FACULTY OF AGRICULTURE
COMMON REGULATIONS FOR ALL
M.Sc. (AGRICULTURE / HORTICULTURE) AND MBA (AGRI. BUSINESS MANAGEMENT) PROGRAMMES OFFERED BY
THE FACULTY OF AGRICULTURE
WITH EFFECT FROM 2022-2023

1. Short title and commencement

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

Academic Year and Registration

- 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.
- 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.
- 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

Registration Cards

- A student shall register the courses offered in a semester by writing all the courses in registration card in quadruplicate.
- 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.
- The Dean shall approve the registration cards.
- The approved registration cards shall be maintained by the Head of the Department, Chairman and the student concerned.
- The list of courses registered by the students in each semester shall be sent by the Dean to the Controller of Examinations/University for preparation of Report Cards

2. Definitions

- "Semester" means an academic term consisting of 110 working days including final theory examinations.
- "Subject" means a unit of instruction to be covered in a semester having specific No., title and credits.
- "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.
- "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.

- "Credit Point" means the grade point multiplied by credit hours.
- "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.

"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.

3. Courses offered

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

- Agronomy
- Entomology
- Agricultural Microbiology
- Genetics and Plant Breeding
- Seed Science and Technology
- Plant Molecular biology and Biotechnology
- Horticulture -
  - Fruit Science
  - Vegetable Science
  - Floriculture and Landscape Architecture
  - Plantation, Spices, Medicinal and Aromatic Crops
- Plant Pathology
- Soil Science and Agricultural Chemistry
- Agricultural Extension
- Agricultural Economics
- M.B.A (Agri. Business Management)

4. Eligibility for admission

Candidates for admission to the M.Sc. (Ag./Hort.) programme should satisfy the following requirements.

4.1. Candidates seeking admission to the M.Sc. (Ag./Hort.) Degree programme should have completed any one of the following four year degree programme from Faculty of Agriculture, Annamalai university or Universities/colleges accredited with ICAR, New Delhi.

- **For M.Sc. (Ag.) Agronomy**

Eligibility: B.Sc. (Hons.) Agriculture / B.Sc. (Ag.) courses of four years duration.

- **For M.Sc. (Ag.) Entomology, Genetics and Plant Breeding, Plant Pathology, Soil Science and Agricultural Chemistry, Seed Science and Technology, Plant Molecular biology and Biotechnology, Agricultural Microbiology, Agricultural Extension, Agricultural Economics and M.B.A (Agri. Business Management)**

Eligibility: B.Sc. (Hons.) Agriculture / B.Sc. (Hons.) Horticulture/B.Sc. (Ag.)/B.Sc. (Hort.) of four years duration.

- **For M.Sc. (Hort.)**
  Eligibility: B.Sc. (Hons.) Agriculture / B.Sc. (Hons.) Horticulture/ B.Sc. (Hort.) and B.Sc. (Ag.) courses of four years duration.

4.2. 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 points 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.

4.3. 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

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

5.1. 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 year 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. The requirement shall be treated as satisfactory in the cases in which a student submits his/ her thesis any time during the 4th semester of his/ her resident ship at the University.

5.2 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.

I) Course work	
Major Courses	20
Minor Courses	08
Supporting Courses	06
Common Courses	05
Seminar	01
ii) Thesis Research	30
Total credits	**70**

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

Minor courses: From the courses closely related to a student's major subjectchosen by the students in consultation with the Head of the department and the Chairman based on their research specialization.

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, Agricultural Entomology, Genetics and Plant Breeding, Plant Pathology, Soil Science and Agricultural

Chemistry, Seed Science and Technology, Plant 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 M.Sc. (Ag.) Agricultural Extension, 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)

Common Courses: The following courses (one credit each) will be offered to all students undergoing 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 (1+0)
3. PGS 503 - Basic Concepts in Laboratory Techniques (0+1)
4. PGS 504 - Library and Information Services (1+0)
5. PGS 505 - Intellectual Property and its management in Agriculture (1+0)

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).

5.4. 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.

6. Attendance requirement

6.1. 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.

6.2 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.

7. Advisory Committee

7.1. 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.

7.2 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. However, they are restrained from the evaluation of Research/Seminar evaluation.

7.3. **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.

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 will enter into Memorandum of Understanding (MOU) with other Universities/ Institutions for conducting research. 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, SAC, by mutual consent, primarily on the basis of intellectual input and time devoted for carrying out the research work at the particular institution.

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.

Changes in the Advisory Committee:

i. 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.

ii. 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:

   a) The concerned staff member must be resident in India and if he/ she agrees to guide research and must be available for occasional consultations;
   b) An application is made by the student concerned duly supported by the Advisory Committee;
   c) The Head of the Department and the Dean, Faculty of Agriculture agree to the proposal;

iii. 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.

iv. The change shall be communicated to all concerned by the Head of Department.

7.4. **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.

8. Programme of Study

8.1 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.

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

8.3 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.

9. EVALUATION OF STUDENTS' PERFORMANCE

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

9.1 First Test (FT) and Mid-semester examination (MSE)

9.1.1 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.

9.1.2 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 sixth week from the date of registration of the course and evaluate. The evaluation process will be of descriptive type.

9.1.3 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.

9.1.4. 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.

9.1.5 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.

9.1.6 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.

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

9.1.8 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.

9.1.9 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
Total	**100**	**100**	**100**

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

9.2. Final examinations

9.2.1. The final theory and Practical examinations will be of two and a half hours duration each conducted separately by the University.

9.2.2. The final theory and Practical examinations will be evaluated by respective course teacher)

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

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

Final theory examination

For subjects with Practical (2½ hour duration) (Total marks: 30)

1. Definitions	5 out of 7	5 x1 marks	5 marks
2. Short Notes	2 out of 3	2 x2½ marks	5 marks
3. Essay Type	Either or type (one question from each unit)	5 x 4 marks	20 marks

For subjects without Practical (2½ hour duration) (Total marks: 50)

1. Definitions	6 out of 8	6 x1 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)	5 x 7 marks	35 marks

9.2.4**. 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.

9.2.5. 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	55
2	Assignment/specimen collection	5	5
3	Record	5	5
4	Viva voce	5	5
	Total	**40**	**70**

The pattern of Practical part should be uniform in each Department

9.3. 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 Re-appearance (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 a10 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.

9.4. Class / Percentage ranking

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

OGPA	Percentage	**Class**
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

10. Credit Seminar

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

10.1 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.

10.2. 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.

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

10.4. 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. 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.

10.5 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
Total	**100**

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

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

11.2. 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.

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

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

12. Research Work

12.1. 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.

12.2. 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.**

13. Evaluation of Thesis Research

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

13.2. 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.

13.3. 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.

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

Situation - I

The students 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/ unfavorable 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 favorable 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.

Situation -V

If a student could not complete qualifying examination till the end of the final semester/grace period, 'E' grade should be awarded for the final block of the research credits registered in the final semester. He / She has to re-register the same block of research credits in the next semester and attend the qualifying examination when conducted by the Controller of Examinations.

14. Submission of Thesis

14.1. 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.

14.2 The research credits registered in the last semester of post graduate programme 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.

14.3 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.**

14.4 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 %.**

15. Grace period

15.1 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 (s) who re-register the credits after availing the grace period will not be permitted to avail grace period.

15.2 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.

16. 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.

17. 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.

18. Evaluation of Thesis

18.1 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.

18.2 The external examiner will send the evaluation report in duplicate one marked to the Controller of Examination and another to the Head of the Department along with the corrected copy of the thesis. If the report is favorable, 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.

18.3 In case of rejection of the thesis by the external examiner the Head of the Department concerned and Advisory Committee refer the thesis for valuation by a second external

examiner. If the second external examiner recommends the thesis for acceptance, Viva-Voce will be conducted.

18.4 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.

18.5 After incorporating the suggestions of the examiners and those received at the time of viva-voce, two hard bound copies of thesis should be submitted to the Department (one to the scholar and one to the chairperson) and two soft copies in CDs to the University. At the time of final submission, the advisory committee members should certify the corrections and suggestions carried out as indicated by the examiners. However, fellowship holder has to submit a hard bound copy also as per the need, 3 copies of abstract of thesis (in 10-15 lines), 2 copies of the summary of the findings both in Tamil and English and also in C.D. form.

19. Revision of thesis

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

19.1 For revision of draft, the thesis should be resubmitted after a minimum of one month from the date of communication from the controller of examination

19.2 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 carrying out the necessary corrections indicated by the external examiner and necessary certificates obtained from the chairman and HOD before the conduct of the final viva-voce.

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

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

20.1 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.

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

20.3 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

21. 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 also 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 Advisor 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 and10 for writing the report followed by viva-voce similar to dissertation
- 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

22. Result notification

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

22.2 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 transcript. Based on the total credits admitted, the final Grade Point Average shall be calculated and given.

23. 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.

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SST M.Sc. (Ag.) Seed Science and Technology

Courses with Credit Load

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

Distribution Pattern of Courses and Credit (For Research Program)

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

Distribution Pattern of Courses and Credit (For IDEA Program)

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

Distribution Pattern of Courses and Credit

S. No.	Course Code	Course Title	Credit Hours
		Compulsory Major Courses	
1	SST 501*	Seed Developmental Biology	2(1+1)
2	SST 503*	Seed Production Principles and Techniques in Field Crops	3(2+1)
3	SST 504*	Seed Production Principles and Techniques in Vegetable crops	3(2+1)
4	SST 507*	Seed Legislation and Certification	3(2+1)
5	SST 508*	Post-Harvest Handling and Storage of Seeds	3(2+1)
		Optional Major Courses	
5	SST 502	Seed Dormancy and Germination	2(1+1)
6	SST 505	Seed Production Techniques in Fruits, Flowers, Spices, Plantation and Medicinal Crops	3(2+1)
7	SST 513	Principles of Seed Production	3(2+1)
8	SST 514	Hybrid Breeding	3(2+1)
9	SST 515	Mutagenesis and Mutation Breeding	3(2+1)
		Minor Courses	
12	SST 506	Seed Production Techniques in Forage, Pasture and Green manure crops	2(1+1)
13	SST509*	Seed Quality Testing and Enhancement	2(1+1)
14	SST 510	Seed Technology of Tree Species	2(1+1)
15	SST 511	Seed Industry and Marketing Management	2(1+1)
16	SST 512	Seed Health Testing and Management	2(1+1)
		Supporting Courses	
22	PGS 501	Library and Information Services	0+1
23	PGS 502	Technical Writing and Communications Skills	0+1
24	PGS 503	Intellectual Property and its Management in Agriculture	1+0
25	PGS 504	Basic Concepts in Laboratory Techniques	0+1
26	PGS 505	Agricultural Research, Research Ethics and Rural Development Programme	1+0
27	AGR 591	**Master's Seminar**	1 (0+1)
28	AGR 599	**Research**	30

Programme Outcomes (POs)

1. Learn the meaning of seed, its structure, development and maturation and their importance in crop production
2. Students will acquire knowledge and basic principles related to quality seed production of varieties and hybrids in agricultural and horticultural crops
3. To promulgate knowledge about mechanism involved in dormancy and stress management for quality seed production
4. To initiate basic methods and principle related to seed quality testing and seed standards
5. To disseminate the knowledge on seed laws related to quality control programme for the needy fast growing seed sector

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PO and CO Mapping Matrix

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

SEMESTER WISE DISTRIBUTION OF COURSES (RESEARCH)

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

SEMESTER WISE DISTRIBUTION OF COURSES (IDEA)

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

SST 501-SEED DEVELOPMENTAL BIOLOGY - (1+1)

Learning objectives

- To impart basic knowledge of seed development and its structures.
- To appraise students with its relevance to production of quality seed.
- Student gain knowledge about meaning of seed and its structure
- Student will get knowledge on seed development and maturation of various crop plants
- Student will get knowledge on pollination behavior and food reserves accumulation pattern of crop plant

Theory

Unit I; Introduction

Floral biology – types of pollination, mechanisms; sporogenesis – micro and megasporogenesis; gametogenesis – development of male and female gametes and their structures; pollination and fertilization mode of pollination, double fertilization, factors affecting pollination, fertilization; self-incompatibility and male sterility.

Unit II; Seed development

Embryogenesis – development of monocot and dicot embryos– embryo plane formation – development of endosperm, cotyledons and seed coat – hard seed; apomixis – identification, classification, significance and its utilization; poly-embryony types and significance; haplontic and diplontic sterility system, causes of embryo abortion, embryo rescue technique; somatic embryogenesis.

Unit III; Synthesis of storage reserves

Source of assimilates – mechanism of translocation; chemical composition–synthesis and deposition of storage reserves – starch, protein, fat and secondary metabolites – hormonal regulation.

Unit IV; Types of seeds and seed desiccation

Maturation drying – orthodox and recalcitrant seeds – desiccation tolerance– mechanism – structural changes during desiccation – role of LEA protein.

Unit V; Maturity index

Seed maturity indices – physiological and harvestable maturity; biotic and abiotic factors influencing seed development–development of hard seeds.

Practical

Study of floral biology of monocots and dicots. microsporogenesis and megasporogenesis. study of pollen grains – pollen morphology, pollen germination and pollen sterility - Anatomy and morphology of seed coat – Hard seed coat development- Seed development and maturation in agricultural and horticultural crops - types monocot and dicot embryos. External and internal structures of monocot and dicot seeds. seed coat structures- biochemical changes during seed development- physiological and harvestable maturity indices - seed dormancy- preparation of seed albums and identification.

Lesson plan

Theory lecture schedule

1. Floral biology, Types of pollination, mechanisms; sporogenesis, Micro and megasporogenesis; gametogenesis,
2. Development of male and female gametes and their structures
3. Pollination and fertilization–mode of pollination, double fertilization, factors affecting pollination, Fertilization; self-incompatibility and male sterility.
4. Embryogenesis, Development of monocot and dicot embryos, Embryo plane formation
5. First Test
6. Development of endosperm, cotyledons and seed coat–hard seed
7. Apomixis, identification, classification, significance and its utilization

8. Poly- embryony–types and significance
9. **Mid semester examination**
10. Haplontic and diplontic sterility system, Causes of embryo abortion
11. Embryo rescue technique, Somatic embryogenesis
12. Seed development, Source of assimilates – mechanism of translocation, Chemical composition – synthesis and deposition of storage reserves
13. Starch, protein, fat and secondary metabolites, Hormonal regulation
14. Maturation drying – OrthodoX seeds, Recalcitrant seeds
15. Desiccation tolerance - Mechanism, Structural changes during desiccation, Role of LEA protein
16. Seed maturity indices, Physiological maturity, Harvestable maturity
17. Biotic factors influencing seed development, Abiotic factors influencing seed development, Development of hard seeds.

Practical schedule

1. Study on floral biology of monocot
2. Study on floral biology of dicot plant. Study on pollen morphology of different crops
3. Pollen germination and viability test in major crops
4. Seed embryo and endosperm development in monocots
5. Seed embryo and cotyledon development in dicots
6. Anatomy and morphology of seed coat during development
7. Hard seed coat development
8. Study one EXternal and internal structures
10. Seed development and maturation in agricultural crops – physical and physiological changes
11. Seed development and maturation in horticultural crops-physical and physiological changes
12. Study of biochemical changes during seed development and maturation in agricultural crops
13. Study of biochemical changes during seed development and maturation in horticultural crops
14. Study on physiological and harvestable maturity and maturity indices in differentcrops
15. Study on acquisition of seed dormancy and germination at different stages of maturity
16. Preparation of seed album and identification of seeds
17. **Final Practical examination.**

Course outcome

CO1: Successful completion of this course enable students to take up advanced research on seed developmental biology

CO2: Understanding on fundamental aspects of gametogenesis

CO3: Student learns about seed development and maturity

CO4: Acquire Knowledge on physiological and harvestable maturity

CO5: To understand the basic concepts on seed dormancy.

CO-PO Mapping matrix

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

References

1. Adkins SW, Ashmore SE and Navi SC. 2007. *Seeds: Biology, DevelopmentandEcology*.CAB International, OXford shire, UK.

2. Bewley JD, Bradford KJ, Hilhorst HWM and Nanogaki H. 2013. *Seeds: Physiology of Development, Germination and Dormancy*. Springer, New York.
3. Black M, Bewley JD and Halmer P. 2006. *The Encyclopedia of Seeds: Science, Technology and Uses*. CAB International publications, UK.
4. Maiti RK, Sarkar NC and Singh VP. 2006. *Principles of Post Harvest Seed Physiology and Technology*. Agro bios, Jodhpur, Rajasthan.
5. Vanangamudi, K. 2014. Seed Science and Technology – An illustrated text book. New India Publishing Agency, New Delhi.

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1. https://springer.com/in/book/9783642810619
2. https://springer.com/in/book/9780792373223
3. https://springer.com/gp/book/9780792346456
4. https://cabi.org/bookshop/book/9780851997230
5. https://worldcat.org/title/seed-development-and germination/oclc/44954614

SST502 – SEED DORMANCY AND GERMINATION - (1+1)

Learning objectives

- To study the basic concepts of dormancy, evolution of dormancy during seed development and its mechanism.
- To impart knowledge on significance, induction and release of seed dormancy.
- Study about the methods to overcome the seed dormancy.
- To study about germination, types and factors influencing germination and their management.
- To know about physical, physiological, biochemical changes during seed germination.

Theory

Unit I; Seed dormancy concept and theories

Seed dormancy – definition, concept and theories – significance – evolution; classification and mechanism of dormancy – ecological significance – environmental factors influencing dormancy induction and release – seasonal influence – winter and summer annuals

Unit II; Dormancy induction and control

Induction of dormancy during development – hormonal, physiological, molecular and genetic control of dormancy – maternal and paternal contribution –secondary dormancy induction mechanism; artificial induction of dormancy and release - soil seed bank – natural release of dormancy and its mechanism; dormancy breaking–principles and methods.

Unit III; Seed germination

Seed germination – types and phases of germination; imbibition – pattern and water kinetics – events of germination – physical, physiological, biochemical changes - aerobic and anaerobic respiration quiescent

Unit IV; Physiological and biochemical changes

Enzyme activation–mechanism–factors affecting enzyme activation–break down of stored materials – starch, protein and fat – energy generation – mobilization of storage reserves–changes in phenolic compounds.

Unit V; Molecular and genetic mechanisms

Molecular and genetic control of seed germination – auto tropism; factors affecting germination – media– temperature –light –gases; *in-situ* and viviparous germination–causes and mechanism–pattern of seed germination–tri-phasic curve.

Practical

Seed dormancy – identification of dormancy - Estimation of ABA and GA in dormant and non-dormant seeds - Study on artificial induction of dormancy - Dormancy breaking methods – scarification and stratification - Dormancy breaking methods – hormonal and chemical

treatments - Dormancy breaking methods – after ripening and leaching of inhibitors - Dormancy breaking methods – combined treatments - Assessing the period of natural release of seed dormancy - Seed germination – studying the pattern of imbibitions - Studying the pattern of seed germination in different media - Study on influence of light and temperature on germination and seedling development - Estimation of hydrolytic enzyme – amylase in different species - Estimation of hydrolytic enzyme – protease - Estimation of hydrolytic enzyme – lipase - Estimation of dehydrogenase enzyme and respiratory quotient in seeds - Estimation of food reserve composition during seed germination.

Lesson plan

Theory lecture schedule

1. Seed dormancy–definition, concept and theories –significance–evolution
2. Classification and mechanism of dormancy– ecological significance
3. Induction of dormancy during development – hormonal, physiological, molecular and genetic control of dormancy – maternal and paternal contribution;
4. Environmental factors influencing dormancy induction and release – seasonal influence – winter and summer annuals.
5. **First Test**
6. Secondary dormancy induction mechanism; artificial induction of dormancy and release.
7. Soil seed bank – natural release of dormancy and its mechanism.
8. Dormancy breaking–principles and methods.
9. **Mid-semester Examination**
10. Seed germination–types and phases of germination; imbibition–pattern and water kinetics.
11. Events of germination–physical, physiological, biochemical changes aerobic and anaerobic respiration quiescent.
12. Enzyme activation–mechanism–factors affecting enzyme activation
13. Breakdown of stored materials – starch, protein and fat - Energy generation – mobilization of storage reserves–changes in phenolic compounds.
14. Molecular and genetic control of seed germination – auto tropism
15. Factors affecting germination – media– temperature –light –gases
16. *In-situ* and viviparous germination – causes and mechanism
17. Pattern of seed germination–tri-phasic curve.

Practical schedule

1. Seed dormancy–identification of dormancy
2. Estimation of ABA and GA in dormant and non-dormant seeds
3. Study on artificial induction of dormancy
4. Dormancy breaking methods – scarification and stratification
5. Dormancy breaking methods–hormonal and chemical treatments
6. Dormancy breaking methods–after ripening and leaching of inhibitors
7. Dormancy breaking methods–combined treatments
8. Assessing the period of natural release of seed dormancy
9. Seed germination–studying the pattern of imbibition
10. Studying the pattern of seed germination in different media
11. Study on influence of light and temperature on germination and seedling development
12. Estimation of hydrolytic enzyme–amylase in different species
13. Estimation of hydrolytic enzyme–protease
14. Estimation of hydrolytic enzyme–lipase
15. Estimation of dehydrogenase enzyme and respiratory quotient in seeds
16. Estimation of food reserve composition during seed germination
17. **Final Practical Examination**

Course outcome

CO 1: Students be able to understand the basic concepts of seed dormancy and evolution of dormancy during seed development

CO 2: Acquire knowledge on mechanism and induction of dormancy

CO 3: Students learn about the various methods to break the seed dormancy

CO 4: Understand about seed germination, types and various factors affecting seed germination

CO 5: Understand the various methods of testing hormones and food reserve composition.

CO-PO Mapping matrix

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

References

1. Baskin C and Baskin JM. 2014. *Seeds: Ecology, Biogeography, and Evolution of Dormancy and Germination*. Academic Press, Cambridge, UK.
2. Kozlowski TT. 2012. *Seed Biology: Importance, Development and Germination*. (Vol. I). Academic Press Inc., New York.
3. Rattan Lal Agarwal. 2021. Seed Technology. Oxford and IBH Publishing Co. Pvt Ltd.
4. Phundan Singh. 2013. Principles of Seed Technology. Kalyani Publishers.
5. P. K. Upadhyay. 2013. Principles of Seed Technology. Kalyani Publishers.

e-resources

1. https://springer.com/in/book/9780792373223
2. https://elsevier.com/books/the-germination-of-seeds/mayer/978-0-08-028853-6
3. https://agriinfo.in/botany/18/
4. https://mdpi.com/journal/agriculture/special_issues/Seed_Technology
5. https://bioone.org/journals/the-arabidopsis-book/volume-2008/issue 6/tab.0119/Seed-Dormancy-and-Germination/10.1199/tab.0119.full

SST 503 - SEED PRODUCTION PRINCIPLES AND TECHNIQUES IN FIELD CROPS - (2 + 1)

Learning objectives

- To impart knowledge on production principles involved in quality seed production of field crops.
- To appraise student with knowledge on management practices involved in quality seed production of field crops.
- To impart knowledge of seed production planning of field crops
- To appraise students with knowledge on importance of quality seed production in agriculture.
- To impart knowledge on concept of participatory seed production

Theory

Unit I; Introduction

Importance of seed – seed quality concept – factors influencing seed production; generation system of seed multiplication – classes of seed, stages of seed multiplication in varieties and hybrids – seed multiplication ratio (SMR) – seed replacement rate (SRR) – seed renewal period (SRP) – varietal replacement rate (VRR).

Unit II; Seed Production of Cereals and Millets

Genetic and agronomic principles of variety and hybrid seed production; methods and techniques of seed production in varieties and hybrids of important cereals and millets – wheat, oat, rice, maize, sorghum and pearl millet; varietal seed production in small millets – finger millet, fox tail millet, little millet, kodo millet, proso millet and barnyard millet.

Unit III; Seed Production of Pulses

Methods and techniques of varietal seed production in major pulses – black gram, green gram, cowpea, chickpea, horse gram, soybean and lentil – varietal and hybrid seed production in red gram.

Unit IV; **Seed Production of Oilseeds and Fibers**

Methods and techniques of seed production in major oil seed crops – groundnut, sesame – varietal and hybrid seed production in sunflower, castor and mustard; varietal seed production in minor oilseed crops (safflower, linseed, Niger) – varietal and hybrid seed production in cotton – varietal seed production in jute.

Unit V; Seed Production Planning

Seed production planning for varieties and hybrids of major crops; participatory seed production – seed hubs, seed village concept and community seed bank.

Practical

Seed selection–quality of seed on field establishment; Sowing and nursery management techniques; Planting–age of seedling on crop establishment–rice and pearl millet; Isolation distance and border rows in hybrid seed production field–space and barrier isolation; modifying isolation based on border rows in maize; Planting design for hybrid seed production–rice, maize, pearl millet, cotton, red gram, sunflower; Practicing breeding tools for hybrid seed production–detasseling–emasculation and dusting; Study on methods of achieving synchronization–rice, bajra, sunflower; Practicing supplementary pollination–rice and sunflower; Study on foliar nutrition and influence on seed yield; Practicing rouging operation–identification of off-types, pollen shedders, shedding tassels, partials, selfed bolls; Pre and post harvest sanitation operations–cereals, millets and pulses; Estimation of shattering and shattering loss; study on in-situ germination and loss; Visit to seed production fields; Visit to seed industry; Seed production planning and economics of seed production–varieties; Seed production planning and economics of seed production–hybrids.

Lesson plan

Theory lecture schedule

1. Seed – its Importance and concept of quality seed in crop production.
2. Factors influencing seed production.
3. Generation system of seed multiplication and its classes of seed.
4. Stages of seed multiplication in varieties and hybrids seed multiplication ratio (SMR) seed replacement rate (SRR) seed renewal period (SRP) varietal replacement rate (VRR).
5. Genetic and agronomic principles of variety and hybrid seed production.
6. Basic principles in seed production
7. Methods and techniques of seed production in rice
8. Methods and techniques of seed production in wheat
9. **First test**
10. Methods and techniques of seed production in maize
11. Methods and techniques of seed production in sorghum
12. Methods and techniques of seed production in pearl millet
13. Methods and techniques of seed production in oats.
14. Varietal seed production in small millets- finger millet
15. Varietal seed production in small millets - fox tail millet and little millet.
16. Varietal seed production in small millets - proso millet, barnyard millet and kodo millet.
17. **Mid semester examination**
18. Floral structure, breeding and pollination mechanism in Pulses.
19. Varietal and hybrid seed production in red gram.
20. Varietal seed production in black gram and green gram
21. Varietal seed production in cowpea and horse gram
22. Varietal seed production in chick pea

23. Varietal seed production in soybean and lentil
24. Floral structure, breeding and pollination mechanism in oil seeds
25. Methods and techniques of seed production in groundnut.
26. Methods and techniques of seed production in sesame.
27. Methods and techniques of seed production in castor and mustard
28. Varietal and hybrid seed production in sunflower.
29. Varietal and hybrid seed production in cotton.
30. Varietal seed production in safflower.
31. Varietal seed production in linseed and Niger
32. Seed production planning for varieties and hybrids of major crops
33. Seed village concept
34. Participatory seed production, seed hubs and community seed bank.

Practical schedule

1. Seed selection and performance of quality seed on field establishment.
2. Sowing and nursery management techniques.
3. Planting – age of seedling on crop establishment – rice and pearl millet.
4. Isolation distance and border rows in hybrid seed production field – space and barrier isolation and modifying isolation based on border rows in maize
5. Planting design for hybrid seed production – rice, maize, pearl millet, cotton, red gram and sunflower.
6. Practicing breeding tools for hybrid seed production – detasseling – emasculation and dusting.
7. Study on methods of achieving synchronization of flowering – rice, bajra and sunflower.
8. Practicing supplementary pollination – rice and sunflower.
9. Study on foliar nutrition and influence on seed yield.
10. Practicing rouging operation – identification of off-types, pollen shedders, shedding tassels, partials and selfed bolls.
11. Pre and post harvest sanitation operations – cereals, millets and pulses.
12. Estimation of shattering and shattering loss
13. Study on in-situ germination and loss.
14. Visit to seed production fields.
15. Seed production planning and economics of seed production – varieties.
16. Seed production planning and economics of seed production – hybrids.
17. **Practical examination**

Course Outcome

CO1: Students understand the importance of improved varieties of quality seeds in agriculture
CO2: Students know the basic principles involved in seed production
CO3: Student grasp the significance of various tools involved in hybrid seed production of field crops
CO4: Student understand the systems of quality control in seed production of field crops.
CO5: Build confidence among students to start a private seed venture.

CO-PO Mapping matrix

	PO1	PO2	PO3	PO4	PO5
CO1	3				
CO2		3			
CO3					

CO4					2
CO5					

References

1. Agrawal RL. 2019. Seed Technology. Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
2. Joshi AK and Singh BD. 2004. Seed Science and Technology. Kalyani Publishers, New Delhi.
3. Maiti RK, Sarkar NC and Singh VP. 2006. Principles of Post Harvest Seed Physiology and Technology. Agro bios, Jodhpur, Rajasthan.
4. McDonald MB and Copeland L. 1998. Seed Production Principles and Practices. CBS Publishers, New Delhi.
5. Singhal NC. 2003. Hybrid Seed Production in Field Crops. Kalyani Publications, New Delhi. Sen S and Ghosh N. 2010. Seed Science and Technology. Kalyani Publishers, New Delhi.

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1. https://springer.com/in/book/9780792373223
2. https://springer.com/in/book/9780412075513
3. https://nipabooks.com/info/9788190723763/seed-production-of-field-crops
4. https://amazon.in/Production-Field-Crops-Brajesh-Tiwari/dp/9380179405
5. https://agriinfo.in/botany/18/

SST 504 - SEED PRODUCTION: PRINCIPLES AND TECHNIQUES IN VEGETABLE CROPS - (2+1)

Learning objectives

- To impart knowledge on principles involved in quality seed production of vegetable crops.
- To impart knowledge on practices involved in quality seed production of vegetable crops.
- To make students thorough knowledge on vegetable seed production.
- To enable the students to take up seed production venture in low volume high value crops.
- To make students awareness about the important and status of vegetable seed industry.

Theory

Unit I; Seed production techniques in solanaceous and malvaceous crops

Importance and present status of vegetable seed industry – factors influencing vegetable seed production; varietal and hybrid seed production techniques in major solanaceous vegetable crops – tomato, brinjal, chilli; malvaceous vegetable crop – seed production techniques of bhendi.

Unit II; Seed production techniques in cucurbitaceous and cole crops

Varietal and hybrid seed production techniques in important cucurbitaceous vegetables – gourds and melons, cole crops – cauliflower, cabbage, knol-khol, root vegetables – carrot, beetroot, turnip, radish and other temperate/ hilly vegetable crops.

Unit III; Seed production techniques in leguminous and leaf vegetables

Varietal seed production techniques in major leguminous vegetables – peas and beans; seed production techniques in leafy vegetables – amaranthus, palak, spinach, and lettuce.

Unit IV; Seed production techniques in tuber crops and bulb crops

Seed production techniques in tuber crops – potato, sweet potato, colocasia, tapioca and yam, seed-plot technique in potato – true potato seed (TPS) production techniques – seed production techniques in bulb crops – onion, garlic.

Unit V; Vegetative and clonal multiplication

Vegetative and clonal multiplication – methods, merits and demerits; clonal multiplication – potato, sweet potato, colocasia, tapioca and yam.

Practical

Identification of vegetable seeds - Study on sowing and nursery management - Study on transplanting and age of seedling on crop establishment - Studying floral biology of solanaceous, malvaceous and cucurbitaceous vegetable crops - Studying floral biology of other vegetable crops - Practicing planting design for hybrid seed production - Modification of sex ratio in cucurbits - Practicing emasculation and pollination methods - Practicing rouging operations – identification of off-

types – selfed fruits - Harvesting methods – single and multiple harvesting method - Practicing seed extraction methods – wet methods – tomato, brinjal, other cucurbitaceous fruits - Seed extraction – dry methods – chillies, bhendi, cucurbitaceous - Visit to seed production fields - Visit to private seed industry - Planning and economics of varietal seed production - Planning and economics of hybrid seed production.

Lesson plan

Theory lecture schedule

1. Importance and present scenario of vegetable seed industry
2. Factors influencing vegetable seed production
3. Varietal seed production techniques in Tomato
4. Hybrid seed production techniques in Tomato
5. Varietal and hybrid seed production techniques in Brinjal
6. Varietal and hybrid seed production techniques in Chilli
7. Varietal seed production techniques in Bhendi
8. Hybrid seed production techniques in Bhendi
9. **First Test**
10. Varietal and hybrid seed production techniques in Gourds
11. Varietal and hybrid seed production techniques in Melons
12. Varietal and hybrid seed production techniques in Cabbage
13. Varietal and hybrid seed production techniques in Cauliflower
14. Varietal and hybrid seed production techniques in Knol-Khol
15. Varietal and hybrid seed production techniques in Carrot and Beetroot
16. Varietal and hybrid seed production techniques in Turnip and Radish
17. **Mid Semester Examination**
18. Varietal seed production techniques in Peas and Beans
19. Varietal seed production techniques in Amarathus
20. Varietal seed production techniques in Palak
21. Varietal seed production techniques in Spinach and Lettuce
22. Varietal seed production techniques in Potato
23. Varietal seed production techniques in Sweet Potato
24. Varietal seed production techniques in Colocasia,
25. Varietal seed production techniques in Tapioca and Yam
26. Varietal seed production techniques in Potato – True Potato Seed (TPS)
27. Varietal seed production techniques in Onion
28. Varietal seed production techniques in Garlic
29. Vegetative and clonal multiplication methods – Merits and Demerits
30. Clonal multiplication in Potato
31. Clonal multiplication in Sweet Potato
32. Clonal multiplication in Colocasia
33. Clonal multiplication in Tapioca
34. Clonal multiplication in Yam

Practical schedule

1. Identification of vegetable seeds
2 Study on sowing and nursery management
3 Study on transplanting and age of seedling on crop establishment
4 Studying floral biology of solanaceous, malvaceous and cucurbitaceous vegetable crops
5 Studying floral biology of other vegetable crops
6 Practicing planting design for hybrid seed production
7 Modification of sex ratio in cucurbits
8 Practicing emasculation and pollination methods
9 Practicing rouging operations – identification of off-types – selfed fruits
10 Harvesting methods – single and multiple harvesting method
11 Practicing seed extraction methods – wet methods – tomato, brinjal, other cucurbitaceous fruits
12 Seed extraction – dry methods – chillies, bhendi, cucurbitaceous

13 Visit to seed production fields
14 Visit to private seed industry
15 Planning and economics of varietal seed production
16 Planning and economics of hybrid seed production
17. Final Practical Exam

Course outcome

CO 1: Understand the seed production of post-harvest techniques of solanaceous and malvaceous crops
CO 2: Understand the seed production techniques of cucurbitaceous and cole crops
CO 3: Understand the seed production techniques of leguminous and leaf vegetables
CO 4: Understand the seed production techniques of tuber crops and bulb crops
CO 5: Understand the present scenario of vegetable seed industry

CO-PO Mapping matrix

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

References

1. Agarwal RL. 2012. *Seed Technology*. Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
2. Kulkarni GN. 2011. *Principles of Seed Technology*. Kalyani Publishers, New Delhi.
3. McDonald MB and Copeland L. 1998. *Seed Production: Principles and Practices*. CBS Publishers, New Delhi.
4. Sen S and Ghosh N. 2010. Seed Science and Technology. Kalyani Publishers, New Delhi.
5. Vanangamudi K, Natarajan N, Srimathi P, Natarajan K, Saravanan T, Bhaskaran M, Bharathi A, Natesan P and Malarkodi K. 2006. *Advances in Seed Science and Technology*. Vol. 2.*Quality Seed Production in Vegetables*. Agro bios, Jodhpur.

e-resources

1. https://springer.com/in/book/9780792373223
2. http://203.64.245.61/fulltext-pdf/EB/1900-2000/eb0021.pdf
3. http://worldseed.org/wp-content/uploads/2017/01/Seed-Production-Goodpractice-10.01.17-final.pdf
4. https://trove.nla.gov.au/work/6862691?q&sort=holdings+desc&-=1541066209257&versionId=45008917+251246346
5. https://agriinfo.in/botany/18/

SST 505 -SEED PRODUCTION TECHNIQUES IN FRUITS, FLOWERS, SPICES, PLANTATION AND MEDICINAL CROPS - (2+1)

Learning objectives

- To teach the scope commercial seed production techniques
- To bring out the problems and associated with commercial seed production of fruits of flower crops.
- To excavate the problems involved the commercial seed production of spices and plantation crops.
- To expose the perspectives made in commercial seed production.
- To encourage the agricultural and horticultural graduates to become agri – horti preuners

Theory

Unit I; Scope for seed production

Scope for seed production in fruits, flowers, spices, plantation and medicinal crops; factors influencing seed production and quality; propagation methods – seed and clonal propagation; seed and seedling standards; propagation and seed production techniques in major tropical, sub-tropical and temperate fruit crops; seed orchards – seed collection, extraction processing and storage techniques.

Unit II; Seed production techniques in flower crops

Seed production techniques in commercially important flower crops – nursery management, clonal propagation, planting, seed crop management, post-harvest seed handling and storage techniques.

Unit III; Seed production techniques in spices and other spices

Seed production techniques in commercially important seed spices and other spices – nursery management, sowing, seed crop management and post-harvest seed handling and storage techniques.

Unit IV; Seed production in commercially important plantation crops

Seed production in commercially important plantation crops – mother tree selection – criteria – nursery management, elite seedling production, planting, plantation management, post-harvest handling and storage techniques.

Unit V; Methods of quality seed production

Methods of quality seed production in commercially important medicinal plants – nursery management, sowing, seed crop management, post-harvest handling and storage methods.

Practical

Study on the floral biology and pollination mechanism - Identification of seeds of fruits, flowers, spices, plantation and medicinal crops - Selection of mother plants and trees – phenotypic characters and genotypic characters - Study on different types of clonal and vegetative propagules - Seed and clonal standards of vegetatively propagating crops - Germination improvement treatments for seeds and vegetative propagules - Study on selection of planting materials and sowing methods - Nursery management practices for elite seedling production - Seed extraction methods – wet method and dry method - Post harvest seed handling – seed grading, upgrading techniques - Study of seed storage techniques - Practicing seed germination enhancement techniques in fruits, spices and plantation crops.

Lesson plan

Theory lecture schedule

1. Scope for seed production in fruits and flowers
2. Floral biology of flowers and medicinal plants
3. Floral biology of spices and plantation crops
4. Factors influencing seed production and quality
5. Propagation methods – Fruits and Flower crops
6. Clonal propagation
7. Seed and seedling standards
8. Propagation and seed production in techniques in Cassava and Sweet potato
9. **First Test**
10. Seed production techniques in commercially important flower crops
11. Quality seed production in Jasmine and Rose

12. Quality seed production in Marigold, Chrysanthemum and Zinnia
13. Seed orchards – seed collection, extraction processing, techniques
14. Seed storage techniques
15. Quality seed production in Black Pepper and Cardamom
16. Quality seed production in Coriander, Fenugreek and Nutmeg
17. **Mid Semester Examination**
18. Nursery management in temperate fruit crops
19. Clonal propagation, planting, seed crop management
20. Post-harvest seed handling and seed storage techniques
21. Seed production techniques in Tea and Coffee
22. Seed production techniques in Cashew, Coconut and Arecanut
23. Tree crop nursery management, sowing
24. Tree seed crop management
25. Post-harvest seed handling and storage techniques
26. Commercial quality seed production in Medicinal crops
27. Quality seed production in Ashwagandha and Rauvolfia
28. Seed production techniques in Senna, *Solanum nigrum* and Vettiver
29. Medicinal seed crop management
30. Post-harvest handling in medicinal crop seed
31. Handling and storage of medicinal crop seed
32. Factors influencing in seed production
33. Factors influencing in medicinal crops
34. Propagating methods of medicinal crops

Practical schedule

1. Study on the floral biology and pollination mechanism
2. Identification of seeds of fruits, flowers, spices, plantation and medicinal crops
3. Selection of mother plants and trees – phenotypic characters and genotypic characters
4. Study on different types of clonal propagules
5. Study on different types of vegetative propagules
6. Seed and clonal standards of vegetatively propagating crops
7. Germination improvement treatments for seeds propagules
8. Germination improvement treatments for vegetative propagules
9. Study on selection of planting materials and sowing methods
10. Nursery management practices for elite seedling production
11. Seed extraction methods – wet method
12. Seed extraction methods – dry method
13. Post-harvest seed handling – seed grading, upgrading techniques -
14. Study of seed storage techniques
15. Practicing seed germination enhancement techniques in fruits and spices crops.
16. Practicing seed germination enhancement techniques in plantation crop.
17. **Final Practical Examination**

Course outcome

CO 1: Understand the seed production in fruits, flowers, spices, plantation and medicinal crops
CO 2: Understand the seed production techniques of flower crops
CO 3: Understand the seed production techniques of spices and other spices
CO 4: Understand the seed production techniques of plantation crops
CO 5: Understand the methods of quality seed production

CO-PO Mapping matrix

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

CO 4		3			
CO 5		3			

References

1. Vanangamudi K and Natarajan K. 2008. *Advances in Seed Science and Technology. Quality Seed Production in Spices, Plantation, Medicinal and Aromatic crops* (Vol. 5). Agrobios. Jodhpur.
2. Vanangamudi KM Prabu and Lakshmi S. 2012. *Advances in Seed Science and Technology Vol. 7. Flower Seed Production*. Agrobios, Jodhpur.
3. Dhirendra khale, Mohan Sadashiv Bhale. 2000. Seed Technology. Scintific Publishers (India).
4. Phundan Singh. 2013. Principles of Seed Technology. Kalyani Publishers.
5. Joshi AK and Singh BD. 2004. Seed Science and Technology. Kalyani Publishers, New Delhi.

e-resources

1. http://worldseed.org/wpcontent/uploads/2017/01/Seed-Production-Good-practice-10.01.17-final.pdf
2. https://ncbi.nlm.nih.gov/pmc/articles/PMC4233836/
3. https://academia.edu/35629702/Hybrid_Seed_Production_and_Flowers
4. http://agrimoon.com/horticulture-icar-ecourse-pdf-books/
5. https://cbp.icar.gov.in/EBook.aspx

SST 506 - SEED PRODUCTION TECHNIQUES IN FORAGE, PASTURE AND GREEN MANURE CROPS -(1+1)

Learning objectives

- To impart knowledge on basic principles and methods of quality seed production in forage and green manure crops
- To appraise students with its relevance to production of quality seed in forage and fodder crops
- To impart comprehensive knowledge of seed production in green manure crops with adequate Practical training.
- To impart knowledge on the principles and techniques of seed processing for quality up gradation
- To know about the post-harvest handling techniques of seeds

Theory

Unit I; Introduction

Scope and importance of seed production in forage, pasture and green manure crops – factors influencing seed production – seasonal influence; problems and constraints in seed production – seed set, shattering and seed dormancy; vegetative and clonal propagules and apomictic seed.

Unit II; Quality seed production in fodder crops

Quality seed production techniques in major fodder crops – lucerne, hedge lucerne, leucaena, fodder sorghum, fodder maize and oats

Unit III; Quality seed production in forage grasses

Seed and planting material production techniques of major forage grasses – bajra -napier grass, guinea grass, Dinanath grass and Cenchrus sp.; forage legumes Stylosanthus, cowpea and berseem.

Unit IV; Quality seed production in green manure crops

Seed production techniques in major green manure crops – Glyricidia, Sesbania sp., sunnhemp, daincha, jute and Tephrosiasp

Unit V; Post harvest handling and upgradation

Post-harvest seed handling – processing, threshing, grading and upgrading; dormancy breaking and germination improvement – quality standards for seed and vegetative propagules

Practical

Seed collection and identification of seeds – seed setting and shattering loss, maturity indices – Seed extraction and threshing – separation of ill filled seeds – seed and clonal material standards ,

quality of planting materials and vegetative propagules – seed quality analysis in forage, fodder crops, determinate and indeterminate crops –ratooning on seed quality – quality enhancement techniques – seed extraction and dormancy breaking treatment – preparation and planting of vegetative propagules –seed production in fodder and green manure crops - economics of seed production in fodder, forage and green manure crops

Lesson plan

Theory lecture schedule

1. Scope and importance of seed production in forage, pasture and green manure crops
2. Factors influencing seed production, seasonal influence; problems and constraints in seed production
3. Seed setting, shattering and seed dormancy; vegetative and clonal propagules and apomictic seed.
4. Quality seed production techniques in fodder crops Lucerne and hedge Lucerne
5. **First test**
6. Quality seed production techniques in fodder crops Leucaena and fodder sorghum
7. Quality seed production techniques in fodder crops Fodder maize and oats
8. Seed and planting material production techniques of forage grasses Bajra and Napier grass
9. **Mid semester Examination**
10. Seed and planting material production techniques of forage grasses Guinea grass, Dinanath grass and *Cenchrus* sp
11. Seed and planting material production techniques of forage legumes Stylosanthus, cowpea and berseem.
12. Seed production techniques in green manure crops Glyricidia and Sesbania sp
13. Seed production techniques in green manure crops Sunnhemp and Daincha
14. Seed production techniques in green manure crops Jute and Tephrosia sp
15. Post-harvest seed handling processing, threshing, grading and upgrading
16. Dormancy breaking treatments and germination improvement
17. Quality standards for seed and vegetative propagules

Practical schedule

1. Seed collection and identification of seeds
2. Estimation of seed setting and shattering loss
3. Maturity indices – determination of physiological and harvestable maturity
4. Seed extraction and threshing methods
5. Separation of ill filled seeds – practicing different methods
6. Study of seed and clonal materials – standards
7. Quality of planting material and vegetative propagules on crop establishment
8. Seed quality analysis in forage and fodder crops – tiller wise quality analysis
9. Seed quality analysis in determinate and indeterminate crops
10. Study on effect of ratooning on seed quality
11. Practicing seed quality enhancement techniques
12. Practicing different seed extraction and dormancy breaking treatments
13. Preparation of vegetative propagules and planting
14. Planning for seed production in fodder and green manure crops
15. Economics of seed production in fodder, forage crops and green manure crops
16. Visit to forage and fodder seed production farms
17. **Final Practical Examination**

Course outcome:

CO 1: The students gain confidence to start a seed venture on forage and green manure crops.

CO 2: Students understand seed production techniques in these crops help to produce quality seeds to meet the growing needs

CO 3: Knowledge on processing sequence for various forage, fodder and green manure crops.

CO 4: Students acquire knowledge on seed treatment procedures

CO 5: Students also acquire skill on seed handling, seed processing, grading and upgrading of forage and green manure crops.

CO-PO Mapping matrix

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

References

1. FAO. 2007. Quality Declared Seed System. FAO Plant Production and Protection Publication, FAO, Rome
2. Phundan Singh. 2013. Principles of Seed Technology. Kalyani Publishers.
3. P. K. Upadhyay. 2013. Principles of Seed Technology. Kalyani Publishers.
4. Joshi AK and Singh BD. 2004. Seed Science and Technology. Kalyani Publishers, New Delhi.
5. Kulkarni GN. 2011. Principles of Seed Technology. Kalyani Publishers, New Delhi.

e-resources

1. https://.igfri.res.in/
2. https://cgspace.cgiar.org/handle/10568/4479
3. https://euroseeds.eu/grasses-and-clovers
4. https://sare.org/learning-center/green-manures
5. https://.ndri.res.in/ndri/Design/forageres_mag_cen.html

SST 507 - SEED LEGISLATION AND CERTIFICATION - (2+1)

Learning objectives

- To impart knowledge on seed legislation in relation to seed certification and quality control systems.
- Awareness on usage of quality seeds among farmers increases the seed demand.
- To regulate the seed quality and to avoid the spurious seeds in the market, seed legislation and certification procedures should be known by all the stake holders.
- This course will provide comprehensive knowledge on seed policies.
- This course will provide the knowledge about seed law enforcement and seed certification procedures to the learners.

Theory

Unit I; Genesis of seed Industry in India

Genesis of seed Industry in India; seed quality control – concept and objectives; regulatory mechanisms – Seed Act (1966) – Seed Rules (1968) – statutory bodies – Central Seed Committee – Central Seed Certification Board.

Unit II; Seed Control and New National seed Policy act

Seed Control Order (1983) – New Policy on Seed Development (1988) – Exim Policy – National Seed Policy (2002) – Plant Quarantine Act.

Unit III; WTO and IPR

Introduction to WTO and IPR – UPOV and its role – OECD seed certification schemes – PPV & FR Act (2001) and Rules (2003) – Seed Bill (2004 and 2011): Seed certification system in SAARC countries, Europe, Canada, Australia and USA.

Unit IV; Seed certification

Seed certification – history and objectives; general and specific crop standards, field and seed standards; seed certification agency – role of certification agency/ department and seed certification officers, phases of seed certification; field inspection – counting procedures – liable for rejection (LFR) – downgrading and partial rejection – reporting.

Unit V; Post-harvest inspection, sampling, testing, labelling, sealing and grant of certificate

Post-harvest inspection – construction of seed lot number; seed sampling – testing – labelling, sealing and grant of certificate – types and specifications for tags and labels; seed lot validity and revalidation; appellate authority, stop sale order, penalties records and registers to be maintained by seed processing units and seed dealers – verification procedures, role of seed analyst and seed inspector in quality regulation.

Practical:

Preparation of sowing report – varieties – transplanted and direct sown crops and hybrids; Verification of sowing report – seed certification procedures; Field inspection – estimation of area and isolation distance, stages of inspection for varieties and hybrids – procedures; Practicing field counting procedures – methods for row planting, broadcasted – varieties; Practicing field counting procedures – direct sown and transplanted crops – varieties; Study on field counting procedures – hybrids – planting design, planting ratio and block method and double count; Identification of contaminants – genetic and physical contaminants, procedure to remove partials, pollen shedders and shedding tassels; Assessing and calculation of field standards for important crops; LFR, partial rejection and downgrading – reasons, procedures and preparation of reports; Yield estimation – single and multiple harvest crops; Post harvest inspection – groundnut, cotton, pulses; Inspection and maintenance (licence and renewal) of records in processing unit – float test, preparation of processing report and seed lot number construction; Visit to seed certification agency/ department; Visit to grow-out test field; Visit to seed retail shop – procedures followed by Seed Inspector, verification of records and reporting; Procedure to issue tag, specification, bagging, tagging, labelling and sealing.

Lesson plan

Theory lecture schedule:

1. Introduction of seed in India, Genesis of seed Industry in India-Pre independence and post-independence.
2. Seed quality control – concept and objectives
3. Evaluation of 2nd five yr. plan-committee on plan project review 1961, Third five yr plan 1961-66, salient achievement of NSC,
4. Annual plans 1966-1969, Fourth Five yr plan 1969-74, unique feature of TDC, Fifth five yr. plan 1974-79.
5. Seed Act (1966) - Fifth, Sixth and Eight yr. plan, Role of public and private seed sector
6. Seed Rules (1968) – statutory bodies
7. Central Seed Committee – Central Seed Certification Board.
8. Seed Control Order (1983) – New Policy on Seed Development (1988),
9. **First test**
10. National Seed Policy (2002) – Plant Quarantine Act.
11. Introduction to WTO and IPR, IPR ia an international Setting, Agricultural related IPRs.
12. UPOV and its role – OECD seed certification schemes.
13. PPV & FR Act (2001) and Rules (2003)
14. Registrable and non-Registrable Plant Varieties in India.
15. Seed Bill (2004 and 2011):
16. Seed certification system in SAARC countries, Europe, Canada, Australia and USA
17. **Mid semester examination**
18. Seed certification – Introduction, definition, history and objectives
19. General and Specific crop standards, field and seed standards
20. Concept of seed certification, Principles for forming seed certification agency
21. Seed certification agency – role of certification agency/ department and seed certification officers.
22. Classes of seed
23. Phases of seed certification, Seed quality
24. Generation system of seed multiplication, Eligibility requirements for certification
25. Field inspection-definition, objectives and Procedure.
26. Field inspection-methods and counting procedure.

27. (LFR) – downgrading and partial rejection – reporting.
28. Post-harvest inspection – construction of seed lot number
29. Seed sampling – testing – labeling, sealing
30. Grant of certificate – types and specifications for tags and labels
31. Seed lot validity and revalidation
32. Appellate authority, stop sale order, penalties records and registers to be maintained by seed processing units
33. Seed dealers – verification procedures.
34. Role of seed analyst and seed inspector in quality regulation

Practical Schedule

1. Preparation of sowing report varieties transplanted and direct sown crops and hybrids;
2. Seed certification procedures;
3. Field inspection – estimation of area and isolation distance, stages of inspection for varieties and hybrids – procedures;
4. Practicing field counting procedures – methods for row planting, broadcasted – varieties;
5. Practicing field counting procedures – direct sown and transplanted crops – varieties;
6. Study on field counting procedures – hybrids – planting design, planting ratio and block method and double count;
7. Identification of genetic and physical contaminants,
8. Assessing and calculation of field standards for important crops;
9. LFR, partial rejection and downgrading – reasons, procedures and preparation of reports;
10. Yield estimation – single and multiple harvest crops;
11. Post-harvest inspection – groundnut, cotton, pulses;
12. Inspection and maintenance (licence and renewal) of records in processing unit – float test, preparation of processing report and seed lot number construction;
13. Visit to seed certification agency/ department;
14. Visit to grow-out test field;
15. Visit to seed retail shop – procedures followed by Seed Inspector, verification of records and reporting;
16. Procedure to issue tag, specification, bagging, tagging, labelling and sealing.
17. **Final practical Examination**

Course outcome

CO1: This course will be useful to develop human resource on seed certification and legislation.
CO2: To understand legal Procedures related to seed quality control.
CO3: To really understand the procedure for seed certification
CO4: To Grasp the importance of Indian minimum seed certification standards.
CO5: Successful completion of this course enables students to become a Seed Certification Officer and Seed Inspector.

CO-PO Mapping matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	-	-	2	3	-	1
CO2	-	3	2	2	3	-	1
CO3	-	-	-	-	2	-	-
CO4	-	-	-	3	1	-	1
CO5	-	-	-	-	1	1	-

References:

1. Agarwal RL. 2012. *Seed Technology*. OXford & IBH Publishing Company Pvt. Ltd., New Delhi.

2. Anon. 2016. *Manual of Seed Certification Procedures*. Directorate of Seed Certification, Coimbatore, Tamil Nadu.
3. Chakrabarthi SK. 2010. *Seed Production and Quality Control*. Kalyani Publishers, New Delhi
4. Sharma P. 2008. *Seed Legislation*. Gene-tech Book Publishers, New Delhi.
5. Tunwar NS and Singh SV. 2003. *Indian Minimum Seed Certification* Standards. Central Seed Certification Board, Ministry of Agriculture, GOI, New Delhi.

e- resources:

1. http://cms.tn.gov.in/sites/default/files/documents/seed-certification-0.pdf
2. http://odishaseedsportal.nic.in
3. https://www.india.gov.in/my-government/documents/e-books
4. https://books.google.co.in/books 5
5. https://dl.sciencesocieties.org/publications/books

SST 508 – POST HARVEST HANDLING AND STORAGE OF SEEDS - (2+1)

Learning objectives

- This course helps the student to know the healthyseedsarethedemandingenterpriseoftherecenteraftheproductionofhighyieldin theneXtseason.
- To know about the Seed treatments-methods, seed treating compounds, seed disinfestations and Packaging: principles and practices and materials.
- To get an idea about processing plant design and layout.
- To study about the Seed storage and its importance and factors affecting it.
- To study about the Conservation of orthodox and recalcitrant seeds – invitro storage techniques and cryopreservation

Theory

Unit I; Basics of seed processing

Seed processing–objectives and principles; processing sequence–threshing, shelling, ginning, eXtraction methods; drying – principles and methods; seed cleaning, grading, upgrading – methods – machineries and equipment – scalper, pre-cleaner, cleaner cum grader, specific gravity separator, indented cylinder, disc separator, spiral separator, velvet separator, magnetic separator, electronic colour sorter –working principles and functions.

Unit II; Seed processing plant and its equipment

Online seed processing – elevators and conveyers – processing plant – specifications, design and layout; mechanical injury–causes and detection–management.

Unit III; Seed treatment

Seed treatment–methods–pre and mid storage seed treatments, seed treating formulations and equipment; packaging materials– types– bagging and labeling; seed blending–principle and methods.

Unit IV; Seed storage and its importance

Seed storage – purpose and importance – factors affecting storage, optimum condition for storage of different seeds; storage principles – Harrington's thumb rule – concepts and significance of moisture equilibrium–maintenance of safe seed moisture–physical, physiological, biochemical and molecular changes during seed storage–storage behaviour of orthodoX and recalcitrant seeds–prediction of viability–viability nomograph.

Unit V; Dry and invitro storage techniques

Methods of seed storage–modified atmospheric storage–ultra dry storage–vacuum storage–cryopreservation–germplasm storage–gene banks–NBPGR, IPGRI and National seed storage laboratory; seed storage godown–structure–maintenance–sanitation.

Practical

Seed eXtraction–wet and dry methods; Seed processing sequence for different crops; Design of processing plant–equipment's–estimation of processing efficiency-Seed drying methods–principle and methods; Practicing seed grading–upgrading techniques; Delinting methods–assessment of mechanical damage; Seed packaging–effect of packaging materials on seed longevity; Prediction of viability during storage–viability nomograph and accelerated ageing test; Storage behavior of recalcitrant and orthodox seeds Pre-storage seed treatments–protectants–antioXidants–halogens; Seed storage godown–sanitation, fumigation –visit to seed storage godown and cold storage unit.

Lesson plan

Theory lecture schedule

1. Purpose of seed processing plant.
2. Different methods of threshing, ginning, shelling and extraction methods for various crops.
3. Seed quality improvement through upgrading, drying, cleaning and grading methods.
4. Seed cleaning Pre-cleaning & Pre–conditioning, machineries and equipment's.
5. Upgrading the quality of cleaned seed - Type of upgrading Operations and machineries.
6. Seed processing - elevators and conveyors - Design and layout of seed processing plant
7. Seed deterioration-causes for seed deterioration - changes during seed deterioration.
8. Seed quality improvement through upgrading - floatation technique in cereals and pulses.
9. **First test**
10. Seed treatment – history, concepts / principles and methods
11. Types of seed treatment - seed disinfection, seed disinfestations and seed protection
12. Different methods of seed treatment include -Chemicals used for Seed treatment mercurial Compounds and non-mercurial
13. Equipment for seed treatment: Slurry treater, Direct treaters, Drum mixer, Grain auger, Shovel and Coloring of Seeds
14. Seed packing and handling
15. Packaging Material - Types of packaging material: Moisture vapour permeable container, Moisture vapour resistant container and Moisture vapour proof container.
16. Equipment used for packaging of seeds and Bagging and handling
17. **Mid semester examination.**
18. Seed storage – purpose and importance and Factors affecting storage
19. Optimum condition for storage of different seeds
20. Storage principles -Harrington's thumb rule
21. Concepts and significance of moisture equilibrium -Maintenance of safe seed moisture
22. Physical, physiological, biochemical and molecular changes during seed storage
23. Storage behaviour of orthodoX and recalcitrant seeds
24. Prediction of viability–viability nomograph.
25. Factors affecting- seed longevity moisture, storage environment-biotic factors.
26. Seed storage containers MVIP and MVP containers
27. Storage container -selection criteria for agricultural and horticultural crops.
28. Improved methods of seed storage - modified ultra-dry, controlled atmosphere and vacuum storage.
29. Storage of cereals, pulses, oil seeds, fibres and fodder crops.
30. Storage of horticultural crops, vegetatively propagated crops and synthetic seeds.
31. Seed storage – traditional -modern storage - bagged storage system- silo storage – air tight – aerated-low temperature storage.
32. Controlled atmosphere storage - damp grain storage system with chemicals.
33. Prediction of storability -viability -equations -nomograph
34. Germplasm storage –gene bank- IPGRI- NBPGR.

Practical schedule

1. Seed structure germinability, and its relationship on germinability.

2. Seed eXtraction–wet and dry methods

3. Chemical composition in relation to seed viability
4. Seed storage in different containers-their effect on seed storage
5. Seed drying methods–principle and methods
6. Effect of moisture content on seed longevity.
7. Effect of Relative humidity on seed longevity.
8. Delinting methods–assessment of mechanical damage
9. Visit to seed processing unit;
10. Seed packaging–effect of packaging materials on seed longevity
11.Accelerated ageing for predicting longevity of different kinds of seeds
12. Pre-storage seed treatments–protectants–antioXidants–halogens.
13. Assessing physical changes during seed storage
14. Assessing physiological changes during seed storage;
15. Assessing biochemical changes during seed storage;
16. Storage behavior of recalcitrant seeds;
17. **Final Practical examination**

Course outcome

CO 1: The students be able to know about the seed processing principles and methods
CO 2: To know about the machineries in seed processing plant
CO 3: Students be able to know about the seed storage techniques for recalcitrant and orthodox seeds
CO 4: Invitro germplasm storage techniques and cryopreservation
CO 5: Students get an idea about seed storage go down and its maintenance

CO-PO Mapping matrix

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

References

1. Agrawal. RL 1996 Seed Technology Oxford & IBH Publication, New Delhi
2. Gupta D. 2009. *Seeds: their conservation principles and practices*. Sathish serial publishing house. New Delhi.
3. Kulkarni GN. 2011. *Principles of Seed Technology*. Kalyani Publishers, New Delhi.
4. Padmavathi S, Prakash M, EzhilKumar S, Sathiyanarayanan G and Kamaraj A. 2012. *A Textbook of Seed Science and Technology*, New India Publishing Agency, New Delhi.
5. Sen Sand Ghosh N. 2010. *Seed Science and Technology*. Kalyani Publishers, New Delhi. Singhal NC. 2010. *Seed Science and Technology*. Kalyani Publishers, New Delhi.

e- resources

1. http://fao.org/3/a-ah803e.pdf
2. agritech.tnau.ac.in/seed certification/seedtech_indeX.html
3. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=17806
4. http://bcseeds.org/wp-content/uploads/2015/01/Seed-Processing-2015-update.pdf
5. https://carolinafarmstewards.org/wpcontent/uploads/2012/05/SeedProcessing andStorageVer_1pt3.pdf

SST509- SEEDQUALITYTESTINGANDENHANCEMENT - (1+1)

Learning objectives

- To provide a comprehensive knowledge on all aspects of seed quality testing.
- To provide a knowledge on seed quality evaluation.
- To provide a knowledge on seed enhancement.
- To impart knowledge on principles, techniques and methods of seed testing and seed quality enhancement.
- To provide a comprehensive knowledge on relevance to crop performance.

Theory

Unit I; Seed Testing, Sampling and Purity Analysis

Seed testing – history and development; seed testing in India; ISTA and its role in seed testing; Seed lot and size, types of seed and size, samples – sampling – intensity and methods, sampling devices, receipt and registration of submitted samples in the laboratory and sub sampling; purity analysis – components and procedure – determination of other distinguishable varieties (ODV) and test weight determination – application of heterogeneity test – method of testing coated and pelleted seeds; seed moisture estimation – principles and methods, application of tolerances.

Unit II; Germination Test, Seedling Evaluation and Seed Health Test.

Seed germination test – requirements, media and methods – seedling evaluation, tolerance and reporting results; viability test (TZ test) – principle, procedure and evaluation; vigour tests – concept of seed vigour and vigour test – types of vigour tests – direct and indirect tests – physical, physiological and biochemical tests –principles and methods; seed health test–principles and methods.

Unit III; Genetic Purity Assessment and Testing of GM Seeds.

Genetic purity assessment–laboratory methods–physical, chemical, biochemical and molecular tests – growth chamber and field testing (Grow Out Test) methods; testing of GM seeds; storage of guard sample–referral test; application of tolerance in seed testing; advanced non- destructive techniques of seed quality analysis–soft X-ray imaging–hyper spectral imaging, thermal imaging–spectroscopy–e-nose and machine vision techniques.

Unit IV; Seed Quality Enhancement Techniques

Seed quality enhancement techniques–history and development; classification–physical, physiological and protective seed treatments–special seed treatments; physical seed treatment–liquid floatation, specific gravity separation, irradiation, electric and electro-magnetic seed treatments–principles and methods–seed pelleting and coating principles, purpose and methods.

Unit V; Biological and Physiological Seed Treatments.

Biological seed treatments – microbial inoculation; organic seed treatment–integrated seed treatment–concept and methods of designer seed. Physiological seed enhancement treatments–seed infusion, seed priming–principles and methods–physiological, biochemical and molecular mechanisms; pre-germination and fluid drilling techniques;

Practical

Seed testing – sampling and dividing methods; Determination of seed test weight and heterogeneity test; Physical purity analysis – components, procedure, reporting results. Seed moisture estimation – methods and equipment. Conduct of seed germination test and seedling evaluation; Conduct of quick viability (tetrazolium) test and evaluation. Conduct of vigor tests – direct, indirect test and special tests. Genetic purity assessment – laboratory and conventional methods – image analysis for seed quality. Conducting different seed health tests to identify bacteria, fungi and insects. Visit to seed testing laboratory. Seed enhancement techniques – practicing physical treatments and water floatation techniques; Seed coating and pelleting – uses of adhesives and filler materials. Performing seed priming – hydro, halo and bio-priming – solid matrix priming; Practicing seed infusion and microbial inoculation treatments; Practicing pre-germination technique; Studying integrated seed treatment/ designer seed treatment.

Lesson plan

Theory lecture schedule

1. Seed testing–history and development; seed testing in India;
2. ISTA and its role in seed testing; Seed lot and size, types of seed and size, samples – sampling

–intensity and methods, sampling devices, receipt and registration of submitted samples in the laboratory and sub sampling;

3. Purity analysis – components and procedure – determination of other distinguishable varieties (ODV) and test weight determination – application of heterogeneity test – method of testing coated and pelleted seeds;
4. Seed moisture estimation – principles and methods, application of tolerances. Seed germination test – requirements, media and methods – seedling evaluation, tolerance and reporting results; viability test (TZ test) – principle, procedure and evaluation;
5. **First Test**
6. Vigour tests – concept of seed vigour and vigour test – types of vigour tests – direct and indirect tests – physical, physiological and biochemical tests –principles and methods;
7. Seed health test–principles and methods.
8. Genetic purity assessment–laboratory methods–physical, chemical, biochemical and molecular tests – growth chamber and field testing (Grow Out Test) methods;
9. **Mid-semester Examination**
10. Testing of GM seeds; storage of guard sample–referral test; application of tolerance in seed testing;
11. Advanced non- destructive techniques of seed quality analysis–soft X-ray imaging–hyper spectral imaging, thermal imaging–spectroscopy–e-nose and machine vision techniques.
12. Seed quality enhancement techniques–history and development;
13. Classification–physical, physiological and protective seed treatments–special seed treatments; physical seed treatment–liquid floatation, specific gravity separation, irradiation, electric and electro-magnetic seed treatments–principles and methods
14. Seed pelleting and coating principles, purpose and methods.
15. Biological seed treatments – microbial inoculation; organic seed treatment–integrated seed treatment–concept and methods of designer seed.
16. Physiological seed enhancement treatments–seed infusion,
17. Seed priming–principles and methods–physiological, biochemical and molecular mechanisms; pre-germination and fluid drilling techniques;

Practical schedule

1. Seed testing–sampling and dividing methods;
2. Determination of seed test weight and heterogeneity test;
3. Physical purity analysis–components, procedure, reporting results;
4. Seed moisture estimation–methods and equipment;
5. Conduct of seed germination test and seedling evaluation;
6. Conduct of quick viability (tetrazolium) test and evaluation;
7. Conduct of vigour tests–direct, indirect test and special tests;
8. Genetic purity assessment–laboratory and conventional methods–image analysis for seed quality;
9. Conducting different seed health tests to identify bacteria, fungi and insects;
10. Visit to seed testing laboratory;
11. Seed enhancement techniques–practicing physical treatments and water floatation techniques;
12. Seed coating and pelleting–uses of adhesives and filler materials;
13. Performing seed priming–hydro, halo and bio-priming–solid matrix priming;
14. Practicing seed infusion and microbial inoculation treatments;
15. Practicing pre-germination technique;
16. Studying integrated seed treatment/designer seed treatment.
17. **Final Practical Examination.**

Course outcome

CO 1: Successful completion of this course by the students is useful to acquire technical skill on seed quality analysis.

CO 2: It helps the students to acquire knowledge on seed quality evaluation.

CO 3: It is useful for the students to acquire technical skill on seed enhancement.

CO 4: This course leads to the development of human resource on seed quality analysis.

CO 5: It is useful for the students to acquire a comprehensive knowledge on crops.

CO-PO Mapping matrix

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

References

1. Agrawal PK. 1993. Hand book of Seed Testing. Ministry of Agriculture, GOI, New Delhi Agrawal RL. 1997. Seed Technology. Oxford & IBH.
2. Copeland LO and McDonald MB. 2001. Principles of Seed Science and Technology. 4th Ed. Kluwer Academic publishers, USA.
3. International Seed Testing Association. 2019. International Rules for Seed Testing 2019. Published by ISTA, Zurichstr, Switzerland.
4. ISTA. 1999. Seed Science and Technology, 27th supplement.
5. Vanangamudi. K, G. Sastry, S. Kalaivani, A. Selvakumari, M. Vanangamudi and P. Srimathi. 2010. Seed Quality Enhancement: Principles and Practices. Scientific Publishers.

e-resources

1. http://agritech.tnau.ac.in/seed/Seed_seedtesting.html
2. https://betterseed.org/resources/seed-testing-accreditation-schemes/
3. https://freelims.org/blog/the-importance-of-seed-quality-testing.html
4. https://fao.org/3/AD232E/AD232E10.htm
5. https://onlinelibrary.wiley.com/doi/10.1111/rec.13184

SST 510 – SEED TECHNOLOGY OF TREE SPECIES - (1+1)

Learning objectives

- To learn about importance and establishment of tree seed species
- To know about reproduction mechanisms, seed dispersal process and factors influencing seed set
- To study about seed certification procedures for tree seeds
- To get a knowledge of post-harvest handling of seeds
- To understand the seed production techniques of tree seed species

Theory

Unit I; Significance of tree seed production

Importance of tree seeds–seed quality in plantation establishment–scope of seed production in tree species; seed structure and its significance in natural regeneration of forest species.

Unit II; Reproduction mechanisms and seed dispersal

Reproductive biology – angiosperms and gymnosperms – reproductive age – seasonal influence on flowering–reproductive efficiency; factors influencing seed set–pollination – pollinating agents – self incompatibility – seed dispersal – mode and mechanism of dispersal.

Unit III; Certification standards for tree species

Seed stand–selection and delineation–seed production area–seed zone–selection criteria for candidate, plus and elite tree; seed orchards – definition – types –seedling and clonal seed orchard–pollen dilution zone–seed orchard establishment and management; OECD certification programme for forest reproductive materials and seeds–ISTA certification standards for tree species.

Unit IV; Post harvest techniques for better seed quality

Physiological maturity–maturity indices–determining optimum harvestable maturity; seed

collection – methods – factors influencing seed collection – precautions in collection of recalcitrant seeds; seed eXtraction – methods – wet, dry and cone eXtraction; drying – critical moisture content – seed processing; dormancy – types of dormancy in tropical, sub tropical and temperate tree seeds – dormancy breaking treatments; recalcitrant seeds–mechanism.

Unit V; Seed production and management techniques for tree species

Seed production and handling techniques in important tree borne oil seeds (*Madhuca, Pongamia*, *Azadirachta*, *Simaruba*, *Callophyllum*), timber (teak, sandal, pine, cedar, redsanders, shisham), fuelwood (*Acacias*), pulpwood (Bambusa, *Ailanthus*, *Casuarina*, *Melia*, *Eucalyptus*), fodder (*Leucaena, Albizzia*) and ornamental (*Cassia*, *Delonix*) tree species.

Practical

Study of tree seed structure–internal and eXternal structures- Study on phenology of different tree species; Selection procedure of candidate and plus trees; Assessment of seed set, physiological and harvestable maturity; Assessing natural regeneration in different tree species; Study on seed dispersal methods and dispersal distance in different species; Seed collection techniques in important tree species–seed collection–orthodoX and recalcitrant seeds–safety measures during collection; Seed eXtraction methods–wet and dry eXtractions–fruits, pods, cones, etc.; Study on different seed drying methods and precautions; Practicing seed grading and upgrading techniques; Practicing seed dormancy breaking methods; Germination improvement treatments for elite seedling production; Study on storage of recalcitrant seed; Estimation of critical moisture content for safe storage; Visit to seed production area and seed orchard; Visit to tree seed processing unit

Lesson plan

Theory lecture schedule

1. Importance of tree seeds–seed quality in plantation establishment–scope of seed
2. Production in tree species
3. Seed structure and its significance in natural regeneration of forest species.
4. Reproductive biology – angiosperms and gymnosperms – reproductive age – seasonal influence on flowering–reproductive efficiency
5. **First test**
6. Factors influencing seed set–pollination – pollinating agents – self incompatibility – seed dispersal – mode and mechanism of dispersal.
7. Seedstand–selectionanddelineation–seedproductionarea–seedzone–selectioncriteria for candidate, plus and elite tree
8. Seed orchards – definition – types –seedlingandclonalseedorchard–pollendilutionzone–seedorchardestablishmentand management
9. **Mid-semester examination**
10. OECD certification programme for forest reproductive materials and seeds–ISTA certification standards for tree species
11. Physiological maturity–maturity indices–determining optimum harvestable maturity
12. Seed collection – methods – factors influencing seed collection – precautions in collection of recalcitrant seeds
13. Seed eXtraction – methods – wet, dry and cone eXtraction; drying – critical moisture content – seed processing
14. Dormancy – types of dormancy in tropical, sub tropical and temperate tree seeds – dormancy breaking treatments
15. Recalcitrant seeds–mechanism
16. Seed production and handling techniques in important tree borne oil seeds (*Madhuca, Pongamia*, *Azadirachta*, *Simaruba*, *Callophyllum*), timber (teak, sandal, pine, cedar, redsanders, shisham),
17. Fuelwood (*Acacias*), pulpwood (Bambusa, *Ailanthus*, *Casuarina*, *Melia*, *Eucalyptus*), fodder (*Leucaena, Albizzia*) and ornamental (*Cassia*, *Delonix*) tree species.

Practical schedule

1. Study of tree seed structure–internal and eXternal structures;
2. Study on phenology of different tree species;
3. Selection procedure of candidate and plus trees;

4. Assessment of seed set, physiological and harvestable maturity;
5. Assessing natural regeneration in different tree species;
6. Study on seed dispersal methods and dispersal distance in different species;
7. Seed collection techniques in important tree species–seed collection–orthodox and recalcitrant seeds–safety measures during collection;
8. Seed extraction methods–wet and dry extractions–fruits, pods, cones, etc.;
9. Study on different seed drying methods and precautions;
10. Practicing seed grading and upgrading techniques;
11. Practicing seed dormancy breaking methods;
12. Germination improvement treatments for elite seedling production;
13. Study on storage of recalcitrant seed;
14. Estimation of critical moisture content for safe storage;
15. Visit to seed production area and seed orchard;
16. Visit to tree seed processing unit.
17. **Final Practical Examination**

Course outcome

CO 1: After the completion of course, students have better understanding the importance of tree seed species and their production

CO 2: This course is helpful for the students to learn about seed dispersal mechanisms and factors influencing seed formation

CO 3: Students get knowledge tree seed certification procedures

CO 4: From this course students absorb post-harvest handling methodologies and seed dormancy breaking

CO 5: Students understand procedure for seed production of most important tree species

CO and PO Mapping Matrix

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

References

1. Ram Prasad and Khandya AK. 1992. *Handling of Forestry Seeds in India*. Associated Publishers, New Delhi.
2. Sivasubramaniam K, Raja K and Geetha R. 2012. *Recalcitrant Seeds–Causes and Effects*.
3. Sathish Serial Publishing House. Azadpur, New Delhi.
4. Umarani R and Vanangamudi K. 2004. *An Introduction to Tree Seed Technology*. International Book Distributors, Dehradun.
5. Vanangamudi K,Natarajan K,Saravanan J,Natarajan N,Umarani R,Bharathi A and Srimathi

e- resources

1. http://fao.org/3/a-ah803e.pdfhttp://fao.org/3/ad232e/AD232E01.htm
2. https://springer.com/gp/book/9783540490289
3. http://fao.org/docrep/006/ad232e/ad232e00.htm
4. http://envis.nic.in/ifgtb/pdfs/Tree%20Seed%20Management.pdf
5. https://forestry.gov.uk/PDF/FCBU054.pdf/$FILE/FCBU054.pd

SST 511 – SEED INDUSTRY AND MARKETING MANAGEMENT -(1+1)

Learning objectives:

To enable the students to learn about

- Seed industry objectives and role in Indian agriculture
- Seed industry organisation and its components
- Seed production and distribution systems
- Seed marketing, importance, problems and perspectives
- Seed demand forecasting methods and techniques

Theory:

Unit I; Introduction

Introduction to seed industry–genesis, growth and structure of seed industry –mission and objectives–present status of Indian and global seed industry –role of seed industry in Indian agriculture; government initiatives – seed hubs, seed villages and community seed production system.

Unit II; Organization setup

Seed industry–organization setup and functions -public, private, MNC's, seed corporations; structure of small, medium and large seed industries, components of seed industry – public private partnership – custom seed production – risk management – human resource – infrastructure – processing unit – storage godown.

Unit III; Distribution system

Seed production and distribution systems in state and central government; seed supply chain systems – seed production and distribution – planning, organization and coordination, staffing, assembling of resources; cost of seed production – overhead charges.

Unit IV; Seed marketing

Seed marketing – definition – importance – role of marketing; type of markets – domestic and global market – problems and perspectives; marketing policies – seed marketing schemes – marketing channels, responsibilities of dealers - marketing mix.

Unit V; Demand forecast and seed pricing

Seed demand forecasting – purpose – methods and techniques; indenting and seed dispatch procedures and forms – seed store records – maintenance – missing link in seed supply chain; market intelligence – SWOT analysis; seed cost analysis; seed pricing – policy – components of seed pricing – factors – local market rate (LMR) – fixation of procurement and sale price of seed.

Practical

Data collection on status of Indian and global seed industry; Assessing the factors influencing farmers References and assessment of seed demand and supply; Planning for establishment of small, medium and large seed industry; Planning for establishment of seed production and processing unit; Economics of seed production – varieties and hybrids ;Seed pricings and cost analysis; Exercise on fixing seed procurement and sale price; Study of marketing channels – domestic and international; Maintenance of carryover seeds – Assessing risk factors in seed industry and their management; Plant Sciences – Seed Science and Technology; Survey and interaction with seed dealers and distributors; Visit to state seed corporations; Visit to MNCs and expert discussion; Case studies and SWOT analysis; Visit to modern seed processing

unit and advanced seed storage complex; Custom seed production, contract farming and procurement – procedures; Planning and preparation of project proposal for setup of a seed industry.

Lesson plan

Theory lecture schedule:

1. Introduction to seed industry – genesis, growth and structure of seed industry – mission and objectives
2. Present status of Indian and global seed industry - role of seed industry in Indian agriculture
3. Government initiatives - seed hubs, Seed villages and community seed production system
4. Seed industry – organization setup and functions - public, private, MNC's, seed corporations;
5. **First test**
6. Structure of small, medium and large seed industries, components of seed industry – public private partnership.
7. Custom seed production – risk management – human resource – infrastructure – processing unit – storage godown.
8. Seed production and distribution systems in state and central government;
9. **Mid-Semester Examination**
10. Seed supply chain systems – seed production and distribution
11. Planning, organization and coordination, staffing, assembling of resources; cost of seed production – over head charges.
12. Seed marketing – definition – importance – role of marketing, Type of markets and problems and perspectives.
13. Marketing policies – seed marketing schemes – marketing channels, responsibilities of dealers - marketing mix.
14. Seed demand forecasting – purpose – methods and techniques;
15. Indenting and seed dispatch procedures and forms – seed store records – maintenance – missing link in seed supply chain;
16. Market intelligence –SWOT analysis; seed cost analysis; seed pricing – policy.
17. Components of seed pricing – factors –local market rate (LMR) – fixation of procurement and sale price of seed.

Practical schedule

1. Data collection on status of Indian and global seed industry;
2. Assessing the factors influencing farmers References and assessment of seed demand and supply;
3. Planning for establishment of small, medium and large seed industry;
4. Planning for establishment of seed production and processing unit;
5. Economics of seed production – varieties and hybrids; Seed pricings and cost analysis;
6. Exercise on fixing seed procurement and sale price;
7. Study of marketing channels – domestic and international;
8. Maintenance of carry over seeds
9. Assessing risk factors in seed industry and their management;

10. Seed Science and Technology; Survey and interaction with seed dealers and distributors;
11. Visit to state seed corporations
12. Visit to MNCs
13. MNC - expert discussion, Case studies and SWOT analysis;
14. Visit to modern seed processing unit and advanced seed storage complex;
15. Custom seed production, contract farming and procurement – procedures
16. Planning and preparation of project proposal for setup of a seed industry;
17. **Final Practical examination.**

Course Outcome:

At the end of the course students will be able to

CO 1: Understand present status of Indian and global seed industry

CO 2: Gain knowledge on government initiatives on seed hubs, seed villages and community seed production systems

CO 3: Gain knowledge on organization setup and functions of seed industry and its structure

CO 4: Gain expertise on seed marketing, types of markets and its marketing policies

CO 5: Expose on planning and preparation of project proposal for setup of a seed industry

CO and PO Mapping Matrix

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

References:

1. Acharya S S and Agarwal N L. 2004. Agricultural Marketing in India. 4th Ed. Oxford and IBH.
2. Kalyani Singh A K and Pandey S. 2005. Rural Marketing. New Age Publications.
3. Singh G and Asokan S R. 1991. Seed Industry in India: A Management Perspective Oxford & IBH Publishing Co Pvt. Ltd., New Delhi.
4. Singh S. 2004. Rural Marketing –Focus on agricultural Inputs. Vikas Publishing House.
5. Pundan Singh, 2013. Principles of seed technology. Kalyani publishers, New Delhi

e-resources:

1. https://link.springer.com/chapter/10.1007/978-1-4615-1783-2-15http://fao.org/3/V4450E/V4450E00.htmhttps://books.google.co.in/books?id=vPVlBos4WkYC
2. http://download.nos.org/srsec319new/319EL19.pdfhttps://isengewant.de/Marketing-of-Seeds-By-Premjit-Sharma.pdf

3. https://kopykitab.com/A-Handbook-of-Seed-Processing-and-Marketing-by-Gaur-SC
4. www.gov.mb.ca
5. www.agricoop.nic.in

SST 512 - SEED HEALTH TESTING AND MANAGEMENT -(1+1)

Learning objectives:

- To expose the students those seeds are the foundation for crop production and importance of seed health.
- To acquire knowledge on screening techniques for seed quality and seed testing.
- To insist the importance of phyto-sanitary certificates for maintaining the quality seed.
- To appraise students with its relevance to detect and management of seed borne pest and diseases to provide healthy seeds.
- To acquaint the students with principles and practices of seed health testing and management of seed borne pathogens and storage insects.

Theory

UNIT I; Seed health in seed industry and plant quarantine

History and economic importance of seed health in seed industry and plant quarantine – important seed borne and seed transmitted pathogens – role of micro organisms in seed quality deterioration – storage and field fungi – effect of storage fungi on seeds – factors influencing storage fungi and management.

UNIT II; Seed health testing

Transmission of pathogens – mode and mechanism – seed certification standards; mycotoxins – types and its impact on plant, animal and human health; seed health testing methods – direct examination, incubation, serological and molecular methods.

UNIT III; Phytosanitary system- national and international

Production of disease free seeds in agricultural and horticultural crops; management of seed borne pathogens – plant quarantine – Indian system and networking, post-entry quarantine and international systems – Pest Risk Analysis (PRA); Sanitary and Phyto sanitary System (SPS) – certificates; International Seed Health Initiative(ISHI) on seed health standards.

UNIT IV; Storage pest and storage structures

Storage pests – insects, mites, rodents and their development – economic importance; insect infestation – factors influencing, sources and kinds, biochemical changes in stored seeds due to insect infestation; detection methods and estimation of storage losses; types of seed storage structures – domestic and commercial.

UNIT V; Seed storage control measures

Fumigation – principles and techniques – type of fumigants; preservatives and seed protectants on seed quality – non-chemical methods for managing seed storage pests – controlled and modified atmospheric storage – trapping devices – IPM for seed storage.

Practical

Detection of seed borne pathogens – direct examinations- incubation methods – serological methods – molecular methods; Seed transmission of seed borne fungi, bacteria and viruses; Management of seed borne pathogens –seed treatment techniques;

identification of storage insects; methods of detection of insect infestation; Management of storage pests - methods – fumigation – usage of fumigants and insecticides.

Lesson plan

Theory lecture schedule

1. Seed health – history and economic important – seed industry and plant quarantine.
2. Seed borne and seed transmitted pathogens – role of microbes in seed quality deterioration.
3. Effect of storage fungi on seeds – factors affecting storage fungi and management.
4. Seed borne pathogens – transmission – mode and mechanism - Seed certification standards
5. **First test**
6. Mycotoxins – types and its impact on plant, animal and human health.
7. Seed health testing techniques – direct examination and incubation.
8. Seed health testing techniques - serological and molecular methods.
9. **Mid-semester Examination**
10. Production and management of disease free seeds in agricultural and horticultural crops.
11. Plant quarantine – national and international – PRA – SPS.
12. ISHI on seed health standards.
13. Storage pests – insect infestation – sources and kinds.
14. Biochemical changes due to insect infestation – detection methods - storage loses.
15. Seed storage structures – domestic and commercial.
16. Fumigation – principles and techniques –type of fumigants, seed storage management.
17. IPM for seed storage.

Practical schedule

1. Detection of seed borne pathogens – direct examination
2. Detection of seed borne pathogens – incubation methods
3. Detection of seed borne pathogens – serological methods
4. Detection of seed borne pathogens – molecular methods
5. Study on seed transmission of seed borne fungi, bacteria and viruses
6. Identification of storage fungi
7. Management of seed borne pathogens – seed treatment methods
8. Identification of storage insects – internal and external feeders influencing insects
9. Study on the effect of pre harvest spray on field carryover storage pests
10. Estimation of storage losses due to pests
11. Methods of detection of insect infestation
12. Management of storage pests – pesticides, dose determination, preparation of solution and application
13. Management of storage pests – non-chemical management methods
14. Demonstration of controlled atmospheric storage
15. Safe handling and use of fumigants and insecticides
16. Visit to seed storage godowns
17. **Final practical examination**.

Course outcome:

CO 1: Students able to know the importance on production of healthy and quality seeds.

CO 2: Proficiency in assessing the insect infestation by modern technology to maintain seed quality.

CO 3: Help them to upgrade the seed health and importance of quality seeds.

CO 4: Set forth knowledge on various seed storage structures, storage pests and its mechanism to control for successful seed storage.

CO 5: Students acquire knowledge on detection and management of seed borne pathogens and storage pests to meet Phyto-sanitary requirements for seed business.

CO-PO Mapping matrix

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

References:

1. Agarwal VK and Sinclair JB. 1996. *Principles of Seed Pathology*. Edition, CRC Press Inc. BocaRaton, FL.
2. Karuna V. 2009. *Fundamentals of Seed Pathology*. Kalyani Publishers, New Delhi.
3. Kulkarni GN. 2011. Principles of Seed Technology. Kalyani Publishers, New Delhi.
4. McDonald MB and Copeland L. 1998. Seed Production Principles and Practices. CBS Publishers, New Delhi.
5. Dhirendra khale, Mohan Sadashiv Bhale. 2000. Seed Technology. Scintific Publishers (India).

e- resources:

1. https://link.springer.com/book/10.1007/978-1-349-02842-9
2. https://crcpress.com/Principles-of-Seed
3. https://books.google.co.in/books/about/Seed_Pathology.html
4. https://taylorfrancis.com/books/9781315365695
5. https://elsevier.com/books/insects-and-seed-collection-storage-testing-and-certification/kozlowski/978-0-12-395605-7

Common Courses

STA 501 STATISTICAL METHODS FOR APPLIED SCIENCES -(2+1)

Learning 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 poison 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). X^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 poison
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. 2^2 Factorial Experiment
14. 2^3Factorial Experiment
15. Complete confounding in 2^3 Factorial Experiment
16. Analysis of Split-plot and Strip-plot design

17. Final Practical Examination

References 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.

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

Objectives

1. Introduction to Networking and Internet Applications that aims at exposing the students to understand analogy of computer, basic knowledge of MS Office.
2. Give students an in-depth understanding of why computers are essential components in business, education and society.
3. Provide hands-on use of Microsoft Office applications Word, Excel, Access and PowerPoint. Completion of the assignments will result in MS Office applications knowledge and skills.
4. To get familiar with basics of the Internet Programming and different IT tools in Agriculture.

Theory

Unit I

Introduction to Computers, Anatomy of computer, Operating Systems, definition and types, Applications of MS Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions.

Unit II

Database, concepts and types, uses of DBMS in Agriculture, World Wide Web Statistical Sciences: Computer Application.

(WWW): Concepts and components, Introduction to computer programming languages, concepts and standard input/output operations. e-Agriculture, concepts and applications,

Unit III

Programming fundamentals with C – Constants and Variables – Data Types – Arithmetic expressions – assignment statements - Logical expressions – Control flow – Arrays and Structures.

Unit IV

Hyper Text Markup Language (HTML), DHTML, web based application development. Static websites, dynamic websites. Client Side processing – scripting languages.

Unit V

Use of ICT in Agriculture, Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc.,

Lecture schedule

1. Introduction to Computers, Anatomy of Computers.
2. Memory concepts.
3. Booting sequence of operating system.
4. Operating systems.
5. DOS, Windows, Unix
6. Types of VIRUS.
7. MS Office word, Creating, Editing, Formatting a document and saving a document.
8. MS Excel Data Presentation, Data graph creation.
9. **First test**
10. MS Power Point Presentation.
11. MS Access Concepts of Database, Creating Database.
12. Statistical analysis and mathematical expressions.
13. Database Concepts.
14. Database in Agriculture.
15. Internet - World Wide Web (WWW)
16. Programming Languages, Computer programming languages.
17. e-Agriculture concepts and applications.
18. Programming Fundamentals with C.
19. **Mid Semester Examination**
20. Constant and Variable.
21. Data Types.
22. Operators.
23. Arrays and Structures.
24. HTML-DHTML.
25. Web based applications development.
26. Client side processing.
27. Scripting Languages
28. ICT in Agriculture.
29. IT application.
30. Computer Control devices.
31. Agri input management.

32. Smartphone Apps in Agriculture.
33. Agriculture for farm advises.
34. Agri-input management.
35. Postharvest management.

Practical schedule

Sl.	List of Programs
1.	MSWORD- Creating, Editing and Presenting a Scientific Document
2.	MS POWER POINT- creating, editing and presenting a scientific Document
3.	MSEXCEL- Creating a spreadsheet, writing expressions, Entering formula expression through the formula tool bar and use of inbuilt statistical, mathematical functions
4.	MSEXCEL- Creating graphs, analysis of scientific data- Data analysis t-test, Regression, ANOVA
5.	MSACCESS: Creating Database, preparing queries and reports
6.	MSACCESS: Demonstration of Agri-information system
7.	C program to find addition and subtraction of two numbers
8.	C Program to find whether the given input is palindrome or not
9.	C program to find the given number is Armstrong or not
10.	C program for finding Fibonacci series.
11.	C Program to find Factorial of a given number.
12.	C Program for calculating student grade using if-else and switch statement
13.	Introduction to World Wide Web (WWW) and its components
14.	HTML: Creation of website
15.	HTML: Creation of Scientific Calculator
16.	Internet: Presentation and management agricultural information through web
17.	**Final practical Exam**

Course outcomes

At the end of the course students will be able to

CO 1: Describe the usage of computers and why computers in society.
CO2: E-Agriculture concepts and applications
CO 3: Learn categories of programs.
CO 4: Web based application development
CO 5: Information Technology applications and systems.

CO-PO Mapping matrix

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

References

1. Satish Jain, M Geetha, Kratika, (2012) Computer Course Windows 7 With Ms Office 2010, Bpb Publications.
2. Anupama Jain and Avneet Mehra (2012), Computer Fundamental MS Office: Including Internet & Web Technology 2010.
3. Programming in Ansi C Paperback – 8 May 2012, by E Balagurusamy (Author).
4. Cox V, Wermers L and Reding E.E. 2006. *HTML Illustrated Complete*. 3rd Ed. Course
   Technology.
5. Meera SN 2008 ICTs in agricultural extension: Tactical to Practical.

COMPULSARY COMMON COURSES

PGS 501 - AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES - (1+0)

Learning objectives

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

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

References

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.

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

Learning objectives

- 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- BASIC CONCEPTS IN LABORATORY TECHNIQUES - (0 + 1)

Learning objectives

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

Practical

Unit-I; Safety measures and common laboratory equipment's

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; Neutralization of acid and bases ;preparation of buffers of different strengths and ph values.

Unit-III; Use and handling of laboratory equipment's

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 equipment's. 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, and 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**

References

1. Furr, A.K.2000.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, 5th Edition, McGraw Hill, USA.
4. Gupta, P.K. 1997.Elements of Biotechnology, Rastogi Publications. Meerut.

5. Singh, B.D. 2005.Biotechnology, Expanding Horizons, Kalyani Publications, New Delhi.

e-resources

1. Analytical chemistry vol.1 (pdf) www.freebookcentre.net.
2. Micheal Zehfus Analytical chemistry www.freebook centre.net.
3. Introduction to Instrumental Analytical Chemistry Roger Terril www.freebook centre.net.
4. Analytical Chemistry lecture notes sadhu malyadri centre.net.
5. Manfred Sietz and Andreas Sonnenberg. Short introduction into analytical chemistry www.freebookcentre.net.

PGS 504 - LIBRARY AND INFORMATION SERVICES -(0+1)

Learning objectives

- 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 References 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 References 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
15. e-resources access methods.
16. **Final Practical examination**

PGS 505 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN

AGRICULTURE - (1+0) (e-course)

Learning 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 lecture 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**

References

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.

Non gradual compulsory courses

NGC 001* DISASTER MANAGEMENT - (1+ 0)
(e-Course)

Learning objectives

To introduce students to the key concepts and practices of mitigation for natural disasters and calamities and to equip them for disaster preparedness to conduct thorough assessment of hazards, risks vulnerability and capacity building strategies.

Theory

Unit I; Natural disaster

Natural Disasters - meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves.

Unit II; Climate change

Climatic change - Global warming, sea level rise, ozone depletion, Manmade disasters - Nuclear disasters, chemical disasters, biological disasters.

Unit III; Man – made disaster

Building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, disaster management- efforts to mitigate natural disasters at national and global levels – India's key hazards, vulnerabilities and disaster response mechanisms in India.

Unit IV; Disaster warning, response and preparedness

Concept of disaster management, national disaster management framework; financial arrangements, role of NGOs, community-based organizations, and media central, state, district and local administration. Dissemination of disaster warning, response to natural disasters, national, state, district level, relief – food and nutrition – water – health – mental health services.

Unit V; Rehabilitation

Rehabilitation – food - clothing - utensils - fuel – shelter – relief camp – sanitation and hygiene. Resilent farming concepts – reclamation and revival of the agriculture system after natural disaster (Bio-shield). Preparedness – Emergency Operations Centres (EOCS).

Theory lecture schedule

1. Natural Disaster - meaning and nature of natural disasters, their types and effects.
2. Flood, drought, cyclone, earthquakes landslides, avalanches, volcanic eruptions, Heat and cold waves.

3. Climatic change- Global warming, sea level rise, ozone depletion
4. **First test**
5. Manmade disaster - Nuclear disasters, chemical disasters, biological disasters.
6. Building fire, coal fire, forest fire. oil fire.
7. Air pollution, water pollution, deforestation, industrial wastewater pollution.
8. Disaster management- efforts to mitigate natural disasters. India's key hazards, vulnerabilities and disaster response mechanism in India.
9. **Mid-Semester examination**
10. Concept of disaster management, national disaster management framework.
11. Financial arrangements, role of NGOs, community-based organizations and media.
12. Central, state, district and local administration.
13. Dissemination of disaster warning - response to natural disasters, national, state, district level.
14. Relief – food and nutrition – water – health – mental health services.
15. Rehabilitation – tolerant and resistant crops- resilient farming concepts – bioshields - livelihood options – insurance and compensation.
16. Disaster preparedness - clothing and utensils and fuel – shelter – relief camp – sanitation and hygiene.
17. Preparedness – Emergency Operations Centers (EOCS).

References

1. Gautam, D R. 2009. *Community based disaster risk reduction*. Mercy Corps, Lalitpur, Nepal.
2. Gupta, HK. 2003. *Disaster management*. Indian National Science Academy. Orient Blackswan.
3. Hodgkinson, PE and Stewart, M. 1991. *Coping with Catastrophe: A handbook of disaster management.* Routledge.
4. Ministry of Home Affairs. 2010. *Standard operating procedure for responding to natural disasters,* Ministry of Home Affairs – Disaster management Division, New Delhi.
5. Sharma,VK.2001. *Disaster management*. National Centre for Disaster Management, India.

e - resources

1. http:// research.un.org/en/disaste
2. https://searchworks.stanford.edu/
3. http://guodes.litrary.illinois.edu>c.php
4. http:// libguides. auu.edu.au>c.php
5. www.wcpt.org

NGC 512 - CONSTITUTION OF INDIA - (1+0)

Learning objectives

1. To Understand the basic feature of Indian constitution
2. To gain knowledge about basic rights and duties of Indian citizens
3. To ponder over the form of Indian Political system
4. To have broad understanding about the pivotal provision related with liberty, quality and fraternity

Theory

Unit I; **Constitution of India** and **Basic features and Fundamental Principles**

Meaning of the Constitution and Constitutionalism - Origin & Development of the Constitution of India - salient features of the Constitution of India.

Unit II; Fundamental Rights and Duties

Fundamental Rights - Fundamental Duties - The Directive Principles of state policy

Unit III; Union Government

Executive: President, Prime Minister and Council of Ministers. – Legislature, Parliament- Judiciary: Supreme Court

Unit IV; State Government and Local Government

Executive: Governor, Chief Minister and Council of Ministers -Legislature- High Courts - Local Governments

Unit V; Constitutional Commissions

Election Commission -UPSC- Finance Commission

Theory lecture schedule

1. Constitution of India – Definition, Basic features
2. Fundamental principles
3. Difference between constitution and constitutionalism
4. Origin and development of constitution
5. **First test**
6. Salient features of constitution of India
7. Fundamental rights and Fundamental duties
8. Direct principles of state policy
9. **Mid Semester Examination**
10. Union government -President, Prime Minister and Council of Ministers
11. Legislature, Parliament
12. Judiciary: Supreme Court
13. Executive: Governor
14. Chief Minister and Council of Ministers and Legislature
15. High Courts and Local Governments
16. Election Commission and UPSC
17. Finance Commission

References

1. The Constitution of India **2017** Kindle Edition- Government of India
2. Bahkshi P. M. 2015 The Constitution of India. Universal Law Publishing Co Ltd
3. Pylle M.V. 2018 An Introduction to The Constitution of India. Vikas Publishing
4. Bhansali S.R.2015. Textbook on The Constitution of India. Universal LexisNexis

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

Advisory committee	Name	Signature
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

Advisory committee	**Name**	**Signature**
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	Aver age
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

Advisory committee	**Name**	**Signature**
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

Advisory committee	**Name**	**Signature**
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, Annamalai nagar.

(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, Annamalai nagar. (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

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, Annamalai nagar 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 :