAL NURSERY (0+10)**

#### **LEARNING OBJECTIVES**

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

#### **WORK PLAN**

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

#### **COURSE OUTCOMES**

- CO1:** Students can gain knowledge on establishment and management of a commercial nursery
- CO2:** Can practice skills in various propagation methods and care of nursery plants and skillful in managing nursery business

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

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	3	3	2
CO2	3	2	3	2	1	3

#### **EXP HOR 423 COMMERCIAL LANDSCAPING (0+10)**



## LEARNING OBJECTIVES

- To enable students to gain hands-on –experience in landscape designing and execution
- To develop entrepreneurial skills and confidence among students to develop their own landscape company.

## WORK PLAN

Planning and designing different types of location specific gardens, e.g., home garden, institutional garden, public garden, corporate-and factory garden including preparation of cost estimates and execution.

## COURSE OUTCOMES

- CO1:** Student can gain hands on experience in landscape designing and execution  
**CO2:** Can gain entrepreneurial skills required to do landscape projects  
**CO3:** will become capable of managing landscape projects and company.

## CO-PO MAPPING MATRIX

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

## EXP HOR 424 PROCESSING AND VALUE ADDITION OF HORTICULTURAL CROPS (0+10)

## LEARNING 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.

## WORK PLAN

Students shall identify the crop and value addition technique and prepare a process flow chart along with the technical and economic feasibility. Hands on training will be provided in licencing, procurement of raw materials, handling, processing, packing, ehavior and marketing. Visit to commercial processing units – Project preparation and working out cost economics.

## COURSE OUTCOMES

- CO1:** Student can gain basic knowledge on value added products  
**CO2:** Can gain skills required to manage processing units  
**CO3:** Will become capable of doing value addition works in horticultural products.

## CO-PO MAPPING MATRIX

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

## EXP AEC 421 MARKETING SKILLS FOR AGRI PROFESSIONALS (0+10)

### LEARNING OBJECTIVE

- To import practical knowledge and understanding marketing of products.

### WORK PLAN

Market survey to gain experience on working out consumer profile, competitors, substitutes and their price and features. Designing market strategy. Forecasting market demand. Pricing methods, creating and organizing an advertising campaign. Various packaging materials used for Agri based products. Product distribution network, marketing cost, marketing planning process. Marketing research and information system for new product development and options for extending product life cycle. Spot and online marketing. Export-import policies for agriculture sector.

### COURSE OUTCOMES

- CO1: Students can design and forecast the market strategy
- CO2: Acquire skills on distribution network and market planning process
- CO3: Develop the capacity to new product development and marketing.

### CO-PO MAPPING MATRIX

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

## EXP AEC 422 MANAGERIAL SKILLS FOR AGRIPRENEURS (0+10)

### LEARNING OBJECTIVE

- The objective of the course is to develop skills on analyzing case studies related to management aspects.

### WORK PLAN

Case studies on supply chain management – approaches, elements, demand and procurement management in supply chain. Case studies on logistics management – elements, warehousing, sales and distribution management. Case studies on value chain in food retailing, marketing mix, brand management. Case studies on advertisement strategies, rural marketing, rural market research, buyer behavior. Case studies on customer relationship management.

### COURSE OUTCOMES

- CO1: Improve skills on supply chain management
- CO2: Knowledge development on marketing mix and brand management
- CO3: Develop the customer relationship management.

### CO-PO MAPPING MATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	-	2	3	2	-	-

CO2	3	-	3	-	3	-
CO3	-	2	3	-	-	3

### EXP AEX 421 EXTENSION AND COMMUNICATION SKILLS (0+10)

#### LEARNING OBJECTIVES

To enable the students to

- Acquire Skills on selection and transfer of technology
- Acquire media skills
- Acquire programme planning and execution skills
- Acquire marketing and agricultural finance skills

#### WORK PLAN

Acquisition of skills in the selection of technologies along with the scientists of Agricultural Research stations, 'transfer of technologies skills' with the Krishi Vigyan Kendra, Cane divisions of sugar mills, State department of Agriculture, Horticulture and Rural Development, 'media skills' with All India Radio and Doordharsan, 'programme planning and execution skills' with the NGOs, 'marketing skills' with input dealers, 'agricultural finance skills' with credit institutions.

#### COURSE OUTCOMES

CO 1: Students can gain knowledge on 'transfer of technologies skills'

CO 2: Develop 'media skills' with mass media

CO 3: Improve programme planning and execution skills' with the NGOs, and 'marketing skills' with input dealers

CO 4: Acquaint with 'agricultural finance skills' with credit institutions.

#### CO-PO MAPPING MATRIX

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

### EXP AEX 422 TRANSFORMATION THROUGH EXTENSION PROGRAMME PLANNING (0+10)

#### LEARNING OBJECTIVE

- To Acquire extension programme planning, execution and evaluation skills

#### WORK PLAN

Understanding the principles of extension programme planning, collecting facts, practicing various techniques of Participatory Rural Appraisal, analyzing the agricultural situation, determining programme objectives, (immediate and long term), selection of problems based on the classification, finding solutions with village level extension worker, developing plan of work and calendar of operations, executing the plan of work and calendar of operations, evaluating the progress with concurrent and ex-post facto evaluation.

#### COURSE OUTCOMES

CO 1: Practicing various techniques of Participatory Rural Appraisal

CO 2: Develop programme objectives and selection of problems

**CO 3:** Developing plan of work and calendar of operations, executing the plan of work

#### CO-PO MAPPING MATRIX

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

#### EXP AHS 421 BROILER PRODUCTION (0+10)

##### LEARNING OBJECTIVES

- To provide a comprehensive knowledge about the scientific rearing of the broiler.
- To enable the students to acquire practical knowledge to manage a profitable small-scale commercial broiler farm.
- To impart the “cutting edge” technologies used in broiler industry which will reinforce the student’s entrepreneurship skills.

##### WORK PLAN

Introduction - Broiler industry in India - Systems of rearing and housing - Cleaning and disinfection of shed and equipment - Brooding management - Litter management - Feeding management - Day to day routine managements - Disease management and vaccination schedule - Summer management - Dressing of broilers- Value added broiler meat products - Farm economics and marketing of broiler and products -Visit to broiler farms.

##### COURSE OUTCOMES

**CO 1:** Practicing various techniques of scientific rearing of the broiler

**CO 2:** Develop management of brood, litter and feeding etc.,

**CO 3:** Understand the farm economics and marketing of broiler

##### CO-PO MAPPING MATRIX

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

#### EXP AHS 422 JAPANESE QUAIL PRODUCTION (0+10)

##### LEARNING OBJECTIVES

- To develop interest in scientific rearing of Japanese quail.
- To promote entrepreneurship among the students through systematic imparting of practical knowledge and startup guidance.
- To explore the possibilities of local marketing and maximizing income through value added products.

##### WORK PLAN

Introduction - Japanese quail industry in India - Systems of rearing and housing - Cleaning and disinfection of shed and equipment - Brooding management - Litter management - Feeding management - Day to day routine managements - Disease management and vaccination schedule - Summer management - Dressing of quails - Value added quail egg and meat products - Farm economics and marketing of Japanese Quail egg and meat products- Visit to quail farms.

### **COURSE OUTCOMES**

- CO 1:** Practicing various techniques of scientific rearing of Japanese quail
- CO 2:** Develop management of brood, litter and feeding etc.,
- CO 3:** Understand the farm economics and marketing of Quil

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

	<b>PO 1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3	3	3	2	3	3
<b>CO2</b>	3	3	3	3	3	3
<b>CO3</b>	3	3	3	2	3	2

### **EXP AHS 423 TECHNOLOGY OF VALUE-ADDED MILK PRODUCTS (0+10)**

#### **LEARNING OBJECTIVES**

- To impart comprehensive knowledge of the existing technologies in Dairy Products preparation.
- To gain hands on experience in different technologies used in Dairy products preparation and to develop entrepreneurship skills among the students.

#### **WORK PLAN**

Introduction- Dairy Industry in India-Preparation of fermented Dairy products- Curd- Lassi- Preparation of fat rich Dairy products- Cream-Butter-Ghee- Preparation of Indigenous Dairy products- Paneer- Preparation of flavoured milk- Preparation of Ice cream- Marketing of Dairy products.

#### **COURSE OUTCOMES**

- CO 1:** Understand the various existing technologies in Dairy Products
- CO 2:** Acquire the techniques in the Preparation of fat rich Dairy products
- CO 3:** Preparation of Ice cream- Marketing of Dairy products.

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

	<b>PO 1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>CO1</b>	3	2	3	2	3	1
<b>CO2</b>	3	2	3	2	3	3
<b>CO3</b>	3	2	3	2	3	3