PONDICHERRY UNIVERSITY

PUDUCHERRY – 605 014

5th PG BOARD OF STUDIES
IN
AGRICULTURAL ENTOMOLOGY

M.Sc. Ag. (Agricultural Entomology)

REGULATIONS AND CURRICULUM

(Effective from 2021-2022)

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE

AND RESEARCH INSTITUTE (PAJANCOA&RI)

(Government of Puducherry Institution)

KARAIKAL – 609 603

REGULATIONS

PONDICHERRY UNIVERSITY

POSTGRADUATE DEGREE PROGRAMME

M.Sc. Ag. (Agricultural Entomology)

SEMESTER SYSTEM – REGULATIONS

1. SYSTEM OF EDUCATION

1.1 The rules and regulations provided herein shall govern Master degree programme in M.Sc. Ag. (Agricultural Entomology) offered by Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA & RI), Karaikal under Pondicherry University.

1.2 The duration of Master's programme is two academic years (4 semesters). The first year of study shall be the first and second semesters after admission. The second year of study shall be the third and fourth semesters.

2. COMMENCEMENT

These regulations shall come into force from the academic year **2021-22**

3. DEFINITIONS

3.1 **'PG Coordinator'** means a teacher of a department who has been nominated by the Head of the Department to coordinate the postgraduate programmes in the department. The coordinator looks after registration, time table preparation, regulation of credit load, maintenance of individual student's files, *etc*.,

3.2 **'Semester'** means a period consisting of 110 working days inclusive of the mid-semester and practical examinations but excluding the study holidays and final theory examinations.

3.3 **'Academic year'** means a period consisting of two consecutive semesters including the inter-semester break as announced by the Dean.

3.4 **'Curriculum'** is a group of courses and other specified requirements for the fulfillment of the postgraduate degree programme.

3.5 **'Curricula and syllabi'** refer to list of approved courses for postgraduate degree programmes wherein each course is identified with a three-letter code, a course number, outline of the syllabus, credit assigned and schedule of classes.

3.6 **'Course'** is a teaching unit of a discipline to be covered within a semester having a specific number and credits as detailed in the curricula and syllabi issued by the University.

3.7 **'Major Course'** means the subject of Department or discipline in which the student takes admission.

3.8 **'Minor Course'** means the course closely related to a student's major course.

3.9 **'Supporting Course'** means the course not related to the major course. It could be any course considered relevant for student's research work or necessary for building his/her overall competence.

3.10 '**Non-Credit course'** means a course which is compulsorily registered by the postgraduate student for the completion of postgraduate degree programme. The non-credit course will be evaluated as Satisfactory or Not-satisfactory. The marks obtained by the student in a non-credit course will not be taken into account for calculating OGPA

3.11 **'A credit'** in theory means one hour of class room lecture and a credit in practical means two and half hours of laboratory or workshop or field work per week.

Explanation : A 1+1 course (2 credits) means 1 hour theory and 2.5 hours practical per week.
A 0+1 course (1 credit) means 2.5 hours practical per week
A 1+0 course (1 credit) means 1 hour theory per week

3.12 **'Credit Load'** of a student during a semester is the total number of credits of all the courses including non-credit courses, that a student register during that particular semester.

3.13 **'Grade Point'** means the total marks in percentage obtained in a course divided by 10 and rounded to two decimals.

3.14 **'Credit Point' means** the grade point multiplied by the credit load of the course.

3.15 **'Overall Grade Point Average (OGPA)'** means the total credit point of the courses completed by the student divided by total credits of the courses studied. The OGPA is to be worked out by rounding to nearest two decimals.

3.16 **'Arrear examination'** is an examination written for the failed course by a student without undergoing regular classes in that course.

3.17 **'Transcript Card'** is the consolidated report of academic performance of a student issued by the University on completion of the curriculum fulfillment. The format of Transcript Card is furnished in *Annexure-1.*

4. POSTGRADUATE PROGRAMMES

The postgraduate programme offered in the discipline of Agricultural Entomology is

M.Sc. Ag. (Agricultural Entomology)

5. ADMISSION

5.1 **Eligibility for admission:**

i. Candidates seeking admission to master degree programme should have a four year bachelor's degree from State Agricultural Universities (SAU) or from other universities recognized by UGC/ICAR.

ii. Candidate who has undergone the course credit system with an OGPA of 3.00 out of 4.00 or 7.00 out of 10.00 or 70 percent aggregate alone is eligible to apply for various Master's degree programmes in this Institute. However, this will not apply to SC/ST candidates / State Department of Agriculture and Farmers Welfare nominees. Just a pass in the concerned degree is sufficient for them.

iii. Prescribed minimum qualification from a recognized University for admission to Master's degree programme:

Discipline	Requirement for Master's Degree
M.Sc. Ag. (Agricultural Entomology)	B.Sc.(Ag.) / B.Sc. (Horti.) / B.Sc. (Forestry)/ B.Tech. (Ag. Biotech.) / B.Tech. (Hort.)

5.2 **Method of selection**:

i. Candidates shall be required to be present on the specified date for a written test at their own expenses. If selected, they should come prepared to pay fees and get admitted immediately.

ii. The students will be ranked based on total marks scored by them in the categories mentioned below

Category	Weightage of marks (%)
OGPA in Bachelor's degree programme	60
Entrance Exam	30
Excellence in Co-curricular activities	5
Awards/Medals obtained	3
Service Experience	2
Total	**100**

iii. Written test with objective type (multiple choices) questions in the specific subject will be of one hour duration. A minimum of 50% (15 marks) is must for considering the candidate for admission. However, in case of SC/ST candidates, a minimum of 40% (12 marks) is must for considering the candidate for admission.

iv. Candidates applied for two subjects should write the examination for both subjects continuously for two hours.

v. Seats are reserved for candidates belonging to scheduled Castes/Scheduled Tribes/Other Backward Classes as per the norms of Government of Puducherry.

vi. Two seats of the total sanctioned strength, irrespective of the discipline, are reserved for the in-service candidates of Department of Agriculture and Farmers Welfare, Government of Puducherry.

6. LANGUAGE REQUIREMENT

The medium of instruction is English. The postgraduate students should have adequate knowledge in English to read, write and speak in English and able to prepare high quality research papers in English.

7. RESIDENTIAL REQUIREMENT

7.1 The minimum residential requirement for Masters' degree shall be two academic years (four semesters) and the course should be completed within the maximum period of four academic years (eight semesters) from the date of admission.

7.2 **Extension of residential requirement:** If any student fails to complete the programme within the maximum time limit, Pondicherry University can decide and give an extension for a period of one year (two semesters) over and above the maximum period of four years for Master's degree in exceptional cases.

8. REGISTRATION

The list of courses offered to the student in each semester shall be sent by the Dean to the Controller of Examinations for Registration of examination as instructed by the University from time to time.

9. DISCONTINUANCE AND READMISSION

As per University Regulations.

10. ADVISORY COMMITTEE

10.1 Each Postgraduate student shall have an advisory committee to guide the student in carrying out the programme. Only recognized teachers are eligible for teaching PG courses and guiding thesis research.

10.2 **Chairman/Guide**:

i. The approved guides by the Dean of the college only can be the guide for the students.

ii. Every student shall have a Chairman of the Advisory Committee who will be from his/her major field of studies.

iii. The Head of the departments will allot the masters students among the recognized guides.

iv. A teacher should have a minimum of two years of service before retirement for allotment of Master's students.

v. Normally there should not be more than four Master's students at any one time under a guide.

vi. However, a guide operating externally funded schemes with student fellowship can supervise a maximum of five students with the approval of the Dean.

10.3 **Members** :

i. The advisory committee shall comprise a Chairman and two members. One member shall be from the concerned department and another member shall be from other department or discipline related to field of thesis research.

ii. In thesis topics involving more of inter-disciplinary approach, the number of advisory committee members from other disciplines may be increased by one with prior approval of the Dean.

iii. External experts may be included as member/co-Chairman in the advisory committee based on the need and expertise of the member, without any financial commitment to the College so as to improve the quality of the thesis. The external expert member proposed should meet the minimum qualification required and the proposal is to be approved by the Dean.

10.4 **Formation of advisory committee:**

i. For Master's Programme the advisory Committee Chairman and members will be in the cadre of Professors, Associate Professors and Assistant Professors having three years of experience.

ii. Only recognized teachers are eligible for teaching PG Courses and guiding thesis research.

iii. A proposal for the formation of the advisory committee (Form 1) of the student shall be forwarded by the Heads of the Department to the Dean for approval within one month from the commencement of the first semester.

10.5 **Changes in advisory committee:**

i. The proposal for changes in the advisory committee (Form 1a) is to be sent to the Dean for approval, if it is keenly felt that such changes are absolutely necessary. The reason for such change should be indicated.

ii. The changes may be effected immediately, when the existing members are transferred elsewhere or resigned or retired.

iii. If a guide goes abroad or within India for more than 6 months, to attend any training or on leave for more than six months, the Chairman of the Advisory Committee has to be changed immediately. The same conditions will apply to members also.

10.6 **Absence of member during qualifying/final viva-voce examination**:

i. Conducting qualifying and thesis final viva voce examination in the absence of members is not allowed.

ii. Under extra-ordinary circumstances if the qualifying/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.

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

iv. In the absence of the Chairman of advisory committee, respective Heads of Departments should act as Co-Chairman with prior permission of Controller of Examinations.

10.7 **Duties and responsibilities of the advisory committee**:

i. Drawing the student's academic plan for postgraduate programme.

ii. Guidance throughout the programme of the student.

iii. Guiding the student in selecting a topic for thesis research and seminar.

iv. Evaluation of research and seminar credits.

v. Correction and finalization of thesis draft

vi. The members should meet together along with the student for all the above purposes and sign the appropriate documents.

11. PLAN OF COURSE WORK:

The student's plan for postgraduate course work (Form 2) drawn up by advisory committee shall be sent for the approval of the Dean before the commencement of the mid semester examination during the first semester.

12. PROGRAMME OF RESEARCH WORK

The proposal for research programme of the student, in the prescribed format (Form 3) and approved by the advisory committee, shall be sent for approval of the

Dean before the end of the semester in which the research credits are registered for the first time or before taking up of the research work whichever is earlier.

13. CREDIT REQUIREMENTS

13.1 **Minimum credit requirement:** A postgraduate student should complete a minimum of 55 credits as detailed below for award of the Master's degree.

Details	Minimum Credits
Major courses	20
Minor courses	09
Supporting courses	05
Seminar	01
Research	20
TOTAL	**55**
Non-credit compulsory courses*	06

* Six courses (PGS 501 to PGS 506) are of general nature and are compulsory for all Master's programme.

Course code	Course Title	Credit hour
PGS 501	Library and information services	0+1
PGS 502	Technical writing and communication skills	0+1
PGS 503	Intellectual property and its management in agriculture (e-course)	1+0
PGS 504	Basic Concepts in Laboratory techniques	0+1
PGS 505	Agricultural research, research ethics and rural development programmes (e-course)	1+0
PGS 506	Disaster management (e-course)	1+0

13.2 **Maximum credit load:** A postgraduate student can register a maximum of 22 credits per semester including non-credit courses, seminar and research. However, research credits registered per semester should not exceed 10.

13.3 **Comprehensive qualifying examination and thesis:** A postgraduate student should successfully complete a comprehensive qualifying examination and thesis in the major field of study and submission of thesis thereon.

13.4 **Extra Credits:**

i. Over and above the prescribed minimum credit requirements, extra course credits up to a maximum of six can be registered for Master's programme.

ii. The extra credits registered will be accounted for calculation of OGPA.

14. ATTENDANCE REQUIREMENTS

14.1 i. A minimum of 80 per cent attendance separately in theory and practical of the concerned course is a must, failing which the student shall not be permitted to appear for both final theory and final practical examinations in the course concerned and grade 'E' (incomplete) will be awarded.

ii. If a student falls short of the required attendance to an extent of 10 per cent or less, the shortage may be condoned by the Dean on the recommendation of the Advisory

Committee and the concerned Head of the Department, on the condition that such shortage in attendance was due to unavoidable circumstances (on medical grounds) and such absence was continuous.

14.2 The student securing 'E' grade in a course must re-register the course when offered again with the permission of the University.

14.3 **Calculation of Attendance**

a) THEORY:

i. Number of classes conducted for a course from the first instructional day as per the time table to the last theory class of that semester is to be construed as the total number of theory classes conducted by the course teacher.
ii. The mid-semester examinations are normally conducted during class hours.
iii. The attendance for mid semester examination shall be counted as a theory class for calculating attendance.

b) PRACTICAL:

i. Number of practical classes conducted for a course from the first instructional day as per the time table to the last practical class of that semester is to be construed as the total number of practical classes conducted by the course teacher.
ii. The final practical examination will be conducted after the completion of 96 working days as per the schedule.
iii. The attendance for practical examination shall not be counted for calculating the attendance for practical.

14.4 For calculating 80 per cent attendance the number of instructional days may be calculated only from the date of joining of the student for first year first semester only.

14.5 The students failing to attend the classes / examinations on non-official ground will be treated as absent.

14.6 Students deputed for sports, cultural meets *etc*., with prior permission of the Dean of the college shall be given attendance for the period of absence. However, students under this category must have attended a minimum of 50 per cent classes in the total theory and practical classes conducted.

15. EVALUATION OF STUDENT'S PERFORMANCE

15.1 **Distribution of marks:**

i. All students shall abide by the rules for evaluating the course work under the semester system of education, as prescribed from time to time by the university. The weightage of Theory and Practical shall be in the ratio of 80:20 respectively.
ii. The student should secure a minimum of 50 per cent marks in theory as well as in practical with an aggregate of 70 per cent to secure a pass in a course.
iii. The student should secure a minimum of 50 per cent marks in the final theory examination conducted by the University for securing a pass in a course.

iv. In each course, examinations will be conducted for 100 marks as detailed below.

Examination	Courses with theory and practical	Courses with only theory	Courses with only practical
Mid Semester (Internal)	20	30	30
Term paper (Internal)	10	10	10
Final Theory (External)	50	60	--
Final Practical	20	--	60
TOTAL	100	100	100

15.2 **Mid Semester Examination (Internal Assessment):**

i. Writing the mid-semester examination is a pre-requisite for writing the final theory and final practical examinations.

ii. Student failing to write mid-semester examination(s), shall not be permitted to attend the classes further in the course(s) concerned and the student will be awarded 'E' grade.

iii. The mid-semester examinations shall be conducted for a duration of one hour and for 20 or 30 marks.

iv. The Head of the Department with the help of the concerned PG coordinator shall prepare and announce the schedule of mid-semester examinations.

v. The mid-semester examinations shall be conducted from the 56th working day of the semester.

vi. The mid-semester examination shall be conducted and evaluated internally by the concerned course teacher(s).

vii. The mid-semester examination mark list should be sent by the course teacher to the academic section of the college 10 days prior to the commencement of final practical examinations along with term paper mark.

15.3 **Missing Examination:**

i. Missing examination shall be permitted only for mid-semester examination in deserving cases on the recommendation of the course teacher/Chairman and Head of the department and on prior approval by the Dean.

ii. The missing tests are not allowed for final theory and final practical examinations.

iii. The student shall write, in advance, to the Dean through the Chairman, PG coordinator and Head of the Department stating the reason for missing the mid-semester examination(s). Based on the recommendation of the Chairman, PG coordinator and the Head of the Department, the Dean shall permit the student for missing the mid-semester examination(s).

iv. A student missing mid-semester examination(s) with the prior approval of the Dean shall be permitted to take up missing examination of the particular course, subject to payment of the prescribed missing examination fee for each missing mid-semester examination.

v. Students deputed for official programmes of the College/University are exempted from paying the fee for missing test.

vi. Such missing examinations should be completed outside the regular class hours within 15 working days after the respective examinations.

vii. Attendance will not be given for taking up missing examinations.

15.4 **Final Theory Examination:**

i. An examination schedule prepared by the Controller of Examination for the final theory examinations shall be the final. The schedule of examinations shall be adhered strictly.

ii. The duration of final theory examinations will be two and half hours for courses with theory and practical (50 marks) or three hours for courses with only theory (60 marks).

iii. The final theory examinations shall be conducted by the University. Evaluated by two examiner, one by internal and one by external. However, in case of Non-credit e-courses, the final theory examination shall be conducted internally by the course teacher.

iv. In the evaluation process, if deviation is more than 20 per cent between the first and second evaluator, the paper shall be referred to third examiner who shall also be an external examiner.

15.5 **Final Practical Examination:**

i. The Dean shall announce the commencement of final practical examinations. The Heads of the Departments shall prepare the schedule for practical examination.

ii. The final practical examinations shall be conducted after the completion of minimum of 96 working days.

iii. Submission of bonafide practical records certified by the Course Teacher is a pre-requisite for appearing in a practical examination failing which 'F' grade will be awarded.

iv. For conducting final practical examination in each course, an *external examiner* (faculty of the Department other than the course teacher) shall be nominated by the Dean and the course teacher will be the *internal examiner*.

v. In the event of external/internal examiner nominated for practical examination could not conduct the examination, then the Dean shall nominate an alternative examiner to conduct practical examination.

vi. The duration of final practical examination shall be two and half hours.

vii. The practical examinations shall be jointly conducted by the internal and external examiners with mutual co-operation.

viii. They shall evaluate the candidates appearing at the examination according to their performance and the Forms so prepared shall be signed by both the examiners.

ix. The practical examination marks should be communicated to the University/ uploaded in the university website within 10 days after conduct of examination duly signed by all the examiners and hard copy forwarded to the university thereon.

15.6 **Arrear examination:**

i. Arrear examination is permitted for the final theory and final practical examinations only.

ii. The students are permitted to write the arrear examinations as and when conducted by the University.

iii. A student is permitted to write the final theory and practical examinations only two times during 4 years duration excluding the regular final examination (Mid-semester marks and Term paper marks shall be retained as such).

iv. In the event of a student failing to secure pass in the two arrear examinations permitted, he/she has to re-register the course along with the juniors as and when the course(s) are offered with the permission of the University and on payment of the prescribed fees.

15.7 **Evaluation of course**:

i. Each course shall carry a maximum of 100 marks. The results of the course shall be indicated by the grade points ranging from 0 to 10.

ii. The total marks in percentage obtained by the student in a course shall be divided by 10 and rounded to two decimal places to get the grade point.

iii. The minimum Grade Point to be secured for the successful completion of a course shall be 7.00.

iv. In case of courses with theory and practical, minimum of 50 per cent mark separately in theory and practical with an aggregate of 70 per cent is essential.

v. Securing a grade point less than 7.00 in a course will be treated as 'F' (Failed) and the Grade Point will be 0.00 for calculating the GPA/OGPA. The following symbols may be used

E - INCOMPLETE (Lack of 80 per cent Attendance/other reasons)
F - FAILED

15.8 **Question paper pattern for theory examinations** :

15.8.1 The question paper pattern for mid semester (internal) examinations are indicated below:

Part	Type of question	Number of questions	Number of questions to be answered	Mark per question	Total marks
Courses with theory and practical (1+1 or 2+1 courses) (20 Marks & 1 hour duration)					
A	Objective*	20	20	0.5	10
B	Definitions/Concepts	12	10	1.0	10
	TOTAL				**20**
Courses with only theory (1+0 or 2+0 courses) (30 Marks & 1 hour duration)					
A	Objective*	30	30	0.5	15
B	Definitions/Concepts	18	15	1.0	15
	TOTAL				**30**

Courses with only practical (0+1 courses) (30 Marks & 1 hour duration)					
A	Objective*	30	30	0.5	15
B	Definitions/Concepts	18	15	1.0	15
	TOTAL				**30**

* Questions should be Fill-up the blanks, Choose the best among four options, True / False or Match the following type with equal number of question in each type and one or two more questions in any one type if examination is conducted for 30 marks

15.8.2 The question paper pattern final theory (external) examinations are indicated below:

Part	Type of question	Number of questions	Number of questions to be answered	Mark per question	Total marks
Courses with theory and practical (1+1 or 2+1 courses) (50 Marks & 2.5 hours duration)					
A	Objective (MCQ's only)	20	20	0.5	10
B	Definitions/Concepts	12	10	1.0	10
C	Paragraph answers	7	5	2.0	10
D	Essay type answers (**EITHER OR** type) - One main question from each unit shall have one choice	5	5	4.0	20
	TOTAL				**50**
Courses with only theory (1+0 or 2+0 courses) Final Theory Examination (60 Marks & 3.0 hours duration)					
A	Objective (MCQ's only)	20	20	0.5	10
B	Definitions/Concepts	18	15	1.0	15
C	Paragraph answers	7	5	2.0	10
D	Essay type answers (**EITHER OR** type) - One main question from each unit shall have one choice.	5	5	5.0	25
	TOTAL				**60**

15.9 **Question paper pattern for final Practical Examination**: The following distribution of marks shall be adopted in conducting the final practical examinations.

Details	Courses with Theory and Practical	Courses with only Practical
Practical Field work / Lab Work / Written exam	20	60
Total	**20**	**60**

For conducting practical examinations, the type and number of questions can be decided by the concerned internal and external examiners. Choice may be given to the extent of 20 per cent under subjective type questions.

15.10 **Term Paper**:

i. Submission of a term paper by the students is a must.

ii. The term paper topics shall be assigned by the course teacher. Term papers should cover a wide range of subjects within the course limits.

iii. The term paper shall be evaluated by the course teacher.

15.11 **Return of evaluated answer papers**:

i. The evaluated answer papers of mid-semester shall be shown to the students after the examination. Discrepancies if any, in awarding marks, the student can approach the teacher concerned immediately for rectification.

ii. The answer paper should be retained by the course teacher for 6 months or declaration of results by Pondicherry University, whichever is earlier and then disposed off.

16. COMPREHENSIVE QUALIFYING EXAMINATION

16.1 i. Only those postgraduate students who successfully complete the comprehensive qualifying examination shall be admitted to candidacy of the degree.

ii. The qualifying examination consists of written and oral examination in major subjects only and the students should be allowed after completion of 80 per cent of total course credit load including major and minor courses.

iii. The qualifying examination shall be conducted only in the major courses as per the norms given below:

Question paper setting	-	External
Evaluation of answer book	-	External
Qualifying marks	-	60 per cent
Viva Voce	-	External
Grading	-	Satisfactory/Not Satisfactory

16.2 **Selection of examiner**:

i. The Head of the concerned PG Department shall send a panel of examiners for conducting the qualifying examination (Form 4). However, the University can draw its own panel of examiners.

ii. The panel of examiners for qualifying examinations shall be given three months before the date of completion of the student's course work.

16.3 **Written examination**:

i. Normally the qualifying examination shall be completed before the end of third semester of the postgraduate programme.

ii. The controller of examination shall conduct the qualifying written examination

iii. The written examination shall be conducted for major courses only.

iv. The question paper for the written examination shall be of 3 hours duration and each question need not be restricted to any particular topic in a course but it

should be a comprehensive of the syllabus of each course.

v. The question paper pattern for the written examination is given below.

Part	Type of question	Number of questions	Number of questions to be answered	Mark per question	Total marks
A	Paragraph answers	7	5	5	25
B	Essay type answers	7	5	15	75
				TOTAL	**100**

16.4 **Oral examination:**

i. Only those students who secure 'SATISFACTORY' grade in written qualifying examination shall be permitted to attend the oral qualifying examination

ii. The advisory committee shall conduct the oral examination with one external examiner, who sets the question paper for the written qualifying examination.

iii. The performance of the student(s) in the qualifying viva-voce examination shall be graded as "Satisfactory" or "Not satisfactory".

iv. If the performance of the student is "Not Satisfactory" in the oral examination, he/she has to appear for the oral examination again.

16.5 **Communication of results of qualifying examination**:

i. The Chairman of the advisory committee shall act as Chairman for the examination committee.

ii. The Chairman of the advisory committee shall be responsible for communicating the results of the examination to the Controller of Examinations in the prescribed format (Form 5).

16.6 **Failure/absence in qualifying examination**:

i. A student is permitted to write the qualifying examination only three times including the regular attempt.

ii. A student who fails or absents in the comprehensive qualifying written/viva-voce examination shall apply to the University with the recommendation of the Chairman of the advisory committee, Head of the Department and the Dean for re-examination.

iii. A student who applies for re-examination should attend written examination and viva-voce after paying the prescribed re-examination fee.

iv. Re-examination shall not take place earlier than three months after the previous qualifying examination.

v. If a student fails even in the second re-examination (third attempt), he/she cannot continue as a student in the University for Award of Master's degree in the University.

vi. The research credits registered in the final semester shall not be evaluated unless he/she successfully completes the qualifying examination.

17. CREDIT SEMINAR

17.1 Seminar is compulsory for all the postgraduate students and each postgraduate

student should register and present one seminar with 0+1 credit.

17.2 Registration of seminar credits is not allowed in the first semester.

17.3 **Seminar topic:**

i. The seminar topic should be only from the major field and should not be related to the area of thesis title.

ii. The seminar topics are to be assigned to the students by the Chairman at the beginning of the semester in which he/she registers seminar credits and the progress made by the student should be monitored.

17.4 **Evaluation of seminar:**

i. The students should prepare a seminar paper after reviewing all the available literature and present the seminar after completion of 80 per cent attendance in the semester in the presence of the Advisory committee, staff and postgraduate students of the concerned department.

ii. The circular on the presentation of the seminars by the postgraduate students may be sent to other departments to enable those interested to attend the same.

iii. After carrying out the corrections/suggestions, the student should submit two copies of the seminar papers, one to the Chairman and the other to the department.

iv. The performance of the student in the credit seminar has to be evaluated for 100 marks by the Advisory Committee. Grade Point may be given based on the following norms:

Particulars	Marks
Coverage of literature	40
Presentation	30
Use of audio visual aids	10
Capacity to participate in discussion and answer the questions	20
TOTAL	**100**

17.5 The students who fail to present the seminar must be awarded 'F' grade and the student should again register the seminar credits and present the seminar in the subsequent semester. The minimum of 80 per cent attendance requirement for presenting the seminar after re-registration need not be insisted.

17.6 Presenting a seminar is a must for the award of the degree.

18. THESIS RESEARCH

18.1 **Selection of topic :**

i. With the guidance of the advisory committee the students should identify the tentative area of research and include it in the plan of work.

ii. The advisory committee should guide the students in selecting a specific topic in the identified research area and for preparing a detailed proposal. While selecting the topic for thesis research, the specialization and competency of teachers, thrust area identified by the department, external funded schemes operated in the department and also the aptitude of the student may be taken into consideration.

iii. The topic for thesis research for the students of Master's programme should be of

such a nature as to indicate a student's potentialities for conducting research and to train him in research.

iv. The thesis shall be on a topic falling within the field of the major specialization and shall be the result of the student's own work.

v. A certificate to this effect duly endorsed by the Chairman of the Advisory Committee shall accompany the thesis.

18.2 **Research proposal:**

i. The research proposal has to be presented by the student in a meeting organized by the Head of the department to get the opinion/suggestions of the teachers of the department for improving it.

ii. Three copies of the research proposal in the prescribed format (Form 3) should be sent to the Dean through the Head of the department for approval before the end of the semester in which the student has registered research credits for the first time or before taking up the field / laboratory experiments whichever is earlier.

18.3 **Evaluation of thesis research:**

i. After assigning the research problem, for each semester the student has to submit a detailed programme of work to be carried out by him/her during the semester in the prescribed proforma (Proforma-1). After scrutiny and approval, a copy of the programme has to be given to the student for carrying out the work during the semester.

ii. Attendance register must be maintained in the department for all the PG students to monitor whether the student has 80 per cent of attendance in research.

iii. After completion of 80 per cent 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 award '**SATISFACTORY** or **NOT SATISFACTORY**' depending upon quantity and quality of work done by the student during the semester. The procedures of evaluating research credits under different situations are explained hereunder.

a. **SITUATION I**: The student has completed the research credits as per the approved programme and awarded '**SATISFACTORY**' by the advisory committee. Under the said situation the student can be permitted to register fresh block of research credits in the subsequent semester. If the student is awarded '**NOT SATISFACTORY**' he/she has to reregister the same block of research credits in the subsequent semester.

b. **SITUATION II**: If the student has not secured the minimum attendance of 80 percent, then the grade 'E' should be awarded. The student has to reregister the same block of research credits for which 'E' grade was awarded in the following semester with prior permission from the University. Until the completion of re-registered credits, the student should not be allowed to register for fresh block of research credits.

c. **SITUATION III**: The student 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 disease or lack of such necessary experimental conditions.
- Non-availability of treatment materials like planting materials chemicals, *etc*.
- Any other impeding/unfavorable situation for carrying out research.

Under the said situations III, Grade 'E' should be awarded. The student has to reregister the same block of research credits for which 'E' grade was awarded in the following semester with prior permission from the University. Until the completion of re-registered credits, the student should not be allowed to register for fresh block of research credits.

d. **SITUATION IV:** When the student failed to complete the work even in the 'Second time' registration, the student will be awarded '**NOT SATISFACTORY**' and he/she has to reregister the same block of research credits in the subsequent semester with the prior permission from the University.

e. **SITUATION V:** If a student secures 'F' grade in course work and/or cannot complete the qualifying examination till the end of final semester/grace period, the research credits registered in the final semester shall not be evaluated unless he/she successfully completes the qualifying examination. The research credits registered by the student during the final semester shall be evaluated within 15 days from the date of declaration of result of the course or the qualifying examination, as the case may be.

18.4 **Re-registration of research credits**: Students have to obtain prior permission of the University for re-registering the research credits. However, the University can permit the registration of research credit only three times. Permission to register for the fourth time shall be given only by the Academic Council.

19. SUBMISSION OF THESIS

i. The research credits registered in the last semester of postgraduate programmes should be evaluated only at the time of the submission of thesis by the advisory. committee. Students can submit the thesis at the end of the final semester. The list of enclosures to be submitted along with the thesis is furnished in *Annexure-2*.

ii. If a postgraduate 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 the thesis provided the student satisfies 80 per cent attendance requirement.

iii. Copy of the thesis to be sent for evaluation should be submitted in paper pack.

iv. After incorporating the suggestions of the examiners and those received at the time of viva-voce, the thesis should be submitted to the College/university in hard bound copies (four copies) and soft copies (in pdf format) in CDs (two copies).

19.1 **Grace period:**

i. Students can avail a grace period upto three months for submission of thesis after the closure of final semester by paying prescribed fine to the University.

ii. If a student is not able to submit the thesis within three months grace period, the student has to re-register the credits in the forthcoming semester.

iii. The student who re-register the credits after availing the grace period will not be permitted to avail grace period for the second time.

iv. The Heads of the Departments can sanction the grace period based on the recommendation of advisory committee and a copy of the permission letter along with the receipt for payment of fine should accompany the thesis while submission.

19.2 **Re-registration and submission of thesis:** 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 with 80 per cent attendance.

19.3 **Publication of articles:** Part of thesis may also be published in advance with the permission of the Chairman. If any part is published, the fact should be indicated in the certificate given by the Chairman that the work had been published in part/ full in any referred scientific or popular journals, proceedings, *etc*.

20 EVALUATION OF THESIS

20.1 The thesis submitted in partial fulfillment of a Master's degree shall be evaluated by an external examiner nominated by the Controller of Examinations. However, the Dean can send panel of three examiners (Form 6).

20.2 An oral examination will be conducted by the Advisory Committee after the thesis is recommended by the external examiner and carrying out the corrections/suggestions made by the external examiner by the student.

20.3 The Chairman of the advisory committee shall communicate the date of final thesis viva-voce examination to the student and advisory committee members within one month and the thesis final viva-voce examination shall be completed within six months from the date of receipt of the report from the external examiner.

20.4 The Chairman shall send the recommendations of the advisory committee (Form 7) along with necessary certificate/documents in duplicate to the University.

20.5 i. In case, the External examiner does not recommend the thesis for the award of the degree, the advisory committee may send their recommendation for scrutiny of the thesis by another external examiner, through the Dean to Controller of Examinations within one month from the date of receipt of the thesis. The Controller of Examinations may, on the recommendation of the advisory committee and Dean, refer the thesis for scrutiny and independent judgment to a second external expert chosen by him.

ii. If the second external expert recommends the thesis for acceptance, this recommendation may be accepted.

iii. If the second examiner also does not recommend the thesis for acceptance, the degree shall not be awarded.

21 REVISION OF THESIS

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

i. For revision of draft, the thesis should be resubmitted after a minimum of one month from the date of communication from the Dean.

ii. If the revision is recommended for repeating lab experiments, field trial *etc*, resubmission must be after a minimum period of six months.

21.2 At the time of resubmission, the advisory committee should give a certificate for having carried out the corrections/recommendations. The resubmitted copies of thesis should have incorporated the necessary corrections as indicated by the external examiners.

22 FAILURE TO APPEAR FOR FINAL VIVA/NON SUBMISSION OF THESIS AFTER VIVA

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

22.1 The thesis viva-voce must be completed within **four years from the date of** first registration for Master's programmes. The prescribed penalty/fine must be charged to the candidate.

22.2 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 at the time of sending the proposal for result declaration.

23 MALPRACTICES IN EXAMINATION AND MISCONDUCT OF STUDENTS

23.1 The Dean of the College shall be responsible for dealing all cases of unfair means by students in writing records, term papers and mid-semester examinations.

23.2 In case of final theory and final practical examination, the cases of malpractice will be dealt as per Chapter XV (A) of the Academic Ordinance of the University.

23.3 **Ragging rules:** Students found involved in ragging will be dealt as per the orders of the Supreme Court of India. The matter shall be reported to the University.

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

24 The schedule for the important records to be sent to the Dean is furnished below and should be followed strictly so as to get back the above academic reports in time for maintenance in the students file.

Sl. No.	Particulars	Time Schedule
1	Formation of advisory committee **(Form 1)**	Within one month of the commencement of first semester
2	Plan of course work **(Form 2)**	Before the commencement of mid semester examination in the first semester

3	Programme of research work **(Form 3)**	Before the end of the semester in which the student registers the research credit for the first time or the commencement of the research work whichever is earlier.
4	Proposal for qualifying examination **(Form 4)**	Two months before the completion of the course work.
5	Qualifying examination result **(Form 5)**	Immediately
6	Panel of external examiners for thesis evaluation **(Form 6)**	Three months before the probable date of submission of thesis
7	Final viva-voce result **(Form 7)**	Fifteen days from the examination

25 AWARD OF DEGREE AND ISSUE OF TRANSCRIPT CARD

25.1 **Eligibility for the Award of the Degree:** The successful completion of all the prescribed courses included in the Curricula and Syllabi shall be minimum requirement for the award of the Degree.

25.2 **Class Ranking**: In calculation of Class equivalent for OGPA the following classification will be adopted. First class with Distinction and first class shall be awarded to those students who have completed the course without arrear and all others shall be awarded second class

OGPA	Class
9.00 and above	First class with Distinction
8.00 to 8.99	First class
7.00 to 7.99	Second Class

25.3 **Percentage conversion**: For obtaining the percentage equivalent to the OGPA, the OGPA secured by the student shall be multiplied by 10.

25.4 **Transcript card:**

i. The Transcript card shall contain entry of all the courses and the Grade Points and OGPA obtained by the candidates indicating the number of times appeared. This will have to be prepared for all the students by the Controller of Examinations.

ii. For preparation of Transcript card, the Dean should send recent passport size photograph of the students along with filled in proforma and the prescribed fee.

26 REMOVAL OF DIFFICULTIES:

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

26.2 Every order issued by the Vice-Chancellor under this provision shall be laid before the Academic Council of the University in the next meeting after the issuance.

26.3 Not-withstanding anything contained in the regulations, the Board of Studies or Academic Council reserve the right to make changes whenever necessary.

27. REGULATIONS GOVERNED BY PAJANCOA & RI

27.1 ADMISSION

27.1.1 Application for admission:

i. Application for admission shall be made in the prescribed form to be downloaded from the website of the college (www.pajancoa.ac.in) after notification is issued to this effect.

ii. The admissions shall be regulated and made in accordance with the admission rules and regulations in force.

iii. Candidates seeking admission to the various Postgraduate degree courses are permitted to apply for only two subjects. Separate applications should be used for each course.

27.1.2 Admission procedure:

i. The admission is based on the merit category of the candidate and availability of vacancies at the time of counseling.

ii. All admissions made by this Institute are provisional and subject to the approval of the University.

iii. The candidates who have offered admission should report to the college on or before the due date mentioned failing which their right of admission is forfeited

27.2 FEE STRUCTURE

27.2.1 Fee structure is being revised every year with 10% fee hike. Lodging fees and charges for electricity, water and computer are revised based on the requirements and power tariff prevailing from time to time.

27.2.2 In the case of new admissions, the fees for the first semester should be paid at the time of admission.

27.2.3 For the remaining semesters, the fees should be paid on the date of registration of the semester.

27.2.4 Candidates who discontinue after admission are not eligible for refund of fees except caution money deposit.

27.2.5 In case of a student who re-registers with junior batch, he/she has to pay the semester fess applicable to the junior batch in which he/she registers, besides the re-registration fee.

27.3 REGISTRATION

27.3.1 All newly admitted candidates should register during the first semester of the programme. A candidate admitted to the Postgraduate programme should report to the Head of the Department concerned on the date of registration. It is the responsibility of the candidate to register the courses in person on the due date prescribed for the purpose.

27.3.2 **In ABSENTIA** registration will not be permitted on any circumstances.

27.3.3 The Head of the Department and the PG coordinator shall help the student in selecting the courses for registration.

27.3.4 Admitted candidates shall register with the respective Department at the beginning of each semester and this should be completed within two working days.

27.3.5 **Late registration**:

i. Late registration is permitted by the Dean of college within seven working days from the commencement of the semester provided the prescribed late registration fee is paid before registration.

ii. Registration beyond seven working days is not allowed except for new entrants who are admitted late due to administrative reasons in the first semester.

27.3.6 **Registration cards:**

i. A student shall register the courses offered in a semester by writing all the courses in registration card in quadruplicate. The format of registration card is given in *Annexure-4*.

ii. 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.

iii. The Dean shall approve the registration cards.

iv. The approved registration cards shall be maintained by the Dean, PG coordinator, Chairman and the student concerned.

v. 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

27.3.7 The mess dues clearance certificate has to be produced by the student at the time of registration.

27.4 ARREAR EXAMINATION:

i. The prescribed arrear examination fee should be paid on or before the specified date.

ii. The Registration for the arrear examination shall be done on the date specified by the Dean. Each registration is considered as an attempt even if the student is absent for the examination.

27.5 QUALIFYING EXAMINATION

The Heads of departments will monitor and coordinate the conduct of both the written and oral qualifying examinations.

27.6 SUBMISSION OF THESIS

The research credits registered in the last semester of postgraduate programmes should be evaluated only at the time of the submission of thesis by the advisory committee. Students can submit the thesis at the end of the final semester. The list of enclosures to be submitted along with the thesis is furnished in *Annexure-5*.

27.7 REVISION OF THESIS

The prescribed fine for late submission of revised thesis may be collected from the students submitting thesis beyond the due date with the recommendation of the Chairman. The Dean shall ensure that the delay is due to the fault of the student.

27.8. MERIT SCHOLARSHIP/RESEARCH ASSISTANTSHIP

27.8.1 PAJANCOA & RI PG fellowship shall be awarded to all the students who are admitted into the Masters programme based on allotment of Government fund. The PG students should be a resident of PAJANCOA & RI hostels. The award of PG fellowship is governed by the approved PG fellowship rules.

27.8.2 The Dean shall call for applications and sanction the scholarship every year.

27.8.3 The students availing any scholarship/fellowship are permitted to switch over to other fellowship/scholarship only one time during the course of study.

27.8.4 **Student SRF/JRF:**

i. The selection of student SRF/JRF in external funded schemes will be made by the existing committee members for selection of regular SRF/JRF.

ii. The PG coordinator of the concerned department will be an additional member of the committee.

iii. The panel of names after the selection has to be sent to the Dean for approval in the prescribed Proforma.

iv. If a student SRF/JRF discontinues before submitting the thesis or switch over to other fellowship/scholarship, the amount already paid has to be recovered in full in one lump sum with 6% penal interest.

27.9 RECOGNITION OF POSTGRADUATE TEACHERS

27.9.1 The Dean normally recognizes teachers for offering courses and guiding the students of Master's programme based on the request of teachers and the recommendation of Head of the department.

27.9.2 The recognized PG teachers shall offer courses to masters students as required by the concerned Heads of departments, normally, in their own field of specialization unless extra-ordinary circumstances demand for offering other courses.

27.9.3 All the recognized guides for Master's programme are competent to guide research work of Master's degree students in their own fields of specialization. The Heads of departments shall assign students to the recognized guides taking into account their specialization. The students should be uniformly distributed instead of all of them taking research topics in one or two specialized branches in the department.

27.9.4 **Teachers for Master's programme:** The following faculty shall be recognized as PG teachers for Master's programme

i. Professors

ii. Associate Professors

iii. Assistant Professors: Persons having Ph.D. degree with one year of active experience in the concerned field (or) Persons having a Master's degree with three years of active experience in the field. In case of contingencies, like start of new PG programme, persons having Ph.D. degree in the concerned field may be recognized as PG Teacher.

27.9.5 **Guides for Masters programme:** PG Teachers after handling PG courses in two semesters are eligible to guide M. Sc. students. In case of contingencies, like start of new PG programme, persons having Ph.D. degree in the concerned field may be recognized as PG Guide.

27.9.6 The Heads of departments will forward the proposals based on the qualification and experience of the teacher as given above. The proposals can be sent when there is acute need for teachers/guide in the prescribed format, given in the *Annexure-6*.

27.9.7 While forwarding the application the Head of the Department should consider the seniority of the teacher, number of courses handled and number of research schemes operated.

27.10 GUIDELINES FOR HEADS OF THE DEPARTMENTS IN MONITORING PROGRESS OF POSTGRADUATE STUDENTS

27.10.1 **Student records:** The "Individual student" file (clip file) containing all the academic records of the student concerned with students bio-data shall be maintained by the PG coordinator on behalf of the Institution. In each file a sheet containing the following information has to be attached.

Date of registration :

Date of qualifying examination :

Due date for thesis submission :

Date of submission of thesis :

Date of viva-voce :

Remarks :

27.10.2 The activities listed out in the following table must be meticulously taken care by the Professor and Head of the Department concerned

Sl.No.	Particulars	Time Schedule
1	List of courses to be offered along with time table	A week before the commencement of each semester
2	Course registration particulars	Within 10 working days from the date of commencement of each semester
3	Time table for mid-semester examinations	A week before the scheduled date for the examinations notified in the academic calendar
~~4~~	Mark lists after completing examinations	Within 10 days from the date of conduct of examinations
5.	Class grade chart	Within 7 days from the date of closure of each semester

27.10.3 The time table for various examinations and evaluations of research credits should be prepared in advance as indicated in the academic calendar of semester concerned and such dates already fixed should not be postponed or changed subsequently.

27.10.4 The Heads of the Departments should monitor the progress of the postgraduate students. Each department should maintain a list of thesis produced so far with the abstract of the same in both hard and soft copies.

Form – 1

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

FORMATION OF ADVISORY COMMITTEE

(To be sent in triplicate within one month from the commencement of First semester)

1. Name of the student :
2. Registration No. :
3. Degree :
4. Subject :
5. Advisory committee :

Sl. No.	Advisory Committee	Name, Designation and Department	Date of Retirement	Signature
1	Chairman			
2	Member 1			
	Member 2			
3	Additional Member			

6. Reason for additional member :

Signature of the student

PG coordinator **Head of the Department**

DEAN

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

Form – 1a

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

CHANGE IN ADVISORY COMMITTEE

(To be sent in triplicate)

1. Name of the student :
2. Registration No. :
3. Degree :
4. Subject :
5. Proposed change :

		Name and designation	Date of retirement	Signature
a.	Existing Chairman/ member			
b.	Proposed Chairman/ member			

6. Reasons for change :

Signature of the student

Chairman of the Advisory Committee **PG coordinator**

Head of the Department **DEAN**

Form – 2

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

PLAN OF COURSE WORK

(To be sent in triplicate before the commencement of mid semester examinations in the first semester)

1. Name of the student :
2. Registration No. :
3. Degree :
4. Subject :
5. Course Programme :

S. No	Course No	Course Title	Credit Hour
		MAJOR COURSES	
		MINOR COURSES	
		SUPPORTING COURSES	
		NON-CREDIT COURSES	
		SEMINAR	
		RESEARCH	
		TOTAL	

6. Tentative area of research :
   (indicate the major field of specialization)

Signature of the student

APPROVAL OF THE ADVISORY COMMITTEE

Advisory committee	Name	Signature
Chairman		
Members	1.	
	2.	
	3.	

PG coordinator **Head of the Department**

DEAN

Form – 3

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

PROGRAMME OF RESEARCH WORK

(To be sent in triplicate before the end of the semester in which the student registers research credit for the first time or the commencement of research work whichever is earlier)

1. Name :
2. Registration No. :
3. Degree :
4. Subject :
5. Date of joining :
6. Title of the research project :
7. Objective(s) :
8. Duration :
9. Location (campus/station) :
10. Review of work done :
11. Broad outline of work/methodology :
12. Semester wise break up of work :

Signature of the student

APPROVAL OF THE ADVISORY COMMITTEE

Advisory committee	Name	Signature
Chairman		
Members	1.	
	2.	
	3.	

PG coordinator **Head of the Department**

DEAN

Form – 3a

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

CHANGE IN PROGRAMME OF RESEARCH

(To be sent in triplicate)

1. Name :
2. Registration No. :
3. Degree :
4. Subject :
5. Reason for change :
6. Proposed change in the approved : programme of research
7. Number of credits completed so far : under the approved programme
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
Chairman		
Members	1.	
	2.	
	3.	

PG coordinator **Head of the Department**

DEAN

Form – 4

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

PROPOSAL OF QUALIFYING EXAMINATION

(To be sent in triplicate)

1. Name of the Department :
2. Degree :
3. Subject :
4. Whether all the courses have been completed :
5. Number of credits completed :
6. Whether the students have an OGPA of not less than 7.00/10.00 :
7. List of PG students appearing for qualifying examination :

Sl. No.	Name	Registration No.	OGPA

8. Panel of External examiners :

Sl. No.	Name and Designation	Address	Area of specialization
1.			
2.			
3.			

9. Remarks :

PG coordinator **Head of the Department**

DEAN

Form – 5

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

COMMUNICATION OF RESULT OF QUALIFYING EXAMINATION

(To be sent in triplicate)

1. Name of the student :
2. Registration No. :
3. Degree :
4. Subject :
5. Date of examination :
6. Date of previous examination (only in case of re-examination) :
7. Result (Successful/ Not successful*) :

(*) to be written by the external examiner

EXAMINATION COMMITTEE

	Name in block letters	**Signature**
Chairman		
Members	1.	
	2.	
	3.	
External Examiner		

Signature of Chairman with name and designation

PG coordinator

Head of the Department

DEAN

Form – 6

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

PROPOSAL OF EXTERNAL EXAMINERS FOR THESIS EVALUATION

(To be sent in duplicate in Confidential cover)

1. Name of the student :
2. Registration No. :
3. Degree :
4. Subject :
5. Thesis title :
6. Name of the Chairman :
7. Panel of external examiners* :

Sl. No.	Name and Designation	Address	Area of specialization
1.			
2.			
3.			

*Three external examiners should be given

8. Remarks :

Signature of the Chairman of the advisory committee

DEAN

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Form – 7

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

RESULT OF FINAL THESIS VIVA-VOCE EXAMINATION

(To be sent in duplicate)

1. Name of the student :
2. Registration No. :
3. Degree :
4. Subject :
5. Thesis title as in final copy of the thesis :
6. Date and time of *viva-voce* :
7. Particulars of the External examiner(s) who has/have evaluated the thesis :

Name and Designation of the External Examiner	**Remarks of the External Examiner**
	RECOMMENDED / RECOMMENDED FOR REVISION / NOT RECOMMENDED

8. **Recommendation of the Examining committee present at the time of final *viva voce* examination**:
   a. Recommends/ does not recommend unanimously the award of degree
   b. The performance of the candidate in final *viva voce* is assessed as _____ (very good/ good/ satisfactory/ not satisfactory)

Sl. No.	**Capacity of examiner**	**Name in block letters**	**Signature**
1.	Chairman/Co-opted Chairman*		
2.	Member 1.		
3.	2.		
4.	Additional member		
5.	Co-opted member*		

* If co-opted in the absence of Chairman/Member

The original report(s) from the external examiner(s) is/ are enclosed

Head of the Department

Chairman of the Examining committee / Advisory committee with designation

Annexure – 1

DETAILS ON FEE TO BE PAID BY THE STUDENT

(Other than admission fee and semester fee)

Sl. No.	Particulars	Amount (Rs.)
1.	Late Registration fee	1000
2.	Missing mid-semester examination fee (per course)	1000
3.	Re-registration fee with juniors	1000
4.	Duplicate Hall ticket	200
5.	Fee for Transfer Certificate and Conduct Certificate	200
6.	Re-examination fee for qualifying exam	5000
7.	Fee for availing grace period for submission of thesis	
	a) Upto one month	1000
	b) Up to three months	2500
8.	Penalty for re-viva voce examination for thesis	5000
9.	Fee for late submission of thesis after final viva-voce	5000
10.	Examination fee (per course)	*
11.	Arrear Examination fee (per course)	*
12.	Revaluation fee (per course)	*
13.	Re-totaling fee (per course)	*
14.	Fee for Provisional Degree Certificate	*
15.	Fee for Transcript Card	*
16.	Fee for Degree Certificate	*
17.	Fee for Migration Certificate	*

*** As fixed by Pondicherry University from time to time**

Annexure – 2

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

STUDENT REGISTRATION CARD - PG

Name of the student	_____	Academic Year	_____
Registration No.	_____	Semester	_____
Degree Programme	_____	Date of Registration	_____
Year of Admission	_____	Date of Commencement	_____

COURSES REGISTERED

Sl. No.	Course Code	Course Title	Credit Hours	Remarks
		TOTAL CREDIT HOURS REGISTERED		

Signature of the Student	**Signature of the Chairman**	**Signature of the Head of the Department**	**Coordinator of Examinations**

APPROVED BY

DEAN
PAJANCOA&RI, KARAIKAL

Annexure-3

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

LIST OF ENCLOSURES TO BE SUBMITTED ALONG WITH THESIS

A. At the time of sending thesis for External Evaluation:

To be submitted to the university

1. One copy of abstract of thesis
2. One copy of the summary of research finding in English (within one page)
3. One copy of the summary of research finding in Tamil (within one page)
4. One page abstract of thesis with key words
5. Result of comprehensive qualifying examination
6. Permission and fee receipt for availing grace period, if any.

To be submitted to the college along with above list

7. Clearance certificates from Hostel
8. Clearance certificates from Library
9. Clearance certificates from Department
10. Clearance certificates from Staff advisor
11. Clearance certificates from Physical Education
12. Approved registration cards (One set)
13. Report cards (one set)
14. Course completion certificate (signed by Chairman and HOD)
15. Attendance Certificate

B. At the time of submission after final viva-voce:

1. Report of the final thesis viva voce examination (To be sent in duplicate)
2. External Examiners thesis evaluation report (Two copies – original + Xerox)
3. Certificate for having carried out the suggestions of the external examiner and advisory committee
4. Thesis in hard bound copy – One Number.
5. Soft copy the thesis in CD (cover to cover in PDF format) - Two Number.

Annexure - 4

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

PROPOSAL FOR RECOGNITION OF TEACHERS FOR TEACHING/GUIDING PG STUDENTS

1. Particulars of the teacher seeking recognition

a. Name of the teacher :

b. Date of birth of the teacher :

c. Designation & present official address of the teacher :

d. Date of joining service in the entry cadre :

e. Academic qualifications

Date of acquiring Bachelor's Degree :

Date of acquiring Master's Degree :

Date of acquiring Ph.D degree :

f. Total service as on the date of this proposal (excluding extraordinary leave) :

g. Date of retirement :

2. Recognition proposal submitted for (tick any one)

a. Recognition as teacher for Masters Programme

b. Recognition as Guide for Masters Programme

3. Teaching experience as on the date of Application

a. No. of UG courses offered :

c. No. of M.Sc courses offered :

Signature of the teacher with date

4. Particulars to be furnished by Head of the Department

No. of existing recognized teachers/guides pertaining to this proposal in your department :

Justification for additional requirement of teachers/guide :

Signature of the Head of Department

Approval of the Dean

Proforma – 1

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

PROFORMA FOR REGISTRATION OF RESEARCH CREDITS

PART- A : PROGRAMME

Semester : I / II Year : Date of registration :

1. Name of the student :
2. Registration No.
3. Total research credits completed so for :
4. Research credits registered during the semester :
5. Programme of work for this semester (list out the items of research work to be undertaken during the semester) :
   i)
   ii)
   iii)
   iv)

APPROVAL OF THE ADVISORY COMMITTEE

Advisory committee	Name	Signature
Chairman		
Members	1.	
	2.	
	3.	

(Approval may be accorded within 10 days of registration)

PROFORMA FOR EVALUATION OF RESEARCH CREDITS

PART - B EVALUATION

(Evaluation to be done before the closure of semester)

Date of closure of semester :

Date of evaluation :

1. Whether the research work has been carried out as per the approved programme :
2. If there is deviation specify the reasons :
3. Performance * :

(*) Performance may be indicated as **SATISFACTORY /NOT SATISFACTORY**

APPROVAL OF THE ADVISORY COMMITTEE

Advisory committee	**Name**	**Signature**
Chairman		
Members	1.	
	2.	
	3.	

Proforma-2

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

PERMISSION FOR LATE REGISTRATION

1.	Name of the student	:
2.	Registration No.	:
3.	Degree	:
4.	Department	:
5.	Semester and Academic year	:
6.	Date of commencement	:
7.	Date of registration without fine	:
8.	Last date for registration with fine	:
9.	Date on which registration is sought	:
10.	Reason	:
11.	Signature of the student	:
12.	Remarks and recommendation of the Chairman	:

Signature of the Chairman

PG Coordinator **Head of the department**

DEAN

Profrma-3

PONDICHERRY UNIVERSITY
PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

WILLINGNESS TO BE GIVEN BY THE STUDENTS TO AVAIL FELLOWSHIP FROM EXTERNALLY FUNDED SCHEMES

1.	Name of the student	:
2.	Registration No.	:
3.	Degree	:
4.	Subject	:
5.	OGPA of Bachelor degree	:
6.	Name of the Chairman	:
7.	Discipline/Department	:
8.	Thesis topic, if allotted	:
9.	Current semester and year in which studying	:
10.	Whether all the course works have been completed , if not indicate the pending courses with credit loads	:

Undertaking by the student:

i. I am willing to avail the proposed fellowship under the scheme entitled_____ _____.

ii. If I leave in the middle of the tenure of the fellowship, I am willing to repay the fellowship availed with 6% penal interest or any levy/fine imposed by the College/University.

iii. I am fully aware that in case of campus transfer due the award of the fellowship that I have to loose the research credits already registered.

iv. I am fully aware that there is no guarantee for the continuation of the courses, which I currently undergo, in the other campus to which I am likely to be transferred.

v. I am willing to abide by all the rules and regulations laid down by the College/University in this regard.

Date: **Signature of Student**

Chairman of the Advisory Committee **Head of the Department**

DEAN

Proforma-4

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

ALLOTMENT OF STUDENTS UNDER JRF/SRF STUDENT FELLOWSHIP

(To be submitted to the Dean)

1.	Title of the scheme	:	
2.	Location of the scheme (Department)	:	
3.	Date of sanction of the scheme	:	
4.	Period of the scheme	:	
5.	Type of fellowship	:	JRF/SRF
6.	Period of fellowship (only for the period of research credits registered)	:	
7.	Amount of fellowship	:	Rs……..p.m
8.	Amount of contingent grant	:	Rs……p.a.
9.	Amount of T.A. provided	:	Rs……..p.a.
10.a.	Whether the technical programme submitted by the student to Dean is the same as envisaged in the scheme proposal	:	Yes / No
b.	If not, whether the revised programme of research is submitted (If yes, date of approval by the Dean)	:	
11.	No. of research credit(s) completed so far by the proposed fellowship awardees (student)	:	
12.	Whether the credits earned earlier are to be retained or to be cancelled?	:	
13.	Whether funds received	:	Yes / No
14.	Name of the student(s) & ID.No.	:	
15.	Number of semesters for which fellowship may be sanctioned	:	
16.	Can the fellowship be sanctioned for grace period also.	:	Yes / No

Principal Investigator **Head of the Department** **Dean**

List of Enclosures

1. Copy of concurrence of the sponsor of the sponsor to avail student fellowship
2. Copy of administrative sanction by Dean
3. Student's willingness and undertaking

PONDICHERRY UNIVERSITY
PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

SPONSOR'S CONCURRENCE (PROFORMA)

1.	Title of the scheme	:	
2.	Location of the scheme (Department)	:	
3. a.	Name & Designation of the PI	:	
b.	Name and designation of the Co-PI	:	
4.	Type of fellowship	:	JRF/SRF
5.	Period of fellowship	:	
a.	Indicate the period of fellowship to be awarded	:	
b.	Amount of fellowship	:	Rs……p.m.
c.	Amount of contingent grant	:	Rs……p.a.
d.	Amount of T.A. Provided	:	Rs……p.a.
e.	Whether Institutional charges paid	:	Yes/No Rs……

Signature of the Sponsor

To
The Dean
PAJANCOA&RI
Karaikal – 609 603

Proforma-6

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

DEPARTMENT OF _____

COURSE COMPLETION CERTIFICATE

This is to certify that Thiru./Selvi/Tmt. _____ Registration No. _____ has completed all the course and research credit requirements on _____ for the award of _____ degree.

Professor and Head

Signature of the Chairman
(with Name and designation)

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

JUSTIFICATION FOR LATE SUBMISSION OF THESIS (if applicable)

1. Name of the student :
2. I.D. No. :
3. Degree :
4. Subject :
5. Date of first registration for the degree :
6. Number of semesters for which the candidate could not register :
7. Reason for not registering and continuing the study :
8. Period of delay in submission of thesis :
9. Period lost due to transfer/ill health :
10. Date of submission of thesis :

Signature of the student

11. Specific remarks and recommendation of the Chairman :

Signature of the Chairman with designation

12. Specific remarks and recommendation of the Head of department :

Signature of the Head

13. Approval of the Dean :

Signature of the Dean

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

PROFORMA FOR EVALUATION OF THESIS

Name of the degree programme: _____.

1. Name and Designation of the examiner :

2. Address of the Examiner :

   Telephone/Mobile :
   Fax :
   e-mail :

3. Name of the candidate :

4. Registration No. :

5. Title of the thesis :

6. Date of receipt of the thesis copy :

7. Date of despatch of the detailed report and thesis by the examiner to the Dean :

8. Examiner's recommendations choosing one of the following based on quality of thesis :
   a. Recommended for award
   b. Recommended for revision

9. Please state whether a list of questions if any to be asked at the viva-voce examination (Questions to be attached) :

Date :
Official Seal :

Signature of the Examiner

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.

Proframa-9

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

DEPARTMENT OF _____

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

(To be enclosed along with result of the final viva voce examination)

Certified that Thiru/Selvi/Tmt _____

Registration No. _____ has carried out all the corrections and suggestions as pointed out by the external examiners(s) and the advisory committee and has submitted **FOUR** copies of his/her M.Sc. thesis in hard bound cover and **TWO** soft copies of thesis in PDF format in CDs.

Head of the department

Signature of the Chairman with Name and designation

Profrma-10

PONDICHERRY UNIVERSITY
PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

PROFORMA FOR OBTAINING PERMISSION TO PRESENT PAPERS IN SEMINAR/SYMPOSIA/TRAINING

(To be sent in triplicate)

1.		Name of the student	:
2.		Registration No.	
3.		Department & College	:
4.		Name of the Chairman with designation	:
5.		Whether course work has been completed?	
6.		Title of paper/poster to be presented (enclose copy)	:
7.	a.	Name of the seminar/symposium	:
	b.	Venue	:
	c.	Dates(From-To)	:
8.		Period of absence (in days) inclusive of travel time	:
9.		Whether the paper was sent through proper channel (copy to be enclosed)	:
10.		Cost of travel & registration fee borne by the student himself (or) supported by the scheme in which he is drawing fellowship?	:

Date: Signature of the Student

Specific Recommendations:

Chairman **Professor and Head**

PERMISSION TO ATTEND THE SEMINAR/SYMPOSIA

(to be issued by the Dean)

1. Permitted without any financial commitment to the College/ University / **Not permitted**
2. Period of absence from_____ to _____(_____ days) is to be treated as duty and can be counted for attendance.
3. Period of absence from _____to _____(_____days) **is not treated as duty and cannot be counted for attendance.**
4. The student should submit a report to the Dean, within 3 days after his return.

DEAN

Profrma-11

PONDICHERRY UNIVERSITY
PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE, KARIAKAL – 609 603

APPLICATION FOR ISSUE OF CONDUCT AND TRANSFER CERTIFICATES

(To be submitted by the student with the recommendation of the Chairman/Head)

1. Name of the student :
2. Registration No. :
3. Name of the Chairman :
4. Designation of the Chairman :
5. Name of the course undergone :
6. Year of joining course :
7. Year of leaving the course :
8. Whether copy of the PC enclosed :
9. Whether original clearance certificate from warden enclosed :

Date: **Signature of the Student**

Recommendations:

Certified that the conduct and characters of Mr/Ms. _____ were _____ during the period of his/her studies. The certificates may be issued accordingly.

Chairman **PG Co-ordinator** **Professor & Head**

CURRICULUM

LIST OF COURSES

Code	Course Title	Credits
	Major Courses (20 Credits)	
ENT 501*	Insect Morphology	1+1
ENT 502*	Insect Anatomy, Physiology and Nutrition	2+1
ENT 503	Principles of Taxonomy	2+0
ENT 504*	Classification of insects	2+1
ENT 505*	Insects Ecology	1+1
ENT506	Insect Pathology	1+1
ENT 507*	Biological control of crop pests and weeds	1+1
ENT 508*	Toxicology of insecticides	2+1
ENT 509	Plant resistance to insects	1+1
ENT 510*	Principles of integrated pest management	1+1
ENT 511	Pests of field crops	1+1
ENT 512	Pests of Horticultural and Plantation crops	1+1
ENT 513	Storage Entomology	1+1
ENT 514	Insect vectors of plant viruses and other pathogens	1+1
ENT 515	General Acarology	1+1
ENT 516	Soil Arthropods and their management	1+1
ENT 517	Vertebrate pest management	1+1
ENT 518*	Techniques in Plant Protection	0+1
ENT 519	Commercial Entomology	1+1
ENT 520	Plant Quarantine	2+0
	Minor courses (9 Credits)	
BIC 510*	Plant Biochemistry	2+1
CRP 501*	Principles of Plant Physiology	2+1
AGR 513	Principles and Practices of Organic Farming	2+1
PAT 504	Diseases of Field crops	2+1
	Supporting Courses (5 Credits)	
STA 501	Statistical Methods	1+1
STA 502	Design of Experiments	1+1
STA 503	Data Analysis using Statistical Packages- I	0+1
	Seminar and Research (21 Credits)	
ENT 591	Seminar	0+1
ENT 599	Research	0+20
	Non-Credit Compulsory Courses (6 Credits)	
PGS 501*	Library And Information Services	0+1
PGS 502*	Technical Writing and Communication Skills	0+1
PGS 503 *	Intellectual Property and Its Management In Agriculture *(e-Course)*	1+0
PGS 504*	Basic Concepts In Laboratory Techniques	0+1
PGS 505*	Agricultural Research, Research Ethics and Rural Development Programmes *(e-Course)*	1+0
PGS 506*	Disaster Management *(e-Course)*	1+0

* Courses to be compulsorily registered by the students

MAJOR – CORE COURSES

ENT 501 INSECT MORPHOLOGY 1+1

Theory

Unit I

Principles, utility and relevance: insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation.

Unit II

Head – origin, structure and modification; types of mouthparts, eyes and antennae,tentorium and neck sclerites, sutures and sulcus.

Unit III

Thorax – Areas and sutures of tergum, sternum and pleuron, pterothorax; Wings: structure and modifications, venation, wing coupling apparatus and mechanism of flight; Legs: structure and modifications.

Unit IV

Abdomen – Segmentation and appendages; Genitalia and their modifications; Embryonic and post-embryonic development

Unit V

Types of metamorphosis. Insect sense organs (mechano–photo and chemo – receptors) and stridulatory organs.

Practical

Study of insect segmentation, various tagmata and their appendages; preparation of permanent mounts of different body parts and their appendages of taxonomic importance includingmale and female genitalia,Sense organs.

References

1. Antony Youdeowei .1997.A laboratory manual of Entomology. Ibadan Oxford University Press.
2. Chapman, RF. 1998. The Insects: Structure and Function. Cambridge Univ. Press, Cambridge.
3. David BV & Ananthakrishnan TN. 2004.General and Applied Entomology. Tata-McGraw Hill, New Delhi.
4. Dunston PA. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publ., New Delhi.
5. Evans JW. 2004. Outlines of Agricultural Entomology. Asiatic Publ., New Delhi.
6. Richards OW & Davies RG. 1977. Imm's General Text Book of Entomology. 10th Ed. Chapman &Hall, London.
7. Saxena RC & Srivastava RC. 2007. Entomology: At a Glance. Agrotech Publ. Academy, Jothpur.
8. Snodgross RE. 1993. Principles of Insect Morphology. Cornell Univ. Press, Ithaca

ENT 502 INSECT ANATOMY, PHYSIOLOGY AND NUTRITION 2+1

Theory

Unit I

Scope and importance of insect anatomy and physiology.

Unit II

Structure, modification and physiology of different systems - digestive, circulatory, respiratory, excretory, nervous, musculature, reproductive, sensory, endocrine and exocrine glands.

Unit III

Thermodynamics; physiology of integument, moulting; growth, metamorphosis and diapause.

Unit IV

Insect nutrition- role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals and other food constituents;

Unit V

Extra and intra-cellular microorganisms and their role in physiology; artificial diets

Practical

Dissection of different insects to study comparative anatomical details of different systems; preparation of permanent mounts of internal systems; chromatographic analysis of free amino acids of haemolymph; determination of chitin in insect cuticle; examination of insect haemocytes; determination of respiratory quotient; preparation and evaluation of various diets; consumption, utilization and digestion of natural and artificial diets.

References

1. Chapman RF. 1998. *Insects: Structure and Function*. ELBS Ed., London.
2. Duntson PA. 2004. *The Insects: Structure, Function and Biodiversity*. Kalyani Publ., New Delhi.
3. Kerkut GA & Gilbert LI. 1985.*Comprehensive Insect Physiology, Biochemistry and Pharmacology.*Vols. I-XIII. Pergamon Press, New York.
4. Klowden, M. J. 2007. Physiological Systems in Insects. Academic Press, New York.
5. Patnaik BD. 2002. *Physiology of Insects*. Dominant, New Delhi.
6. Pritam Singh & Moore RF. 1998. Hand Book of Artificial Diets. Elsevier Sci. Pub. New York.
7. Richards OW & Davies RG. 1977. *Imm's General Text Book of Entomology.* 10th Ed. Vol.1.*Structure, Physiology and Development.* Chapman & Hall, New York.
8. Rockstein, M. 1978. Biochemistry of insects. Academic Press, New York.
9. Saxena RC &Srivastava RC. 2007. *Entomology at a Glance*. Agrotech Publ. Academy, Jodhpur.
10. Wigglesworth, VB. 1984. *Insect Physiology.*8th Ed. Chapman & Hall, New York.

ENT 503 PRINCIPLES OF TAXONOMY 2+0

Theory

Unit I

Introduction to history and principles of systematics and importance. Levels and functions of systematics. Identification, purpose, methods- character matrix, taxonomic keys.

Unit II

Description subjects of descriptions, characters, nature of characters, analogy vs homology, parallel vs convergent evolution, intraspecific variation in characters, polythetic and polymorphic taxa, sexual dimorphism.

Unit III

Classification of animals: Schools of classification- Phenetics, Cladistics and Evolutionary classification. Components of Biological Classification: Hierarchy, Rank, Category and Taxon. Species concepts, cryptic, sibling and etho-species, infra-specific categories. Introduction to numerical, biological and cytogenetical taxonomy.

Unit IV

Nomenclature: Common vs Scientific names. International Code of Zoological Nomenclature, criteria for availability of names, validity of names. Categories of names under consideration of ICZN.

Unit V

Publications, Principles of priority, and homonymy, synonymy, type concept in zoological nomenclature. Speciation, anagenesis vs cladogenesis, allopatric, sympatric and parapatric processes.

References

1. Blackwelder R.E. 1967. Taxonomy - A Text and Reference Book. John Wiley & Sons, New York.
2. George Gaylord Simpson. 1990. Principles of Animal Taxonomy. Columbia University Press, New York
3. Gregg, J.R. 1984.The Language of Taxonomy: An Application of Symbolic Logic to the Study of Classificatory Systems. Columbia Bicentennial Editions and Studies.
4. Kapoor VC. 1983. Theory and Practice in Animal Taxonomy. Oxford & IBH, New Delhi.
5. Mayr E. 1971. Principles of Systematic Zoology. Tata McGraw-Hill, New Delhi.
6. Parker,S.P.1982.Synopsis and Classification of Living Organisms - Vol I and II Mac Graw Hill Book Company, New York
7. Quicke DLJ. 1993. Principles and Techniques of Contemporary Taxonomy. Blackie, London.
8. Winston, J.E.1988.Describing Species: Practical Taxonomic Procedure for Biologists. Columbia University Press, New York
9. Narendran, T.C.2006. introduction to Taxonomy. Zoological survey of India, Kolkata.

ENT 504 CLASSIFICATION OF INSECTS 2+1

Theory

Unit I

Brief evolutionary history of Insects- introduction to phylogeny of insects and Major Classification of Superclass Hexapoda, recent classification — Classes — Ellipura (Collembola, Protura), Diplura and Insecta- Orders contained.

Unit II

Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them. Collembola, Protura, Diplura. Class Insecta: Subclass Apterygota — Archaeognatha, Thysanura. Subclass: Pterygota, Division Palaeoptera — Odonata and Ephemeroptera.

Unit III

Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them .Division: Neoptera: Subdivision: Orthopteroid and Blattoid Orders (=Oligoneoptera: Plecoptera, Blattodea, Isoptera, Mantodea, Grylloblattodea, Dermaptera,Orthoptera, Phasmatodea, Mantophasmatodea, Embioptera, Zoraptera), Subdivision: Hemipteroid Orders (=Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera.

Unit IV

Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them (Continued). Division Neoptera — Subdivision Endopterygota, Section NeuropteroidColeopteroid Orders: Strepsiptera, Megaloptera, Raphidioptera,

Unit V

Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them .Neuroptera and Coleoptera, Section Panorpoid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.

Practical

Study of Orders of insects and their identification using taxonomic keys. Keying out families of insects of different major Orders: Odonata, Orthoptera,Blattodea, Mantodea, Isoptera, Hemiptera,Thysanoptera, Phthiraptera, Neuroptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera. Field visits to collect insects of different orders.

References

1. CSIRO 1990. The Insects of Australia: A Text Book for Students and Researchers. 2nd Ed. Vols.I& II, CSIRO. Cornell Univ. Press, Ithaca.
2. Freeman S & Herron JC. 1998. Evolutionary Analysis. Prentice Hall, New Delhi.
3. Richards OW & Davies RG. 1977. Imm 's General Text Book of Entomology. 10th Ed. Chapman &Hall, London.
4. Ross HH.1974. Biological Systematics. Addison Wesley Publ. Co. Triplehorn CA & Johnson NF.
5. Triple Horn and Norman F. Johnson. 1998. Borror and DeLong's Introduction to the Study of Insects. 7th Ed. Thomson/ Brooks/ Cole, USA/Australia.
6. Gullan P and Kranston PS. 2011. The Insects Outlines of Entomology. John Wiley and Sons, UK.

ENT 505 INSECT ECOLOGY 1+1

Theory

Unit I

History and Definition. Basic Concepts. Organization of the Biological world. Plato's Natural Balance vs Ecological Dynamics as the modern view. Abundance and diversity of insects, Estimates and Causal factors. Study of abundance and distribution and relation between the two. Basic principles of abiotic factors and their generalized action on insects. Implications for abundance and distribution of organisms including insects- Law of the Minimum, Law of Tolerance, andbiocoenosis, Systems approach to ecology.

Unit II

Basic concepts of abundance- Model vs Real world. Population growth basic models – Exponential vs Logistic models. Discrete vs Continuous growth models. Concepts of Carrying capacity, Environmental Resistance and Optimal yield. Vital Statistics- Life Tables and their application to insect biology. Survivorship curves. Case studies of insect life tables. Population dynamics- Factors affecting abundance- Environmental factors, dispersal and migration, Seasonality in insects. Classification and mechanisms of achieving different seasonality- Diapause (Quiescence) -aestivation, hibernation.

Unit III

Biotic factors- Food as a limiting factor for distribution and abundance, Nutritional Ecology. Food chain- web and ecological succession. Interspecific interactions- Basic factors governing the interspecific interactions- Classification of interspecific interactions - The argument of cost-benefit ratios.

Unit IV

Competition - Lotka-Volterra model, Concept of niche ecological homologues, competitive exclusion. Prey-predator interactions- Basic model- Lotka-Volterra Model, Volterra'sprinciple. Functional and numerical response. Defense mechanisms against predators/parasitoids- Evolution of mimicry, colouration, concept of predator satiation; evolution of life history strategies.

Unit V

Community ecology- Concept of guild, Organization of communities- Hutchinson Ratio, May's *d/w*, Relation between the two and their association with Dyar's Law and Przibram's law. Relative distribution of organisms, Concept of diversity- the Wallacian view. Assessment of diversity. Diversity- stability debate, relevance to pest management. Pest management as applied ecology.

Practical

Types of distributions of organisms. Methods of sampling insects, estimation of densities of insects and understanding the distribution parameters- Measures of central tendencies, Poisson Distribution, Negative Binomial Distribution. Determination of optimal sample size. Learning to fit basic population growth models and testing the goodness of fit. Fitting Holling's Disc equation, Assessment of prey-predator densities from natural systems and understanding the correlation between the two. Assessing and describing niche of some insects of a single guild. Calculation of niche breadth, activity breadth and diagrammatic representation of niches of organisms. Calculation of some diversity indices- Shannon's, Simpson's and Avalanche Index and understanding their

associations and parameters that affect their values. Problem solving in ecology. Field visits to understand different ecosystems and to study insect occurrence in these systems.

References

1. Chapman JL & Reiss MJ. 2006. *Ecology: Principles & Applications*. 2nd Ed. Cambridge Univ. Press, Cambridge.
2. Gotelli NJ & Ellison AM. 2004. *A Primer of Ecological Statistics.* Sinauer Associates, Inc., Sunderland, MA.
3. Gotelli NJ. 2001. *A Primer of Ecology.* 3rd Ed. Sinauer Associates, Inc., Sunderland, MA
4. Gupta RK. 2004. *Advances in Insect Biodiversity*. Agrobios, Jodhpur.
5. Krebs CJ. 1998. *Ecological Methodology*. 2nd Ed. Benjamin-Cummings Publ. Co., New York.
6. Krebs CJ. 2001. *Ecology: The Experimental Analysis of Distribution and Abundance.* 5th Ed. Benjamin-Cummings Publ. Co., New York.
7. Magurran AE. 1988. *Ecological Diversity and its Measurement.* Princeton Univ. Press, Princeton. Price PW. 1997. *Insect Ecology*. 3rd Ed. John Wiley, New York.
8. Real LA & Brown JH. (Eds). 1991. *Foundations of Ecology: Classic Papers with Commentaries*. University of Chicago Press, Chicago.
9. Southwood TRE & Henderson PA. 2000. *Ecological Methods.* 3rd Ed. Methuen & Co. Ltd., London.
10. Speight MR, Hunta MD & Watt AD. 2006. *Ecology of Insects: Concepts and Application*. Elsevier Science Publ., The Netherlands.
11. Wilson EO & William H Bossert WH. 1971.*A Primer of Population Biology*. Harvard University, USA.
12. Wratten SD & Fry GLA.1980. *Field and Laboratory Exercises in Ecology*. Arnold, London.
13. Dent, D. R. and Walton, M. P. 1997.Methods in ecological and agricultural entomology. CAB International, UK.
14. Yazdani, S.S. and M.L. Agarwal. 1985. Elements of Insect Ecology. Kalyani Publishers, New Delhi.

ENT 506 INSECT PATHOLOGY 1+1

Theory

Unit I

History of insect pathology, infection of insects by bacteria, fungi, viruses, protozoa, rickettsiae, spiroplasma and nematodes.

Unit II

Epizootiology, symptomatology and etiology of diseases caused by the above and the factors controlling these. Defense mechanisms in insects against pathogens.

Unit III

Examples of successful instances of exploitation of pathogens for pest management

Unit IV

Mass production techniques of pathogens.

Unit V

Safety and registration of microbial pesticides. Use of insect pathogens in integrated management of insect pests.

Practical

Familiarization with equipment used in insect pathology laboratory. Identification of different groups of insect pathogens and symptoms of infection. Isolation, culturing and testing pathogenicity of different groups of pathogens. Testing Koch's postulates. Estimation of pathogen load. Extraction of pathogens from live organisms and soil. Bioassays to determine median lethal doses.

References

1. Boucias DG & Pendland JC. 1998. *Principles of Insect Pathology.* Kluwer Academic Publisher, Boston.
2. Burges HD & Hussey NW. (Eds). 1971. *Microbial Control of Insects and Mites.* Academic Press, London.
3. Steinhaus EA. 1984. *Principles of Insect Pathology.* Academic Press, London.

ENT 507 BIOLOGICAL CONTROL OF CROP PESTS AND WEEDS 1+1

Theory

Unit I

History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control-importation, augmentation and conservation.

Unit II

Biology, adaptation, host seeking behaviour of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa etc., their mode of action. Biological control of weeds using insects.

Unit III

Mass production of quality biocontrol agents- techniques, formulations, economics, field release/application and evaluation.

Unit IV

Successful biological control projects, analysis, trends and future possibilities of biological control.

Unit V

Importation of natural enemies- Quarantine regulations, biotechnology in biological control. Semiochemicals in biological control.

Practical

Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers. Visits (only where logistically feasible) to bio-control laboratories to learn rearing and mass production of egg, egg-larval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds. Field collection of parasitoids and predators.Hands-on training in culturing, identification of common insect pathogens.Quality control and registration standards for biocontrol agents.

References

1. Burges, H.D. and Hussey, N.W. 1971. Microbial control of insects and mites. Academic press, New York.
2. Gautam, R.D. 1994. Biological Pest Suppression. Westville Publishing House, New Delhi.
3. Hall, F. R. and Menn, J. J. 1999. Biopesticides: Use and delivery. Humana Press, New Jersey. USA.
4. Huffaker, C.B. and P.S. Messenger. 1976. Theory and practice of biological control. Academic press, New York.
5. Huffaker, C.D. 1973. Biological control. Plenum Press, New York.
6. Jervis, M. and Kidd, N. 1996. Insect natural enemies: Practical approaches to their study and evaluation. Chapman and Hall, London, Uk.
7. Papavizas, G.C. 1981. Biological control in crop production. Beltsville Symposia in Agricultural Research. Allenened Osmen Publish. USA.
8. Quicke, D. L. J. 1997. Parasitic wasps. Chapman and Hall, London, UK.
9. Tanada, Y. and Kaya, H. 1993. Insect pathology. Academic Press, New York, USA.
10. Coppel, H.C. and J.W. Mertins. 1977. Biological Insect Pest Suppression. Springer – Verlag, Berlin,
11. De Bach, P. 1964. Biological control of Insect pests and weeds. Champman and Hall, London.
12. Quicke, D. L. J. 1997. Parasitic wasps. Chapman and Hall, London, UK.
13. Clausen,CP.1940.Entomophagous insects. McGraw Hill book company Ltd, USA.

ENT 508 TOXICOLOGY OF INSECTICIDES 2+1

Theory

Unit I

Definition and scope of insecticide toxicology; history of chemical control; pesticide use and pesticide industry in India.

Unit II

Classification of insecticides and acaricides based on mode of entry, mode of action and chemical nature. Structure and mode of action of organochlorines, organophosphates, carbamates, pyrethroids, tertiary amines, neonicotinoids, oxadiazines, phenyl pyrozoles, insect growth regulators, microbials, botanicals and new promising compounds.

Unit III

Principles of toxicology; evaluation of insecticide toxicity; joint action of insecticides- synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticide compatibility, selectivity and phytotoxicity.

Unit IV

Insecticide metabolism; pest resistance to insecticides; mechanisms and types of resistance; insecticide resistance management and pest resurgence.

Unit V

Insecticide residues, their significance and environmental implications. Insecticide Act, registration and quality control of insecticides; safe use of insecticides; diagnosis and treatment of insecticide poisoning.

Practical

Insecticide formulations and mixtures; quality control of pesticide formulations; laboratory and field evaluation of bioefficacy of insecticides; bioassay techniques; probit analysis; evaluation of insecticide toxicity and joint action. Toxicity to beneficial insects. Pesticide appliances. Working out doses and concentrations of pesticides; visit to toxicology laboratories. Good laboratory practices.

References

1. Coats, J.R. 1982.Insecticides mode of action. Academic Press, New York.
2. Chattopadhyay SB*. 1985. Principles and Procedures of Plant Protection.* Oxford & IBH, New Delhi.
3. Gupta HCL.1999. *Insecticides: Toxicology and Uses.* Agrotech Publ., Udaipur.
4. Ishaaya I & Degheele (Eds.). 1998. *Insecticides with Novel Modes of Action.* Narosa Publ. House, New Delhi.
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7. Prakash A & Rao J. 1997.*Botanical Pesticides in Agriculture.* Lewis Publ., New York.
8. Regupathy, A and K.P. Dhamu. 2001. Statistical work book for Insecticide Toxicology. Softech Computers, Coimbatore.
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10. Stenersen, J. 2004. Chemical pesticides. Mode of action and Toxicology.CRC press, USA.
11. Yu, 2008.The Toxicology and Biochemistry of Insecticides. CRC Press.
12. Hayes, W.T and E.T. Laws. 1991. Hand book of Pesticides, Academic press, London. Vol 1-3.

ENT 509 PLANT RESISTANCE TO INSECTS 1+1

Theory

Unit I

History and importance of resistance, principles, classification, components, types and mechanisms of resistance.

Unit II

Insect-host plant relationships; theories and basis of host plant selection in phytophagous insects.

Unit III

Chemical ecology, tritrophic relations, volatiles and secondary plant substances; basis of resistance. Induced resistance - acquired and induced systemic resistance. Factors affecting plant resistance including biotypes and measures to combat them.

Unit IV

Screening techniques; genetics of resistance; breeding for insect resistance in crop plants; exploitation of wild plant species; gene transfer, successful examples of resistant crop varieties in India and world.

Unit V

Role of biotechnology in plant resistance to insects.

Practical

Screening techniques for measuring resistance; measurement of plant characters and working out their correlations with plant resistance; testing of resistance in important crops; bioassay of plant extracts of susceptible/resistant varieties; demonstration of antibiosis, tolerance and antixenosis.

References

1. Chelliah, S. and Uthamasamy, S.1995. Plant Resistance to Plants: Principles and Practices. APC Publications Pvt Ltd., New Delhi.
2. Dhaliwal, G.S. & Singh, R. (Eds). 2004. *Host Plant Resistance to Insects - Concepts and Applications.* Panima Publ., New Delhi.
3. Maxwell, F.G. & Jennings, P.R. (Eds). 1980. *Breeding Plants Resistant to Insects.* John Wiley & Sons, New York.
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6. Smith CM. 2005. *Plant Resistance to Arthropods – Molecular and Conventional Approaches.* Springer, Berlin.

ENT 510 PRINCIPLES OF INTEGRATED PEST MANAGEMENT 1+1

Theory

Unit I

History and origin, definition and evolution of various related terminologies.

Unit II

Concept and philosophy, ecological principles, economic threshold concept and economic consideration.

Unit III

Pest survey and surveillance, Forecasting, types of surveys including remote sensing methods, factors affecting surveys;

Unit IV

Tools of pest management and their integration- legislative, cultural, physical and mechanical methods, political, social and legal implications of IPM

Unit V

Pest risk analysis; pesticide risk analysis; cost-benefit ratios and partial budgeting; case studies of successful IPM programmes.

Practical

Characterization of agro-ecosystems; sampling methods and factors affecting sampling; population estimation methods; crop loss assessment direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses. Computation of EIL and ETL; crop modeling; designing and implementing IPM system.

References

1. Dhaliwal GS & Arora R. 2003.Integrated Pest Management – Concepts and Approaches. Kalyani Publ., New Delhi.
2. Dhaliwal GS, Singh R & Chhillar BS. 2006. Essentials of Agricultural Entomology. Kalyani Publ., New Delhi.
3. Flint MC & Bosch RV. 1981. Introduction to Integrated Pest Management. 1st Ed., Springer, New York.
4. Horowitz AR & Ishaaya I. 2004.Insect Pest Management: Field and Protected Crops. Springer, New Delhi.
5. Ignacimuthu SS &J ayaraj S. 2007.Biotechnology and Insect Pest Management. Elite Publ., New Delhi.
6. Metcalf RL &Luckman WH. 1982.Introduction of Insect Pest Management. John Wiley & Sons, New York.
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9. Subramanyam B & Hagstrum DW. 1995. Integrated Management of Insects in Stored Products. Marcel Dekker, New York.

ENT 511 PESTS OF FIELD CROPS 1+1

Theory

Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect and mite pests and vectors of different crops

Unit I

Insect pests of cereals and millets and their management.

Unit II

Polyphagous pests: grasshoppers, locusts, termites, white grubs, hairy caterpillars, and non-insect pests (mites, birds, rodents, snails, slugs etc.).

Unit III

Insect pests of pulses, oilseeds and their management.

Unit IV

Insect pests of fibre crops and forages and their management.

Unit V

Insect pests of tobacco and sugarcane and their management

Practical

Field visits, collection and identification of important pests and their natural enemies; detection and estimation of infestation and losses in different crops; study of life history of important insect pests.

References

1. Atwal AS, Dhaliwal GS & David BV. 2001. *Elements of Economic Entomology.* Popular Book Depot, Chennai.
2. Dhaliwal GS, Singh R & Chhillar BS. 2006. *Essentials of Agricultural Entomology.* Kalyani Publ., New Delhi.
3. Dunston AP. 2007. *The Insects: Beneficial and Harmful Aspects*. Kalyani Publ., New Delhi
4. Evans JW. 2005. *Insect Pests and their Control*. Asiatic Publ., New Delhi.
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7. Saxena RC & Srivastava RC. 2007. *Entomology at a Glance*. Agrotech Publ. Academy, Jodhpur.
8. Regupathy, A and R. Ayyasamy.2013. A guide on crop pests. Namruta Publications, Chennai.

ENT 512 PESTS OF HORTICULTURAL AND PLANTATION CROPS 1+1

Theory

Studies on systematic position, host range, bionomics, seasonal incidence and IPM for pests of the following horticultural and plantation crops.

Unit I

Fruit Crops- Mango , Citrus, Guava ,Banana , Grapes, Sapota, Pomegranate, Jack, Papaya, Ber, Aonla, Fig, Pine apple, Litchi, Noni, Temperate Fruits (Apple, Peach, Plum, Pear)

Unit II

Vegetable and tuber Crops - Bhendi, Brinjal, Gourds, Cole crops, Potato, Sweet potato, Yams, Leguminous vegetables, drumstick and amaranths

Unit III

Plantation Crops - Coconut, Cashew, Coffee, Tea, Cocoa, Rubber, Spices , condiments and masticatory crops -Pepper, cardamom, Turmeric, Ginger, Cinnamon, Chillies, Onion, Curry Leaves, Betel vine, Areca nut

Unit IV

Flower and Ornamental Crops Jasmine, Rose, Crossandra, Nerium, Crotons, Lilly, Coleus, Medicinal plants Ocimum, Periwinkle, Aswagantha, Sarpagandha, medicinal Coleus, Neem

Unit V

Insect Pests of polyhouses

Practical

Field visits, collection and identification of important pests and their natural enemies; detection and estimation of infestation and losses in different crops; study of life history of important insect pests.

References

1. Atwal, A.S. and G.S.Dhaliwal.2002.Agricultural Pests of South Asia and their Management. Kalyani Publishers, New Delhi.
2. Butani, D.K. and M.G.Jotwani.1984.Insects in Vegetables. Periodical Expert Book Agency, New Delhi.
3. Butani , D.K. and M.G.Jotwani.1984.Insects and Fruits. Periodical Expert Book Agency, New Delhi.
4. Chattopadhyay,T.K. 1994. A Text Book on Pomology. Kalyani Publishers, Ludhiana.
5. Dhaliwal, G.S., R. Singh and B.S. Chhillar. 2006. Essentials of Agricultural Entomology. Kalyani Publishers, New Delhi.
6. Srivastava, K.P. and D.K. Butani. 1998. Pest Management in Vegetables. Part I and II. Research Periodicals & Book Publishing House, New Delhi.
7. Verma, I.R., A.K. Verma and D.C.Goutham.2004. Pest Management in Horticultural Crops: Principles and Practices. AsiaTech Publishers, New Delhi.
8. Regupathy, A and R. yyasamy.2013. A guide on crop pests. Namruta Publications, Chennai.

ENT 513 STORAGE ENTOMOLOGY 1+1

Theory

Unit I

Introduction, history of storage entomology, concepts of storage entomology and significance of insect pests. post-harvest losses *in toto vis-à-vis* total production of food grains in India. Scientific and socio-economic factors responsible for grain losses.

Unit II

Important pests namely insects, mites, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products; their systematic position, identification, distribution, host range, biology, nature and extent of damage, role of field and cross infestations and natural enemies, type of losses in stored grains and their effect on quality including biochemical changes, association of stored grain insects with fungi and mites.

Unit III

Ecology of insect pests of stored commodities / grains with special emphasis on role of moisture, temperature and humidity in safe storage of food grains and commodities. Stored grain deterioration process, physical and biochemical changes and consequences. Grain storage, types of storage structures i.e., traditional, improved and modern storage structures in current usage. Ideal seeds and commodities' storage conditions.

Unit IV

Important rodent pests associated with stored grains and their non-chemical and chemical control including fumigation of rat burrows. Role of bird pests and their management. Control of infestation by insect pests, mites and microrganisms. Preventive measures - Hygiene/sanitation, disinfestations of stores / receptacles, legal methods - stored grain insects of quarantine importance.

Unit V

Curative measures - Non-chemical control measures - ecological, mechanical, physical, cultural, biological and engineering. Chemical control - prophylactic and curative - Characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Integrated approaches to stored grain pest management.

Practical

Collection, identification and familiarization with the stored grains / seed insect pests and nature of damage caused by them; detection of insect infestation in stored food grains, stored grain insect detection gadgets; estimation of losses in stored good grains; determination of moisture content in stored good grains; familiarization of storage structures, demonstration of preventive and curative measures including fumigation techniques; treatment of packing materials and their effect on seed quality. Field visits to save grain campaign, central warehouse and FCI warehouses and institutions engaged in research or practice of grain storage like CFTRI, IGSMRI, Hapur etc. (only where logistically feasible).

References

1. Hall DW. 1970. Handling and Storage of Food Grains in Tropical and Subtropical Areas. FAO.
2. Agricultural Development Paper No. 90 and FAO, Plant Production and Protection Series, No. 19, FAO, Rome.
3. Jayas DV, White NDG & Muir WE. 1995. Stored Grain Ecosystem. Marcel Dekker, New York.
4. Khader V. 2004.Textbook on Food Storage and Preservation. Kalyani Publ., New Delhi.
5. Khare BP. 1994. Stored Grain Pests and Their Management. Kalyani Publ., New Delhi.
6. Subramanyam B & Hagstrum DW. 1995. Interrelated Management of Insects in Stored Products. Marcel Dekker, New York.
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8. Prakash, I and Mathur, R.P.1987. Management of rodent pests, ICAR, New Delhi.

ENT 514 INSECT VECTORS OF PLANT VIRUSES AND OTHER PATHOGENS 1+1

Theory

Unit I

History of developments in the area of insects as vectors of plant pathogens. Important insect vectors and their characteristics; mouth parts and feeding processes of important insect vectors. Efficiency of transmission.

Unit II

Transmission of plant viruses and fungal pathogens. Relation between viruses and their vectors.

Unit III

Transmission of plant viruses by aphids, whiteflies, mealy bugs and thrips.

Unit IV

Transmission of mycoplasma and bacteria by leaf hoppers and plant hoppers.

Unit V

Transmission of plant viruses by psyllids, beetles and mites. Epidemiology and management of insect transmitted diseases through vector management.

Practical

Identification of common vectors of plant pathogens- aphids, leafhoppers, whiteflies, thrips, beetles, nematodes; culturing and handling of vectors; demonstration of virus transmission through vectors aphids, leafhoppers and whiteflies.

References

1. Anathakrishnan, T. N. and A. Raman. 1989. Thrips and gall dynamics. Oxford & IBH, New Delhi, India.
2. Basu AN. 1995. *Bemisia tabaci* (Gennadius) - Crop Pest and Principal Whitefly Vector of Plant Viruses. Oxford & IBH, New Delhi.
3. Harris KF & Maramarosh K. (Eds.).1980.Vectors of Plant Pathogens. Academic Press, London.
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5. Youdeovei A & Service MW. 1983. Pest and Vector Management in the Tropics. English Language Books Series, Longman, London.
6. Basu, A.N. and B.K. Giri. 1993. The essentials of viruses, vectors and plant diseases. Wiley Eastern Limited, New Delhi.

ENT 515 GENERAL ACAROLOGY 1+1

Theory

Unit I

History of Acarology; importance of mites as a group; habitat, collection and preservation of mites.

Unit II

Introduction to morphology and biology of mites and ticks.

Unit III

Broad classification- major orders and important families of Acari including diagnostic characteristics .

Unit IV

Economic importance, seasonal occurrence, nature of damage, host range of mite pests of different crops, mite pests in polyhouses, mite pests of stored products and honey bees.

Unit V

Management of mites using acaricides, phytoseiid predators, fungal pathogens Culturing of phytophagous, parasitic and predatory mites.

Practical

Collection of mites from plants, soil and animals; extraction of mites from soil, plants and stored products; preparation of mounting media and slide mounts; external morphology of mites; identification of mites up to family level using keys; studying different rearing techniques for mites.

References

1. Krantz, G.W. 1985. A manual of Acarology (Second edition). Oregon State University, Cornvallis, U.S.A. 509 p.
2. Chhillar BS, Gulati R &Bhatnagar P. 2007. Agricultural Acarology. Daya Publ. House, New Delhi.
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5. Gupta SK. 1985. Handbook of Plant Mites of India. Zoological Survey of India, Calcutta.
6. Gwilyn O & Evans GO. 1992. Principles of Acarology. CABI, London.
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8. Qiang Zhiang Z. 2003. Mites of Green Houses- Identification, Biology and Control. CABI, London.
9. Sadana GL. 1997. False Spider Mites Infesting Crops in India. Kalyani Publ. House, New Delhi.
10. Walter DE & Proctor HC. 1999. Mites- Ecology, Evolution and Behaviour. CABI, London.

ENT 516 SOIL ARTHROPODS AND THEIR MANAGEMENT 1+1

Theory

Unit I

Soil arthropods and their identification, classification and habitats.

Unit II

Estimation of populations; sampling and extraction methods.

Unit III

Role of soil arthropods in detritus feeding, litter breakdown and humus formation. Soil arthropods as bio-indicators of habitat qualities. Effect of soil arthropod activity on soil properties.

Unit IV

Harmful and beneficial soil arthropods and their management, interrelationship among arthropods and other soil invertebrates and soil microorganisms.

Unit V

Anthropogenic effects on soil arthropods.

Practical

Sampling, extraction methods and identification of various types of soil fauna; estimation and assessment of soil arthropod population; techniques and culturing soil invertebrates.

References

1. Anderson JM & Ingram JSI. 1993. Tropical Soil Biology and Fertility: A Handbook of Methods. CABI, London.
2. Dindal DL. 1990. Soil Biology Guide. A Wiley-Inter Science Publ., John Wiley & Sons, New York.
3. Pankhurst C, Dube B & Gupta, V. 1997.Biological Indicators of Soil Health. CSIRO, Australia.
4. Veeresh GK & Rajagopal D. 1988.Applied Soil Biology and Ecology. Oxford & IBH Publ., New Delhi.

ENT 517 VERTEBRATE PEST MANAGEMENT 1+1

Theory

Unit I

Vertebrate pests of different crops; biology of vertebrate pests such as rodents, birds and other mammals. Biology of beneficial birds.

Unit II

Population dynamics and assessment, patterns of pest damage and assessment, roosting and nesting systems in birds.

Unit III

Management strategies –physical (trapping, acoustics and visual) and chemical (poisons, repellents, fumigants and anticoagulants) methods.

Unit IV

Management strategies – biological (predators, parasites), cropping practices, alteration of habitats, diversion baiting and other eco-friendly methods.

Unit V

Operational practices – baiting, bioassays, equipments and educative programmes.

Practical

Identification of important rodent and other vertebrate pests of agriculture, food preference and hoarding, social behaviour, damage assessment, field survey, population estimation, control operation and preventive methods.

References

1. Fitzwater WD & Prakash I. 1989.Handbook of Vertebrate Pest Control. ICAR, New Delhi.
2. Prakash I & Ghosh PK.1997.Rodents in Indian Agriculture. Vol. I State of Art Scientific Publ. Jodhpur.
3. Prater SH. 1971.The Book of Indian Animals. The Bombay Natural History Society, Bombay.
4. Ali S. 1965. The Book of Indian Birds. The Bombay Natural History Society, Bombay.
5. Barnett, SA and Prakash, I. 1975. Rodents of economic importance in India. Oxford Print Croft India Pvt. Ltd., New Delhi.

ENT 5I8 TECHNIQUES IN PLANT PROTECTION 0+1

Practical

Pest control equipments, principles, operation, maintenance, selection, application of pesticides and biocontrol agents, seed dressing, soaking, root-dip treatment, dusting, spraying, application through irrigation water.

Soil sterilization, solarization, deep ploughing, flooding, techniques to check the spread of pests through seed, bulbs, corms, cuttings and cut flowers. Use of light, transmission and scanning electron microscopy. Protein isolation from the pest and host plant and its quantification using spectrophotometer and molecular weight determination using SDS/PAGE.

Use of tissue culture techniques in plant protection. Computer application for predicting/forecasting pest attack and identification.

References

1. Alford DV. 1999. *A Text book of Agricultural Entomology*. Blackwell Science, London.
2. Crampton JM & Eggleston P. 1992. *Insect Molecular Science*. Academic press, London.
3. Bindra OS and Harcharan Singh. 1977. Oxford Publ, New Delhi.

ENT 519 COMMERCIAL ENTOMOLOGY 1+1

Theory

Unit I

Bee keeping- General colony management during different seasons. Seasonal management. Managing colonies for honey production and pollination. Artificial queen rearing. Pests and diseases of honey bees. Bee poisoning. Production and marketing of quality honey and value added honey products. Establishment and maintenance of apiaries.

Unit II

Study of different species of silkworms, characteristic features, moriculture, silk and its uses, pests and diseases of silkworms, rearing and management of silkworms. Lac insect- natural enemies and their management.

Unit III

Economic and public health importance of insect pests in human habitation and habitats, biology, damage and control of mosquitoes, houseflies, bed bugs, ants, termites, cockroaches, flies, silverfish, head and body lice, carpet beetles, cloth moths, crickets, wasps, house dust mites, insect pests of cattle, poultry, pet animals and their management.

Unit IV

Principles and methods of pest management in residential places and public buildings, insecticides for domestic use and their safety, pre- and post- construction termite proofing of buildings, appliances for domestic pest control. Rodent control methods.

Unit V

Organic methods of domestic pest management.

Practical

Assessing pest status in dwellings (labs, canteen or hostel), implementation of pest control against flies, mosquitoes, bed bugs, cockroaches and rodents. Pre- and post-construction termite proofing methods, control of silverfishes in the library. Visit to poultry units and assessing pest status in poultries. Evaluation of commercially available domestic insect pest control products through bioassays. Identification of honey bee species, bee castes and special adaptations, identification and handling of bee-keeping equipments. Handling of honey bees-hive and frame inspection. Honey extraction and processing methods of hive products extraction. Preparation of bee-keeping projects for funding. Visit to bee nursery and commercial apiaries. Silkworm rearing and management. Lac host and crop management technology and processing of lac. Products and byeproducts of lac.

References

1. Aruga H. 1994. *Principles of Sericulture*. Oxford & IBH, New Delhi
2. Atwal A.S. 2000. *Essentials of bee keeping and Pollination*. Kalyani Publ., Ludhiana.
3. Atwal A.S. 2006. *The World of the Honey Bee.* Kalyani Publ., New Delhi.
4. Ganga G. 2003.*Comprehensive Sericulture.* Vol. II. Silkworm Rearing and Silk Reeling. Oxford &IBH, New Delhi.
5. Mishra, R.C. 1999. *Honey Bees and their Management in India.* ICAR, New Delhi.
6. Partiban s& David BV.2007, *Management of Household Pests and Public Health Pests*. Namratha Publ., Chennai
7. Singh S. 1975. *Beekeeping in India.* ICAR, New Delhi.
8. Srivastava K.P. 1993. *A text book of Applied Entomology.* Kalyani Publ., Ludhiana
9. Abrol,PP.2013. A comprehensive guide to bees and beekeeping. Scientific publishers, India.

ENT 520 PLANT QUARANTINE 2+0

Theory

Unit I

Definition and Glossary of quarantine related terms; importance of quarantine – domestic and international.

Unit II

Quarantine restrictions in the movement of agricultural produce, seeds and planting material; case histories of exotic pests/diseases and their status

Unit III

Plant protection organization in India and at international level. History of quarantine legislations, PQ Order 2003., Import and Export of bio-control agents. WTO regulations; non-tariff barriers; Pest risk analysis, Sanitary and Phytosanitary measures.

Unit IV

Identification of pest/disease free areas; contamination of food with toxigens, microorganisms and their elimination; Techniques to detect pest infestations; VHT and other techniques of disinfestation/ salvaging of infested material.

Unit V

Acts related to registration of pesticides. Good laboratory practices for pesticide laboratories; pesticide industry; Environmental Acts, Industrial registration; APEDA

References

1. Rajeev K & Mukherjee RC. 1996. *Role of Plant Quarantine in IPM*. Aditya Books.
2. Rhower GG. 1991. Regulatory Plant Pest Management. In: *Handbook of Pest Management inAgriculture*.2nd Ed. Vol. II.(Ed. David Pimental).CRC Press.
3. FAO. 1997. Quarantine for Seed. FAO Plant production and protection paper 119. Daya Publishing House, Delhi. 296 p.

MINOR COURSES

BIC 510 PLANT BIOCHEMISTRY 2+1

Theory

Unit I

Scope and importance of biochemistry in Agriculture, Plant cell organelles and their separation, structure and function of cell organelle. Photosynthetic pigments in relation to their functions. Sucrose-starch interconversion, biosynthesis of structural carbohydrates.

Unit II

Biochemistry of nitrogen fixation and nitrate assimilation, Ammonia assimilating enzymes sulphate reduction and incorporation of sulphur into amino acids. Biosynthesis storage proteins and lipids.

Unit III

Biochemistry of seed germination and development, Biochemistry of fruit ripening. Biochemical aspects of biotic and abiotic stresses, ROS. Enzymic and non enzymic antioxidants. Biosynthesis and mechanism of action of osmoprotectants - glycine-betaine, proline; polyamines; heat shock proteins.6

Unit IV

Plant defense system - PR proteins, phytoalexins, cinnamic acid, salicylates, jasmonic acid, toxic amino acids - mode of action. Anti-nutritional factors in pulses, cereals, oil seeds, fruits and vegetables.

Unit V

Biochemistry and significance of secondary metabolites-shikimate pathway, cyanogenic glycosides, glucosinolates, phenolic compounds, terpenoids, alkaloids. 7

Practical

Cell fractionation - Estimation of - total sugars; starch by anthrone method; amylase; total free amino acids; Proline; protein by Lowry's method; peroxide value; total phenols; tannins; cyanogens; alkaloids; lycopene and carotene. Enzyme extraction methods - Assay of catalase, Peroxidase and polyphenol oxidase

References

1. Buchanan BB, Gruissem W and Jones RL. 2000. Biochemistry and Molecular Biology of Plants. 2nd Ed. John Wiley.
2. The Biochemistry of Plants - A comprehensive treatise Vol.1- 8, (ed) Conn, E.E. and P.K. Stumpf, Academic Press, New York
3. Dey PM and Harborne JB. 1997. Plant Biochemistry. Academic Press.
4. Goodwin TW and Mercer EI. 1983. Introduction to Plant Biochemistry. Pergamon Press.
5. Heldt HS. 1997. Plant Biochemistry and Molecular Biology. Oxford Univ. Press.
6. Lea PJ and Leegood RC. 1993. Plant Biochemistry and Molecular Biology. 2nd Ed. John Wiley.

CRP 501 PRINCIPLES OF PLANT PHYSIOLOGY 2+1

Theory

Unit I

Soil and plant water relations, water and its role in plants, properties and functions of water in the cell water relations-cell water terminology, water potential of plant cells. Mechanism of water uptake by roots- transport in roots, aquaporin's, movement of water in plants. Water loss from plants-Energy balance-Solar energy input-energy dissipation at crop canopy level- evapotranspiration - transpiration –Driving force for transpiration, plant factors influencing transpiration rate. Stomata structure and function – mechanism of stomatal movement, antitranspirants. Physiology of water stress in plants: Influence of water stress at cell, organ, plant and canopy levels. Indices for assessment of drought resistance.

Unit II

The role of mineral nutrients in plant metabolism: Essential elements, classification based on function of elements in plants. Uptake of mineral elements in plants –Mechanisms of uptake-translocation of minerals in plants. Physiological and metabolic functions of mineral elements, critical levels, deficiency symptoms, nutrient deficiency and toxicity. Foliar nutrition.

Unit III

Photosynthesis and its importance in bio productivity. Photochemical process, photochemical reactions, CO_2 reduction in Calvin cycle, supplementary pathway of C fixation in C4 and CAM plants and its significance. Photorespiration and its relevance. Photosynthesis as a diffusive process - effect of environmental factors on photosynthetic rates. Translocation of photosynthates and its importance in sink growth. Mitochondrial respiration, growth and maintenance respiration, cyanide resistant respiration and its significance.

Unit IV

Secondary metabolites and their significance in plant defence mechanism.

Unit V

Growth and differentiation. Hormonal concept of growth and differentiation, plant growth hormones and their physiological role synthetic growth regulators, growth retardants., Apical dominance, senescence, fruit growth, abscission. Photomorphogenesis: Photoreceptors, phytochrome, cryptochrome, physiology of flowering- Photoperiodism and Vernalisation.

Practical

Measurement of plant water status: Relative water content, water saturation deficits Chardakov's test. Measurement of transpiration rate. Stomatal physiology, influence of ABA on stomatal closing. Mineral nutrients: Deficiency symptoms of nutrients, Radiant energy measurements, separation and quantification of chlorophylls, Measurement of gas exchange parameters, conductance, photosynthetic rate, Estimation of reducing sugars, starch. Estimation of NO_3, free aminoacids in the xylem exudates, quantification of proteins. Bioassays for different growth hormones - Auxins, Gibberellins, Cytokinins, and ethylene. Leaf Area measurement and Growth analysis - Assessment of Drought tolerance: CSI - Quantification of osmolyte: Proline. Estimation of Total Phenolics.

References

1. Taiz, L. and Zeiger, E., 2010. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA
2. Taiz, L ., Zeiger, E. and., Ian M. Moller, 2015. Plant Physiology and Development. Publishers: Sinauer Associates, Inc., Massachusetts, USA
3. Pandey, S. N. and B. K. Sinha, 2006. Plant Physiology. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Ray Noggle, G. and Fritz, G.J., 1991, Introductory Plant Physiology, Prentice Hall of India Pvt. Ltd., New Delhi.
5. Jain, J. K., 2007. Fundamentals of Plant Physiology. S. Chand and Company Ltd., New Delhi.

AGR 513 PRINCIPLES AND PRACTICES OF ORGANIC FARMING 2+1

Theory

Unit I

Organic Agriculture: concept and definition, its relevance to India and global agriculture - Bio diversity conservation - Sustainability through organic farming system -Indices of Sustainability.

Unit II

Organic sources of nutrients-manures-bio-fertilizers, effective microorganisms organic inputs - Input management for sustainable organic agriculture - Nutrient recycling - Soil fertility and soil health.

Unit III

Role of Indigenous Technical Knowledge **(**ITK) based practices in organic agriculture - Organic farming system.

Unit IV

Management of weeds, diseases and insect pests, biological agents, tools, pheromones, bio-pesticides - Quality assessment of organic produces

Unit V

Organic certification, labelling and accreditation procedures, national and international standards, policy issues - Organic agriculture and national economy - Export avenues.

Practical

Composting - Vermicomposting - Use of bio-fertilizers and bio-pesticides through seed treatment and soil application - Organic livestock production, organic horticultural crop production - Indigenous technical knowledge **(**ITK) based inputs preparation-collection and documentation of important ITK's - Experiencing the eco-friendly way of weed, pest and disease management - Visit to organic farms - Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms – Visit to organic market.

References

1. Ananthakrishnan TN. (Ed.). 1992. Emerging Trends in Biological Control of Phytophagous Insects. Oxford and IBH.
2. Association for Promotion of Organic Farming, Bangalore. WHO. 1990.
3. Lampin N. 1990. Organic Farming. Press Books, lpswitch, UK.
4. Gaur AC. 1982. A Manual of Rural Composting, FAO/UNDP Regional Project Document,
5. Palaniappan SP and Anandurai K. 1999 .Organic Farming – Theory and Practice. Scientific Publ.
6. Public Health Impact of Pesticides Used in Agriculture. WHO.
7. Rao BV Venkata. 1995. Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective: Publ., Parisaraprajna Parishtana, Bangalore.
8. Reddy MV. (Ed.). 1995. Soil Organisms and Litter Decomposition in the Tropics. Oxford and IBH.
9. Sharma A. 2002. Hand Book of Organic Farming. Agrobios Publ.
10. Singh SP. (Ed.) 1994. Technology for Production of Natural Enemies. PDBC, Bangalore.
11. Stockdale E. *et al*., 2000. Agronomical and environmental implication of organic farming systems. Advances in Agronomy, 70, 261-327.
12. Subba Rao NS. 2002. Soil Microbiology. Oxford and IBH.
13. Trivedi RN.1993. A Text Book of Environmental Sciences, Anmol Publ.
14. Veeresh GK, Shivashankar K and Singlachar MA. 1997. Organic Farming and Sustainable Agriculture.
15. Veeresh, G.K. 2010. Organic farming, Cambridge University press.
16. Woolmer PL and Swift MJ. 1994. The Biological Management of Tropical Soil Fertility. TSBF and Wiley.

PAT 504 DISEASES OF FIELD CROPS 2+1

Theory

Unit I

Introduction, symptoms, etiology, epidemiology and management of diseases of cereal crops - Rice, pearl millet, sorghum, maize and minor millets

Unit II

Introduction, symptoms, etiology, epidemiology and management of diseases of pulse crops - Red gram, Chick pea, Black gram, Green gram, Cowpea and Soybean

Unit III

Introduction, symptoms, etiology, epidemiology and management of diseases of oilseed crops – Groundnut, Sun flower, Sesame, safflower, Coconut, Linseed, Castor and Jatropa

Unit IV

Introduction, symptoms, etiology, epidemiology and management of diseases of cash crops- Cotton, sugarcane, sugarbeet, tobacco, Jute, mulberry and betelvine

Unit V

Introduction, symptoms, etiology, epidemiology and management of diseases of Fodder legume and green manure crops - Berseem, Oats, Guar,Subabul, Agathi, Sesbania, Daincha, Sunnhemp, Lucerne and Cowpea.

Practical

Detailed study of symptoms and host parasite relationship of important diseases of above-mentioned crops. Collection and dry preservation of diseased specimens of important crops

Suggested Readings

1. Kolte S.J., Diseases of Oil Seeds, CRC Press.
2. S.H. OU. 1984. Rice diseases. 2nd Edition. CMI Publication England.
3. Rangaswami G. andMahadevan A. 2006 Diseases of Crop plants in India, 4th Edition. Prentice Hall Publication.
4. Janes, J.D. 2005 Phytobacteriology Principles and practice, CABI publications.
5. Chaube, H.S. and Pundhir V.S. 2005, Crop diseases and their management. Prentice Hall of India.
6. Agrios G.N. 2005, Plant Pathology, 5th Edition, Academic Press.
7. Joshi, L.M., Singh, D. V., & Srivastava, K. D., 1984. Problems and Progress of Wheat Pathology in South Asia. Malhotra Publ. House, New Delhi.
8. Rangaswami G. 1999. Diseases of Crop Plants in India. 4th Ed. Prentice Hall of India, New Delhi.
9. Ricanel C, Egan BT, GillaspieJr AG & Hughes CG. 1989. Diseases of Sugarcane, Major Diseases. Academic Press, New York.
10. Singh RS. 1998. Plant Diseases. 7th Ed. Oxford & IBH, New Delhi.
11. Singh US, Mukhopadhyay AN, Kumar J &Chaube HS 1992. Plant Diseases of International Importance. Vol. I. Diseases of Cereals and Pulses. Prentice Hall, Englewood Cliffs, New Jersey.

SUPPORTING COURSES

STA 501 STATISTICAL METHODS 1+1

Theory

Unit I

Theory of probability. Random variable and mathematical expectation.

Unit II

Discrete and continuous probability distributions: binomial, poisson, normal distribution, concept of sampling distribution: chi-square, t and f distributions. Introduction to theory of estimation and confidence -intervals. Tests of significance based on normal, chi-square, t and f distributions.

Unit III

Introduction to sampling techniques- simple random sampling, stratified random sampling and systematic sampling.

Unit IV

Correlation and regression: Types of correlation. Pearsons correlation, rank correlation; Regression: Simple regression- assumptions, fitting of simple linear regression, Properties. Testing the significance of correlation coefficient. Testing and interpretation of regression coefficient

Unit V

Multiple regression, testing the regression coefficients, coefficient of determination.

Practical

Problems based on Binomial, Poisson, Normal Distributions; Large sample tests, testing of hypothesis based on exact sampling distributions — chi square, t and F; Correlation and regression analysis.

References

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Applied Statistics, 2006, Sultan Chand and Sons, New Delhi.
2. Chandel, S.R.S., 1999, A hand book of Agricultural Statistics, Achal Prakashan Mandhir, Kanpur.
3. Gomez, K.A. and Gomez, A.A., 1984, Statistical Procedures for Agricultural Research, John Wiley and Sons, New York.
4. Sahu P.K, 2009, Agriculture and Applied Statistics-I and II, Kalyani Publishers, Ludhiana.
5. K.P. Dhamu and K. Ramamoorthy, 2007, Statistical Methods, Agrobios (India), Jodhpur.
6. G. Nageshwara Rao , 2007, Statistics for Agricultural Sciences, BS Publications, Andhra Pradesh
7. Rangaswamy, R. 2009, A Text book of Agricultural Statistics, Wiley Eastern Limited, New Delhi

STA 502 DESIGN OF EXPERIMENTS 1+1

Theory

Unit I

Need for designing of experiments, characteristics of a good design. Basic principles of designs - randomization, replication and local control.

Unit II

Uniformity trials, Analysis of variance, Multiple comparison Procedures-Least significant difference and Duncan's multiple range test. Completely randomized design, randomized block design and Latin square design.

Unit III

Analysis of covariance, missing plot techniques in randomized block design and Latin square design.

Unit IV

Factorial experiments: 2^n and 3^n factorial experiments. Analysis using regular method, Yates algorithm. Asymmetrical factorial experiments (upto three factors).

Unit V

Split plot and strip plot designs. Data Transformations-Logrithmic, angular and square root transformation.

Practical

Analysis of data obtained from CRD, RBD**,** LSD; Analysis of factorial experiments- 2^n and 3^n factorial experiments; Analysis with missing data; Split plot and strip plot designs; Transformation of data

References

1. Cochran WG and Cox GM. 1957. *Experimental Designs.* 2nd Ed. John Wiley. Dean AM and Voss D. 1999. *Design and Analysis of Experiments.* Springer.
2. Federer WT. 1985. *Experimental Designs.* MacMillan.
3. Fisher RA. 1953. *Design and Analysis of Experiments.* Oliver and Boyd.
4. Nigam AK and Gupta VK. 1979. *Handbook on Analysis of Agricultural Experiments.* IASRI Publication
5. Pearce SC. 1983. *The Agricultural Field Experiment: A Statistical Examination of Theory and Practice.* John Wiley.
6. G. Nageshwara Rao. 2007, Statistics for Agricultural Sciences, BS Publications, Andhra Pradesh
7. Rangaswamy, R. 2009, A Text book of Agricultural Statistics, Wiley Eastern Limited, New Delhi
8. Design Resources Server: www.iasri.res.in /design.

STA 503 DATA ANALYSIS USING STATISTICAL PACKAGES – I 0+1

Practical

Website creation using HTML and DHTML . Introduction to R / SPSS / equivalent. Use of R / SPSS / equivalent for- Descriptive statistics, data transformations, mean, median, range, variance, standard deviation, skewness, kurtosis. Use of R / SPSS / equivalent for - Covariance, Correlation coefficient, Simple and Multiple Linear regression, Independent sample t test, Paired t test, Z-test. Use of R / SPSS / equivalent for - ANOVA, Completely Randomized Design (One way ANOVA), Randomized Block Design (Two way ANOVA), Factorial Designs Split-Plot Design, Split-Block (Strip-Plot) Design, Split-Split-Plot Design, Chi-square goodness of fit test and Chi-square test of independence, Plots

References

1. Fazreil Amreen, GIMP Starter, 2013, Packt Publishing
2. Bethany Hiitola, Inkscape 0.48 Essentials for Web Designers, 2010, Packt Publishing
3. John Paul Mueller, HTML5 Programming with JavaScript for Dummies, 2013, John Wiley and Sons, Inc.
4. J.M. Gustafson, HTML5 Web Application Development By Example, 2013, Packt Publishing
5. Sarah Stowell, Using R for Statistics, 2014, APress
6. Joaquim.P. Marques de Sa, Applied Statistics using SPSS, STATISTICA, MATLAB and R, Springer
7. Elementary Statistics with R - http://www.r-tutor.com/elementary-statistics
8. Design Resources Server, IASRI(ICAR), India - www.iasri.res.in/design
9. Rajender Parsad, R. Srivastava, V.K. Gupta, Design and Analysis of Agricultural Experiments, IASRI(ICAR), India - http://www.iasri.res.in/design/Electronic-Book/index.htm
10. Rajender Parsad, V.K. Gupta, Lal Mohan Bhar, V.K. Bhatia, Advances in Data Analytical Techniques, IASRI(ICAR), India - http://www.iasri.res.in/ebook/EBADAT/index.htm
11. PSPP Manual - http://www.gnu.org/software/pspp/manual/pspp.pdf
12. Gnumeric Manual - https://help.gnome.org/users/gnumeric/stable/gnumeric.html

NON-CREDIT COMPULSORY COURSES

PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

Practical

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

PGS 502 TECHNICAL WRITING AND COMMUNICATION SKILLS 0+1

Practical

Technical Writing - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts 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.

Communication Skills - 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.

Suggested Readings

1. Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India. Collins' Cobuild English Dictionary. 1995. Harper Collins.
2. Gordon HM and Walter JA. 1970. Technical Writing. 3rd Ed. Holt, Rinehart and Winston.
3. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
4. James HS. 1994. Handbook for Technical Writing. NTC Business Books.
5. Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
6. Mohan K. 2005. Speaking English Effectively. MacMillan India.
7. Richard WS. 1969. Technical Writing. Barnes and Noble.
8. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek.
9. Sethi J and Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
10. Wren PC and Martin H. 2006. High School English Grammar and Composition. S.Chand and Co.

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

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings

1. Erbisch FH and Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
2. Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill. Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC and Aesthetic Technologies.
3. Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
4. Rothschild M and Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.
5. Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.
6. The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

PGS 504 BASIC CONCEPTS IN LABORATORY TECHNIQUES 0+1

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separator funnel, condensers, micropipettes and vaccupets; ashing, drying and sterilization of glassware; Drying of solvents/chemicals.

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

Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electric wiring and earthing. Preparation of media and methods of sterilization;

Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy.

Specific methodologies concerning each discipline

Suggested Readings

1. Furr, A.K. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
2. Gabb, M.H. and W.E. Latchem. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

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

Theory

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 Centers (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.

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

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) Panchayat Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Suggested Readings

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

PG5 506 DISASTER MANAGEMENT 1+0
(e-Course)

Theory

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

Suggested Readings

1. Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.
2. Hodgkinson PE and Stewart M. 1991. Coping with Catastrophe: A Handbook of Disaster Management. Routledge.
3. Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.