



**ANNAMALAI UNIVERSITY**

(Accredited with 'A' Grade by NAAC)



**FACULTY OF AGRICULTURE**

(Accredited by ICAR)

**DEPARTMENT OF AGRONOMY**

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**Academic Regulations and Syllabi**

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**MASTER OF SCIENCE IN AGRONOMY**

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

**2022-2023 Onwards**

**FACULTY OF AGRICULTURE**  
**Common Regulations for All M.Sc. (Agriculture/Horticulture) and M.B.A. (Agri- Business Management) programmes offered by the Faculty of Agriculture**  
*(With effect from 2022-2023)*

**1. Short title and commencement**

- 1.1 These rules and regulations shall govern the post graduate studies leading to the award of degree of Master of Science (Agriculture/Horticulture) and M.B.A. (Agri. Business Management) in the Faculty of Agriculture.
- 1.2 They shall come into force with effect from the academic year 2022 – 2023.

**2. Academic Year and Registration**

- 2.1 An academic year shall be normally from July to June of the following calendar year otherwise required under special situations. It shall be divided into two academic terms known as semesters. The Academic Calendar will be developed by the University from time to time and notified accordingly by the Registrar in advance.
- 2.2 An orientation programme shall be organized by the Dean, Faculty of Agriculture for the benefit of the newly admitted students immediately after commencement of the semester.
- 2.3 On successful completion of a semester, the continuing students shall register for subsequent semester on the date specified in the Academic/ Semester Calendar or specifically notified separately. Every enrolled student shall be required to register at the beginning of each semester till the completion of his/ her degree programmes

**3. Registration Card**

- 3.1 A student shall register the courses offered in a semester by writing all the courses in registration card in quadruplicate.
- 3.2 The Chairman, PG coordinator and Head of the Department are responsible to furnish the registration particulars of the students with their signature in the registration card to the Dean.
- 3.3 The Dean shall approve the registration card.
- 3.4 The approved registration card shall be maintained by the Head of the Department, Chairman and the student concerned.
- 3.5 The list of courses registered by the students in each semester shall be sent by the Head of the Department to the Controller of Examinations/University for preparation of Report Cards

**4. Definitions**

- 4.1 **Semester** means an academic term consisting of 110 working days including final theory examinations.
- 4.2 **Subject** means a unit of instruction to be covered in a semester having specific No., title and credits.
- 4.3 **Credit hour** means, one hour lecture plus two hours of library or homework or two and half hours of laboratory/field practical per week in a semester.
- 4.4 **Grade Point of a subject** means the value obtained by dividing the percentage of marks earned in a subject by 10 and the Grade Point is expressed on a 10 point scale.
- 4.5 **Credit Point** means the grade point multiplied by credit hours.
- 4.6 **Grade Point Average (GPA)** means the quotient of the total credit points obtained by a student in various subjects at the end of each semester, divided by the total credit hours taken by the

student in that semester. The grading is done on a 10 point scale and the GPA has to be corrected to two decimals.

4.7 **Overall Grade Point Average (OGPA)** means the quotient of cumulative credit points obtained by a student in all the subjects taken from the beginning of the first semester of the year divided by the total credit hours of all the subjects which he/she had completed up to the end of a specified semester and determines the overall performance of a student in all subjects during the period covering more than one semester. The OGPA has to be arrived at the second decimal place.

## 5. Programmes offered

The details of various post-graduate degree programmes at Masters' level offered in the Faculty of Agriculture are as follows:

1. M.Sc. (Ag.) Agronomy
2. M.Sc. (Ag.) Entomology
3. M.Sc. (Ag.) Agricultural Microbiology
4. M.Sc. (Ag.) Genetics and Plant Breeding
5. M.Sc. (Ag.) Seed Science and Technology
6. M.Sc. (Ag.) Molecular biology and Biotechnology
7. M.Sc. (Ag.) Plant Pathology
8. M.Sc. (Ag.) Soil Science and Agricultural Chemistry
9. M.Sc. (Ag.) Agricultural Extension Education
10. M.Sc. (Ag.) Agricultural Economics
11. M.B.A. (Agri-Business Management)
12. M.Sc. (Hort.) Fruit Science
13. M.Sc. (Hort.) Vegetable Science
14. M.Sc. (Hort.) Floriculture and Landscaping
15. M.Sc. (Hort.) Plantation, Spices, Medicinal and Aromatic Crops

## 6. Eligibility for admission

Candidates for admission to the M.Sc.(Ag./Hort.) and M.B.A.(Agri- Business Management) programme should satisfy the following requirements.

6.1. Candidates seeking admission to the M.Sc. (Ag./Hort.) and M.B.A.(Agri- Business Management) Degree programme should have completed any one of the following four year degree programmes from Faculty of Agriculture, Annamalai University or Universities/colleges accredited with ICAR, New Delhi.

Program of study	Eligibility
M.Sc. (Ag.) Agronomy	B.Sc. (Hons) Agriculture/ B.Sc.(Ag.) courses of four years duration.
M.Sc. (Ag.) Entomology, M.Sc. (Ag.) Genetics and Plant Breeding, M.Sc. (Ag.) Plant Pathology, M.Sc. (Ag.) Soil Science and Agricultural Chemistry, M.Sc. (Ag.) Seed Science and Technology, M.Sc. (Ag.) Molecular biology and Biotechnology, M.Sc. (Ag.) Agricultural Microbiology, M.Sc. (Ag.) Agricultural	B.Sc. (Hons) Agriculture / B.Sc. (Hons) Horticulture/ B.Sc. (Ag.)/ B.Sc. (Hort.) of four years duration.

Extension Education, M.Sc. (Ag.) Agricultural Economics and M.B.A. (Agri. Business Management)	
M.Sc. (Hort.) Fruit Science M.Sc. (Hort.) Vegetable Science M.Sc. (Hort.) Floriculture and Landscaping M.Sc. (Hort.) Plantation, Spices, Medicinal and Aromatic Crops	B.Sc. (Hons) Agriculture / B.Sc. (Hons) Horticulture/ B.Sc.(Hort.) and B.Sc. (Ag.) courses of four years duration.

6.2. Candidates who have undergone the programme under conventional system should possess not less than a second class Bachelor's degree. The candidates under 4 point grade systems should possess a minimum OGPA of 2.5 out of 4.00 and 2.75 out of 4.00 in the subject concerned. For those under 10 point system a minimum OGPA of 6.50 out of 10.00 and 7.00 out of 10.00 in the subject concerned is required. However, for SC/ST candidates OGPA of 6.75 out of 10.00 in the subject concerned is sufficient.

6.3. An entrance test will be held separately for each Degree programme. Selection of candidates shall be based on OGPA, Subject OGPA, Entrance Test and Interview.

6.4. A student can apply to a maximum of two subjects only.

## 7. Programme Requirements

### 7.1. Residential requirements

The duration for the M.Sc. (Agriculture/Horticulture) and MBA programme will be of two years with four semesters. A student registered for M.Sc. (Agriculture/Horticulture) programme should complete the course within five academic years from the date of his/her admission. In case a student fails to complete the degree programme within the maximum duration of residential requirement, his/ her admission shall stand cancelled.

### 7.2. Credit Grade Point Requirements

A student enrolled for the Master's degree programme to earn eligibility for the degree is required to complete 70 credits as detailed below.

Course work	Credit
Major	20
Cours	08
20	06
Minor	05
Courses	01
08	
Supporting	
Courses	
06	
Common	
Courses	
05	
Seminar	

Thesis Research	30
<b>Total credits</b>	<b>70</b>

**7.3 Major course:** From the Discipline in which a student takes admission. Among the listed courses, the core courses compulsorily to be taken will be given \*mark

**7.4 Minor course:** From the courses closely related to a student's major subject, minor courses shall be chosen by the students in consultation with the Head of the department and the Chairman based on their research specialization.

**7.5 Supporting courses:** The subjects not related to the major subject. It could be any subject considered relevant for student's research work (such as Statistical Methods, Design of Experiments, etc.) or necessary for building his/ her overall competence.

a. List of supporting courses for M.Sc. (Ag.) Agronomy, Entomology, Genetics and Plant Breeding, Plant Pathology, Soil Science and Agricultural Chemistry, Seed Science and Technology, Molecular biology and Biotechnology, Agricultural Microbiology and Horticulture are

STA 501 Statistical Methods for Applied Sciences 3(2+1)

COM 501 Information Technology in Agriculture 3(2+1)

b. List of supporting courses for Agricultural Economics and M.B.A (Agri- Business Management)

STA 502 Statistical Methods for social Sciences 3(2+1)

COM 501 Information Technology in Agriculture 3 (2+1)

c. List of supporting courses for M.Sc. (Ag.) Agricultural Extension education,

STA 502 Statistical Methods for social Sciences 3 (2+1)

COM 502 Computer application for Agricultural extension research 3 (2+1)

**7.6 Common Courses:** There will be five common courses (one credit each) will be offered to all students undergoing Master's degree programme. Among the five common courses, the following four courses will be offered in all the Master's degree programme:

1. PGS 501- Agricultural Research, Research Ethics and Rural Development Programmes (1+0)
2. PGS 502 - Technical Writing and Communications Skills (0+1)
3. PGS 504- Library and Information Services (0+1)
4. PGS 505- Intellectual Property and its management in Agriculture (1+0)

The fifth common course for Master's degree programme in Agronomy, Entomology, Genetics and Plant Breeding, Seed Science and Technology, Molecular biology and Biotechnology, Plant Pathology, Soil Science and Agricultural Chemistry, Agricultural Microbiology, Fruit Science, Vegetable Science, Floriculture and Landscaping, and Plantation, Spices, Medicinal and Aromatic Crops will be

- PGS 503 - Basic Concepts in Laboratory Techniques (0+1)

The fifth common course for Master's degree programme in Agricultural Economics and M.B.A (Agri. Business Management) will be

- PGS 507 – Basic Analytical Techniques (0+1)

The fifth common course for Master's degree programme in M.Sc. (Ag.) Agricultural Extension will be

- PGS506– Basic Laboratory Techniques for Audio and Video Production (0+1)

Some of these courses are already in the form of e-courses/ MOOCs. The students may be allowed to register these courses/ similar courses on these aspects, if available online on SWAYAM or any other platform. If a student has already completed any of these courses during UG, he/ she may be permitted to register for other related courses with the prior approval of the Head of Department (HoD)/ Board of Studies (BoS).

### **7.7 Minimum Grade point requirement**

A post graduate student should maintain a minimum Grade Point of 6.50 out of 10 to secure a pass in a subject. In the subjects in which a student fails, he/she has to reappear for the examination to get a pass in that subject.

## **8. Attendance requirement**

8.1. One hundred per cent attendance is expected of each student. A student, who fails to secure a minimum of **80 per cent** of attendance in each subject separately for theory and practical, shall not be permitted to appear for the final examination in that subject and will be required to repeat the subject when ever offered.

In case of new admission, who are permitted to join late due to administrative reasons, the attendance will be calculated from the date of joining of the student. However, for genuine reasons, condonation of attendance deficiency may be considered by the Vice-Chancellor on the recommendation of the Head of the Department and the Dean, Faculty of Agriculture on payment of condonation fee prescribed by the University.

8.2. Students absenting from the classes with prior permission of the Head of the Department/Dean, Faculty of Agriculture on official University business shall be given due consideration in computing attendance.

## **9. Advisory Committee**

9.1. Each post-graduate student shall have an Advisory Committee to guide him/her in carrying out the research programme. The Advisory Committee shall comprise a Major Adviser (Chairman) and two members. Of the two members, one will be from the same Department and the other in the related field from the other Departments of Faculty of Agriculture. The Advisory Committee shall be constituted within three weeks from the date of commencement of the first semester.

9.2. For interdisciplinary research requiring expertise from teaching staff of other faculties, due permission need to be obtained from the Dean, Faculty of Agriculture to nominate them as Technical advisors. An official letter in this regard needs to be communicated to the individual concerned through the respective Head of the Department and Dean. However, they are restrained from the evaluation of Research/Seminar.

### **9.3. Major Adviser (Chairman)**

Every student shall have a Major Adviser who will be from his/her major field of studies. The appointment of Major Adviser (Chairman) shall be made by the Head of the Department concerned. The chairman in consultation with the Head of the Department will nominate the other two members. In the event of the Major Adviser being away on other duty/leave for a period of more than three months, the member of the Advisory Committee from the same Department will officiate as the Major Adviser.

9.4 Advisor/ Co-guide/ Member, Advisory Committee from other collaborating University/ Institute/ Organization

- In order to promote quality Post-graduate research and training in cutting edge areas, the University may permit the scholar to conduct research in other university/ research institute/ Organization. While constituting an Advisory Committee of a student, if the Chairperson, Advisory Committee feels the requirement of involving of a faculty member/ scientist of such partnering university/ Institute/ Organization, he/ she may send a proposal to this effect to the Dean, Faculty of Agriculture along with the proposal for consideration of Student's Advisory Committee.
- The proposed faculty member from the partnering institution can be allowed to act as Chairperson/ Co-guide/ Member, Advisory Committee, by mutual consent, primarily on the basis of intellectual input and time devoted for carrying out the research work at the particular institution.

#### 9.5 Allotment of students to the retiring persons

Normally, retiring faculty may not be allotted with M. Sc. Student if he/ she is left with less than 2 years of service.

#### 9.6 Changes in the Advisory Committee:

- Change of the Chairperson or any member of the Advisory Committee is not ordinarily permissible. However, in exceptional cases, the change may be effected with due approval of the Dean, Faculty of Agriculture.
- Normally, staff members of the university on extra ordinary leave or on study leave or who leave the University service will cease to continue to serve as advisors of the Post-graduate students of the University. However, the Dean, faculty of Agriculture may permit them to continue to serve as advisor subject to the following conditions:
  - The concerned staff member must be resident in India and if he/ she agrees to guide research and must be available for occasional consultations;
  - An application is made by the student concerned duly supported by the Advisory Committee;
  - The Head of the Department and the Dean, Faculty of Agriculture agree to the proposal;
- In case the Chairperson/ member of Advisory Committee retires, he/ she shall be allowed to continue provided that the student has completed his course work and minimum of 10 research credits and the retiring Chairperson/ member stays at the Headquarters of the College, till the thesis is submitted.
- The change shall be communicated to all concerned by the Head of Department.

#### 9.7 Guidelines on the duties of the Advisory Committee

- Guiding students in drawing the outline of research work
- Guidance throughout the programme of study of the students.
- Evaluation of research and seminar credits.
- Correction and finalization of thesis draft.
- Conduct of final Viva-Voce examination.
- The proceedings of the Advisory Committee will be sent to the Head of the Department concerned within 10 working days.
- Periodical review of the Advisory Committee proceedings will be made by the Head of the Department concerned.

## 10. Programme of Study

10.1. The student's plan for the post-graduate work, drawn up by the Advisory Committee, shall be finalized before the end of the first semester.

10.2. The programme shall be planned by the Advisory Committee taking into account his/her previous academic training and interest.

### 10.3. Programme of research work

The outline of research work of the student, in the prescribed manner and as approved by the Advisory Committee, shall be forwarded by the Chairman to the Head of the Department concerned by the end of the first semester.

## 11. Evaluation of Students' Performance

Multiple levels of evaluation (First Test, Midterm and Final semester) will be conducted.

### 11.1. First Test (FT)

Every teacher handling a subject shall conduct first Test (FT) as per the scheme drawn by the Head of the Department concerned /PG coordinator on the fourth week from the date of registration of the course, and evaluate. The evaluation process will be based on objective type questions and short concepts.

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

11.2.1. Every teacher handling a subject shall conduct Mid-Semester Examination (MSE) as per the scheme drawn by the Head of the Department concerned /PG coordinator, on the eighth week from the date of registration of the course and evaluate. The evaluation process will be of descriptive type.

11.2.2. The answer scripts of both FT and MSE will be shown to the student after valuation, and returned to the course teacher. The Head of the Department will be responsible to ensure the distribution of answer papers to the students. The marks obtained by the students should be sent to the Controller of Examinations through the Head of the Department concerned within fifteen working days.

11.2.3. Writing the first test and mid-semester examination is a pre-requisite for writing the final theory and practical examinations. If a student does not appear for FT/MSE, he/she is not eligible to appear for the final examinations. Such candidate has to reappear for the FT/MSE as and when the respective examinations are conducted only after getting permission from the Head of the Department concerned.

11.2.4. The FT and MSE marks will not be shown separately in the grade sheet but will be combined with the respective final theory and practical marks. FT and MSE marks awarded in a course will be added to the supplementary examinations also.

11.2.5. The FT and MSE marks will be furnished to the Head of the Department within 10 days after the conduct of Ft and MSE. If the student is not satisfied with the award of the marks, he/she shall appeal to the Dean, through Head of the Department 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 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.

11.2.6. The first test will be of 30 minutes duration and MSE of theory will be of one hour duration.

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

11.2.8. A student who fails to attend a first test and mid-semester examination due to unavoidable circumstances shall be permitted with prior approval of the head of the Department to take up



missing examination of the particular course. Such tests should be completed ordinarily within 15 working days after the respective FT/MSE.

The distribution of marks will be as indicated below.

Test	Subjects with Practical	Subjects without Practical	Subjects without Theory
First test	10	20	20
Mid-Semester	20	30	30
Final theory	30	50	-
Final practical	40	-	50
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

The question paper model and distribution of marks for Mid Semester examinations is as follows.

**First Test (30 minutes duration) (Total Marks: 10)**

1. Objective Type	10 out of 12	10 x 0.5 marks	5 Marks
2. Definitions/ Short Concepts	5 out of 7	5 x 1 marks	5 Marks

**Mid-semester examination**

**For Subjects with practical(One hour duration) (Total marks: 20)**

1. Objective Type	10 out of 12	10 x 0.5 marks	5 Marks
2. Definitions/ Concepts	5 out of 7	5 x 1 marks	5 Marks
3. Short Notes	2 out of 3	2 x 2 ½ marks	5 Marks
4. Essay Type	1 out of 2	1 x 5 marks	5 Marks

**For Subjects without practical (One hour duration) (Total marks: 30)**

1. Objective Type	10 out of 12	10 x 0.5	5 Marks
2. Definitions/Concepts	5 out of 7	5 x 1	5 Marks
3. Short Notes	4 out of 5	4 x 2 ½	10 Marks
4. Essay Type	2 out of 3	2 x 5	10 Marks

**11.3. Final examination**

11.3.1. The final theory examination will be of two and a half hours duration and practical examination will be of three hours duration, both conducted separately by the University. The question paper for the theory examination will be set as per Bloom's taxonomy by the concerned course teacher in consultation with the Head of the Department. The final theory and practical examinations will be evaluated by respective course teacher.

11.3.2. The question paper model and distribution of marks for final theory examinations are as follows.

**Final theory examination (3 hours duration)**

**For subjects with practical (Total marks: 30)**

1. Definitions	5 out of 7	5 x 1 marks	5 marks
2. Short Notes	2 out of 3	2 x 2½ marks	5 marks
3. Essay Type	Either or type (one question from each unit)	5 x 4 marks	20 marks

**For subjects without practical (Total marks: 50)**

1. Definitions	6 out of 8	6 x 1 marks	6 marks
2. Short Notes	3 out of 5	3 x 3 marks	9 marks
3. Essay Type	Either or type (one question from each unit; At least two questions must represent K6 level of Bloom's taxonomy)	5 x 7 marks	35 marks

### 11.3.3. Practical Examination

Practical examinations will be conducted in the last practical class. 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. If a student secures a 'pass' in the practical examination of a particular course and fails in the theory examination, then, the practical examination marks obtained in the first attempt will be added to the supplementary examinations also and he/she doesn't require to reappear for practical examination.

### Assignment

Each student will be assigned a topic by the concerned course teacher. Such topic should cover a wide range of topics within the subject limits. The topic should be different from that of the credit seminar. Assignments will be evaluated during practical examination.

The distribution of marks for **final practical examination** for courses with theory and practical and only practical is as follows:

S.No.	Particulars	Courses with theory and practical	Courses only with practical
1	Practical part	25	35
2	Assignment/specimen collection	5	5
3	Record	5	5
4	Viva voce	5	5
<b>Total</b>		<b>40</b>	<b>50</b>

**The pattern of practical part should be uniform in each Department**

### 11.4. GRADING

- The student should secure 60 per cent marks separately in theory and practical and 65 per cent marks in aggregate to secure a pass in the subject. Students who secure marks below 65 per cent in a subject will be treated as Reappearance (RA).
- Each subject shall carry a maximum of 100 marks for purpose of grading. The grading shall be done as grade point, i.e., the percentage of marks earned in a subject is divided by ten. The grade point is expressed on a 10 point scale up to two decimals.
- The reappearance examinations for the candidates who fail in a subject or subjects will be held in the subsequent semester.
- Students who did not fulfill the required minimum attendance of **80 per cent** will be awarded 'E' grade and has to repeat the subject.

### 11.5. Percentage equivalence and Class ranking

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

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

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

<b>OGPA</b>	<b>Percentage</b>	<b>Class</b>
9.00 and above	90 and above	Distinction
8.00 to 8.99	80.00 to 89.99	I Class
7.00 to 7.99	70.00 to 79.99	II Class
6.50 to 6.99	65.00 to 69.99	Pass

## 12. Credit Seminar

Seminar is compulsory for all the students and each student should present a seminar of 0+1 credit in the third semester.

12.1. The seminar topic should be only from the major field and should not be related to the area of thesis research. The seminar topics are to be assigned to the students by the Chairman of the Advisory Committee in consultation with the Head of the Department concerned within 2 weeks after the commencement of the semester.

12.2. Under the guidance and supervision of the Chairman of the Advisory Committee, the student will prepare the seminar paper after reviewing all the available literature and present the seminar 2 weeks after completion of Mid-Semester Examination in the presence of the Head of the Department, Advisory Committee, staff members and PG students.

12.3. The circular on the seminars by the post-graduate students shall be sent to other Departments to enable those interested to attend the same.

12.4. The Chairman will monitor the progress of the preparation of the seminar paper and correct the manuscript containing not less than 25 typed/printed pages with a minimum number of 50 references covering the recent 10 years' time. The student will submit 2 copies of the corrected manuscript to the Head of the Department concerned through the Chairman before presentation. The student will incorporate suggestions and carry out corrections made during the presentation and resubmit three fair copies to the Head of the Department concerned through the Chairman (one copy each to Dept. Library, Chairman and the student) within 10 days after presentation.

12.5. The performance of the student has to be evaluated for 100 marks and Grade Point will be awarded by Advisory Committee. The Grade Point may be given based on the following norms.

Coverage of Literature	40
Presentation	30
Use of Audio-Visual Aids	10
Capacity to Participate in the discussion and answer the Questions	20
<b>Total</b>	<b>100</b>

## 13. Absence of advisory committee member during final viva-voce examination:

13.1 Conducting final viva voce examination in the absence of advisory committee members is not allowed.

13.2. Under extra-ordinary circumstances if the final viva-voce examination to postgraduate student has to be conducted in the absence of one or two advisory committee members, permission to conduct the examination by co-opting another member in such contingencies should be obtained from the Dean in advance through the Head of the Department. The Chairman of the advisory committee in consultation with the concerned member and Head of the Department will co-opt another member.

13.3. The co-opted member should be from the same department of the member who is not attending the examinations.

13.4. In the absence of the Chairman of advisory committee, respective Heads of Departments should act as Co-chairman with prior permission of Dean.

#### **14. Research Work**

14.1. The topic of thesis research to be carried out by the student will be assigned by the Chairman of the Advisory Committee in consultation with the Head of the Department concerned. After assigning the topic, each student may be instructed to submit a detailed programme of work to be carried out by him/her during the semester in the prescribed proforma. After scrutiny and approval, a copy of the programme may be given to the student for carrying out the work during the semester in the prescribed proforma. The evaluation of research work done by the student should be based on the approved programme.

14.2. The distribution of research credits will be as follows:

I Semester	0+ 2
II Semester	0+ 6
III Semester	0+ 10
IV Semester	0+ 12*
Total	0 + 30

(\* In the fourth semester, out of 12 credits, 8 credits will be for evaluation of research and remaining 4 credits for evaluation of viva voce)

#### **15. Evaluation of Thesis Research**

15.1. Attendance register must be maintained in the department by HOD /major adviser for all the students to monitor whether the student has 80% of attendance in research.

15.2. The student has to submit his/her research observation note book to the major Adviser. The major Adviser will scrutinize the progress and sign the note book with remarks as frequently as possible. This note book will form the basis for evaluation of research progress.

15.3. After completion of 80% attendance for research and on or before the last day of the semester, the advisory committee should evaluate the progress of research work as per the approved programme and monitoring register and award **SATISFACTORY OR UNSATISFACTORY** depending upon quantity and quality of work done by the student during the semester.

15.4. The procedure of evaluating research credits under different situations are explained hereunder.

#### **Situation - I**

The student has completed the research credits as per the approved program and awarded **‘SATISFACTORY’** by the advisory committee. Under the said situation, the student can be permitted to register fresh credits in the subsequent semester. If the student is awarded **‘UNSATISFACTORY’**, he/she has to register afresh the same block of the research credits in the subsequent semester.

#### **Situation - II**

The student who does not satisfy the required **80 per cent** attendance shall be awarded grade **‘E’**.

#### **Situation-III**

The student who could not complete the research work as per the approved programme of work for reasons beyond his/her control such as

- Failure of crop
- Non-Incidence of pests or diseases or lack of such experimental conditions
- Non-availability of treatment materials like planting materials chemicals etc.
- Any other impeding/ unfavourable situation for satisfying the advisory committee
- Under the situations II&III, grade ‘E’ should be awarded. The student has to re-register the same block of research credits for which ‘E’ grade was awarded in the following semester. The student should not be allowed to register for fresh (first time) research credits.
- In the mark sheet, it should be mentioned that ‘E’ grade was awarded due to lack of attendance or want for favourable conditions.

#### **Situation – IV**

The student who fails to complete the research work after repeating the registration for the second time will be awarded **‘Unsatisfactory’**.

- For the registration of research credits for the third time, permission has to be obtained from the Dean of the Faculty and permission for further registration for the fourth time has to be obtained from the University.
- Re-registration of further research credits shall be decided by the University based on the recommendation of the Advisory Committee, Head of the Department concerned and the Dean, Faculty of Agriculture.

### **16. Submission of Thesis**

16.1. The thesis for his/her Master’s degree should be of such a nature as to indicate a student’s potentialities for conduct of independent research. The thesis shall be on topic falling within the field of the major subject and shall be the result of the student’s own work. A certificate to this effect duly endorsed by the Major Adviser (Chairman) shall accompany the thesis.

16.2. The research credits registered in the last semester of post graduate programmes should be evaluated only at the time of the submission of thesis, by the advisory committee. Students can submit the thesis at the end of the final semester. If a post graduate student has completed the thesis before the closure of the final semester, the chairman can convene the advisory committee meeting and take decision on the submission of thesis provided the student satisfies 80 per cent attendance requirement. Two copies of the thesis should be submitted in paper pack for evaluation to the HOD.

16.3. The thesis shall contain a certificate from the supervisor specifying that the thesis submitted is a record of research work done by the candidate during the period of study under him/her, and that the thesis has not previously formed the basis for the award of any Degree, Diploma, Associateship, Fellowship or similar title. A statement from the supervisor indicating the extent to which the thesis represents independent work on the part of the candidate should also be made including free from plagiarism **above the specified level.**

16.4. The thesis shall also contain a declaration by the candidate that the work reported in the thesis has been carried out by the candidate himself/herself and that the material from other sources, if any, is duly acknowledged and no part of the thesis is plagiarized **more than 25 %.**

### **17. Grace period**

17.1. Students can avail a grace period up to a month for submission of thesis/project report after the closure of final semester by paying necessary fine as prescribed by the University. If a student is not able to submit the thesis within a month (grace period), the student has to re-register the credits in the forthcoming semester. The student who re-register the credits after availing the grace period will not be permitted to avail grace period.

17.2. Based on the recommendation of advisory committee and the Head of the Department, the Dean, can sanction the grace period. A copy of the permission letter along with the receipt for payment of fine as prescribed by the University should accompany the thesis while submission.

### **18. Submission of thesis after re-registration**

The minimum of 80 per cent attendance requirement for submitting the thesis after, re-registration need not be insisted for those students who have fulfilled the minimum academic and residential requirement i.e. 2 years (4 semesters) and completed the minimum credit requirements for getting Degree.

### **19. Publication of articles**

Part of the thesis may also be published in advance with the permission of the HOD. If any part is published, the fact should be indicated in the certificate given by the chairman that the work has been published in part/full in the scientific or popular journals, proceedings, etc. The copies are to be enclosed in the thesis at the time of submission.

### **20. Evaluation of Thesis**

20.1. The thesis submitted in partial fulfillment of a Master's degree shall be evaluated by an external examiner. The external examiner shall be a specialist in the student's major field of study from outside Annamalai University and shall be appointed by the University as per the recommendation of the Head of the Department.

20.2. The external examiner will send the evaluation report in duplicate, one marked to the Controller of Examinations and another to the Head of the Department along with the corrected copy of the thesis. If the report is favourable, Viva-Voce will be arranged by the Head of the Department concerned and conducted by the Advisory Committee along with the external examiner. The chairman of the advisory committee shall send the recommendations of the examining committee to the Controller of Examinations through Head of the Department after the student duly carries out the corrections/ suggestions mentioned by the external examiner (a certificate to be enclosed along with the recommendation). On the unanimous recommendation of

the committee and with the approval of the University, the degree shall be awarded to the candidate.

20.3. In case of rejection of the thesis by the external examiner, the Head of the Department concerned and Advisory Committee shall refer the thesis for evaluation by a second external examiner. If the second external examiner recommends the thesis for acceptance, Viva-Voce will be conducted.

20.4. If the revision of the thesis is recommended for repeating experiments, field trial etc., resubmission must be done by the candidate concerned after a minimum of six months. The revised version should be sent to the examiner who recommended revision.

20.5. After incorporating the suggestions of the examiners and those received at the time of viva-voce, three hard bound copies of thesis should be submitted to the Department (one to the scholar, one to the chairperson and one to the Department Library) and one soft copy in CD to the Department. Along with two copies of the thesis, two copies of abstract of thesis (in 10-15 lines) and summary of the findings both in Tamil and English and soft copy both in a C.D. shall be submitted. At the time of final submission, the Chairman of the advisory committee should certify that the corrections and suggestions have been carried out as indicated by the examiners.

## **21. Revision of thesis**

If an examiner recommends for revision of thesis, the following norms will be adopted.

21.1. For revision of draft, the thesis should be resubmitted after a minimum of one month from the date of communication from the Controller of Examinations

21.2. At the time of submission, the advisory committee should give certificate for carrying out the corrections/recommendations. The resubmitted copies of thesis should be got corrected after carrying out the necessary corrections indicated by the external examiner and necessary certificates shall be obtained from the chairman and HOD before the conduct of the final viva-voce.

21.3. A fine prescribed by the University to be collected from the students at the time of resubmission of thesis.

## **22. Failure to appear for final Viva-voce/ Non submission of thesis after viva-voce.**

22.1. If a candidate fails to appear before the examining committee for final viva-voce, on the date fixed by the HOD, the following are the time frame and penalty.

22.2. The re-viva-voce must be completed within two years. An amount of fine prescribed by the University must be charged to the candidate.

22.3. After successful completion of thesis final viva-voce, if a student fails to submit the corrected version of the thesis within 15 days, he/she will be levied a fine prescribed by the University at the time of sending the proposal for result declaration.

## **23. Internship during Masters Programme**

### **Internship for Development of Entrepreneurship in Agriculture (IDEA)**

Currently, a provision of 30 credits for dissertation work in M.Sc. programmes helps practically only those students who aspire to pursue their career in academic/ research. There is hardly any opportunity/ provision under this system to enhance the entrepreneurship skills of those students who could start their own enterprise or have adequate skills to join the industry.

Therefore, in order to overcome this gap, an optional internship/ in-plant training (called as IDEA) in lieu of thesis/ research work is recommended which will give the students an opportunity to have a real-time hands-on experience in the industry .It is envisaged that the internship/ in-plant training would enhance the interactions between academic organizations and

the relevant industry. It would not only enable the development of highly learned and skilled manpower to start their-own enterprises but also the industry would be benefitted through this process. This pragmatic approach would definitely result in enhanced partnerships between academia and industry.

The main objectives of the programme:

1. To promote the linkages between academia and industry
2. To establish newer University – Cooperative R&D together with industry for knowledge creation, research and commercialization
3. Collaboration between Universities and industries through pilot projects
4. To develop methods for knowledge transfer, innovation and networking potential
5. To enhance skill, career development and employability

Following criteria for IDEA will be taken into consideration:

- At any point of time there will not be more than 50% of students who can opt under IDEA
- Major Adviser will be from Academia and Co-advisor (or Advisory Committee member) from industry
- Total credits (30) will be divided into 20 for internship/ in-plant training and 10 for writing the report followed by viva-voce, similar to thesis research
- Work place will be industry; however, academic/ research support would be provided by the University or both. MoU may be developed accordingly
- The IPR, if any, would be as per the University policy

## **24. Result notification**

24.1. After the completion of each semester, the student will be given the statement of marks by the Controller of Examinations.

24.2. The transcript will be prepared by Controller of Examinations. The various subjects taken by a student along with the credits and the grade obtained shall be shown on his/her transcript. Based on the total credits admitted, the final Grade Point Average shall be calculated and given.

## **25. Award of Medals**

Medal should be awarded only if the student is a rank holder and secures at least 8.5 OGPA, clears all courses in first attempt and in the programme having a batch of at least three students.

## **26. Transitory Regulations**

Separate time table of course work under old semester system will be arranged by the HOD. for students with attendance deficiency in a course/courses provided such course/courses are not currently offered due to the introduction of the revised syllabi with effect from the academic year 2022 – 2023. The candidates under old semester system will, however, complete all the examinations within a period of four academic years from the year of admission.

## **27. 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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### GAGR 21 M.Sc. (Ag.) Agronomy

#### Courses with Credit

I) Course work	Credit
Major Courses	20
Minor Courses	08
Supporting Courses	06
Common Courses	05
Seminar	01
II) Thesis Research / IDEA	30
<b>Total credits</b>	<b>70</b>

#### Distribution Pattern of Courses and Credit (Research)

Semester	Major Courses	Minor Courses	Supporting Courses	Common Courses	Seminar	Research	Credit
I	8	-	6	2	-	2	18
II	12	-	-	2	-	6	20
III	-	6	-	1	1	10	18
IV	-	2	-	-	-	12	14
Credit Load	<b>20</b>	<b>8</b>	<b>6</b>	<b>5</b>	<b>1</b>	<b>30</b>	<b>70</b>

#### Distribution Pattern of Courses and Credit (IDEA)

Semester	Major Courses	Minor Courses	Supporting Courses	Common Courses	Seminar	IDEA	Credit
I	8	-	6	2	-	-	16
II	12	-	-	2	-	-	14
III	-	6	-	1	1	10	18
IV	-	2	-	-	-	10 +10	22
Credit Load	<b>20</b>	<b>8</b>	<b>6</b>	<b>5</b>	<b>1</b>	<b>30</b>	<b>70</b>

## Distribution Pattern of Courses and Credit

### Distribution of Courses

Code	Course Title	Credits
<b>Compulsory Major Courses</b>		
AGR 501*	Modern Concepts in Crop Production	3(3+0)
AGR 502*	Principles and Practices of Weed Management	3(2+1)
AGR 505*	Principles and Practices of Water Management	3(2+1)
AGR 506*	Principles and Practices of Soil Fertility and Nutrient Management	3(2+1)
<b>Major optional courses</b>		
AGR 503	Conservation Agriculture	2(1+1)
AGR 507	Agronomy of Major Cereals and Pulses	3(2+1)
AGR 508	Agronomy of Oilseed, Fibre and Sugar crops	3(2+1)
AGR 509	Agro Meteorology and Crop Weather Forecasting	3(2+1)
AGR 504	Agronomy of Fodder and Forage crops	2(1+1)
<b>Minor Course</b>		
AGR 510	Dry land farming and Watershed Management	3(2+1)
AGR 511	Agrostology and Agroforestry	3(2+1)
AGR 512	Principles and Practices of Organic Farming	3(2+1)
AGR 513	Agronomy of Medicinal Aromatic and under-utilized crops	2(1+1)
AGR 514	Cropping Systems and Sustainable Agriculture	2(2+0)
<b>Supporting Course</b>		
STA 511	Statistical Methods for Applied Sciences	3(2+1)
COM 521	Information Technology in Agriculture	3(2+1)
<b>Common courses</b>		
PGS 501	Library and Information services	1(0+1)
PGS 502	Technical writing and Communication Skill	1(0+1)
PGS 503	Intellectual property and its Management in Agriculture	1(1+0)
PGS 504	Basic Concepts in Laboratory Techniques	1(0+1)
PGS 505	Agricultural Research Methodology and Research Ethics and rural development Programmes	1(1+0)
<b>Non-Gradial Compulsory Courses</b>		
NGC 511	Disaster management (Contact Hour :1)	-
NGC 512	Constitution of India (Contact Hour :1)	-
VAC	Value added Course	-
AGR 591	Seminar	1(0+1)
AGR 596/597/598/599	Research/ IDEA	30
		-

\*Compulsory Courses

### **Programme Outcome (PO)**

1. Graduate will acquire core knowledge leading to awareness on advancements in the field of agriculture and horticulture including crop production, soil fertility, crop protection, crop improvement, microbiology, bio technology, agricultural extension and economics.
2. Graduates will have expertise in handling scientific and innovative experimental tools in biological sciences, analytical techniques for plant and soil samples, microbial technologies, biotechnological tools, statistical tools & analysis, research data computation, etc, required for higher learning, research and development.
3. Graduates will be mastering the modern agronomic techniques of crop production, water, soil & nutrient management, plant protection with respect to insect pest and plant diseases , crop improvement and ecosystem restoration.
4. Graduate will be able to design and execute individual research project, write concise & persuasive research articles and communicate effectively with their scientific colleagues, farmers and the general public.
5. Graduate will be able to communicate research and educational materials properly and competently.

### **PO and CO Mapping Matrix**

<b>AFFINITY LEVEL</b>	
1	<b>Low</b>
2	<b>Moderate/ Medium</b>
3	<b>Substantial /High</b>

**SEMESTER-WISE DISTRIBUTION OF COURSES (RESEARCH)**

<b>Sl. No.</b>	<b>Course Title</b>	<b>Credit</b>
<b>I Semester</b>		
1.	Major Courses	8
2.	Supporting Courses	
	STA501 - Statistical Methods for Applied Sciences	3
	COM 501 - Information Technology in Agriculture	3
3.	Common Courses	
	PGS 501 - Library and information services	1
	PGS 502 - Technical writing and communications skills	1
4.	<b>AGR 596 Research</b>	2
	<b>Total</b>	<b>18</b>
<b>II Semester</b>		
1.	Major Courses	12
2.	Common Courses	
	PGS 503 - Intellectual property and its management in agriculture	1
	PGS 504 - Basic Concepts In Laboratory Techniques	1
3.	<b>AGR 597 Research</b>	6
	<b>Total</b>	<b>20</b>
<b>III Semester</b>		
1.	Minor courses	6
2.	Common course	
	PGS 505 - Agricultural research, research ethics and rural development programmes	1
3.	NGC 511 - Disaster Management (Contact hour 1+ 0)	-
4.	NGC 512 - Constitution of India (Contact hour 1+ 0)	-
5.	<b>AGR 591 Master's Seminar</b>	1
6.	<b>AGR 598 Research</b>	10
7.	Value Added Course (Contact hour 3+0) ( <a href="https://annamalaiuniversity.ac.in/studport/value_added_crs.php">https://annamalaiuniversity.ac.in/studport/value_added_crs.php</a> )	-
	<b>Total</b>	<b>18</b>
<b>IV Semester</b>		
1.	Minor course	2
2.	<b>AGR 599 Research</b>	12 (8+4)
	<b>Total</b>	<b>14</b>

**SEMESTER-WISE DISTRIBUTION OF COURSES (IDEA)**

<b>Sl. No.</b>	<b>Course Title</b>	<b>Credits</b>
<b>I Semester</b>		
1.	Major Courses	8
2.	Supporting Courses	
	STA501 - Statistical Methods for Applied Sciences	3
	COM 501 - Information Technology in Agriculture	3
3.	Common Courses	
	PGS 501 - Library and information services	1
	PGS 502 - Technical writing and communications skills	1
	<b>Total</b>	<b>16</b>
<b>II Semester</b>		
1.	Major Courses	12
2.	Common Courses	
	PGS 503 - Intellectual property and its management in agriculture	1
	PGS 504 - Basic Concepts In Laboratory Techniques	1
	<b>Total</b>	<b>14</b>
<b>III Semester</b>		
1.	Minor courses	6
2.	Common course	
	PGS 505 - Agricultural research, research ethics and rural development programmes	1
3.	Disaster Management (Contact hour 1+ 0)	-
4.	Constitution of India (Contact hour 1+ 0)	-
5.	<b>AGR 591 Master's Seminar</b>	1
6.	<b>AGR 596/597/598 IDEA</b>	10
7.	Value Added Course (Contact hour 3+0) ( <a href="https://annamalaiuniversity.ac.in/studport/value_added_crs.php">https://annamalaiuniversity.ac.in/studport/value_added_crs.php</a> )	-
	<b>Total</b>	<b>18</b>
<b>IV Semester</b>		
1.	Minor course	2
2.	<b>AGR 599 IDEA</b>	20 (10+10)
	<b>Total</b>	<b>22</b>

## SYLLABUS

### AGR 501 MODERN CONCEPTS IN CROP PRODUCTION (3+0)

#### Course objective

- To impart knowledge on advanced concepts of crop growth and productivity in relation to climate change.
- To incur acquaintance on recent trends in soil nutrient management in crop production.
- To cognizant about interaction of inputs on growth and yield of crops.
- To acquire knowledge on modern concepts in farm mechanization and energy management
- To acquire gen on remote sensing and precision agriculture.

#### Theory

##### UNIT I Concepts of crop growth and distribution

Agro ecological zones of India. Crop distribution - physical, chemical and biological factors. Soil and climate influence on crop growth. Crop growth analysis in relation to environment and production functions. Scientific principles of crop production. Concept of soil plant relations. Yield and environmental stress. Relationship between plant population and yield and response curves. Use of growth hormones and growth regulators for better adaptation in stressed condition.

##### UNIT II Soil nutrient laws in crop production

Quantitative agro-biological principles and inverse yield nitrogen law, Mitscherlich yield equation, Bray's nutrient mobility concept, Baule unit - its interpretation and applicability. Soil Health Care (SHC). Sensor based techniques in soil nutrient management. Balanced nutrition and INM. Crop response functions in yield management - future strategies

##### UNIT III Plant ideotypes

Effect of lodging in cereals - management. Physiology of grain yield in cereals. Optimization of plant population and planting geometry for various situations. Plant ideotypes – concepts and applications. Yield maximization.

##### UNIT IV Farm mechanization and energy management

Modern concepts in tillage; zero, minimum and conservation tillage; resource conservation techniques in conventional and modern tillage – conservation agriculture - Energy concepts in farming systems under varied situations. Modern techniques in post-harvest technology. Farm mechanization. Organic agriculture. ITK and its role in crop production.

##### UNIT V Modern concepts and approaches

Crop models- definition, concepts and types (empirical and mechanistic), model application. Precision agriculture- definition, basic concepts, scope and approach. Technologies for precision agriculture – GIS, GPS, sensors and remote sensing. Modern crop production concepts and approach. Soil less cultivation - aeroponic, hydroponic - Vertical farming – artificial intelligence – concept and application. Robotic and drones in agriculture. Protected agriculture - Current stream of taught.

#### Lesson Plan

##### Theory Schedule

1. Crop distribution in agro-ecological zones of India and Tamil Nadu.
2. Growth pattern of crops – rice, wheat, maize, pea, cotton, sugarcane
3. Crop growth analysis CGR, LAI, SLA, RGR, NAR, LAD
4. Plant growth - concepts, factors affecting growth and distribution.
5. Effect of climate change on crop production and climate resilient crops.
6. Principles of biological agriculture- a modern outlook.
7. Concept of soil plant relations
8. Yield and environmental stress.
9. Plant growth hormones and regulators for better adaptation in stressed condition.
10. Crop response production functions
11. Crop response production functions and yield gap analysis.

12. Concept of soil plant, water, nutrient relations - soil - plant nutrient relations.
13. Quantitative agro – biological principles in soil nutrient and crop production
14. Inverse yield nitrogen law - interpretation and applicability. .
15. Mitscherlich yield equation - interpretation and applicability.
16. Bray’s nutrient mobility concept - interpretation and applicability.
17. Baule’s unit - concepts and application in crop growth.
18. Soil Health Care (SHC).
19. Sensor based nutrient application to increase soil health.
20. Concept of balance nutrition and integrated nutrient management.
21. Site specific nutrient management - a modern concept in crop production.
22. Determining the nutrient requirement for yield potentiality of crops.
23. Effect of lodging in cereals and its management on major crops.
24. **Mid semester examination**
25. Physiology of grain yield in cereals
26. Source sink relationship -harvest index in relation to yield of crops.
27. Plant population and planting geometry in relation to different resources.
28. Plant ideotypes - concept of ideal plant type.
29. Ideotypes for some crops/situation.
30. Interaction of inputs on growth and yield attributes of crops.
31. Yield maximization - stability and high yielding varieties.
32. Tillage - objectives and modern concepts - zero, minimum, conservation - advantages and drawbacks.
33. Resource conservation techniques in conventional and modern tillage - conservation agriculture.
34. Farm mechanization – concepts- advantages and disadvantages
35. Farm mechanization for different farming situation and different field crops
36. Energy concepts - different ecosystems – energy saving techniques- labour, fuel,
37. Use of renewable source of energy in agriculture.
38. Modern post-harvest techniques - its impact on crop productivity.
39. Crop quality assessment and standards.
40. ITK – concepts – significance in modern agriculture- types / module for different crops.
41. Organic farming- principles and concepts, current status - inputs
42. Marketing and export potential of organic products.
43. Organic certification – standards and agencies – market and export avenues.
44. Crop modelling for desired crop yield - concepts.
45. Types of Crop modelling - empirical and mechanistic
46. Precision agriculture – concepts, principles, components, merits and demerits.
47. Use of GIS, GPS and remote sensing in modern agriculture - Soil less cultivation, aeroponic, hydroponic.
48. Vertical farming – artificial intelligence – concept and application.
49. Robotics and drones in agriculture - uses.
50. Future needs and scope for modern crop production.
51. Current stream of taught.

### Course Outcomes

**CO 1:** To understand advanced concepts of crop growth and productivity in relation to climate change

**CO 2:** To gain knowledge on Sensor based nutrient application to increase soil health.

**CO 3:** To acquire knowledge on modern concepts in tillage and farm mechanization

**CO 4:** To gain knowledge on principles and components of organic farming, vermi technology, resource conservation technology.

**CO 5:** To gain knowledge on farm mechanization and energy management.

**CO– PO Mapping**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>
<b>CO1</b>	3	2	3	-	2
<b>CO2</b>	3	-	3	-	3
<b>CO3</b>	3	-	3	3	3
<b>CO4</b>	3	3	-	3	3
<b>CO5</b>	-	3	-	-	3

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- Rajesh Singh, Anitha Gehlot, Mahesh Kumar Prajapat, Bhupendra Singh, 2021. Artificial Intelligence in Agriculture, Taylor and Francis Publ.

**e-Resources**

- <http://www.hillagric.ac.in/edu/coa/agronomy/lect/agron-501/501-Modern-Concepts-in-Crop-Production-SSR-MCR.pdf>.
- <https://www.krishisewa.com/miscellaneous/resource-management/1031-site-specific-nutrient-management-ssnm-for-increasing-fertilizer-use-efficiency-and-agriculture-profitability.html>.
- <https://www.jaivikkheti.in/DMS/Final%20ITKS%20edit.pdf>.
- <http://www.hillagric.ac.in/edu/coa/agronomy/lect/agron-501/501-Modern-Concepts-in-Crop-Production-SSR-MCR.pdf>.
- <https://www.manage.gov.in/publications/farmerbook.pdf>.

**AGR 502 PRINCIPLES AND PRACTICES OF WEED MANAGEMENT (2+1)**

**Objectives**

- To expose the concepts and principles of weed management.
- The students will be competent with different scientific advancement in the field of weedscience.
- To acquire knowledge about mode of action of different herbicides.
- The students will critically assess the value of different weed management options incropped and non- cropped areas.
- To aware about the concept of biotechnology in weed management.



## **Theory**

### **UNIT I – Weed biology and Ecology**

Weed biology and ecology. Crop-weed competition including allelopathy. Principles and methods of weed control. Weed indices. Weed shift in different ecosystems.

### **UNIT II – Herbicides – Classification and mode of action**

Herbicides introduction and history of their development. Classification based on chemical, physiological application and selectivity. Mode and mechanism of action of herbicides.

### **UNIT III - Herbicide physiology**

Herbicide - structure, activity relationship, factors affecting the efficiency of herbicides, formulations, herbicide mixtures – Herbigation. Herbicide resistance and management. Weed control through use of nano herbicides, myco herbicides, bio-herbicides and allelochemicals. Movement and degradation of herbicides in soil and plants. Herbicide resistance in weeds and crops. Sequential application of herbicides and their management. Herbicide combination and rotation.

### **UNIT IV - Weed management in major crops**

Weed management in major crops and cropping systems. Alien, invasive and parasitic weeds; weed shifts in crops. Aquatic and perennial weed control. Weed control in non-cropped area.

### **UNIT V - Integrated weed management**

Integrated weed management. Recent development in weed management- robotics. Use of Drones and Aeroplanes, etc: Cost benefit analysis of weed management.

## **Practical**

Identification of important weeds of different crops, Preparation of weed herbarium, Weed survey in crops and cropping systems, Study of crop weed competition in on-going research experiments. Weed indices calculation and interpretation with data. Preparation of spray solutions of herbicides for high and low volume sprayers. Use of various types of spray pumps and nozzles and calculation of swath width. Economic analysis of weed management practices in different crops and cropping systems. Calculation of herbicide dose requirement. Study of herbicide residue analysis in plants and soils. Bio-assay of herbicide residues.

### **Theory lecture schedule**

1. Weed biology – definition - characteristics and classification of weeds
2. Weed ecology – persistence of weeds
3. Survival mechanism of weeds, biology of weeds, weed migration, weed seed distribution in different ecosystems. Weed seed dormancy, germination, establishment and perennation of weeds in different ecosystems
4. Crop weed competition. Allelopathy- concept, types, allelochemicals sources and liberation , stimulatory effect and use of allelopathy in agriculture
5. Principles of weed management- preventive measures
6. Cultural methods of weed management.
7. Mechanical methods of weed management.
8. Biological method of weed control.
9. Weed indices for assessing weed control methods
10. Weed shift in different ecosystems
11. History and development of herbicides.
12. Classification and characteristics of herbicides
13. Absorption, translocation of herbicides - mode of action of herbicides
14. Selectivity of herbicides in plants.
15. Ecological role of weeds in agro ecosystems of crop manipulations
16. Herbicide structure –activity relationship
17. **MID-SEMESTER EXAMINATION**
18. Factors affecting herbicides efficiencies
19. Herbicide formulations and its suitability

20. Herbicides and herbicide mixtures and their compatibility and efficiency – Herbigation.
21. Adjuvants, herbicide protectants and antidotes
22. Factors affecting herbicides efficiencies
23. Herbicide resistant on crops and their management
24. Weed control through nano,bio-herbicides, mycoherbicides and allelo chemicals
25. Degradation of herbicides in plants and soils. Herbicide residues and their management.
26. Herbicide resistant weeds and their impact on weed management
27. Sequential application of herbicides. Herbicide rotation and its significance on weed management
28. Weed management in major crops and different cropping systems
29. Principles , concepts and designing of IWM for major crops
30. Management of perennial, noxious and problematic weeds
31. Management of alien, invasive, parasitic and aquatic weed, weed control in non cropped area
32. Recent development in weed management- robotics, use of drones and aero plane etc,
33. Cost: Benefit analysis of weed management.
34. Current stream of taught.

### **Practical schedule**

1. Identification, characterization of wet land weeds ,
2. Identification, characterization of garden land weeds
3. Identification, characterization of dry land weeds
4. Identification, characterization of aquatic weeds
5. Preparation of weed herbarium
6. Phytosociological survey of weeds
7. Study of crop weed competition
8. Assessment of soil weed seed bank and seed production potential
9. Preparation of spray solutions of herbicides for low and high volume sprayers
10. Use of various types of spray pumps
11. Use of various types of nozzles and calculation of swath width
12. Herbicide application techniques
13. Calculation of herbicide dose requirement
14. Working out weed indices of different weed management practices
15. Economic analysis of weed management practices in different cropping systems
16. Study of herbicide residue analysis in plant and soils. Bio- assay of herbicide residues

### **17. Practical examination**

#### **Course Outcomes:**

**CO 1:** To understand the knowledge on weed biology and survey of weeds in variedecosystem.

**CO 2:** To identify the nature, type and economic uses of weeds in varied habitat.

**CO 3:** To gain knowledge on herbicide application techniques

**CO 4:** To evaluate different methods of weed control

**CO 5:** To formulate integrated weed management practices for different ecosystems

## CO– PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	3	3	3	3	-
CO2	3	-	3	3	-
CO3	3	3	3	3	3
CO4	3	3	3	-	3
CO5	3	3	3	3	-

### References:

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4. [http://www.agritech.tnau.ac.in/agriculture/agri\\_weedmgt.html](http://www.agritech.tnau.ac.in/agriculture/agri_weedmgt.html)
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## AGR 505 PRINCIPLES AND PRACTICES OF WATER MANAGEMENT (2+1)

### Objectives

- To educate the principles of water management and practices to augment water productivity.
- The students will study on soil, water plant relationship, crop water requirement for different crops.
- The students will acquire knowledge on various methods of scheduling irrigation, irrigation design and layout.
- The students will aware about designing of drip and sprinkler irrigation system.
- The students will learn about quality of irrigation water and various drainage methods.

## **Theory**

### **Unit I History and importance of irrigation water in India and states**

History of irrigation in India - water resources of India and states. Scope for water storage and conservation in India and Tamil Nadu. Major irrigation projects and extent of area and crops irrigated in India and Tamil Nadu.

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

Water and its role in plants. Hydrological cycle. Soil-water-plant relationships. Soil water potential - concepts. Soil water – classification, movement in soil and plants. Absorption and conduction in plants, evaporation, transpiration, estimation of evapotranspiration and effective rainfall. Plant adaptation to water stress. Water availability and its relationship with nutrient availability and losses.

### **Unit III Crop water requirement and irrigation scheduling**

WR of crops - soil, plant and meteorological factors influencing CWR. Concepts in estimation of WR of crops; soil moisture depth concepts. Scheduling of irrigation based on various criteria. Water management of crops under climate change scenario.

### **Unit IV Methods of irrigation and WUE**

Irrigation methods - surface and subsurface, overhead, pressurized, Pivot irrigation, Automated irrigation; deficit irrigation; fertigation; layout; operation procedures. Pot watering in netted houses, poly house and greenhouse - application standards. Water use efficiency of crops under different soil water atmospheric situations. Irrigation efficiency.

### **Unit V Water management in problem soils, drainage and quality of irrigation water**

Quality of irrigation water- criteria used. Effect of poor quality water on plant growth. Management of saline water for irrigation. Excess soil water and plant growth- drainage management of crops and methods of drainage, drainage layout and suitability to crops. Rain water management and its utilization for crop production. Water management for different crops and cropping systems under normal and problem soils.

### **Practical**

Estimation of soil moisture by various direct and indirect methods - gravimetric, volumetric, Determination of permanent wilting point by sunflower pot culture technique. Determination of field capacity and PWP by pressure plate apparatus. Determination of hygroscopic coefficient. electrical resistance - soil moisture curves - determination of infiltration rate, hydraulic conductivity, AET and ER - plant water status by direct method - Estimation of water requirement and Irrigation requirement of crops -irrigation efficiency calculation - comparison of various water measuring devices, and methods - economics of certain micro irrigation systems - assessment of water quality.

## **Lecture Schedule**

1. History of irrigation, water resources of India and states - occurrences of groundwater - aquifers - need and importance for irrigation.
2. Major and minor irrigation projects of India and Tamil Nadu. Area of crops irrigated in India and states - scope for extension.
3. Possibility for water conservation and storage in India and Tamil Nadu.
4. Water demand from different sectors - water user's associations - forecast for next ten years.
5. Water and its role in plants, importance of hydrological cycle. Soil water potential concepts and units of expression.
6. Physical and biological classification of water and various factors influencing soil water potentials and availability.
7. Soil moisture constants - ASM - RAW -MAD - for various soil types.
8. Rooting pattern and moisture extraction from soil by plants, ERZ concepts
9. Soil water movement in soil and plants - theories governing in absorption and conductance.
10. Loss of water from soil and plant - evaporation and transpiration - transpiration -an inevitable process - The process relating to transpiration -transpiration dynamism - Transpiration efficiency - transpiration coefficient.

11. Soil water and plant relationship -absorption - conductance and loss - factors affecting it, soil, plant and atmospheric factors.
12. Plants stress, water deficit and its adaptations, and methods to overcome.
13. Water availability and its relationship with nutrient availability and losses.
14. Water needs of crops, soil moisture depth, and factors influencing WR of crops.
15. Methods of estimating WR of crops, and role of crop factor in estimation of CWR in different stages.
16. Scheduling of irrigation - criteria for scheduling irrigation - criteria based on plant and soil water, climatological approach - empirical formula - evaporative pans -pan factors - crop coefficient. Water management of crops under climate change scenario.
17. **Mid Semester Examination**
18. Advanced trends and concepts in scheduling irrigation - modification in the existing.
19. Method of irrigation, surface and subsurface methods - advantages and disadvantages – pivot irrigation.
20. Overhead and micro-irrigation - sprinkler irrigation - suitability - components - operations- advantages and disadvantages.
21. Drip irrigation - suitability - components - layout - operation - advantages and disadvantages.
22. Special and advanced methods of irrigation - suitability and advantages
23. Concept of fertigation- fertilizer type for suitability - method of applying fertilizer through irrigation water -fertigation tanks - venturris-fertigation under sub surface method
24. Irrigation under controlled environment - glass houses - green house - poly house - netted house - pot watering - sprinkling - pipe irrigations. Automated irrigation, deficit irrigation, fertigation
25. WUE - definition and concept - methods to improve water use efficiency – increasing WUE under increased and reduced yield conditions. Irrigation efficiency.
26. Irrigation management for cereals, pulses, oilseeds, fibers, sugar crops, commercial crops and horticultural crops.
27. Quality of water for irrigation - standards - use of saline water for irrigation.
28. Effect of poor quality water on plant growth and their management.
29. Soil water - excess water - causes for excess water in soil - effect on soil and plants - tolerance of plants for water stagnated environment.
30. Removal of excess water - drainage - methods of draining water - surface and subsurface method - layout.
31. Irrigation management for problem soils - non drainable, undulating, saline and alkali soils.
32. Rain water management and its utilization for crop production.
33. Water management for cropping systems - annuals - perennials, intercropping systems - sequential systems.
34. Current stream of taught.

#### **Practical schedule**

1. Estimation of soil moisture content by direct and indirect methods.
2. Standardizing soil moisture curve for different soil types.
3. Determination of soil moisture constants and soil moisture depletion.
4. Calculation of infiltration by double ring method.
5. Assessment of hydraulic conductivity.
6. Estimation of plant water status - RWC by direct method.
7. Estimation of WR of crops using Pan and modified Penman method.
8. Computation of AET and ER.
9. Computation of water saving and irrigation efficiency parameters of different surface methods.
10. Observation of various water measuring devices at field level.
11. Determination of NIR, GIR for various crops and seasons.
12. Designing and cost of sprinkler irrigation.
13. Designing and economics of drip irrigation.

14. Calculation on fertigation.
15. Study of the quality of irrigation water.
16. Visit to certain irrigation stations

### 17. Practical Examination

#### Course Outcomes:

**CO 1:** To understand the principles involved in estimating water requirement for different crops.

**CO 2:** To gain knowledge on various methods of irrigation scheduling and approaches.

**CO 3:** To acquire knowledge on pressurized irrigation system to economize the water.

**CO 4:** To construct ideologies pertaining to water management in problem soils

**CO 5:** To analyse the quality of irrigation water

#### CO– PO Mapping

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

#### Suggested readings

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2. Lenka D. 2005. Irrigation and drainage. Kalyani publishers, New Delhi.
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5. Michael, A.M. 2009. Irrigation theory and practice. Vikas publishing house pvt. Ltd., New Delhi
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9. Sankara Reddi, G.H. and Yellamanda Reddy, T. 2005. *Efficient use of irrigation water*. Kalyani Publications
10. Singh Pratap and Maliwal PL. 2005. Technologies for food security and sustainable agriculture. Agrotech publ. Udaipur.

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2. <http://www.fao.org/docrep/t0667e/t0667e00.htm#Contents>
3. <http://www.fao.org/docrep/w4367e/w4367e17.html>

4. [http://www.fao.org/nr/water/docs/watermanagement/docs/mod\\_india.pdf](http://www.fao.org/nr/water/docs/watermanagement/docs/mod_india.pdf)
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## **AGR 506 PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT (2+1)**

### **Objectives**

- To expertize in soil fertility and nutrient management in agriculture.
- To develop critical thinking skills and ability to assess and comprehend the ~~essentially~~ <sup>essentiality</sup> of plant nutrients for crop production.
- To become outstanding leaders and team players in collaborative and interdisciplinary application soil fertility to address local, regional, national and/or global problems.
- To upgrade technical knowhow and skills in soil testing and application of nutrients prescription report.
- To understand the methodologies for soil fertility assessment and methods of fertilizer application

### **Theory**

#### **UNIT I Soil fertility and productivity**

Soil fertility and productivity - factors affecting, features of good soil management. Problems of supply and availability of nutrients. Relation between nutrient supply and crop growth.

#### **UNIT II Functions and availability of essential nutrients**

Nitrogen, Phosphorus and Potassium - functions- deficiency and toxicity symptoms, forms, transformation in soil. Organic and mineral N balance in soil. Mineralization of N compounds - soil losses. Nitrogenous fertilizer materials - time and methods of N application. Methods to increase NUE. Slow release fertilizer. Biological N fixation, symbiotic and free living N fixers. Phosphatic fertilizer materials - time and methods of application, practices of increasing their efficiency of applied and available phosphorus (PSB). Potassic fertilizer materials - time and methods of application. Physiological methods of increasing FUE.

#### **UNIT III Fertilizer and its utilization**

Secondary and micronutrients: Ca, Mg, S, Fe, Zn, B, Cu, Mo, Mn – functions, deficiency symptoms, time and method of application. Commercial fertilizers - composition, water soluble and Nano fertilizers. Relative fertilizer value and cost. Crop response to different nutrients. Residual effects of fertilizers. Fertilizer mixtures and grades.

#### **UNIT IV Interrelationship of nutrients**

Interrelationship of nutrient availabilities; CEC and availability of plant nutrients. INM; INPSS; CNC, CNR, DRIS - significance - crop logging. Site specific nutrient management – sensors in nutrient management - Economics of nutrient use.

#### **UNIT V Organics in soil fertility**

Recycling of organic wastes, farm wastes and residue management. Preparation and use of farmyard manure, compost, vermicompost. Organic concentrates – composition, availability and crop response. Biofertilizers in soil and crop productivity. Green manure in sustaining the soil fertility and productivity.

### **Practical**

Determination of soil pH, EC, organic carbon. Estimation of total N and available nitrogen, phosphorus and potassium in soils. Determination of S in soils. Determination of total N, P, K and S in plants. Interpretation of interaction effects. Computation of economic and yield optima.

### **Theory Schedule**

1. Soil fertility and crop productivity- definition and concepts - agronomic significance for sustainable crop production.
2. Problems of supply and availability of nutrients and features of good soil management.

3. Factors influencing nutrient supply and crop growth.
4. Different soils of India- characteristics and functions
5. Soil health and its importance, soil less cultivation
6. Problem soils and their management
7. Methodologies for soil fertility assessment – approaches for fertilizer scheduling
8. Availability of plant nutrients in soil - macronutrients - criteria of essentiality of nutrients.
9. Availability of plant nutrients in soil – secondary and micro - criteria of essentiality of nutrients.
10. Essential plant nutrients – their functions- macronutrients – N, P, K.
11. Essential plant nutrients – their functions – secondary and micronutrients.
12. Identification of nutrient deficiency, toxicity and its symptoms – critical levels.
13. Transformation and dynamics of plant nutrients – nitrogen.
14. Transformation and dynamics of phosphorus and potassium.
15. FUE-agronomic, chemical and physiological methods of estimating FUE.
16. FUE-techniques for increasing FUE.
17. **Mid semester examination**
18. Commercial fertilizers - composition, solid, water soluble and Nano fertilizers, application.
19. Relative fertilizer value and cost. Fertilizer mixtures and grades.
20. Crop response to different nutrients. Nutrient budgeting-imbbalances - concepts – crops and cropping system.
21. Residual effects of fertilizers. Economics of fertilizer use
22. Nutrient availability – soil moisture and nutrient interaction.
23. Time and methods of manures and fertilizer application
24. Foliar nutrition- application and its concept - uses.
25. Crop response to different nutrients - Interrelationship of nutrient availabilities.
26. Fertilizer related environmental and groundwater pollution.
27. Soil pH and CEC – Importance in availability of plant nutrients.
28. INM, IPNSS- importance and essentiality - crops and cropping system
29. CNC, CNR, DRIS - significance - crop logging
30. Site specific nutrient management – sensors in nutrient management.
31. Recycling of organic wastes, farm wastes and residue management.
32. Preparation and use of farmyard manure, compost, vermicompost. Organic concentrates – composition, availability and crop response.
33. Biofertilizers and green manure in sustaining the soil fertility and productivity.
34. Current stream of taught.

### **Practical Schedule**

1. Soil collection and plant sample analysis
2. Determination of soil pH and determination of EC
3. Determination of organic carbon
4. Determination of total N and available N in soils
5. Determination of P in soils
6. Determination of K in soils
7. Determination of S in soils
8. Determination of total N in plants
9. Determination of total P in plants
10. Determination of total K in plants
11. Determination of total S in plants
12. Interpretation of interaction between nutrient effects
13. Calculating C: N ratio and fertilizer schedule for different cropping system.
14. Diagnosis of nutrient deficiencies for major nutrient and management methods.
15. Diagnosis of nutrient deficiencies for minor nutrient and management methods
16. Computation of economic and yield optima



## 17. Practical examination

### Course Outcomes:

**CO 1:** To expand breadth of knowledge and expertise in soil fertility and productivity incrop production.

**CO 2:** To develop scientific capability in independently assessing, interpreting, and summarizing soil problems.

**CO 3:** To propose, evaluate or execute experimental protocol regarding nutrient budgeting for crop production.

**CO 4:** To foster commitment to ethical behavior in fertilization of crops with respect to environment perspectives

**CO 5:** To gain knowledge about soil fertility assessment and methods of fertilizer application

### CO– PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	2	3	1	-	-
CO2	3	3	3	-	3
CO3	2	3	3	3	2
CO4	3	2	3	2	3
CO5	3	3	2	-	-

### Suggested Readings

1. Brady, N.C. and Weil, R.R 2013. The nature and properties of soils. 14<sup>th</sup> Ed, Perason Education India, Chennai
2. Dipak Ranjan Biswas. 2021. A text book of fertilizers. New India Publishing agency, New Delhi
3. Frederick R. Troeh and Louis M Thompson. 6<sup>th</sup> Ed. 2005. Soils and Soil fertility. Blackwell publishing company, New Jersey, USA
4. Havlin, J.L., Tisdale, S.L., Beaton, J.D., and Nelson, W.L. 2006. Soil fertility and fertilizers. 7<sup>th</sup> Ed., Pearson/Prentice Hall, Upper Saddle River, New Jersey.
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9. Tandon, H.L.S. 1992. Management of nutrient interactions in Agriculture. FDCO, New Delhi.
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### e-Resources

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3. [http://www.omafra.gov.on.ca/english/crops/facts/cover\\_crops01/cover.htm](http://www.omafra.gov.on.ca/english/crops/facts/cover_crops01/cover.htm)
4. <http://www.omafra.gov.on.ca/english/crops/soils/fertility.html>.
5. [https://www.researchgate.net/publication/309211815 Principles and Practices of Soil Fertility and Nutrient Management](https://www.researchgate.net/publication/309211815_Principles_and_Practices_of_Soil_Fertility_and_Nutrient_Management).

## AGR 503 CONSERVATION AGRICULTURE (1+1)

### Objective

1. To impart knowledge of conservation of agriculture for enhancing agricultural productivity.
2. To acquire knowledge on nutrient, water and weed management in conservation agricultural.
3. To understand the practices to sustain crop productivity and soil health.
4. Students will incur knowledge on various aspects of CA in different situation.
5. To acquire skills in practicing CA.

### Theory

#### UNIT I Conservation Agriculture

Conventional and conservation agriculture systems, sustainability concerns, conservation agriculture: Principles, Historical background and present concept, global experiences, present status in India.

#### UNIT II Nutrient and water management

Nutrient management in CA, water management, weed management, energy use, insect-pest and disease management, farm machinery, crop residue management, cover crop management.

#### UNIT III Soil health management

Climate change mitigation and CA, C-sequestration, soil health management, soil microbes and CA

#### UNIT IV Agroforestry and dry land farming

CA in agroforestry systems, rainfed / dryland regions

#### UNIT V Adoption of CA

Economic considerations in CA, adoption and constraints, CA: The future of agriculture

### Practical

Study of long-term experiments on CA, Evaluation of soil health parameters, Estimation of C-sequestration, Machinery calibration for sowing different crops, weed seed bank estimation under CA, energy requirements, economic analysis of CA.

### Theory lecture schedule

1. Conventional and conservation agriculture systems, concepts and sustainability concerns.
2. Historical background and present concept, global experiences, present status in India.
3. Tillage-concepts; zero tillage, minimum tillage over conventional tillage.
4. Permanent soil cover/mulching; types, application areas, advantages and crop production.
5. Crop diversification- Cover crops, crop rotation and inter cropping.
6. Nutrient and Water management in CA.
7. **Mid- semester examination.**
8. Weed management in conservation agriculture systems.
9. Energy use, insect-pest and disease management in CA.
10. Farm machinery, crop residue management.
11. Climate change mitigation and CA.
12. C-sequestration, soil health management, soil microbes and CA.
13. CA in agroforestry systems, rainfed / dryland regions.
14. Economic considerations in CA, adoption and constraints,
15. CA: The future of agriculture
16. Policy issues required for conservation agriculture.
17. Current stream of taught.

### Practical schedule

1. Study of long-term experiments on CA
2. Effect of different tillage practices in conservation agriculture
3. Effect of minimum tillage in conservation agriculture
4. Effect of mulching on soil moisture conservation
5. Crop rotation, in conservation agriculture
6. Intercropping in conservation agriculture
7. Utilization of organic manure in conservation agriculture

8. Utilization of green manure in conservation agriculture
9. Crop residues in conservation agriculture
10. Agro forestry systems in conservation agriculture
11. Evaluation of soil health parameters
12. Estimation of C-sequestration,
13. Machinery calibration for sowing different crops
14. Weed seedbank estimation under CA
15. Energy requirements, economic analysis of CA
16. Role of bio fertilizers in conservation agriculture
17. **Practical examination**

### Course Outcomes

- CO 1:** To acquire knowledge on concepts of conservation agriculture.
- CO 2:** To gain the information about the impact of conservation agriculture on nutrient management.
- CO 3:** To understand the concepts of CA for soil health management.
- CO 4:** To understand about CA in agroforestry systems
- CO 5:** To understand Utilization of green manure in conservation agriculture

### CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	2	2	3	3	2
CO2	2	3	3	2	3
CO3	3	2	2	3	2
CO4	3	3	3	3	3
CO5	2	-	2	2	-

### References

1. Arakeri HR and Roy D. 1984. Principles of Soil Conservation and Water Management. Oxford and IBH.
2. Bisht JK, Meena VS, Mishra PK and Pattanayak A. 2016. Conservation Agriculture-An approach to combat climate change in Indian Himalaya. Publisher: Springer Nature. Doi: 10/1007/978-981-10-2558-7.
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### e-resources

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2. <https://www.davuniversity.org/images/files/study-material/AGS%20226%20Conservation%20Agriculture%20.pdf>.

3. <https://study.com/academy/lesson/what-is-sustainable-agriculture-definition-benefits-and-issues.html>
4. <https://www.britannica.com/technology/carbon-sequestration>
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## **AGR 507 AGRONOMY OF MAJOR CEREALS AND PULSES ( 2+1)**

### **Objectives**

- The students will gain knowledge of input management in field crops about the integrated approach of plant nutrition and sustainability of soil fertility towards sustainable agriculture.
- The students will acquaint about prevailing cultivation practices for field crops and practices to improve their productivity
- The students will study the constraints in field crop production and their remedial measure with suitable management practices.
- The students will learn about the recent trends in cultivation of crops
- The students will acquire knowledge about post-harvest management practices and value addition

### **Theory**

Origin and history, adaptability, area and production, classification, improved varieties, climate, soil, nutrition, water and cultural requirements, quality components, post-harvest handling and processing of the produce for the maximum production of following crops

#### **UNIT I Kharif Cereals**

Rice, Maize, Bajra and Jowar

#### **UNIT II Rabi Cereals**

Wheat, Barley and Oats

#### **UNIT III Kharif Pulses**

Soybean, Red gram, Cowpea, Green gram & Black gram

#### **UNIT IV Rabi Pulses**

Chickpea, Lentil and Field pea

### **Unit V By-products utilization**

By-products utilization; low cost and cost effective technologies; trends and future thrust; farm mechanization, constraint and yield gap analysis. Recent advances in research on cereals and pulses – Current stream of thought.

### **Practical**

Planning, seed bed preparation and layout of field experiments, Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities, Intercultural operations in different crops. Phenological studies at different growth stages of crops. Working out growth indices (CGR, RGR, NAR, LAI, LAD, LAR, LWR, SLA, SLW etc.). Assessment of land use and yield advantage (rotational intensity, cropping intensity, diversity index, sustainable yield index, crop equivalent yield, LER, aggressivity, relative crowding coefficient, monetary yield advantage, competition ratio and ATER) of prominent intercropping systems of different crops. Judging of physiological maturity in different crops. Estimation of crop yield on the basis of yield attributes. Estimation of protein content in pulses. Working out harvest index of various crops. Determination of cost of cultivation of different crops. Study of seed production techniques in various crops. Visit of field experiments on cultural, fertilizer, weed control and water management aspects. Visit to nearby villages for identification of constraints in crop production.

## **Theory Lecture Schedule**

1. Importance, origin, history, area, production, distribution and general production constraints of paddy. Classification, cropping system of paddy and their adaptability in different agroclimatic zone.
2. Climate, soil, water and cultural requirement of and improved varieties of paddy for maximization of production.
3. Nutrient, water and weed management in relation to latest research in paddy crop. Handling and processing of produce of paddy.
4. Importance origin, history, area, production, distribution and general production constraints of maize. Classification, cropping system of maize and their adaptability in different agroclimatic zone.
5. Climate, soil, water and cultural requirement of and improved varieties of maize for maximization of production. Nutrient, water and weed management in relation to latest research in maize crop.
6. Nutrient, water and weed management in relation to latest research in maize crop Handling and processing of produce of maize.
7. Importance origin, history, area, production, distribution and general production constraints of bajra Classification, cropping system of bajra and their adaptability in different agroclimatic zone.
8. Climate, soil, water and cultural requirement of and improved varieties of bajra for maximization of production. Nutrient, water and weed management in relation to latest research in bajra crop.
9. Nutrient, water and weed management in relation to latest research in bajra crop Handling and processing of produce of bajra.
10. Importance origin, history, area, production, distribution and general production constraints of jowar Classification, cropping system of jowar and their adaptability in different agroclimatic zone.
11. Climate, soil, water and cultural requirement of and improved varieties of jowar for maximization of production. Nutrient, water and weed management in relation to latest research in jowar crop.
12. Nutrient, water and weed management in relation to latest research in jowar crop Handling and processing of produce of jowar.
13. Importance, origin, history, area, production, distribution and general production constraints of wheat, barley and oats.
14. Classification, cropping system of wheat, barley and oats their adaptability in different agroclimatic zone.
15. Climate, soil, water and cultural requirement of and improved varieties of wheat, barley and oats for maximization of production.
16. Nutrient, water and weed management in relation to latest research in wheat, barley and oats. Handling and processing of produce of wheat, barley and oats.
- 17. MID-SEMESTER**
18. Importance, origin, history, area, production, distribution and general production constraints of red gram. Classification, cropping system of red gram and their adaptability in different agro climatic zone. Climate, soil, water and cultural requirement of and improved varieties of red gram for maximization of production.
19. Nutrient, water and weed management in relation to latest research in red gram crop. Handling and processing of produce of red gram.
20. Importance, origin, history, area, production, distribution and general production constraints of cowpea. Classification, cropping system of cowpea and their adaptability in different agro climatic zone. Climate, soil, water and cultural requirement of and improved varieties of cowpea for maximization of production

21. Nutrient, water and weed management in relation to latest research in cowpea crop. Handling and processing of produce of cowpea
22. Importance, origin, history, area, production, distribution and general production constraints of green gram. Classification, cropping system of green gram and their adaptability in different agro climatic zone. Climate, soil, water and cultural requirement of and improved varieties of green gram for maximization of production.
23. Nutrient, water and weed management in relation to latest research in green gram crop Handling and processing of produce of green gram.
24. Importance, origin, history, area, production, distribution and general production constraints of black gram. Classification, cropping system of black gram and their adaptability in different agroclimatic zone.
25. Climate, soil, water and cultural requirement, improved varieties, nutrient, water and weed management black gram. Handling and processing of produce of black gram.
26. Importance, origin, history, area, production, distribution and general production constraints of chickpea
27. Classification, cropping system of chickpea and their adaptability in different agro climatic zone
28. Climate, soil, water and cultural requirement, improved varieties, nutrient, water and weed management chick pea. Handling and processing of produce of chickpea
29. Importance, origin, history, area, production, distribution, climate, soil, water and cultural requirement, improved varieties of pigeon pea and lentils
30. Nutrient, water management and general production of pigeon pea and lentils. Handling and processing of produce of pigeon pea and lentils
31. By products utilization and value addition of cereals and pulse crops.
32. Low cost and cost effective technologies for cereals and pulse crops
33. Constraint and yield gap analysis
34. Recent advances in research on cereals and pulse crops and Current stream of thought.

### **Practical Schedule**

1. Planning and layout of field experiments in cereals and pulses.
2. Sowing of certain crops for observations on growth and yield parameters in sole and intercrop situations.
3. Practicing nursery field preparation for different crops.
4. Phenological studies, intercultural operations at different crop growth stages in cereals.
5. Phenological studies, intercultural operations at different crop growth stages in pulses.
6. Working out growth indices (LAI, CGR, RGR, NAR, LAD, LAR, LWR, SLA, SLW).
7. Assessing of physiological maturity in cereals and pulses.
8. Working out harvest index of major crops in cereals and pulses through estimation of yield parameters.
9. Working out cost of cultivation of major cereal and pulse crops.
10. Study of seed production techniques in cereal and pulse crops.
11. Assessment of land use and yield advantage (rotational intensity, cropping intensity, diversity index, sustainable yield index, crop equivalent yield, LER, aggressivity, relative crowding coefficient, monetary yield advantage, competition ratio and ATER) of prominent intercropping systems of different crops
12. Estimation of crop yield on the basis of yield attributes for major cereals and pulses
13. Estimation of protein content in pulses.
14. Planning of field experiments on cultural, fertilizer, weed control and water management aspects.
15. Estimation of quality parameters in cereals and pulses.
16. Visit to nearby crop research stations and farmer's field.
- 17. Practical examination**

**Course Outcomes:**

**CO 1:** To have knowledge about the staple food crops and their cultivation practices with post-harvest technologies

**CO 2:** To assess a nature of the farm site and develop a new cropping system with the available resources

**CO 3:** To understand recent crop management practices on crop productivity and resource use efficiency.

**CO 4:** To gain knowledge about the recent trends in cultivation of crops

**CO 5:** To construct post-harvest management practices and value addition

**CO- PO Mapping**

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	2	3	1	2	3
CO2	3	2	3	2	-
CO3	3	3	3	-	-
CO4	3	3	3	3	-
CO5	-	-	-	3	3

**Suggested Readings**

1. Chidda Singh. 2020. Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Das, N.R. 2007. Introduction to Crops of India. Scientific publishers, Jodhpur, India.
3. De Datta, S.K. 1981. Principles and Practices Rice Production., John Willey and Sons, New York.
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5. Jeswani, L.M. and Baldev, B. 1997. Advances in pulse production technology. ICAR, New Delhi.
6. Mahendra Pal, Jayanta, D. and Rai, R.K. 1996. Fundamentals of cereal crop production. Tata McGraw Hill Publishing Co., New Delhi.
7. Rajendra Prasad. 2004. Text book of field crop production. Technical Editor, ICAR, New Delhi.
8. Reddy, S.R. 2004. Agronomy of field crops. Kalyani Publishers, New Delhi.
9. Singh, C., Singh, P. and Singh, R. 2003. Modern techniques of raising field crops. Oxford and IBH Publishing Co., Pvt., Ltd., New Delhi.
10. Singh, A.K. 2020. Textbook Series: Introduction to major field crops (As per 5<sup>th</sup> Deans Committee Syllabus), Agrotech publishing academy, Udaipur

**e-Resources**

1. [https://drive.google.com/file/d/1NyBJE55HM\\_dxcZ\\_z0VU01ji6LSNq\\_fB3/view](https://drive.google.com/file/d/1NyBJE55HM_dxcZ_z0VU01ji6LSNq_fB3/view).
2. <http://www.hillagric.ac.in/edu/coa/agronomy/lect/agron-501/501-Modern-Concepts-in-Crop-Production-SSR-MCR.pdf>.
3. <https://www.hrsacademy.in/wp-content/uploads/2016/11/Modern-Concepts-of-Agriculture-Integrated-Crop-Management.pdf>.
4. <https://www.agrimoon.com/wp-content/uploads/Introduction-to-major-field-crops.pdf>.
5. [https://drive.google.com/file/d/1NyBJE55HM\\_dxcZ\\_z0VU01ji6LSNq\\_fB3/view](https://drive.google.com/file/d/1NyBJE55HM_dxcZ_z0VU01ji6LSNq_fB3/view).

## AGR 508 AGRONOMY OF OIL SEED, FIBRE AND SUGAR CROPS (2+1)

### Objectives

- To acquire the knowledge of commercial crops for its distribution in India and World in different agroecosystem.
- The students will obtain the basic knowledge of scientific crop production of major oilseed crops.
- To gain knowledge about economic importance, origin, soil and climatic requirement of sugar crops.
- To acquire knowledge about importance of fibre crops and its cultivation practices
- To learn about various production technologies for various tuber and narcotics crops

### Theory

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, manures and manuring, intercultural operations, plant protection measures, harvesting and post-harvest managements practices including quality component, handling and processing of the produce and value addition of the following crops

#### Unit I Kharif oil seeds

Groundnut, Sesame, Castor, Sunflower, Safflower, Soybean etc.

#### Unit II Rabi oil seeds

Rapeseed, Mustard, Linseed, Niger etc.

#### Unit III Fibre crops

Cotton, Jute and Sunhemp, Mesta etc.

#### Unit IV Sugar crops

Sugarcane and Sugarbeet.

#### Unit V Post harvest handling, processing, value addition and by product utilization

Postharvest handling, processing of oilseed crops, fibre crops and sugar crops. Value addition and by product utilization of oilseed crops, fibre crops and sugar crops - low cost and cost effective technologies- trends and future thrust- farm mechanization- constraint and yield gap analysis - Current stream of thought.

### Practical

Planning and layout of field experiments. Preparation of sugarcane setts, its treatment and planting methods. Tying and propping of sugarcane, Determination of cane maturity and calculation on purity percentage, recovery percentage and sucrose content in cane juice. Phenological studies at different growth stages of crops. Intercultural operations for different crops. Cotton - seed treatment. Working out growth indices (LER, CGR, RGR, NAR, LAD, LAR, LWR, SLA, SLW etc). Judging of physiological maturity in different crops and working out harvest index. Working out cost of cultivation of different crops. Estimation of crop yield on the basis of yield attributes. Determination of oil content in oilseeds and computation of oil yield. Estimation of quality of fibre for different fibre crops. Study of seed production techniques in various crops. Visit of field experiments on cultural, fertilizer, weed control and water management aspects. Visit to nearby villages for identification of constraints in crop production

### Theory Lecture schedule

1. Needs for improvement of productivity and production of oilseeds, climate resilient technologies, Importance of oil seed crops and role of oil seeds in Indian economy- constraints in oilseed production.
2. **Rapeseed and Mustard:** Origin, history, geographical distribution and economic importance. Soil and ecosystem. Classification, improved varieties, Land preparation, seeds and sowing.
3. Nutrient, water and weed management, harvesting, cropping system, quality and nutritional considerations and recent advances in rapeseed and mustard cultivation
4. **Linseed and Niger:** Economic importance Origin, distribution and history. Soil, climatic



- requirements, seeds and sowing. Nutrient and water management.
5. Weed management, symptoms and methods of harvesting, cropping systems - quality and nutritional considerations
  6. **Groundnut:** Origin, geographical distribution and economic importance. Soil, climate and their adoptability, classification, types and growth stages of groundnut.
  7. Seeds and sowing, improved varieties, earthing up, nutrient, water and weed management and cropping systems.
  8. Harvesting, aflatoxins, quality and nutritional considerations, recent trends, prospects and constraints in groundnut cultivation
  9. **Sesame:** History Origin, importance, soil and their ecosystem, seeds and sowing, season and improved varieties.
  10. Water, nutrient, and weed management, harvesting, nutritional values, cropping systems, constraints, challenges and opportunities in sesame cultivation
  11. **Castor:** Economic importance Origin, history, distribution, soil and climate, seeds and sowing, improved varieties, nipping and cropping systems, nutrient, water and weed management, methods of harvesting. Quality and nutritional considerations
  12. **Sunflower and Safflower:** Origin, economic importance, soil and climatic requirements, seeds and sowing. High yielding varieties and hybrids
  13. Weed, nutrient, and water management, cropping systems and harvesting.
  14. Oil quality and nutritional considerations, seed setting problems and their management practices and constraints in sunflower cultivation
  15. **Soybean:** Geographical distribution, Origin, , economic importance, soil and ecosystems, seeds and sowing, suitable season and varieties
  16. Nutrient, water and weed management, harvest, nutritional values and recent advances in soybean cultivation.
  17. **Mid semester examination**
  18. **Cotton:** Economic importance, Origin, history, distribution, classification, soil, ecological adaption, improved varieties and hybrids, seeds and sowing
  19. Growth stages, branching pattern, nutrient, water and weed management. Growth retardants and topping
  20. Defoliants, harvesting, quality parameters and climate resilient technologies.
  21. Constraints in cotton cultivation and strategies for yield maximization in Bt cotton,
  22. Production technology for rice fallow cotton and rainfed cotton
  23. **Jute:** Geographical distribution, Origin, soil and climatic requirements, classification, seeds and sowing, varieties, nutrient, water and weed management and harvesting. Recent agronomic practices in jute cultivation
  24. **Sunhemp and Mesta:** Importance, origin, history, soil and climatic adaptability, seeds and sowing, nutrient and water and weed management, harvesting.
  25. **Sugar beet:** Origin, geographical distribution, economic importance, bolting and flowering control in sugar beet, soil and ecosystems, seeds and sowing,
  26. Season and improved varieties nutrient, water and weed management, harvesting and cropping systems, recent advances in sugar beet cultivation
  27. **Sugarcane:** Economic importance Origin, geographical distribution, soil and climatic requirements, nursery, planting techniques and growth stages.
  28. Nutrient, water and weed management, crop logging, drought management, earthing up, detrashing, wrapping and propping, cane ripeners, maturity indices for cane harvesting, manual and mechanical harvesting
  29. Ratoon cane management and constraints and recent advances in sugarcane cultivation
  30. Postharvest handling and processing of oil seeds, fibre crops and sugar crops
  31. By products utilization and value addition of oilseed, fibre and sugar crops
  32. Constraint and yield gap analysis and Low cost and cost effective technologies for oilseeds, fibre

and sugar crops

33. Mechanization in oil seed, fibre and sugar crops cultivation.
34. Current stream of taught.

### **Practical Schedule**

1. Planning and layout of field experiments
2. Sowing/planting techniques of certain crops.
3. Biometric observation studies on growth and yield parameters of crops.
4. Determination of cane maturity and calculation on purity percentage, recovery percentage and sucrose content in cane juice.
5. Phenological studies at different growth stages of oil seeds, fibre and sugar crops.
6. After cultivation practices for different crops .
7. Study of seed treatment techniques and nursery management for different crops.
8. Working out growth indices (LER, CGR, RGR, NAR, LAD).
9. Judging of physiological maturity in different crops and working out harvest index.
10. Working out cost of cultivation for different crops.
11. Estimation of crop yield on the basis of yield attributes.
12. Determination of oil content in oilseeds and computation of oil yield.
13. Estimation of quality parameter in oil seed fibre and sugar crops.
14. Study of seed production techniques in various crops.
15. Visit of field experiments on cultural, fertilizer, weed control and water management aspects.
16. Visit to nearby villages for identification of constraints in crop production.

### **17. Practical examination**

#### **Course Outcomes:**

**CO 1:** To gain the information and acquire practical knowledge about various commercial crops and its beneficial and economic importance to the farming communities.

**CO 2:** To gain knowledge about importance of sugar crops and its cultivation practices

**CO 3:** To formulate different cropping system and production technologies for various fibre crops

**CO 4:** To construct idea regarding knowledge on growing of tuber crops

**CO 5:** To create awareness about narcotics crops and its production technologies

#### **CO– PO Mapping**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>
<b>CO1</b>	3	-	2	2	3
<b>CO2</b>	3	3	3	3	2
<b>CO3</b>	3	2	3	-	2
<b>CO4</b>	3	2	3	-	3
<b>CO5</b>	3	3	3	1	3

#### **Suggested Readings**

1. Chidda Singh. 2020. Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Crop Production Guide. 2005. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
3. Das NR. 2007. Introduction to Crops of India. Scientific Publishers, New Delhi.
4. Das PC. 1997. Oilseed Crops of India. Kalyani Publishers, New Delhi.
5. Hand Book of Agriculture. 2011. ICAR, New Delhi.
6. Massod Ali, S.K. Chaturvedi and S.N. Gurha. 2001. Pulses for Sustainable Agriculture and Nutritional Security. Indian Institute of Pulses Research, Kanpur, India.
7. Palaniappan, S.P. and K. Sivaraman, 1996. Cropping Systems in Tropics. Principles and

- Management, New Age Intel (P) Ltd., Publication.
8. Rajendra Prasad. 2004. Text Book on Field Crop Production, ICAR, New Delhi.
  9. Singh C, Singh P and Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford and IBH, New Delhi.
  10. Singh. S.S. 1988. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.

#### **e- Resources**

1. <http://courseware.cutm.ac.in/wp-content/uploads/2020/06/CPT-II-Lecture-Notes.pdf>.
2. <https://www.fao.org/3/ab988e/ab988e0b.htm>
3. [http://megagriculture.gov.in/public/crops\\_fibre\\_crops.aspx](http://megagriculture.gov.in/public/crops_fibre_crops.aspx).
4. <https://agritech.tnau.ac.in/pdf/AGRICULTURE.pdf>.
5. [https://drive.google.com/file/d/1LjjDWmLk7FakeAQHoGN5BO\\_VZs53tRS/view](https://drive.google.com/file/d/1LjjDWmLk7FakeAQHoGN5BO_VZs53tRS/view)

### **AGR 509 - AGROMETEOROLOGY AND CROP WEATHER FORECASTING (2+1)**

#### **OBJECTIVE**

- Students will learn various weather parameters and its effect on crop production
- Students will understand various monsoons of World and India
- Students will gain knowledge on photosynthetic efficiency by various field crops
- Students will know about evapotranspiration and its effect on crop production
- To impart knowledge about crop weather forecasting to meet the challenges of aberrant weather conditions.

#### **THEORY**

##### **UNIT I – Introduction to Agro – Meteorology.**

Agro meteorology, aim, scope and development in relation to crop environment; composition of atmosphere, distribution of atmospheric pressure and wind.

##### **UNIT II – Role of Solar radiation in crops.**

Characteristics of solar radiation; energy balance of atmosphere system; radiation distribution in plant canopies, radiation utilization by field crops; photosynthesis and efficiency of radiation utilization by field crops; energy budget of plant canopies; environmental temperature: soil, air and canopy temperature.

##### **UNIT III – Temperature and Evapotranspiration.**

Temperature profile in air, soil, crop canopies; soil and air temperature effects on plant processes; environmental moisture and evaporation. Measures of atmospheric temperature and relative humidity vapor pressure and their relationships; evapo-transpiration and meteorological factors determining evapotranspiration.

##### **UNIT IV – Modification of plant environment – Monsoons – Classification of climate.**

Modification of plant environment: artificial rain making, heat transfer, controlling heat load, heat trapping and shading; protection from cold, sensible and latent heat flux, controlling soil moisture. Monsoon and their origin, characteristics of monsoon; onset, progress and withdrawal of monsoon; weather hazards, drought monitoring and planning for mitigation. Principles and systems of climatic classification, different types of clouds and micro-climatology.

##### **UNIT V - Weather forecasting**

Weather forecasting in India; short, medium and long range; aerospace science and weather forecasting; benefits of weather services to agriculture. Remote sensing; application in agriculture and its present status in India; Atmospheric pollution and its effect on climate and crop production; climate change and its impact on agriculture - Current stream of thought.

## **PRACTICAL**

Visit to agro-meteorological observatory and to record sun-shine hours, wind velocity, wind direction, relative humidity, soil and air temperature, evaporation, precipitation and atmospheric pressure, Measurement of solar radiation outside and within plant canopy, Measurement/estimation of evapotranspiration by various methods, Measurement/estimation of soil water balance, Rainfall variability analysis, Determination of heat-unit requirement for different crops, Measurement of crop canopy temperature, Measurement of soil temperatures at different depths, Remote sensing and familiarization with agro-advisory service bulletins, Study of synoptic charts and weather reports, working principle of automatic weather station, Visit to solar observatory

## **THEORY SCHEDULE**

1. Agro meteorology- aim, scope and development in relation to crop environment.
2. Composition of atmosphere.
3. Distribution of atmospheric pressure and wind.
4. Solar radiation – characteristics.
5. Energy balance of atmospheric system.
6. Radiation distribution in plant canopies, radiation utilization by field crops.
7. Photosynthesis and efficiency of radiation utilization by crops.
8. Energy budget of plant canopies.
9. Environmental temperature – soil, air, canopy temperature.
10. Environmental temperature- Temperature profile in air, soil, crop canopies.
11. Soil and air temperature effects on plant processes.
12. Regulation of air, soil temperature for protection against frost and hot winds
13. Environmental moisture and evaporation – measures of atmospheric moisture, temperature.
14. Environmental moisture and evaporation- measures of relative humidity vapour pressure and their relationship.
15. Evapotranspiration and meteorological factors deciding evapotranspiration.
16. Modification of plant environment. Artificial rain making.
17. **Mid-semester examination**
18. Controlling heat load, heat trapping and shading.
19. Protection from cold, reduction in sensible and latent heat flux.
20. Monsoon and their origin, characteristics of monsoon.
21. Onset, progress and withdrawal of monsoon.
22. Weather forecasting in India: short, medium and long range forecasting.
23. Benefits of weather services to agriculture.
24. Forecasting of destructive frost and soil moisture.
25. Phonological forecast, crop yield forecast etc.
26. Aero space science and remote sensing – application in agriculture, present status of remotesensing in India.
27. Atmospheric pollution and its effects on climate and crop production.
28. Climate change, climate variability and its impact on agriculture.
29. Greenhouse effect.
30. Carbon sequestration and carbon trading.
31. Crop weather modeling.
32. Weather in relation to pest and diseases.
33. Crop weather calendar.
34. Current stream of thought.

## PRACTICAL SCHEDULE

1. Visit to agro-meteorological observatory and calculation of time of recording various weather elements
2. Measurement of air, soil temperature and grass minimum temperature and drawing isoline for weather interpretation
3. Measurement of sunshine hours and solar radiation outside and within plant canopy and calculation of length of growing period
4. Humidity measurements – use of wet and dry bulb, Assmann psychrometer, Hygrograph
5. Measurement of wind direction and wind speed
6. Measurement of rainfall - Ordinary and self-recording rain gauges and Dew - dew gauge- Study of rainfall distribution and intensity
7. Measurement of atmospheric pressure - barograph
8. Measurement of Evaporation - Open pan evaporimeter- application of evaporation data
9. Measurement/estimation of evapo-transpiration by Lysimeter and empirical formulae
10. Measurement/estimation of soil water balance
11. Rainfall variability and probability analysis
12. Determination of heat-unit requirement for different crops
13. Measurement of crop canopy temperature and optimum temperature requirements for different growth stages of crops
14. Remote sensing and familiarization with agro-advisory service bulletins and Weather forecasting.
15. Study of synoptic charts and weather reports and preparation of crop weather calendar. Working principle of Automatic Weather Station (AWS)
16. Visit to nearby IMD station.
17. Practical Examination.

### Course Outcomes:

**CO 1:** To acquire knowledge on agrometeorology and its different variables on crop production

**CO 2:** To understand the onset and withdrawal of monsoon and crop seasons

**CO 3:** To gain knowledge about evapotranspiration and its effect on crop production

**CO 4:** To understand weather forecasting and weather in relation to pest and disease management

**CO 5:** To design crop weather calendar for various agro climatic zones

### CO– PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	3	2	3	-	2
CO2	3	-	3	-	-
CO3	3	3	3	-	-
CO4	3	3	3	-	3
CO5	3	3	3	3	3

## REFERENCES

1. Kathiresan, G. 2015. Agro Meteorology, A Simplified Text book, New India Publishing Agency, New Delhi.
2. Lenka, D.1998. Climate, Weather and Crops in India. Kalyani publications. New Delhi.
3. Mavi, H. S and Tupper, G. J. 2004. Agrometeorology: Principles and Application of Climate Studies in Agriculture. Haworth Press.
4. Narayanan,A.L, 2017. Principles of Applied Agricultural Meteorology. Velanpadihappagam,Chidambaram.
5. Venkataraman. S. 2015. Principles and Practice of Agricultural Meteorology, BS Publications, Hyderabad.
6. Reddy, S.R and Reddy, D.S. 2012. Agrometeorology. Kalyani publications. New Delhi.
7. Sahu, D. D. 2010. Agrometeorology and Remote Sensing: Principles and Practices. Agrobios. Jodhpur.
8. Varshneya, M.C. and Balakrishana Pillai, P. 2003. Textbook of Agricultural Meteorology. ICAR. New Delhi.
9. Kelkar, R.R. 2009. Monsoon prediction, BS Publication, Hyderabad.
10. Critchfield, H. J.1995. General Climatology. Prentice Hall of India.

## e-RESOURCES

1. [http://www.agrometeorology.org/files-folder/repository/gamp\\_chapt4.pdf](http://www.agrometeorology.org/files-folder/repository/gamp_chapt4.pdf)
2. <http://www.fao.org/docrep/x5672e/x5672e09.html>
3. [http://www.fao.org/nr/climpag/pub/Agricultural%20and%20Forest%20Meteorology.](http://www.fao.org/nr/climpag/pub/Agricultural%20and%20Forest%20Meteorology)
4. [http://www.agrometeorology.org/files-folder/repository/gamp\\_chapt4.pdf](http://www.agrometeorology.org/files-folder/repository/gamp_chapt4.pdf).
5. <https://agrigyan.in/agro-meteorology-sknau-notes-pdf/>.

## AGR 504 AGRONOMY OF FODDER AND FORAGE CROPS (1+1)

### Objectives

- To teach the crop husbandry for different forage crops along with their processing.
- To understand knowledge about fodder crops cultivation and distribution.
- To acquire the basic knowledge on scientific crop production for year round fodder production.
- To gain knowledge about economic importance, preservation and enrichment of fodders
- The students will learn about economics of fodder production

### Theory

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including all quality factors of important fodder and forage crops/grasses

### UNIT I Agronomy of fodder crops

Fodder sorghum, maize, bajra, guar, cowpea, oats, barley, berseem, senji, lucerne, desmanthus etc.

### UNIT II Production of forage crops

Forage crops/grasses like napier grass, guinea grass, Panicum, Lasiurus, Cenchrus, etc.

### **UNIT III Year round fodder production**

Year-round fodder production and management technique. Preservation and utilization of forage and pasture crops.

### **UNIT IV Preservation and enrichment of fodders**

Principles and methods of hay and silage making - chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage. Physical, chemical and biological methods for improving nutrition value and enrichments of fodder and forage. Value addition of poor quality fodder. Fodder production through hydroponics, azolla cultivation.

### **UNIT V Economics of fodder production**

Economics of forage cultivation, pasture management. Seed production techniques of important fodders, forages and pasture crops- Current stream of thought.

#### **Practical**

Practical training of farm operations in raising fodder crops. Canopy measurement, yield, leaf:stem ratio. Quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose and IVDMD etc. of various fodder and forage crops. Determination and interpretation of anti-quality components like HCN in sorghum and such factors in other crops, hay and silage making and economics of their preparation.

#### **Theory lecture schedule**

1. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of fodder sorghum and maize.
2. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of fodder bajra, fodder grass
3. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of fodder oats, fodder barley
4. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of fodder cow pea, berseem, senji. lucerne and desmanthus
5. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti quality factors of grass lime. napier grass, forage Panicum and guinea grass
6. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of Lasiurus and Cenchrus.
7. **Mid-Semester examination**
8. Year-round fodder, forage and pasture production and management.
9. Preservation and utilization of fodder and forage crops. Fodder production through hydroponics, azolla cultivation.
10. Principles and methods of hay making, chemical and biochemical changes of hay.
11. Nutrient losses and factors affecting quality of hay and silage, use of physical, chemical and biological methods for improving nutrition of hay and silage and their quality enrichments techniques .
12. Nutrient losses and factors affecting quality of silage, use of physical and chemical enrichments.
13. Biological methods for improving nutrition of silage.
14. Value addition of poor quality fodder and forages.
15. Economics of forage cultivation and pasture management.

16. Seed production techniques of important fodders, forages and pasture crops.
17. Current stream of taught.

### Practical

1. Practical training of farm operations in raising fodder crops.
2. Canopy measurement of fodder crops.
3. Yield estimation of fodder crops.
4. Quality estimation of various fodder, viz. crude protein, NDF, ADF, lignin, silica, cellulose, IVDMD etc.
5. Practical training of farm operations in raising forage crops.
6. Canopy measurement of forage crops.
7. Yield estimation of forage crops.
8. Quality estimation of various forage crops, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc.
9. Anti-quality components like HCN in sorghum and such factors in other crops.
10. Hay making.
11. Economics of hay preparation.
12. Silage making.
13. Economics of silage preparation.
14. Nutritional content of hay and silage.
15. Storage of hay.
16. Storage of silage.

### 17. Practical Examination

#### Course Outcomes:

**CO 1:** To gain the information and acquire practical knowledge about various fodder crops and its beneficial and economic importance to the farming communities.

**CO 2:** To gain knowledge about importance of forage crops and its cultivation practices

**CO 3:** To formulate different cropping system and production technologies for year around fodder cultivation.

**CO 4:** To construct idea regarding knowledge on fodder preservation techniques.

**CO 5:** To create awareness about Improvement in nutritional quality of Hay and Silage

#### CO– PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	2	-	2	2	2
CO2	2	3	3	3	2
CO3	2	2	3	-	2
CO4	3	2	2	-	1
CO5	3	3	2	1	1

#### Suggested Readings

1. Anil Kumar Singh, M.A. Khan, Natraja Subash and Krishna Murari Singh. 2013. Forages and Fodder, Daya Publishing House, New Delhi.
2. Chatterjee BN. 1989. Forage crop production - Principles and practices. Oxford and IBH. New Delhi.



3. Das NR. 2007. Introduction to crops of India. Scientific Publishers (India), Jodhpur
4. Jai V.singh; B.S. Chhilla, B.D. Yadav and U.N. Joshi 2010. Forage legume Scientific Publishers (India), Jodhpur.
5. Panda, S.C. 2014. Agronomy of Fodder and Forage crops. Kalyani Publishers, New Delhi.
6. Sharma KK and LL Somani. 2018. Textbook of introductory agroforestry (as per 5<sup>th</sup> Deans committee syllabi). Agrotech Publishing Academy, Udaipur.
7. Singh C, Singh P and Singh R. 2003. Modern techniques of raising field crops. Oxford and IBH. New Delhi
8. Singh P and Srivastava AK. 1990. Forage production technology. IGFRI, Jhansi
9. Singh SP. 2020. Handbook of agroforestry 3<sup>rd</sup> ed. Agrotech Publishing Academy, Udaipur.
10. Tejwani KG. 1994. Agroforestry in India. Oxford and IBH. New Delhi

#### **e-Resources**

1. <https://www.dpi.nsw.gov.au/agriculture/broadacre-crops/forage-fodder>.
2. <https://icar.gov.in/files/forage-and-grasses.pdf>.
3. [http://www.agritech.tnau.ac.in/expert\\_system/cattlebuffalo/Fodder%20Production.html](http://www.agritech.tnau.ac.in/expert_system/cattlebuffalo/Fodder%20Production.html)
4. <https://vikaspedia.in/agriculture/livestock/cattle-buffalo/fodder-production>.
5. <https://www.igfri.res.in/cms/Publication/Miscellaneous/minimal.pdf>

### **AGR 510 DRYLAND FARMING AND WATERSHED MANAGEMENT (2+1)**

#### **Objective**

- To teach the concepts and characteristics of dry land farming
- To educate the Crop production constrains in dry farming
- To impart knowledge on crop adaptation and crop plans for aberrant weather situations in dry land areas
- To incur the acquaintance on soil moisture conservation techniques and mitigating strategies in dry lands.
- To create awareness about the watershed management for sustaining dryland farm productivity.

#### **UNIT I – Dry farming - concept and characteristics**

Definition, concept and characteristics of dry land farming. Dry land versus rainfed farming - significance and dimensions of dry land farming in Indian and Tamil Nadu agriculture.

#### **UNIT II – Crop production constrains**

Soil and climatic parameters with special emphasis on rainfall characteristics. Constraints limiting crop production in dry land areas. Drought - types of droughts. Aridity vs drought, characterization of environment for water availability. Crop planning for erratic and aberrant weather conditions.

### **UNIT III – Stress physiology - Crop adaptation to drought**

Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies. Preparation of appropriate crop plans for dry land areas. Midterm and contingent plan for aberrant weather conditions.

### **UNIT IV – Soil moisture conservation techniques**

Soil compaction – tillage, concept of conservation tillage, tillage in relation to weed control and moisture conservation. Techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics). Antitranspirants. Soil and crop management techniques, seeding and efficient fertilizer use.

### **UNIT V – Watershed resource management**

Concept of watershed resource management, problems, approach and components. Development of cropping and farming system for watershed areas. Alternate land use planning and operation of project for watershed management - Current stream of thought.

## **PRACTICAL**

Seed treatment. Seed germination and crop establishment in relation to soil moisture contents. Study of moisture stress effects and recovery behavior of important crops. Estimation of moisture index and aridity index. Rainfall analysis and crop planning. Spraying of antitranspirants and their effect on crops. Collection and interpretation of data for water balance equations. Study of water use efficiency in different crops. Preparation of crop plans for different drought conditions. Visit to dryland research stations and watershed projects

### **Theory lecture schedule**

1. Dry farming- definition, concept, characteristics.
2. Dimensions of dry land farming in Indian agriculture.
3. Dry farming- classification - significance and dimensions of dry farming in India.
4. Production constraints in dry farming areas.
5. Rainfall characterization and behaviours.
6. Delineation of dry farming areas based on drought indices and their characteristics.
7. Drought and its classification.
8. Drought management strategies and preparation of crop plans for dry land areas.
9. Dry land crop production technologies for sustainable agriculture.
10. Methods of controlling runoff and its significance.
11. Evaporation, evapo-transpiration, mulching, antitranspirants and antievaporants.
12. Drought resistance in crops - mechanism for drought tolerance and crop adaptability to drought situations.
13. Drought tolerant crops and their varieties.
14. Plant ideotypes for dryland areas - shoot and root growth characteristics.
15. Preparation of appropriate crop plans for dryland areas.
16. Midseason correction for aberrant weather situation.
17. **Mid-semester examination**
18. Contingent crop planning to mitigate drought.
19. Soil moisture conservation techniques - agronomic, Engineering and Biological.
20. Moisture retention and availability concepts - Length of Growing Period (LGP) - water absorption by crop plants under stress conditions.

21. Water loss through evaporation and transpiration and its management under stress conditions - effectiveness and economics- management of soil constraints.
22. Agricultural implements and machineries for dry farming.
23. Tillage - soil and crop management techniques - seed hardening and efficient fertilizer use.
24. Integrated farming systems – significance - location specific IFS – models for drylands.
25. Watershed management: definition, concepts, problems, approaches and components of watershed.
26. Problems, approach components, development of cropping systems for watershed areas.
27. Resource management and crop planning – alternate land use pattern
28. Water harvesting techniques - scope and application - rain water management in watershed.
29. Pre and post sowing conservation technologies.
30. Role of organization in promoting watershed.
31. Selection of crops and cropping systems based on rainfall and socioeconomic factors.
32. Classification of land based on LCC and alternative land use systems.
33. Rehabilitation of degraded lands in watershed.
34. Current stream of thought.

### **Practical schedule**

1. Mapping of arid and semiarid zones of Tamil Nadu and India.
2. Study of moisture profiles of soils.
3. Rainfall analysis and interpretation.
4. Classification of climate and estimation of length of growing period
5. Designing cropping systems based on rainfall analysis
6. Use of mulches and antitranspirants.
7. Seed treatment techniques –hardening, seed priming.
8. Estimation of moisture index, aridity index and water-use efficiency.
9. Plant root growth studies with reference to stress management.
10. Study of farm implements in dry farming.
11. Study of water use efficiency in different crops.
12. Collection and interpretation of data for water balance equations.
13. Preparation and methodology for implementation of watershed projects.
14. Preparation of model watershed programme.
15. Visit to nearby watershed.
16. Crop planning for different drought conditions.

### **17. Practical Examination**

### **References**

1. Das, H.P. 2016. Climate change and agriculture implications for global food security. B.S publications, Hyderabad.
2. Dhopte, A.M. 2002. Agro-technology for dryland farming. Scientific Publishers, Jodhpur, India
3. Dhopte, A.M. 2020. Sustainable Dryland Farming. Scientific Publishers, Jodhpur, India

4. Gupta, U.S. 1990. Physiological Aspects of Dry Farming. Oxford and IBH Publication, New Delhi.
5. Jana, B.L. 2021. Water Harvesting and Watershed Management, Agrotech Publishing Academy, Udaipur.
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7. Maloo, S.R. 2021. Sustainable crop production under stress environments, Agrotech Publishing Academy, Udaipur.
8. Nanwal, R.K., and G.A.Rajannanna. 2018. Rainfed Agriculture. New India Publishing Agency, New Delhi.
9. Panda, S.C. 2008. Dryland Agriculture, Agribios, Jodhpur, India.
10. Subansh Meena. 2017. Integrated Watershed Management in Rainfed Agriculture, Random Publications, New Delhi.

**e- Resources**

1. [www.fao.org/docrep/w7314e/w7314e0q.htm](http://www.fao.org/docrep/w7314e/w7314e0q.htm).
2. [www.journeytoforever.org/farm\\_library/AD13.pdf](http://www.journeytoforever.org/farm_library/AD13.pdf).
3. <https://drive.google.com/file/d/1k6I4pAkjrpphKxyUoqEkrOyopyqd4VOD/view>.
4. <http://courseware.cutm.ac.in/wp-content/uploads/2020/05/RFA-Final-notes-converted-1.pdf>.
5. <https://www.egyankosh.ac.in/bitstream/123456789/19611/1/Unit-11.pdf>.

**AGR 511 AGROSTOLOGY AND AGRO-FORESTRY (2+1)**

**Objectives**

- To impart knowledge on importance, problems and management of agrostology lands.
- To acquire sentience about pasture establishment and renovation with ensiling and hay making technique.
- To educate about the forest systems and its role in meeting the livelihoods needs of nation.
- To acquire the basic knowledge of commercialization of Agro-forestry produce.
- To educate about the silvipastoral systems and waste land management.

**Theory**

**UNIT I - Agrostology and its importance in India**

Agrostology - definition and importance. Grassland ecology - principles, community, climax, dominant species, succession, biotype, ecological status of grasslands in India. Grass cover of India. Problems and management of grasslands.

**UNIT II – Classification and importance of pastures**

Pastures - importance, classification (various criteria), scope, status and research needs of pasture. Pasture establishment, their improvement and renovation. Natural pastures, cultivated pastures; common pasture grasses. Silage/ Ensiling and Hay Making

**UNIT III – Forests – Concepts and Principles and agro-Forestry systems**

Forests - definitions, role, benefits -direct and indirect. History of Forestry - definitions, divisions and interrelationships. Basic concepts on forest types of India.

Agroforestry - definition and importance. Agroforestry systems - agrisilviculture, silvipasture, agrisilvipasture, agrihorticulture, aquasilviculture, alley cropping, energy plantation and homestead gardens. Crop production technology in agro- forestry and agrostology system.

#### **Unit IV – Practices of Agroforestry Systems and Commercialization of Agro-forestry Produce**

Criteria for selection and screening of tree species. Advantages of agroforestry, design and diagnosis methodology in relation to agroforestry, strategies for promoting agroforestry, transfer of agroforestry technology. Overview of global agroforestry system- shifting cultivation, taungya cultivation, shelterbelt and wind breaks. Commercialization of agricultural produce with reference to small timber, waxes, oils, gums, dyes, resin, tannin, catch, medicinal and aromatic plants, grasses, bamboos and utilization of wood waste material.

#### **UNIT V – Silvipastoral systems and Waste land management**

Silvipastoral system - meaning and importance for wasteland development. Silvipastoral - selection of species, planting methods, irrigation and manuring in agro-forestry systems. Associative influence in relation to above ground and underground interferences. Lopping and coppicing in agro-forestry systems. Social acceptability and economic viability, nutritive value of trees; tender operation; desirable tree characteristics - Current stream of thought.

#### **Practical**

Preparation of charts and maps of India showing different types of pastures and agro-forestry systems, Identification of seeds and plants of common grasses, legumes and trees of economic importance with reference to agro-forestry, seed treatment for better germination of farm vegetation, methods of propagation/planting of grasses and trees in silvipastoral system, fertilizer application in strip and silvipastoral systems, after-care of plantation, estimation of protein content in loppings of important fodder trees, estimation of calorie value of wood of important fuel trees, estimation of total biomass and fuel wood, economics of agro-forestry, visit to important agro-forestry research stations

#### **Theory lecture schedule**

1. Agrostology: introduction and definition
2. Agrostology: importance
3. Principles of grassland ecology
4. Grassland ecology - community, climax, dominant species, succession, biotype, ecological status of grasslands in India, grass cover of India
5. Grassland ecology - ecological status of grasslands in India, grass cover of India
6. Grassland ecology - grass cover of India
7. Problems and management of grasslands
8. Pastures - scope, status and importance
9. Pastures - classification (various criteria), research needs
10. Pastures establishment and their improvement and renovation
11. Pastures - natural pastures
12. Pasture - cultivated pastures, common pasture grasses, common pasture grasses
13. Silage/ ensiling and hay making
14. Forests - definitions and role
15. Forests - benefits -direct and indirect
16. Forestry – history, introduction and definitions

17. **MID – SEMESTER EXAMINATION**

18. Forestry - divisions and interrelationships, basic concepts on forest types of india
19. Agroforestry: definition and importance
20. Agroforestry systems and agrisilviculture
21. Silvipasture, agrisilviculture, agrihorticulture ,aquasilviculture, alley cropping and energy plantation
22. Crop production technology in agroforestry and agrostology system
23. Criteria for selection and screening of tree species, advantages of agroforestry
24. Design and diagnosis methodology in relation to agroforestry
25. Strategies for promoting agroforestry, transfer of agroforestry technology
26. Overview of global agroforestry system- shifting cultivation, taungya cultivation,
27. Shelter belt and wind breaks, energy plantation and homestead gardens
28. Commercialization of agricultural produce with reference to small timber, waxes, oils, gums, dyes, resin, cannin, cutch, medicinal and aromatic plants, grasses, bamboos and utilization of wood waste material
29. Silvipastoral system: meaning and importance for wasteland development
30. Selection of species, planting methods and problems of seed germination in agro-forestry systems
31. Irrigation and manuring in agro-forestry systems, associative influence in relation to above ground and underground interferences
32. Lopping and coppicing in agro-forestry systems
33. Agro-forestry systems - social acceptability and economic viability, nutritive value of trees
34. Agro-forestry systems - tender operation; desirable tree characteristics and Current stream of thought.

**Practical schedule**

17. Preparation of charts and maps of India showing different types of pastures.
18. Preparation of charts and maps of India showing different types of agro-forestry systems.
19. Identification of seeds and plants of common grasses of economic importance with reference to agro-forestry.
20. Identification of seeds and plants of legumes of economic importance with reference to agro-forestry.
21. Identification of seeds and plants of trees of economic importance with reference to agro-forestry.
22. Seed treatment for better germination of farm vegetation.
23. Methods of propagation/planting of grasses in silvipastoral system.
24. Methods of propagation/planting of trees in silvipastoral system.
25. Fertilizer application in strip systems.
26. Fertilizer application in silvipastroal systems.
27. After-care of plantation.
28. Estimation of protein content in loppings of important fodder trees.
29. Estimation of calorie value of wood of important fuel trees.
30. Estimation of total biomass and fuel wood.
31. Economics of agro-forestry.
32. Visit to important agro-forestry research stations.

### 33. Practical examination.

#### Course outcome

**CO 1:** To gain the information and acquire practical knowledge about grassland ecology and its benefits to the farming communities.

**CO 2:** To gain knowledge about their improvement and renovation-natural pastures.

**CO 3:** To understand knowledge about role of forest and their benefits.

**CO 4:** To understand about Crop production technology in agro- forestry and agrostology system.

**CO 5:** To create awareness about methods of propagation/planting of grasses and trees in silvopastoral system,

#### CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	3	-	2	2	3
CO2	3	3	3	3	2
CO3	3	2	3	-	2
CO4	3	2	3	-	3
CO5	3	3	3	1	3

#### References:

1. Chatterjee BN and Das PK. 1989. *Forage Crop Production. Principles and Practices*. Oxford and IBH, New Delhi.
2. Chauhan SK .2020. *Agroforestry* , Agrotech Publishing Academy, Udaipur .
3. Dwivedi AP. 2019. *Agroforestry- Principles and Practices*. Oxford and IBH. New Delhi.
4. Narayan TR and Dabadghao PM. 1972. *Forage Crop of India*. ICAR, New Delhi.
5. Sen NL, Dadheech RC, Dashora LK and Rawat TS. 2004. *Manual of Agroforestry and Social Forestry*. Agrotech Publishing Academy, Udaipur
6. Shah SA.1988. *Forestry for People*. ICAR. New Delhi.
7. Singh Panjab, Pathak PS and Roy MM.1994. *Agroforestry System for Sustainable Use*. Oxford and IBH. New Delhi.
8. Singh, SP. 2021. *Handbook of Agroforestry 3<sup>rd</sup> ed* , Agrotech Publishing Academy, Udaipur .
9. Solanki KR. 2000. *Multipurpose Tree Species: Research, Retrospect and Prospects*. Agrobios. Jodhpur, Rajasthan.
10. Tejwani KG.1994. *Agroforestry in India*. Oxford and IBH. New Delhi.

#### e- Resources :

1. <http://ecoursesonline.iasri.res.in/course/view.php?id=157>
2. <https://vikaspedia.in/agriculture/forestry/agroforestry>
3. [https://agritech.tnau.ac.in/forestry/agroforestry\\_index.html](https://agritech.tnau.ac.in/forestry/agroforestry_index.html)
4. <http://ecoursesonline.iasri.res.in/Courses/Social%20and%20Farm%20Forestry/FRST201/Start%20to%20read%20the%20Course.html>.

## **AGR 512 PRINCIPLES AND PRACTICES OF ORGANIC FARMING (2+1)**

### **Objectives**

1. To conceptualize the principles and practices of organic farming for sustainable crop production.
2. Aims at incurring knowledge on various aspects of organic farming with relevance to its advantages and shortcomings against conventional high input agriculture.
3. To gain knowledge on the organic residue recycling.
4. To gain knowledge on organic farming towards sustainable agriculture to improve the economic conditions of the farmer.
5. Understand the concept of organic certification and quality products

### **Theory**

#### **UNIT I Organic farming and its importance**

Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; principles of organic agriculture, organics and farming standards. Organic farming and sustainable agriculture, selection and conversion of land and water management; land use, conservation tillage; shelter zones, hedges, pasture management, agro-forestry.

#### **UNIT II Organic residue recycling**

Organic farming - soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost. Green manures, bio fertilizers, and biogas technology.

#### **UNIT III organic farming systems**

Farming systems, application of organic principles in farming systems, selection of crops and other linked enterprises in organic farming. IFS in resource recycling in different farming systems. Intercropping and/ or intensive cropping in relation to maintenance of soil productivity.

#### **UNIT IV Biological methods of Crop protection**

Control of weeds, diseases and insect pest management, biological agents and pheromones, bio pesticides.

#### **UNIT V Organic certification and Marketing**

Socio-economic impacts; marketing and export potential. Inspection, certification, labeling and accreditation procedures. Organic farming and national economy.

### **Practical**

Aerobic and anaerobic methods of making compost, Making of vermicompost, Efficient use of biofertilizers, Technique of treating legume seeds with Rhizobium cultures, Use of Azotobacter, Azospirillum, and PSB cultures in field, Visit to biogas plant, organic farm. Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms - Current stream of thought.

### **Theory lecture schedule**

1. Organic Farming : Definition Prospects – Principles and Concepts – History and genesis of organic farming in world and India
2. Present status of organic farming in World, India and Tamilnadu.
3. Conservation agriculture strategies – soil degradation, water availability, climate change and its effect on agriculture, adaptation and mitigation.
4. Principles of organic agriculture, organics and farming standards, organic farming and sustainable agriculture



5. Pre-requisites and basic steps for organic farming; Conservation to organic farming – Planning and processes in practices – Integration of animal components.
6. Green revolution – definition – impacts – Natural resources and its management
7. Sources of organic manures – plant, animal and microbial origin.
8. On-farm resources; FYM, green manures, crop residues, poultry manure, sheep and goat manures, bio gas slurry and vermi compost.
9. Off-farm resources; coir pith, pressmud, oil cakes, flyash, bio compost, minerals, bone meal, bio fertilizers, traditional preparations.
10. Organic waste recycling methods and techniques – composting, vermicomposting, in situ composting – system approach.
11. Soil and crop management in organic farming; inter cropping and companion planting; crop rotation; green manures and cover crops, mulching.
12. Resource use efficiency and optimization techniques - Resource cycling and flow of energy in different farming system and biogas technology
13. Farming system and environment- Conservation of natural resources and maintenance of Biodiversity.
14. Allied enterprises and their importance - complementary and competitive interactions - Dairy, Sheep and Goat rearing – Aquaculture
15. Allied enterprises and their importance- complementary and competitive interactions- Poultry, Apiculture, sericulture and mushroom cultivation.
16. Indigenous practices of organic farming – role of livestock – cow in organic farming.
17. **MID- SEMESTER EXAMINATION**
18. Initiatives taken by Government (Central/State) - NGOs and other organizations for promotion of organic agriculture.
19. Organic ecosystem and their concepts - Soil and water management- soil organic matter and Humus- Their physical, chemical and biological properties.
20. Choice of crops and varieties in organic farming – Conversion of soil to organic farming.
21. Organic nutrient management-types of organic manures – bio-fertilizers- efficient use of organic sources of nutrients.
22. Organic nutrient resources and its fortification- Constraints of nutrient use in organic farming.
23. Panchagavya – Dasagavya – Amirthakaraisal – preparation – properties – general effects on crops.
24. Bio-intensive nutrient management – application of effective micro organisms (EM) technology.
25. Weed management in organic farming – cultural-mechanical-Biological –Bio herbicides.
26. Pest management in organic farming- different components – parasites- predators, microbial pesticides (Bio) -resistant varieties and pheromones.
27. Disease management in organic farming – cultural, mechanical, biological- biofungicides.
28. Organic production package of important field crops- rice, sorghum, finger millet, cotton, groundnut and soybean.
29. Operational structure of NPOP- Accreditation agencies in the World and India- Role of APEDA and IFOAM
30. Accreditation – standards - procedure of accreditation, Certification - Agencies/organizations. – Standards- procedure for certification.
31. Postharvest processing- labeling and sanitation procedures in organic farming.

32. Marketing and export potential of organic products- Opportunities and constraints
33. Impact of organic farming on food security, environment and health.
34. Current stream of thought.

### Practical Schedule

1. Aerobic and anaerobic methods of compost technology.
2. Practicing enriched compost production technology.
3. Practicing different methods of vermin composting and vermi tea preparation.
4. Practicing the methods of urban wastes and sewage sludge composting.
5. Preparation of biodynamic farming and organic nutrient solutions.
6. Biofertilizers production techniques and its application methods.
7. Preparation of bio pesticide formulations and its application methods
8. Preparation of neem products and other botanicals and their use for pest and disease control.
9. Indigenous technology knowledge (ITK) for nutrient and weed management
10. Indigenous technology knowledge (ITK) for pest and disease management
11. Study of quality parameters of organic products.
12. Visit to organic farm and cost economics of organic production system
13. Visit to organic farmer field.
14. Procedure of inspection and certification.
15. Grading, labeling and packaging of organic products.
16. Visit to organic outlet and study about quality management and trademark.
17. **Practical examination.**

### Course Outcomes

**CO 1:** To acquire knowledge on concepts of organic agriculture.

**CO 2:** To gain the information about the impact of organic farming and indigenous practices on environment.

**CO 3:** To understand the procedure followed for organic certification as per NPOP guidelines namely production standards, labelling and accreditation.

**CO 4:** To equip students with organic control methods of pests and diseases using bio inoculants and bio-agents.

**CO 5:** To gain knowledge on preparation of organic nutrient solutions and marketing

### CO– PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	2	2	3	3	2
CO2	2	3	3	2	3
CO3	3	2	2	3	2
CO4	3	3	3	3	3
CO5	2	-	2	2	-

### Suggested Readings

1. Maliwal, P.L. 2022. Principles of Organic Farming. Scientific Publishers. Jodhpur, India.
2. Palaniappan SP and Anandurai K. 2018. Organic Farming – Theory and Practice.

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3. Rajesh Dutt Singh, Ghanshyam Dwivedi and Sunil Kumar Tiwari. 2020. Kalyani Publishers, New Delhi.
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  5. Singh SP. (Ed.) 1994. Technology for Production of Natural Enemies.PDBC, Bangalore.
  6. Somani, L.L and Jagetiya, B.L . 2021. Handbook of Organic Farming, Agrotech Publishing Academy, Udaipur .
  7. Somasundaran,E., D.Udhaya Nandhini and M.Meyyappan. 2019. Principles of Organic Farming with theory and practicals. New India Publishing Agency, New Delhi.
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  10. Veeresh GK, Shivashankar K and Suiglachar MA. 1997. Organic Farming and Sustainable Agriculture. Association for Promotion of Organic Farming, Bangalore.

#### **e-Resources**

1. [https://www.coabnau.in/uploads/1587019407\\_Principlesoforganicfarming.pdf](https://www.coabnau.in/uploads/1587019407_Principlesoforganicfarming.pdf).
2. [http://orgprints.org/2768/1/eyhorn-2004-Organic\\_Agriculture\\_in\\_India.pdf](http://orgprints.org/2768/1/eyhorn-2004-Organic_Agriculture_in_India.pdf)
3. <http://www.fao.org/organicag/oa-home/en/>
4. <https://www.fibl.org/fileadmin/documents/shop/1636-organic-world-2014.pdf>
5. <https://www.canr.msu.edu/hrt/uploads/535/78622/Organic-Farming-hand-col-2006-10pgs.pdf>.

### **AGR 513 AGRONOMY OF MEDICINAL, AROMATIC AND UNDER-UTILIZED CROPS (1+1)**

#### **Objectives**

- To apprise the economic value of different medicinal, aromatic and underutilized field crops, their importance.
- To encourage students about the sustainable cultivation and collection of medicinal plants of good quality.
- To understand cultivation techniques (agro-techniques) including Quality Plant Materials, Irrigation, Fertilizer, Plant protection, Post-harvest collection and Processing.
- To understand students about the importance of underutilized crops viz., Rice bean, Lathyrus, Cluster bean, French bean, Fenugreek.
- To create a good export market for the herbal raw materials, beverage's and narcotics.

#### **Theory**

##### **UNIT I Importance of medicinal and aromatic plants**

Medicinal plants - definition, history. Importance of medicinal and aromatic plants in human health, national economy and related industries. Classification of medicinal and aromatic plants according to botanical characteristics and uses. Expert potential and indigenous technical knowledge.

##### **UNIT II Crop management of Medicinal plants**

Origin, geographic distribution, economic importance, climate and soil requirements, cultural

practices, yield and important constituents of medicinal plants - Mulhati, Isabgol, Rauwolfia, Poppy, *Aloe vera*, Vetiver, Satavar, Stevia, Safed Musli, Kalmegh, Asaphoetida, *Nuxvomica*, Rosadle etc.

### **UNIT III Crop management of Aromatic plants**

Origin, geographic distribution, economic importance, climate and soil requirements, cultural practices, yield and important constituents of aromatic plants - Citronella, Palmarosa, Mentha, Basil, Lemon grass, Rose, Patchouli, Geranium etc.

### **UNIT IV Crop management of under-utilized crops**

Origin, geographic distribution, economic importance, climate and soil requirements, cultural practices, yield and important constituents of under utilized plants - Rice bean, Lathyrus, Sesbania, Cluster bean, French bean, Fenugreek.

### **UNIT V Crop management of Beverages and Narcotic crops**

Origin, geographic distribution, economic importance, climate and soil requirements, cultural practices, yield and important constituents of Beverages and Narcotic crops - Grain Amaranth, Coffee, Tea and Tobacco - Current stream of thought.

### **Practical**

Identification of crops based on morphological and seed characteristics, Raising of herbarium of medicinal, aromatic and under-utilized plants, Quality characters in medicinal and aromatic plants, Methods of analysis of essential oil and other chemicals of importance in medicinal and aromatic plants.

### **Theory schedule:**

1. History, scope, constraints and opportunities in cultivation of medicinal and aromatic crops in India. Expert potential and indigenous technical knowledge.
2. Mulhati, Isabgol, Rauwolfia – Botanical name, Family, Origin, Importance, chemical composition-origin, distribution, area, production, climate and soil requirements, propagation techniques, planting and after care, nutritional requirements, plant protection, harvesting, yield and Post-harvest handling and processing
3. Poppy, *Aloe vera*, Vetiver, Satavar, Stevia - Botanical name, Family, Origin, Importance, chemical composition-origin, distribution, area, production, climate and soil requirements, propagation techniques, planting and after care, supporting system, nutritional requirements, plant protection, harvesting, yield Post harvest handling and processing
4. Safed Musli, Kalmegh - Botanical name, Family, Origin, Importance, chemical composition-origin, distribution, area, production, climate and soil requirements, propagation techniques, planting and after care, types and varieties, nutritional requirements, plant protection, harvesting, yield Post harvest handling and processing
5. Aromatic plants - Importance – Essential oil Industry in India - Properties of Essential oils, Asaphoetida, *Nuxvomica*, Rosadle - Botanical name, Family, Origin, Importance, chemical composition-origin, distribution, area, production, climate and soil requirements, propagation techniques, planting and after care, training, nutritional requirements, plant protection, harvesting yield, Post harvest handling and processing
6. Citronella and Palmarosa - Botanical name, Family, Origin, Importance, chemical composition-origin, distribution, area, production, climate and soil requirements, types and varieties, propagation techniques, planting and after care, nutritional requirements, plant protection, harvesting, yield Post harvest handling and processing.
7. **MID SEMESTER EXAMINATION**
8. Mentha, Basil - Botanical name, Family, Origin, Importance, chemical composition-

- origin, distribution, area, production, climate and soil requirements, species and varieties, propagation techniques, planting and after care, provision of support, nutritional requirements, plant protection, harvesting , yield Post harvest handling and processing
9. Lemon grass, Rose - Botanical name , Family , Origin ,Importance, chemical composition- origin, distribution, area, production, climate and soil requirements, propagation techniques, planting and after care, training and pruning, nutritional requirements, plant protection, harvesting, yield , Post-harvest handling and processing
  10. Patchouli, Geranium - Botanical name , Family , Origin ,Importance, chemical composition- origin, distribution, area, production, climate and soil requirements, propagation techniques, planting and after care, nutritional requirements, plant protection, harvesting, yield , Post-harvest handling and processing
  11. Rice bean, Lathyrus, Sesbania - Botanical name , Family , Origin ,Importance, chemical composition origin, distribution, area, production, climate and soil requirements, varieties, propagation techniques, planting and after care, training and pruning, nutritional requirements, plant protection, harvesting, yield ,Post-harvest handling and processing
  12. Cluster bean, French bean, Fenugreek- Botanical name , Family , Origin, Importance, chemical composition origin, distribution, area, production, climate and soil requirements, species and varieties, propagation techniques, planting and after care, nutritional requirements, plant protection, harvesting , yield Post harvest handling and processing
  13. Fenugreek, Grain Amaranth - Botanical name , Family , Origin ,Importance, chemical composition origin, distribution, area, production, climate and soil requirements, varieties, propagation and nursery techniques, planting and after care, nutritional requirements, plant protection, harvesting, yield , Post harvest handling and processing
  14. Coffee - Botanical name , Family , Origin ,Importance, chemical composition, origin, distribution, area, production, climate and soil requirements, varieties, propagation techniques, planting and after care, nutritional requirements, plant protection, harvesting, yield, grading and processing, packing , storage and value addition.
  15. Tea - Botanical name , Family , Origin ,Importance, chemical composition origin, distribution, area, production, climate and soil requirements, species and varieties, propagation techniques, planting and after care, training and pruning, nutritional requirements, plant protection, harvesting and yield, grading and processing, packing , storage and value addition and extraction of essential oil.
  16. Tobacco - Botanical name , Family , Origin ,Importance, chemical composition origin, distribution, area, production, climate and soil requirements, species and varieties, propagation techniques, planting and after care, nutritional requirements, plant protection, harvesting, yield, Methods of Curing , Processing , grading , packing storage and value addition.
  17. Current stream of thought.

#### **Practical schedule**

1. Identification, botanical description and varietal features of Ornamental plants.
2. Identification, botanical description and varietal features of Medicinal Plants.
3. Identification, botanical description and varietal features of Aromatic plants.
4. Nursery bed preparation and flower seed sowing.
5. Training and pruning of roses.
6. Planning and layout of ornamental garden.

7. Bed preparation and planting of Medicinal and Aromatic Plants.
8. Protected structures – Care and maintenance.
9. Intercultural operations in flowers crops.
10. Intercultural operations in Medicinal and Aromatic plants.
11. Harvesting and post-harvest handling of cut and loose flowers, floral preservatives to prolong vase-life of cut flowers.
12. Drying / dehydration techniques for flower drying.
13. Processing of medicinal plants
14. Processing of aromatic Plants
15. Procedure for extraction of essential oils.
16. Visit to Commodity Boards and plantation industries.

### 17. Practical Examination

#### Course Outcomes:

**CO 1:** To gain the information and acquire practical knowledge about various Medicinal crops and its beneficial and economic importance to the farming communities.

**CO 2:** To gain knowledge about importance of aromatic crops and its cultivation practices

**CO 3:** To formulate different cropping system and production technologies for various medicinal crops

**CO 4:** To construct idea regarding knowledge on growing of underutilized crops

**CO 5:** To create awareness about narcotics crops and its production technologies

#### CO– PO Mapping

	PO 1	18. PO 2	19. PO 3	20. PO 4	21. PO 5
22. CO 1	23. 3	24. -	25. 2	26. 2	27. 3
28. CO 2	29. 3	30. 3	31. 3	32. 3	33. 2
34. CO 3	35. 3	36. 2	37. 3	38. -	39. 2
40. CO 4	41. 3	42. 2	43. 3	44. -	45. 3
46. CO 5	47. 3	48. 3	49. 3	50. 1	51. 3

#### References

1. Chadha KL and Gupta R. 1995. Advances in Horticulture. Vol. II. Medicinal and Aromatic Plants. Malhotra Publishers. New Delhi.
2. Hussain A. 1993. Medicinal Plants and their Cultivation. CIMAP, Lucknow.
3. Joshi S.G., 2007, Medicinal Plants. Mohan Primalani for oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
4. Kumar, N., Abdul Khader, J.B.M, Rangaswamy, P and Irulappan, I. 2004. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Crops. Oxford and IBH publishing Co, New Delhi.

5. Laxmi Lal. 2020. Production Technologies For Horticultural Crops, Agrotech Publishing Academy, Udaipur .
6. Prajapati ND, Purohit SS, Sharma AK and Kumar T. 2003. A Hand Book of Medicinal Plants: A Complete Source Book. Agrobios.
7. Prasad. G. and m.. V. Reshmi, 2007. A manual of Medicinal trees. Agrobios, (India), Jodhpur, Rajasthan.
8. Sharma R. 2004. Agro-Techniques of Medicinal Plants. Daya Publ. House. Bose, T.K. 1999. Floriculture and Landscaping. Naya Prakash, Kolkatta.
9. Singh, D.K . 2021. Textbook of Horticulture, Agrotech Publishing Academy, Udaipur .
10. Srivastava, H.C.2014. Medicinal and Aromatic Plants. ICAR, New Delhi.

### **e-Resources**

1. <http://jnkvv.org/PDF/AERC/Study-93.pdf>.
2. <http://www.isec.ac.in/29%20Culti%20of%20Medi%20Crops%20&%20Arom%20Crop%20as%20a%20Means%20of%20Diver%20in%20Agri.pdf>.
3. <https://www.agrimoon.com/wp-content/uploads/Medicinal-and-Aromatic-Crops.pdf>.
4. <https://krishi.icar.gov.in/jspui/bitstream/123456789/12920/2/ICAR-CIWA-TB%2828%29%202017.pdf>.

## **AGR 514 CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE (2+0)**

### **Objectives**

- The students will study and understand the cropping and farming systems as a tool forenhancing farm productivity.
- The Students will acquire skill on integrated farming system models for different agroecosystems.
- The students will aware about dry farming and its constraints and mitigation strategies
- The students will gain clear knowledge to incorporate scientific principles of sustainability in LEISA
- The students will familiarize with causes of environmental pollution and its conservation techniques

### **Theory**

#### **UNIT I Cropping systems**

Cropping systems: definition, principles, concepts, classification. Indices and its importance. Physical resources, soil and water management in cropping systems; assessment of land use.

#### **UNIT II Concept of sustainability**

Concept of sustainability in cropping systems and farming systems, scope and objectives. Production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping, mixed cropping and intercropping, mechanism of yield advantage in intercropping systems.

#### **UNIT III Interactions in cropping systems**

Above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping and yield stability in intercropping. Role of non-monetary inputs and low cost technologies. Research need on sustainable agriculture.

#### **UNIT IV Crop diversification and soil health**

Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; organic recycling and crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system.

#### **UNIT V Plant Ideotypes**

Plant ideotypes for drylands; plant growth regulators and their role in sustainability; Resource management under constraint situations. **Artificial intelligence- concept and application -** Current stream of thought.

#### **Theory schedule**

1. Cropping systems: definition, principles and basic concepts, indices and its importance
2. Physical resources, soil and water management in cropping systems; assessment of land use.
3. Advantages and disadvantages of various cropping systems- criteria for assessing yield advantages
4. Principles and factors influencing in cropping scheme, preparation of cropping scheme
5. Farming system: definition, principles, concepts, types and advantages of farming system
6. Scope of farming systems and factors influencing the choice of component elements
7. Component technologies in cropping system and farming systems
8. Farming system management and sustainable agriculture
9. Concept of sustainability in cropping systems and farming systems, scope and objectives
10. Production potential under various cropping systems: monoculture cropping, multiple cropping, alley cropping, sequential cropping, mixed cropping and intercropping
11. Mechanism of yield advantage in intercropping systems, Complementary and competitive interaction in different cropping system – light, nutrient, water and weed.
12. Agronomic requirement for crops and cropping systems in intercropping and sequential cropping
13. Integrated farming system- Scope and advantages- Allied enterprises for wetland, irrigated upland and dryland and their interactions
14. Integrated farming system-models for wetland, irrigated upland and dryland ecosystem
15. Crop interaction: Competition and annidation
- 16. Mid- semester examination**
17. Allelopathy, legume effect- effect of preceding and associated crops.
18. Allelopathy and interaction among crop communities
19. Multi-storied cropping, yield stability in intercropping and evaluation of intercropping systems
20. Cost reduction technologies and non-monetary inputs in cropping and farming system
21. LEISA- principles and concepts – Basic ecological principles of LEISA and promising LEISA techniques
22. Conservation agriculture- Scope, advantages and CA technology for sustainable agriculture
23. Research need on sustainable agriculture.
24. Organic farming- definition-Principles-concepts-prospects
25. Sources of organic manures-plant, animal and microbial origin, On-farm resources; FYM, poultry manure, sheep and goat manures; green manures, biogas slurry and vermicompost
26. Off-farm resources and their management ; coir pith, press mud, oil cakes, fly ash, bio



- compost, minerals, bone meal, bio fertilizers, traditional preparations.
27. Crop residue management (CRM) for sustainable agriculture.
  28. Role of farming elements in reducing agro chemical use, resource management and crop planning
  29. Crop diversification for sustainability; role of organic matter in maintenance of soil fertility
  30. Organic waste recycling methods and techniques- composting, vermicomposting, in situ composting- bio intensive nutrient management, fertilizer use efficiency and concept of fertilizer use in intensive cropping system
  31. Ideal plant type for dry lands
  32. Plant growth regulators (PGR): plant growth regulators and retardants, and their role in sustainability.
  33. Resource management under irrigated and rainfed situations .
  34. Current stream of thought.

**Course Outcomes:**

**CO 1:** To prepare cropping schemes, design, and evaluate cropping system and workout input requirements for crops.

**CO 2:** To understand interaction between different farm enterprises.

**CO 3:** To prepare integrated farming system models for different eco systems.

**CO 4:** To gain knowledge about drought mitigation strategies

**CO 5:** To evaluate different resource management techniques in conservation agriculture

**CO– PO Mapping**

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	3	3	3	3	3
CO2	2	3	3	2	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	-	2	3	-

**References**

1. Choudhary, J. 2019. Textbook of Farming Systems and Sustainable Agriculture (As per 5<sup>th</sup> Deans Committee Syllabi), Agrotech Publishing Academy, Udaipur .
2. Jayanthi, C. Devasenapathy, P and C. Vennila. 2007. Farming systems: Principles and practices. Satish serial publishing House. Delhi.
3. Lalitha B.S., Shankar M.A., G.K. Prajwal Kumar. 2020. Cropping Systems Principles and Practices. New India Publishing agency. New Delhi.
4. Palaniappan SP and Sivaraman K. 1996. *Cropping Systems in the Tropics; Principles and Management*. New Age. International (P) Ltd., New Delhi.
5. Panda SC. 2003. *Cropping and Farming Systems*. Agrobios Publishers. Jodhpur.
6. Reddy, S.R. 2018. Farming System and Sustainable Agriculture. Kalyani Publishers, New Delhi
7. Sankaran S and Mudaliar TVS. 1997. *Principles of Agronomy*. The Bangalore Printing and Publication Co.

8. Singh SS. 2006. *Principles and Practices of Agronomy*. Kalyani Publishers, New Delhi.
9. Somasundaran,E., D.Udhaya Nandhini and M.Meyyappan. 2019. *Principles of Organic Farming with theory and practicals*. New India Publishing Agency, New Delhi.
10. Tisdale SL, Nelson WL, Beaton JD and Havlin JL. 1997. *Soil Fertility and Fertilizers*. Prentice Hall of India pvt. Ltd., New Delhi.

#### **e-Resources**

1. [https://www.coabnau.in/uploads/1609844393\\_Agron.5.6.pdf](https://www.coabnau.in/uploads/1609844393_Agron.5.6.pdf).
2. <http://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDF-downloads/TOFG-all.pdf>
3. [http://nsdl.niscair.res.in/123456789/670Revised Organic farming.pdf](http://nsdl.niscair.res.in/123456789/670Revised%20Organic%20farming.pdf) .
4. <http://hillagric.ac.in/edu/coa/agronomy/lect/agron-511/511-Cropping-System-SSR-MCR.pdf>.
5. <http://jnkvv.org/PDF/0504202013425134200822.pdf>.

### **STA 501 Statistical Methods for Applied Sciences (2+1)**

#### **Objectives**

To acquaint the students about the basics of statistics and design of experiments

#### **Theory**

##### **Unit - I**

Box - Plot, Descriptive Statistics, Exploratory data analysis, Theory of Probability, Random variable and Mathematical Expectations. Concept of Discrete and Continuous Probability Distributions: Binomial, Poisson, Normal Distributions and their applications.

##### **Unit - II**

Concept of Sampling distribution; Chi - Square, t and F distributions. Tests of Significance based on Normal, Chi - Square, t and F distributions.

##### **Unit - III**

Simple, Multiple and Partial Correlation Coefficient; Rank Correlation, Simple and Multiple Linear Regression, Test of Significance of Correlation of Coefficient and Regression Coefficient and Coefficient of Determination

##### **Unit - IV**

Need for Design of Experiments, Characteristics of a good design, Basic Principles of Design of Experiments, Completely Randomized Design, Randomized Block Design and Latin Square Design Layout and their analysis.

##### **Unit - V**

Concepts of Factorial experiments  $2^n$ ,  $3^2$  factorial experiments; Concepts of Confounding in factorial experiments - Confounding in  $2^3$  factorial experiments; partial and total confounding; Split - plot design and Strip - plot design.

#### **LECTURE SCHEDULE**

1. Meaning of Box-Plot
2. Descriptive Statistics - Concepts
3. Exploratory data analysis

4. Theory of Probability
5. Random variable and Mathematical Expectation
6. Discrete probability distributions – binomial and poisson distribution
7. Continuous probability distributions – normal distribution and their application
8. Concept of sampling distribution – Standard Error
9. **First Test**
10. t distribution , F and Chi square distribution
11. Tests of significance based on t, z, (mean and equality of means only).  $\chi^2$  test for goodness of fit.
12. Definition of correlation, significance and types
13. Properties of correlation coefficient
14. Definition of regression – measuring and uses of regression analysis properties.
15. Differences between correlation and regression.
16. Regression co – efficient - simple, linear.
17. **Mid- semester examination**
18. Multiple linear regression co - efficient – standard error of estimate
19. Test of significance of observed regression co -efficient and co - efficient of determination.
20. Characteristics of agricultural experiments: concepts – field studies.
21. Characteristics of agricultural experiments -pot-culture – quantitative and qualitative variables.
22. Sources of errors and estimate of errors
23. Design of Experiments– Basic principles
24. Completely Randomized Design
25. Randomized Block Design
26. Latin Square Design
27. Comparison of treatments – least significant difference method
28. Duncan’s Multiple Range Test (DMRT)
29. Concept of factorial experiments
30.  $2^n$ ,  $3^2$  Factorial experiments
31. Principle of confounding in factorial experiments
32. Confounding in  $2^3$  Factorial experiments
33. Split-pot design
34. strip – plot design

#### **PRACTICAL SCHEDULE**

1. Estimation of samples statistic viz., means, SD, SE and CV.
2. Fitting of distributions – binomial and poisson
3. Z-test, t-test and paired t-test
4. Comparison of two variances using F-test
5. Bartlett’s test for homogeneity of variances
6. Chi-square test for test of goodness of fit and homogeneity of ratio test for independence of attributes
7. Computation of correlation co-efficient and it’s significance
8. Fitting of simple linear regression and testing the significance of regression coefficient
9. Multiple linear regressions fitting and testing
10. Determination of optimum plot size using uniformity trial.

11. Analysis of CRD and RBD
12. Analysis of LSD and DMRT
13. 2<sup>2</sup> Factorial Experiment
14. 2<sup>3</sup> Factorial Experiment
15. Complete confounding in 2<sup>3</sup> Factorial Experiment
16. Analysis of Split-plot and Strip-plot design
17. Final practical Examination

#### **REFERENCE BOOKS**

1. Bhattacharyya, G.K. and R.A. Johnson. 1997. Statistical concepts and methods, John Wiley and Sons, New York.
2. Crozon, F.E. and D.J. Cowden . 1986. Applied General Statistics, Prentice Hall of India, New Delhi.
3. Gomez, K.A. and A.A. Gomez. 1984. Statistical procedure for Agricultural Research, John Wiley and Sons, New York.
4. Panse, V.G. and P.V. Sukhatme. 1961. Statistical methods for Agricultural Workers, ICAR, New Delhi.
5. Ramaswamy, R. 1995. A text book of Agricultural Statistics, Wiley Limited, New Delhi.

#### **PGS 501 - LIBRARY AND INFORMATION SERVICES 0+1**

##### **Objective**

□□ To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

##### **Practical**

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary -Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services - (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing - information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized - library services; Use of Internet including search engines and its resources; e-resources access methods.

##### **Practical Schedule**

1. Introduction to library and its services
2. Role of libraries in education, research and technology transfer;
3. Classification systems and organization of library
4. Sources of information- Primary Sources, Secondary Sources and Tertiary Sources
5. **First test**

6. Intricacies of abstracting and indexing services
7. Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.);
8. Tracing - information from reference sources; Literature survey
9. **Mid- Semester**
10. Citation techniques/Preparation of bibliography;
11. Use of CD-ROM Databases,
12. Online Public Access Catalogue and other computerized - library services
13. Online Public Access Catalogue and other computerized - library services
14. Use of Internet including search engines and its resources
15. Use of Internet including search engines and its resources
16. e-resources access methods.
17. Final practical examination

## **PGS 502 - TECHNICAL WRITING AND COMMUNICATION SKILLS (0+1)**

### **Objective**

□□ To equip the students with skills *Viz.*, writing of dissertations, research papers, etc. and to communicate and articulate in English

### **Practical**

Grammar - Tenses, parts of speech, clauses, punctuation marks; Error analysis  
Common errors; Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers. Proof reading. Technical Writing - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Structure of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

### **Practical schedule**

1. Grammar (Tenses, parts of speech)
2. Grammar (clauses, punctuation marks)
3. Error analysis (Common errors); Concord; Collocation;
4. Phonetic symbols and transcription;
5. **First test**
6. Accentual pattern: Weak forms in connected speech
7. Participation in group discussion, Facing an interview; presentation of scientific papers.
8. Technical Writing- Various forms of scientific writings- theses, technical papers
9. **Mid -semester examination**

10. Technical Writing- reviews, manuals
11. Structure of thesis and research communications
12. Writing of abstracts, summaries, précis, citations etc
13. Commonly used abbreviations in the theses and research communications
14. Illustrations, photographs and drawings with suitable captions
15. Pagination, numbering of tables and illustration, numbers and dates in scientific write-ups
16. Editing and proof-reading, Writing of a review article.
17. Final practical examination

#### Suggested Readings

1. Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
2. Mohan K. 2005. Speaking English Effectively. MacMillan India.
3. Richard WS. 1969. Technical Writing. Barnes & Noble.
4. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek.
5. Wren PC & Martin H. 2006. High School English Grammar and Composition. S.Chand & Co.

## PGS 503 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE (1+0) (e-course)

### Objectives

The objective of the course is to create awareness about intellectual property rights in agriculture. The course deals with management of patents, trademark, geographical indications, copy rights, designs, plant variety protection and biodiversity protection. The students will be taught on the marketing and commercialization of intellectual properties.

### Theory

#### Unit - I- World trade organization - introduction

World Trade Organization - Agreement on Agriculture (AoA) and Intellectual Property Rights (IPR) - importance of intellectual property management - IPR and economic growth - IPR and bio diversity - major areas of concern in intellectual property management - technology transfer and commercialization - forms of different intellectual properties generated by agricultural research.

#### Unit - II- Patent document

Discovery *versus* invention - patentability of biological inventions - procedure for patent protection - preparatory work - record keeping, writing a patent document, filing the patent document - types of patent application - patent application under the Patent Cooperation Treaty ( PCT ).

#### Unit - III- Plant genetic resources

Plant genetic resources - importance and conservation - sui generic system - plant varieties protection and farmers' rights act - registration of extinct varieties registration and protection of new varieties / hybrids / essentially derived varieties - dispute prevention and settlement - farmers' rights.

#### Unit - IV- Trademark

Trademark - geographical indications of goods and commodities - copy rights designs - biodiversity protection.

## **Unit - V- Benefit sharing**

Procedures for commercialization of technology - valuation, costs and pricing of technology - licensing and implementation of intellectual properties - procedures for commercialization - exclusive and non exclusive marketing rights - research exemption and benefit sharing.

### **Theory schedule**

1. World Trade Organization - Agreement on Agriculture (AoA) and Intellectual Property Rights (IPR)
2. Importance of intellectual property management - IPR and economic growth - IPR and bio diversity
3. Major areas of concern in Intellectual property management - technology transfer and commercialization
4. Forms of different intellectual properties generated by agricultural research
5. **First test**
6. Discovery versus invention patentability of biological inventions
7. Procedure for patent protection, Preparatory work - record keeping, writing a patent document, filing the patent document
8. Types of patent application - patent application under the Patent Cooperation Treaty ( PCT )
9. **Mid semester examination**
10. Plant genetic resources - importance and conservation
11. Sui generic system - plant varieties protection and farmers' rights act registration of extant varieties
12. Registration and protection of new varieties / hybrids / essentially derived varieties - dispute prevention and settlement - farmers' rights
13. Trade mark - geographical indications of goods and commodities - copy rights - designs ,Biodiversity protection,
14. Procedures for commercialization of technology - valuation, costs and pricing of technology
15. Licensing and implementation of intellectual properties - procedures for commercialization
16. Exclusive and non exclusive marketing rights - research exemption and benefit sharing
17. **Final practical examination**

Reference books

1. Arun Goyal and Moor Mohamed, 2001. *WTO in the New Millennium*, Academy of Business Studies, New Delhi.
2. Bilek Debroy, 2004. *Intellectual Property Rights*, BR World of books, New Delhi.
3. Ganguli, P., 2001. *Intellectual Property Rights - Unleashing the Knowledge Economy*. Tata McGraw Hill, New Delhi.
4. Narayanan, R., 2006. *Patent Law*, Eastern Law House, New Delhi.
5. Ramappa, T., 2000. *Intellectual Property Rights under WTO - Tasks before India*, Wheeler Publishing, New Delhi.

## **PGS 504- BASIC CONCEPTS IN LABORATORY TECHNIQUES (0 + 1)**

### **Objective**

To acquaint the students about the basics of commonly used techniques in laboratory.

### **Practical**

### **Unit-I-Safety measures and common laboratory equipments**

Safety measures while in labs; Handling of chemical substances ; use of burettes , pipettes, measuring cylinders, flasks, separator funnel, condensers and micropipettes. Washing ,drying and sterilization of glassware; drying of solvents/ chemicals.

### **Unit-II - Preparation of standard solutions**

Weighing and preparation of solutions of different strengths and their dilution ; Handling techniques of solutions; preparations of different agro-chemical doses in field and pot applications; preparation of solutions of acids; Neutralisation of acid and bases ;preparation of buffers of different strengths and ph values.

### **Unit-III-Use and handling of laboratory equipments**

Use and handling of vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath and water bath.

### **Unit-IV - Microscopy and media preparation**

Use and handling of microscope and laminar flow-preparation of media- differential ,selective and enriched media. Methods of sterilization –physical methods-dry and moist heat ,cold ,filtration and radiation, chemical methods and disinfectants.

### **Unit-V - In-vitro culture techniques**

Description of flowering plants in botanical terms in relation to taxonomy- seed viability test-pollen fertility test-tissue culture media-composition of media-media preparation – instant media-aseptic manipulation-procedure for in vitro culture of explants-leaf bit-stem bit-anthers-pollen –microspores-ovule and embryo.

### **Practical schedule**

1. Safety measures in labs and handling of chemical substances.
2. Common laboratory equipments. Calibration and cleanliness of volumetric glass wares.
3. Methods of expressing strength of solutions.
4. Preparation of primary standard solutions and buffer solutions.
5. **First test**
6. Preparation of standard solutions for nutrient analysis of soil, plant and water.
7. Preparation of different agro-chemical doses for field experiments, Preparation of buffer solutions,
8. Handling of instruments-vacuum pumps, thermometers, magnetic stirrer.
9. **Mid semester Examination**
10. Handling of instruments-ovens ,sand bath and water bath.
11. Handling and uses of microscopes and laminar flow.
12. Sterilization by physical methods and Sterilization by chemical methods.
13. Preparation of different media for culturing the micro organisms.
14. Description of flowering plants-seed viability test and pollen fertility test.
15. Aseptic manipulations and media.
16. In vitro culture of different explants.
17. Final practical examination

### **Reference Books**

1. Furr ,A.K.2000.CRC Handbook of laboratory safety.CRC press.
2. Jackson, M.L. 1997. Soil Chemical Analysis. Prentice Hall of India pvt.Ltd.,New Delhi.
3. Prescott.L.M., Harley, P and Klein, A. 2003. Microbiology , 5<sup>th</sup>Edition, MC.Graw Hill,USA.



4. Gupta, P.K. 1997. Elements of Biotechnology, Rastogi Publications, Meerut.
5. Singh, B.D. 2005. Bio technology ,Expanding Horizons, Kalyani Publications, New Delhi.

#### **e-Reference**

1. Analytical chemistry vol.1(pdf) [www.freebookcentre.net](http://www.freebookcentre.net).
  2. Analytical chemistry Dr.michaelzehfus [www.freebookcentre.net](http://www.freebookcentre.net).
  3. Introduction to Instrumental Analytical Chemistry Roger Terri [www.freebookcentre.net](http://www.freebookcentre.net).
  4. Analytical Chemistry lecture notes sadhu malyadri [www.freebookcentre.net](http://www.freebookcentre.net).
- Short introduction into analytical chemistry Dr.manfredsietz and Dr. Andreassonnenberg [www.freebookcentre.net](http://www.freebookcentre.net).

### **PGS 505 - AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES (1+0)**

#### **Objective**

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

#### **Theory**

**UNIT I** History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

**UNIT II** Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

**UNIT III** Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group - Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/ Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

**UNIT IV** Research prioritization and selection of research problem - Research planning - review of literature - setting of objectives and hypothesis - research design and techniques - data collection - analysis - formulation of tables - interpretation of results- Computer software in tabulation, presentation - Thesis writing - writing of research articles- projects and report writing - Formulation and preparation of research / scheme proposal - Impact

factor and citation index - citation and references- Guidelines for oral / poster presentations – Internet in scientific research.

**UNIT V** Authorship and copy right – Plagiarism – Scientific misconduct – Falsification of research results, data fabrication – Peer review, informed consent attribution of authorship and adequacy of peer review publication process -Responsibility of society and self – Public interest in research, relevance to society and motivation - Conflict of interest, moral commitment – Social trends on research ethics, adequate codes of conduct to regulate research activity

### **Theory lecture schedule**

1. History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment
2. National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR); International Agricultural Research Centres (IARC)
3. Partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.
4. Research ethics: research integrity, research safety in laboratories
5. **First test**
6. Welfare of animals used in research, computer ethics, standards and problems in research ethics.
7. Concept and connotations of rural development, rural development policies and strategies.
8. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/ Non-Governmental Organisations.
9. **Mid semester examination**
10. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.
11. Research prioritization and selection of research problem – Research planning - review of literature – setting of objectives and hypothesis – research design and techniques
12. Data collection -- analysis – formulation of tables – interpretation of results- Computer software in tabulation and presentation
13. Thesis writing – writing of research articles- projects and report writing – Formulation and preparation of research / scheme proposal
14. Impact factor and citation index - citation and references- Guidelines for oral / poster presentations – Internet in scientific research.
15. Authorship and copy right – Plagiarism – Scientific misconduct – Falsification of research results, data fabrication – Peer review, informed consent attribution of authorship and adequacy of peer review publication process
16. Responsibility of society and self – Public interest in research, relevance to society and motivation - Conflict of interest, moral commitment

17. Social trends on research ethics, adequate codes of conduct to regulate research activity

**Reference**

1. Bhalla GS and Singh G. 2001. *Indian Agriculture - Four Decades of Development*. Sage Publ.
2. Punia MS. *Manual on International Research and Research Ethics*. CCS Haryana Agricultural University, Hisar.
3. Rao BSV. 2007. *Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives*. Mittal Publ.
4. Singh K. 1998. *Rural Development - Principles, Policies and Management*. Sage Publ.

**ANNEXURE-1**

**PROFORMA FOR FORMATION OF RESEARCH ADVISORY COMMITTEE**

**(To be sent before the end of I Semester)**

1. Name of the student :
2. Enrolment number: Reg. No. :
3. Degree :
4. Subject :
5. Advisory Committee :

S.No.	Advisory Committee	Name, Designation and Department	Signature
1.	Chairperson		
2.	Members		
	Additional Member		
	Reasons for additional Member		

Professor and Head

Additional members may be included only in the allied faculty related to thesis research with full justification at the time of sending proposals (Program of research).

**ANNEXURE-II**  
**PROFORMA FOR CHANGE IN THE RESEARCH ADVISORY COMMITTEE**

1. Name of the student :
2. Enrolment number: Reg. No.
3. Subject :
4. Degree :
5. Proposed Change :

Advisory Committee	Name and designation	Signature
a. Existing member		
b. Proposed member		

6. Reasons for change

Chairperson

Signature of Professor and Head

ANNEXURE-III

**PROFORMA FOR OUTLINE OF RESEARCH WORK (ORW)**  
**(To be sent before the end of I Semester)**

1. Name :
2. Enrolment number: Reg. No.
3. Degree :
4. Subject :
5. Date of Joining :
6. Title of the research project :
7. Objectives :
8. Duration :
9. Review of work done :
10. Broad outline of work/methodology :
11. Semester wise break up of work :

Signature of student

Approval of the advisory committee

<b>Advisory committee</b>	<b>Name</b>	<b>Signature</b>
Chairperson		
Members		
1.		
2.		

Professor and Head

ANNEXURE-IV

**PROFORMA FOR CHANGE IN OUTLINE OF RESEARCH WORK (ORW)**

1. Name :
2. Enrolment number: Reg. No
- 3 Degree :
- 4 Subject
- 5 Reasons for change :
- 6 Proposed change in the approved Program of research:
- 7 Number of credits completed so far Under the approved program:
- 8 a. Whether already earned credits are to be retained or to be deleted:  
b. if retained, justification:

Signature of the student

**Approval of the Advisory Committee**

<b>Advisory committee</b>	<b>Name</b>	<b>Signature</b>
Chairperson		
Members		
Intra		
Inter		

Professor and Head

**ANNEXURE-V**  
**DEPARTMENT OF \_\_\_\_\_**  
**PROFORMA FOR EVALUATION OF SEMINAR**

1. Name of the candidate :
2. Register Number :
3. Degree programme :
4. Semester :
5. Topic of the seminar  
and credit :
6. Distribution of marks

Distribution of marks	Max Marks				
i. Literature coverage	40				
ii. Presentation	30				
iii. Use of audio – visual aid	10				
iv. Interactive skills	20				
Total	100				
Name					
Designation		Chairperson	Intra Member	Inter Member	Average
Signature					

Grade point:

Head of the Department



**ANNEXURE-VI**  
**PROFORMA FOR REGISTRATION OF RESEARCH CREDITS**

(To be given during first week of semester)

**PART A: PROGRAM**

Semester:

Year:

Date of registration:

1. Name of the student and
2. Enrolment number:/Reg. No.:
3. Total research credits completed so far:
4. Research credits registered during the semester:
5. Program of work for this semester (list out the  
Items of research work to be undertaken during  
the semester) :

Approval of advisory committee

<b>Advisory committee</b>	<b>Name</b>	<b>Signature</b>
Chairperson		
Members		
1. Intra		
2. Inter		

Professor and Head

*Approval may be accorded within 10 days of registration*

**ANNEXURE-VII**  
**PROFORMA FOR EVALUATION OF RESEARCH CREDITS**  
**PART B EVALUATION**

**(Evaluation to be done before the closure of Semester)**

Date of Commencement semester:

Date of closure of semester:

Date of evaluation:

1. Name of the student
2. Enrolment number: Reg. No.:
3. Total research credits completed so far:
4. Research credits registered during the semester:
5. Whether the research work has been carried out as per the approved program:
6. If there is deviation specify the reasons :
7. Performance of the candidate :                      **SATISFACTORY /NOT SATISFACTORY**

**Approval of the advisory committee**

<b>Advisory committee</b>	<b>Name</b>	<b>Signature</b>
Chairperson		
Members		
1.Intra		
2.Inter		

Professor and Head

**ANNEXURE- VIII**  
**ANNAMALAI UNIVERSITY**  
**FACULTY OF AGRICULTURE**  
**DEPARTMENT OF \_\_\_\_\_**  
**PROFORMA FOR EVALUATION OF THESIS**

1. Name of the examiner:
2. Postal Address:
3. Telephone/Mobile:
4. E-Mail:
5. Name of the candidate :
6. Title of the thesis:
7. Date of receipt of the thesis copy:
8. Date of dispatch of the detailed report and thesis by the examiner to the Controller of Examinations:
9. Examiner's recommendations choosing one of the following based on quality of thesis  
Please give your specific recommendation (select any one decision from the list below) with your signature and enclose your detailed report in separate sheet(s).
  - a. I recommend that the thesis entitled -----  
-----submitted by ----- be accepted for award of the Degree of MASTER OF SCIENCE (AGRICULTURE / HORTICULTURE / AGRI BUSINESS MANAGEMENT ) of Annamalai University, Annamalainagar.  

**(OR)**
  - b. I do not recommend the acceptance of the thesis entitled.  
-----  
----- Submitted by -----  
-----for award of the Degree of MASTER OF SCIENCE (AGRICULTURE / HORTICULTURE / AGRI BUSINESS MANAGEMENT) of Annamalai University, Annamalainagar. (Please specify reasons)

Date:

Signature with Office Seal:

**Note- Please enclose a detailed report in duplicate duly signed by you giving the merits and demerits of the thesis on the choice of problem, review of literature, methods followed, results and discussion, etc.**

## PROFORMA FOR REPORT OF THE FINAL VIVA VOCE EXAMINATION

The meeting of the Examining Committee for Mr./Ms. -----M.Sc.(Ag.)  
Student Reg.No. ----- Majoring in -----was held at -----  
-a.m /p.m on -----

The following members were present:

1. ----- : Chairperson
2. ----- : Member
3. ----- : Member
4. ----- : External examiner

The committee took note of the report of the external examiner Dr. -----recommending the thesis for acceptance.

The final viva voce examination for the candidate was conducted by the members of the Advisory Committee and external examiner. The candidate has secured satisfactory/unsatisfactory

The Committee recommends/ does not recommend unanimously the award of Degree of M.Sc.(Ag.) to Mr./Ms.-----

1. Chairman
2. Member
3. Member
4. External examiner:

The original report from the External Examiner is attached herewith

Chairperson of the Advisory Committee

Professor and Head

**CERTIFICATE FOR HAVING CARRIED OUT THE SUGGESTIONS OF THE  
EXTERNAL EXAMINER AND ADVISORY COMMITTEE**

Certified that Mr./ Ms. ----- Reg. No. -----has carried out all the corrections and suggestions as pointed out by the External examiner and the Advisory Committee. He / She has submitted **TWO** copies of his/ M.Sc.(Ag.)/(Hort.)/Agri Business Management thesis in hard bound cover and two soft copies in CD format, two copies each of the abstract of thesis and summary of the findings both in Tamil and English in CD format.

Chairperson

Professor and Head

**ANNAMALAI**  **UNIVERSITY**

**DEPARTMENT OF \_\_\_\_\_**  
**FACULTY OF AGRICULTURE**

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Date:

**CERTIFICATE**

This is to certify that the thesis entitled “-----” submitted in partial fulfillment of the requirements for the award of the degree of ----- to Annamalai University, Annamalainagar is a record of bonafide research work carried out by -----, under my guidance and supervision and that no part of this thesis has been submitted for the award of any other degree, diploma, fellowship or other similar titles or prizes and that the work has been published / not been published in part or full in any scientific or popular journals or magazines.

Chairman

1. Chairman :
2. Member :
3. Member :
4. External examiner :

