PONDICHERRY UNIVERSITY

PUDUCHERRY – 605 014

5th PG BOARD OF STUDIES
IN
SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

M.Sc. Ag. (Soil Science and Agricultural Chemistry)

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. (Soil Science and Agricultural Chemistry)

SEMESTER SYSTEM – REGULATIONS

1. SYSTEM OF EDUCATION

1.1 The rules and regulations provided herein shall govern Master degree programme in M.Sc. Ag. (Soil Science and Agricultural Chemistry) 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 PROGRAMME

The postgraduate programme offered in the discipline of Soil Science & Agricultural Chemistry is

M.Sc. Ag. (Soil Science and Agricultural Chemistry)

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. (Soil Science & Agricultural Chemistry)	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	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
nal Assessment	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)	
SAC 501*	Soil Physics	2+1
SAC 502*	Soil Fertility and Fertilizer Use	2+1
SAC 503*	Soil Chemistry	2+1
SAC 504*	Soil Mineralogy, Genesis, Survey and Classification	2+1
SAC 505	Soil Erosion and Conservation	2+1
SAC 506*	Soil Biology and Biochemistry	2+1
SAC 507	Geomorphology and Geochemistry	2+0
SAC 508	Isotopes and Nuclear techniques in Agriculture	2+1
SAC 509	Soil, Water and Air Pollution	2+1
SAC 510	Remote Sensing and GIS techniques for Soil, Water and Crop Studies	2+1
SAC 511	Analytical Techniques and Instrumental Methods in Soil and Plant Analysis	1+1
SAC 512	System Approaches in Soil and Crop Studies	2+1
SAC 513	Management of Problematic Soils and Waters	2+1
SAC 514	Chemistry of Agro Chemicals- Fertilizers and Pesticides	2+1
SAC 515	Land Degradation and Restoration	1+0
SAC 516	Plant Chemistry and Nutrition	2+1
	Minor Courses (9 Credits)	
BIC 510	Plant Biochemistry	2+1
CRP 501	Principles of Plant Physiology	2+1
	One course from any other Department	3
	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)	
SAC 591	Seminar	0+1
SAC 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 COURSES

SAC 501 SOIL PHYSICS 2+1

Theory

Unit I

Scope of soil physics and its relation with other branches of soil science; soil as a three phase system. Soil texture, textural classes, mechanical analysis, specific surface area. Soil consistency; dispersion and workability of soils; soil compaction and consolidation; soil strength; swelling and shrinkage - basic concepts.

Unit II

Soil structure - genesis, types, characterization and management of soil structure; soil aggregation, aggregate stability; soil tilth, characteristics of good soil tilth; soil crusting - mechanism, factors affecting and evaluation; soil conditioners; puddling, its effect on soil physical properties; clod formation.

Unit III

Soil water: content, soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential, soil-moisture characteristic curve; hysteresis, measurement of soil-moisture potential.

Unit IV

Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability and fluidity, hydraulic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils. Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere continuum. Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management.

Unit V

Modes of energy transfer in soils; energy balance; thermal properties of soil; measurement of soil temperature; soil temperature in relation to plant growth; soil temperature management.

Practical

Mechanical analysis by international pipette and other methods - Measurement of Atterberg limits - Aggregate analysis - dry and wet Measurement of soil-water content by different methods - Measurement of soil-water potential by using tensiometer and gypsum blocks - Determination of soil-moisture characteristics curve and computation of pore-size distribution - Determination of hydraulic conductivity under saturated and unsaturated conditions - Determination of infiltration rate of soil - Determination of aeration porosity and oxygen diffusion rate - Soil temperature measurements by different methods - Estimation of water balance components in bare and cropped fields

References

1. Baver LD, Gardner WH & Gardner WR. 1972. *Soil Physics.* John Wiley &Sons.
2. Ghildyal BP & Tripathi RP. 2001. *Soil Physics.* New Age International.
3. Hanks JR & Ashcroft GL. 1980. *Applied Soil Physics.* Springer Verlag.

4. Hillel D. 1972. *Optimizing the Soil Physical Environment toward Greater Crop Yields.* Academic Press.
5. Hillel D. 1980. *Applications of Soil Physics.* Academic Press.
6. Hillel D. 1980. *Fundamentals of Soil Physics.* Academic Press.
7. Hillel D. 1998. *Environmental Soil Physics.* Academic Press.
8. Hillel D. 2003. *Introduction to Environmental Soil Physics.* Academic Press.
9. Indian Society of Soil Science. 2002. *Fundamentals of Soil Science.* ISSS, New Delhi.
10. Kirkham D & Powers WL. 1972. *Advanced Soil Physics.* Wiley-Interscience.
11. Kohnke H. 1968. *Soil Physics.* McGraw Hill.
12. Lal R & Shukla MK. 2004. *Principles of Soil Physics.* Marcel Dekker.
13. Oswal MC. 1994. *Soil Physics.* Oxford & IBH.
14. Saha AK. 2004. *Text Book of Soil Physics.* Kalyani Publ.

SAC 502 SOIL FERTILITY AND FERTILIZER USE 2+1

Theory

Unit I

Soil fertility and soil productivity; nutrient sources - fertilizers and manures; essential plant nutrients - functions and deficiency symptoms. Soil and fertilizer nitrogen - sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation - types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer nitrogen in lowland and upland conditions for high fertilizer use efficiency.

Unit II

Soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils; factors affecting phosphorus availability in soils; phosphatic fertilizers - behavior in soils and management under field conditions. Potassium - forms, equilibrium in soils and its agricultural significance; mechanism of potassium fixation; management of potassium fertilizers under field conditions.

Unit III

Sulphur - source, forms, fertilizers and their behavior in soils; calcium and magnesium- factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers. Micronutrients - critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability.

Unit IV

Common soil test methods for fertilizer recommendations; quantity- intensity relationships; soil test crop response correlations and response functions. Fertilizer use efficiency; blanket fertilizer recommendations - usefulness and limitations; site-specific nutrient management; plant need based nutrient management; integrated nutrient management.

Unit V

Soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.

Practical

Chemical analysis of soil for total and available nutrients - Analysis of manures and fertilizers – Fertilizer recommendations.

References

1. Brady NC & Weil RR. 2002. *The Nature and Properties ofSoils.* 13th Ed. Pearson Edu.
2. Kabata-Pendias A & Pendias H. 1992. *Trace Elements in Soils and Plants.* CRC Press.
3. Kannaiyan S, Kumar K & Govindarajan K. 2004. *BiofertilizersTechnology.* Scientific Publ.
4. Leigh JG. 2002. *Nitrogen Fixation at the Millennium.* Elsevier.
5. Mengel K & Kirkby EA. 1982. *Principles of Plant Nutrition.* International Potash Institute,
   Switzerland.
6. Mortvedt JJ, Shuman LM, Cox FR & Welch RM. 1991. *Micronutrients in Agriculture.* 2nd Ed. SSSA, Madison.
7. Pierzinsky GM, Sims TJ & Vance JF. 2002. *Soils and Environmental Quality.* 2nd Ed. CRC Press.
8. Stevenson FJ & Cole MA. 1999. *Cycles of Soil: Carbon, Nitrogen,Phosphorus, Sulphur, Micronutrients.* John Wiley & Sons.
9. Havlin JL, Tisdale SL, Nelson WL, & Beaton JD. 1999. *Soil Fertility and Fertilizers.* 8th Ed. PHI Learinig Pvt Ltd., Delhi – 110092.
10. Troeh FR & Thompson LM. 2005. *Soils and Soil Fertility.* Blackwell.
11. Kanwar, JS. 1976. Soil Fertility: Theory and Practice. ICAR, New Delhi

SAC 503 SOIL CHEMISTRY 2+1

Theory

Unit I

Chemical (elemental) composition of the earth's crust and soils. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics.

Unit II

Soil colloids: inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC) and its dependence on variable-charge soil components, surface charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation and peptization of soil colloids; electrometric properties of soil colloids; sorption properties of soil colloids; soil organic matter - fractionation of soil organic matter and different fractions, clay-organic interactions.

Unit III

Ion exchange processes in soil; cation exchange- theories based on law of mass action (Kerr-Vanselow, Gapon equations, hysteresis, Jenny's concept), adsorption isotherms, donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, statistical mechanics; anion and ligand exchange - innersphere and outer-sphere surface complex formation, fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions, shift of PZC on ligand exchange, AEC, CEC; experimental methods to study ion exchange phenomena and practical implications in plant nutrition.

Unit IV

Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption; precipitation-dissolution equilibria; step and constant-rate K; management aspects. Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity.

Unit V

Chemistry of salt-affected soils and amendments; soil pH, ECe, ESP, SAR and important relations; soil management and amendments. Chemistry and electrochemistry of submerged soils.

Practical

Determination of CEC and AEC of soils - Analysis of equilibrium soil solution for pH, EC, Eh by the use of Eh-pH meter and conductivity meter - Adsorption-desorption of phosphate/ sulphate by soil using simple adsorption isotherm - Determination of NH_4, P and K fixing capacity of soil - Determination of lime potential of soil - Determination of exchange acidity of soil - Determination of titratable acidity of an acid soil by BaCl2-TEA method - Determination of lime requirement of an acid soil by buffer method - Determination of gypsum requirement of an alkali soil

References

1. Bear RE. 1964. *Chemistry of the Soil.* Oxford and IBH.
2. Bolt GH & Bruggenwert MGM. 1978. *Soil Chemistry.* Elsevier.
3. Greenland DJ & Hayes MHB. 1981. *Chemistry of Soil Processes.* John Wiley & Sons.
4. Greenland DJ & Hayes MHB. *Chemistry of Soil Constituents.* John Wiley & Sons.
5. McBride MB. 1994. *Environmental Chemistry of Soils.* Oxford Univ. Press.
6. Sposito G. 1981. *The Thermodynamics of Soil Solutions.* Oxford Univ. Press.
7. Sposito G. 1984. *The Surface Chemistry of Soils.* Oxford Univ. Press.
8. Sposito G. 1989. *The Chemistry of Soils.* Oxford Univ. Press.
9. Stevenson FJ. 1994. *Humus Chemistry.* 2nd Ed. John Wiley & Sons.
10. Van Olphan H. 1977. *Introduction to Clay Colloid Chemistry.* John Wiley & Sons.
11. Kim H Tan. 1998. Principles of Soil Chemistry. Third Edn., Marcel Dekker Inc.

SAC 504 SOIL MINERALOGY, GENESIS, SURVEY AND CLASSIFICATION 2+1

Theory

Unit I

Fundamentals of crystallography, space lattice, coordination theory, Isomorphism and polymorphism. Classification, structure, chemical composition and properties of clay minerals; genesis and transformation of crystalline and non-crystalline clay minerals; identification techniques; amorphous soil constituents and other non-crystalline silicate minerals and their identification; clay minerals in Indian soils.

Unit II

Factors of soil formation, soil formation models; soil forming processes; weathering of rocks and mineral transformations; soil profile; weathering sequences of minerals with special reference to Indian soils.

Unit III

Concept of soil individual; soil classification systems - historical developments and modern systems of soil classification with special emphasis on soil taxonomy; soil classification, soil mineralogy and soil maps - usefulness.

Unit IV

Soil survey and its types; soil survey techniques - conventional and modern; soil series -characterization and procedure for establishing soil series; benchmark soils and soil correlations; soil survey interpretations; soil mapping, thematic soil maps, cartography, mapping units, techniques for generation of soil maps.

Unit V

Landform - soil relationship; major soil groups of India with special reference to respective states; land capability classification and land irrigability classification; land evaluation and land use type (LUT) -concept and application; approaches for managing soils and landscapes in the framework of agro-ecosystem.

Practical

Identification and quantification of minerals in soil fractions - Morphological properties of soil profile in different landforms - Classification of soils using soil taxonomy - Calculation of weathering indices and its application in soil formation - Grouping soils using available data base in terms of soil quality - Aerial photo and satellite data interpretation for soil and land use - Cartographic techniques for preparation of base maps and thematic maps, processing of field sheets, compilation and obstruction of maps in different scales - Land use planning exercises using conventional and RS tools

References

1. Brady NC & Weil RR. 2002. *The Nature and Properties of Soils.* 13th Ed. Pearson Edu.
2. Buol EW, Hole ED, MacCracken RJ & Southard RJ. 1997. *Soil Genesis and Classification.* 4th Ed. Panima Publ.
3. Dixon JB & Weed SB. 1989. *Minerals in Soil Environments.* 2nd Ed. Soil Science Society of America, Madison.
4. Grim RE. 1968. *Clay Mineralogy.* McGraw Hill.
5. Indian Society of Soil Science 2002. *Fundamentals of Soil Science.* ISSS, New Delhi.
6. Sehgal J. 2002. *Introductory Pedology: Concepts and Applications.* New Delhi
7. Sehgal J. 2002. *Pedology - Concepts and Applications.* Kalyani Publ.
8. USDA. 1999. *Soil Taxonomy.* Hand Book No. 436. 2nd Ed. USDA NRCS, Washington.
9. Wade FA & Mattox RB. 1960. *Elements of Crystallography and Mineralogy.* Oxford & IBH.
10. Wilding LP & Smeck NE. 1983. *Pedogenesis and Soil Taxonomy.* II. *The Soil Orders.* Elsevier.
11. Wilding NE & Holl GF. (Eds.). 1983. *Pedogenesis and Soil Taxonomy.* I. *Concept and Interaction* Elsevier.
12. Soil Survey Staff. 2014. Keys to soil taxonomy. Agency for International Development, USDA, Natural Resource Conservation Service (NRCS), Washington

SAC 505 SOIL EROSION AND CONSERVATION 2+1

Theory

Unit I

History, distribution, identification and description of soil erosion problems in India.

Unit II

Forms of soil erosion; effects of soil erosion and factors affecting soil erosion; types and mechanisms of water erosion; raindrops and soil erosion; rainfall erosivity - estimation as EI30 index and kinetic energy; factors affecting water erosion; empirical and quantitative estimation of water erosion; methods of measurement and prediction of runoff; soil losses in relation to soil properties and precipitation.

Unit III

Wind erosion- types, mechanism and factors affecting wind erosion; extent of problem in the country. Principles of erosion control; erosion control measures - agronomical and engineering; erosion control structures - their design and layout.

Unit IV

Soil conservation planning; land capability classification; soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged and wet lands.

Unit V

Watershed management - concept, objectives and approach; water harvesting and recycling; flood control in watershed management; socioeconomic aspects of watershed management; case studies in respect to monitoring and evaluation of watersheds; use of remote sensing in assessment and planning of watersheds.

Practical

Determination of different soil erodibility indices - suspension percentage, dispersion ratio, erosion ratio, clay ratio, clay/moisture equivalent ratio, percolation ratio, raindrop erodibility index - Computation of kinetic energy of falling rain drops - Computation of rainfall erosivity index (EI30) using rain gauge data - Visits to a watersheds

References

1. Biswas TD & Narayanasamy G. (Eds.) 1996. *Soil Management in Relation to Land Degradation and Environment.* Bull. Indian Society of Soil Science No. 17.
2. Doran JW & Jones AJ. 1996. *Methods of Assessing Soil Quality.* Soil Science Society of America , Spl Publ. No. 49, Madison, USA.
3. Gurmal Singh, Venkataramanan C, Sastry G & Joshi BP. 1990. *Manual of Soil and Water Conservation Practices.* Oxford & IBH.
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5. Indian Society of Soil Science 2002. *Fundamentals of Soil Science.* ISSS, New Delhi.
6. Oswal MC. 1994. *Soil Physics.* Oxford & IBH.

SAC 506 SOIL BIOLOGY AND BIOCHEMISTRY 2+1

Theory

Unit I

Soil biota, soil microbial ecology, types of organisms in different soils; soil microbial biomass; microbial interactions; un-culturable soil biota .

Unit II

Microbiology and biochemistry of root-soil interface; phyllosphere; soil enzymes, origin, activities and importance; soil characteristics influencing growth and activity of microflora.

Unit III

Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil; biochemical composition and biodegradation of soil organic matter and crop residues, humus formation; cycles of important organic nutrients.

Unit IV

Biodegradation of pesticides, organic wastes and their use for production of biogas and manures; biotic factors in soil development; microbial toxins in the soil.

Unit V

Preparation and preservation of farmyard manure, animal manures, rural and urban composts and vermicompost. Biofertilizers - definition, classification, specifications, method of production and role in crop production.

Practical

Determination of soil microbial population - Soil microbial biomass - Elemental composition, fractionation of organic matter and functional groups - Decomposition of organic matter in soil - Soil enzymes - Measurement of important soil microbial processes such as ammonification, nitrification, N_2 fixation, S oxidation, P solubilization and mineralization of other micro nutrients - Study of rhizosphere effect

References

1. Alexander M. 1977. *Introduction to Soil Microbiology.* John Wiley & Sons.
2. Burges A & Raw F. 1967. *Soil Biology.* Academic Press.
3. McLaren AD & Peterson GH. 1967. *Soil Biochemistry.* Vol. XI. Marcel Dekker
4. Metting FB. 1993. *Soil Microbial Ecology - Applications in Agricultural and Environmental Management.*
5. Paul EA & Ladd JN. 1981. *Soil Biochemistry.* Marcel Dekker.
6. Reddy MV. (Ed.). *Soil Organisms and Litter in the Tropics.* Oxford & IBH.
7. Russel RS. 1977. *Plant Root System: Their Functions and Interaction with the Soil.* ELBS & McGraw Hill.
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9. Sylvia DN. 2005. *Principles and Applications of Soil Microbiology.Pearson* Edu.
10. Wild A. 1993. *Soil and the Environment - An Introduction.* Cambridge Univ. Press.

SAC 507 GEOMORPHOLOGY AND GEOCHEMISTRY 2+0

Theory

Unit I

General introduction to geology and geochemistry, major and minor morphogenic and genetic landforms

Unit II

Study of schematic landforms and their elements with special reference to India.

Unit III

Methodology of geomorphology, its agencies, erosion and weathering; soil and physiography relationships; erosion surface of soil landscape.

Unit IV

Geochemical classification of elements; geo-chemical aspects of weathering and migration of elements;

Unit V

Geochemistry of major and micronutrients and trace elements.

References

1. Brikland PW. 1999. *Soils and Geomorophology.* 3rd Ed. Oxford Univ. Press.
2. Likens GE & Bormann FH. 1995. *Geochemistry.* 2nd Ed. Springer Verlag.
3. Mortvedt JJ, Shuman LM, Cox FR & Welch RM. 1991. *Micronutrients in Agriculture.* 2nd Ed. SSSA, Madison.

SAC 508 ISOTOPES AND NUCLEAR TECHNIQUES IN AGRICULTURE 2+1

Theory

Unit I

Atomic structure - electron configuration- nucleus and its constituents, nuclear stability, nuclear energy - radioactivity - discovery - types of radioactive decay -rate of radioactive decay - half life and energy - nature and properties of nuclear radiations- interaction of nuclear radiations with matter

Unit II

Radioactivity and units - Doses of radiation exposure - hazards in handling radioisotopes -personnel monitoring - decontamination - collection, storage and disposal of radioactive wastes -radiation safety and regulatory aspects - international safety standards

Unit III

Principles and use of radiation monitoring instruments - ionization detectors - proportional counters - solid and liquid scintillation counters - neutron moisture meter- mass spectrometry - general principles and techniques of auto radiography. Nuclear reactions - natural and induced - nuclear energy - nuclear reactors and particle accelerators - production and availability of primary radionuclides from nuclear reactors and particle accelerators - synthesis of labeled compounds.

Unit IV

Design and execution of radiotracer experiments - basic assumptions and feasibility correction factors in radio assay - interpretations - Isotopic dilution techniques used in soil and plant research; use of stable isotopes with special reference to ^{15}N - concept of per cent abundance and atom excess - experimental technique - sample processing - measurement by mass spectrometry and emission spectrometry

Unit V

Isotopes and their applications - in soil fertility and plant nutrition; studies on organic matter, nutrient transformations, ion transport, rooting pattern and fertilizer use efficiency, carbon dating-soil water management - environmental studies- mutation breeding and plant genetics - plant protection - food preservation - soil microbiology - forestry and ecology - animal health and production

Practical

Design and features of radioisotope laboratory - Storage and handling of radioactive materials - Determination of half life and decay constant Preparation of soil and plant samples for radioactive measurements Setting up of experiment on fertilizer use efficiency and cation exchange equilibria using radioisotopes - Exercises on Geiger Muller counter and Gamma Ray Spectrometer Isotope dilution analysis Autoradiography - Determination of A, E and L values of soil using ^{32}P/ ^{65}Zn Use of neutron probe for moisture determination - Sample preparation and measurement of ^{15}N enrichment by mass spectrophotometery/ emission spectrometry

References

1. Comer CL. 1955. *Radioisotopes in Biology and Agriculture: Principles and Practice.* Tata McGraw Hill.
2. Glasstone S. 1967. *Source Book on Atomic Energy.* East West Press.
3. L' Annuziata, M.F and J.D.Legg. 1984. Isotopes and Radiation in Agricultural Sciences. Vol. I. Academic press, London.
4. L' Annuziata, M.F and J.D.Legg. 1984. Isotopes and Radiation in Agricultural Sciences. Vol. II. Academic press, London.
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7. Sood, D.D. 1996. Nuclear Materials. Indian Association of Nuclear Chemists and Allied Scientists. BARC. Mumbai.
8. Vose, P.B.1980. Introduction to Nuclear Techniques in Agronomy and Plant Biology. Pergamon press, New York.

SAC 509 SOIL, WATER AND AIR POLLUTION 2+1

Theory

Unit I

Soil, water and air pollution problems associated with agriculture, nature and extent. Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills, etc. Soil, water and air pollutants – their CPC standards and their effect on plants, animals and human beings.

Unit II

Sewage and industrial effluents – their composition and effect on soil properties/health, plant growth and human beings. Soil as a sink for waste disposal.

Unit III

Pesticides – their classification, behavior in soil and effect on soil microorganisms. Toxic elements – their sources, behavior in soil and effect on nutrients availability, effect on plant and human health.

Unit IV

Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of green house gases – carbon dioxide, methane and nitrous oxide.

Unit V

Remediation / amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution.

Practical

Sampling of sewage waters, sewage sludge, solid/liquid industrial wastes, polluted soils and plants. Estimation of dissolved and suspended solids, chemical oxygen demand (COD), biological oxygen demand (BOD), nitrate and ammoniacal nitrogen and phosphorus, heavy metal content in effluents. Estimation of heavy metals in contaminated soils and plants. Management of contaminants in soil and plants to safeguard food safety. Air sampling and determination of particulate matter and oxides of sulphur. Visits to various industrial sites to study the impact of plllutants on soil and plants.

References

1. Lal R, Kimble J, Levine E and Stewart BA. 1995. *Soil Management and Greenhouse effect*. CRC Press.
2. Middlebrooks EJ. 1979. *Industrial Pollution Control. Vol. I. Agro Industries*. John Wiley Interscience
3. Ross SM. *Toxic metals in Soil Plant Systems*. John Wiley and Sons.
4. Vesilund PA and Pierce. 1983. *Environmental Pollution and Control*. Ann. Arbor Science Publ.

SAC 510 REMOTE SENSING AND GIS TECHNIQUES FOR SOIL, WATER AND CROP STUDIES 2+1

Theory

Unit I

Introduction and history of remote sensing; sources, propagation of radiations in atmosphere; interactions with matter (includes soil, water and plant)

Unit II

Sensor systems - camera, microwave radiometers and scanners; fundamentals of aerial photographs and image processing and interpretations.

Unit III

Application of remote sensing techniques - land use (includes surface water bodies and river etc.) soil surveys, crop stress and yield forecasting, prioritization in watershed and drought management, wasteland identification and management.

Unit IV

Introduction to GIS and its application for spatial and non-spatial soil and land attributes.

Unit V

Significance and sources of the spatial and temporal variability in soils; variability in relation to size of sampling; classical and geo-statistical techniques of evolution of soil variability.

Practical

Familiarization with different remote sensing equipments and data product - Interpretation of aerial photographs and satellite data for mapping of land resources - Analysis of variability of different soil properties with classical and geostatistical techniques - Creation of data files in a database program - Use of GIS for soil spatial simulation and analysis - To enable the students to conduct soil spatial variability studies

References

1. Brady NC & Weil RR. 2002. *The Nature and Properties of Soils.* 13th Ed. Pearson Edu.
2. Elangovan K. 2006. *GIS Fundamentals, Applications and Implementations.New* India Publ. Agency.
3. Lillesand TM, Kiefer RW and Chipman, JW. 2004. *Remote Sensing and Image Interpretation.* 5 th Ed. Wiley.
4. Nielsen DR & Wendroth O. 2003. *Spatial and Temporal Statistics.* Catena Verloggmbh.
5. Star J & Esles J. 1990. *Geographic Information System: An Introduction.* Prentice Hall.

SAC 511 ANALYTICAL TECHNIQUES AND INSTRUMENTAL METHODS IN SOIL AND PLANT ANALYSIS 1+1

Theory

Unit I

Analytical chemistry - general principles of analytical chemistry - classification of chemical methods-theory of indicators.

Unit II

Instrumentation techniques - Common problems and maintenance of instruments- principles involved in the measurements of electrical conductivity, pH, redox potential and specific ions – conductometric titrations – potentiometric titrations – redox potential measurements

Unit III

Chromatography techniques - paper chromatography, gas chromatography, TLC, HPLC. electrolysis -electrophoresis - nuclear magnetic resonance.

Unit IV

Optical methods - spectrophotometry - phosphorimetry - fluorimetry - nephlometry and turbidimetry - polarimetry

Unit V

Emission spectroscopy - Principles of visible, ultraviolet and infrared spectrophotometery, atomic absorption, flame-photometry, inductively coupled plasma spectrometry; mass spectrometry X-ray defractrometery. Segmented flow analyzer - N analyzer -soil, water and plant sampling techniques, their processing and handling.

Practical

Preparation of standard solutions for acid-base, oxidation reduction, precipitation and complexometric titrations; Principles and analysis of potentiometry, conductometry, calorimetry/spectrophotometry, turbidometry, flame photometry and atomic absorption spectroscopy.

References

1. Hesse P. 971. *Textbook of Soil Chemical Analysis.* William Clowes & Sons.
2. Jackson ML. 1967. *Soil Chemical Analysis.* Prentice Hall of India.
3. Keith A Smith 1991. *Soil Analysis; Modern Instrumental Techniques.Marce*\ Dekker.
4. Kenneth Helrich 1990. *Official Methods of Analysis.* Association of Official Analytical Chemists.
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6. Piper CE. *Soil and Plant Analysis.* Hans Publ.
7. Singh D, Chhonkar PK & Pandey RN. 1999. *Soil Plant Water Analysis Methods – A Manual* IARI, New Delhi.
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9. Tandon HLS. 1993. *Methods of Analysis of Soils, Fertilizers and* Waters. FDCO, New Delhi.
10. Vogel AL. 1979. *A Textbook of Quantitative Inorganic Analysis.* ELBS Longman.
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13. Sharma BK. 1994. Instrumental methods of Chemical Analysis. Goel Publ., Meerut

SAC 512 SYSTEM APPROACHES IN SOIL AND CROP STUDIES 2+1

Theory

Unit I

Systems concepts - definitions, general characteristics; general systems theory; systems thinking, systems dynamics, systems behavior and systems study.

Unit II

Model: definition and types; mathematical models and their types; modeling: concepts, objectives, processes, abstraction techniques; simulation models, their verification and validation, calibration; representation of continuous systems simulation models - procedural and declarative.

Unit III

Simulation - meaning and threats; simulation experiment, its design and analysis. Response models with single and multiple inputs-Quadratic square root-M&B estimating physical and economic optimum

Unit IV

Application of simulation models in understanding system behavior, optimizing system performance, evaluation of policy options under different soil, water, nutrient, climatic and cultural conditions; decision support system, use of simulation models in decision support system

Unit V

Irrigation models-sensitivity factor-Response factor-estimation-Stewart additive irrigation models-Genson multiplicative model-water productivity function- Quadratic square root models for water and N inputs-Cropping system models

Practical

Use of flow chart or pseudo-code in the program writing - Writing a small example simulation model program - declarative (in Vensim PLE, Stella or Simile) and procedural (in Java, Fortran, QBasic or V Basic) - Conducting simulation experiments in DSSAT, WOFOST or EPIC with requirement of report and conclusion

References

1. Benbi DK & Nieder R. (Eds.). 2003. *Handbook of Processes and Modelling in the Soil - Plant System.* Haworth Press.
2. Hanks J & Ritchie JT. (Eds.). 1991. *Modelling Plant and Soil System. Agronomy.* Bull. No 31. Soil Sci. Society of America, Madison.
3. Rajaraman V. 2004. *Computer Programming in Fortran 90 and 95.* PHI.
4. Tsuji GY, Gerrit H & Philip T. 1998. *Understanding Options for Agricultural Production.* Kluwer Von.
5. Bertalanffy Ludwig 1969. *General Systems Theory: Foundation Development and Application.* Revised Ed. George Braziller Reprint 1998.

SAC 513 MANAGEMENT OF PROBLEMATIC SOILS AND WATERS 2+1

Theory

Unit I

Area and distribution of problem soils - acidic, saline, sodic and physically degraded soils; origin and basic concept of problematic soils, and factors responsible.

Unit II

Morphological features of saline, sodic and saline-sodic soils; characterization of salt-affected soils -soluble salts, ESP, pH; physical, chemical and microbiological properties.

Unit III

Management of salt-affected soils; salt tolerance of crops - mechanism and ratings; monitoring of soil salinity in the field; management principles for sandy, clayey, red lateritic and dry land soils.

Unit IV

Acid soils - nature of soil acidity, sources of soil acidity; effect on plant growth, lime requirement of acid soils; management of acid soils; biological sickness of soils and its management.

Unit V

Quality of irrigation water; management of brackish water for irrigation; salt balance under irrigation; characterization of brackish waters, area and extent; relationship in water use and quality. Agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground waters.

Practical

Characterization of acid, acid sulfate, salt-affected and calcareous soils. Determination of cations (Na+, K+, Ca++ and Mg++) in ground water and soil samples- Determination of anions (Cl^-, SO_4^{2-}, CO_3^{2-} and HCO_3^-) in ground waters and soil samples - Lime and gypsum requirements of acid and sodic soils

References

1. Bear FE. 1964. *Chemistry of the Soil.* Oxford & IBH.
2. Jurinak JJ. 1978. *Salt-affected Soils.* Department of Soil Science &Biometeorology. Utah State Univ.
3. USDA Handbook No. 60. 1954. *Diagnosis and improvement of Saline and Alkali Soils.* Oxford & IBH.

SAC 514 CHEMISTRY OF AGROCHEMICALS - FERTILIZERS AND PESTICIDES 2+1

Theory

Unit I

Fertilizers - production, consumption and future projections with regard to nutrient use in the country and respective states; fertilizer control order.

Unit II

Manufacturing processes for different fertilizers using various raw materials, characteristics and nutrient contents. Recent developments in secondary and micronutrient fertilizers and their quality control as per fertilizer control order. New and emerging issues in fertilizer technology - production and use of slow and controlled release fertilizers, supergranules fertilizers and fertilizers for specific crops/situations.

Unit III

Insecticides - inorganic insecticides - synthetic organic insecticides - organo chlorine compounds organophosphorus compounds - carbamates - pyrethroids and new classes of organic insecticides. Fungicides - classification of fungicides -properties, mode of action of inorganic and dithiocarbamate fungicides - systemic fungicides & newer classes of fungicides like benzimidazoles, oxathiens, piperazine, imidazole, triazole, OP and morpholines.

Unit IV

Herbicides - classification - properties - mode of action of inorganic and organic herbicides like phenoxy compounds, substituted ureas, amides, thiocarbamates, triazines, pyridines, imidazolines and sulphonyl ureas.

Unit V

Effect of pesticides on soil physical and chemical properties - adsorption and desorption in different soils - adsorption mechanisms- Adsorption isotherms. Degradation and persistence of agrochemicals - microbial degradation of agrochemicals. Chemical degradation in soils -agrochemical residues in soils - Organic matter and agrochemical interactions. degradation and persistence in soil, water and plant - terminal residues.

Practical

Sampling of straight, mixed and compound fertilizers for analysis - moisture estimation - analysis of N fertilizers for various forms - biuret estimation in urea - P and K fertilizer analysis by different methods and for different forms. Estimation of micronutrients in fertilizers - quality control standards - visit to fertilizer manufacturing / processing industries and fertilizer testing laboratory.

Formulation analysis - physical and chemical properties of different formulations - analysis of one pesticides from each group. Residue analysis - collection of samples - Extraction and clean up -Determination of pesticide residues - working of formulation centres and pesticide testing laboratory.

References

1. Brady NC & Weil RR. 2002. *The Nature and Properties of Soils.* Pearson Edu.
2. *Fertilizer (Control) Order, 1985 and the Essential Commodities Act.* FAI New Delhi.
3. Kanwar JS. (Ed.). 1976. *Soil Fertility: Theory and Practice.* ICAR.
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5. Prasad R & Power JF. *Soil Fertility Management for Sustainable Agriculture.* CRC Press.
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7. Vogel AI. 1979. *Textbook of Quantitative Inorganic Analysis.* EL BS.
8. Bucheh, K.H. 1983. Chemistry of Pesticides. John Wiley & Sons, New York.
9. Metcalf, R.L. and McKelry, J.J. Jr. Ed. 1975. The future for Insecticides : Needs and Prospects. Vol.6.
10. Rao, V.S. 1983. Principles of Weed Science. Oxford and IBH Publishing Co., New Delhi.
11. O'Brien, and Yamamoto. 1983. Biochemical Toxicology of Insecticides. Academic Press INC., New York.
12. Cremlin, A.J. 1992. Agrochemicals - preparation and mode of action. Oxford IBH publication, New York.

13. Tomlin, C.D.S. 2003. The Pesticide Manual. A World compendium. Thirteenth Edition, Mahamaya Publishers, New Delhi.
14. Gupta, O.P. 1998. Scientific Weed Management. Agro Botanica, Jodhpur.
15. Hance, R.J.. 1980. Interaction between herbicides and the soil. Academic Press Inc., New York.
16. Cheng, H.H. 1991. Pesticides in the Soil Environment: Processes impact and modeling. Soil Science Society of America Book Series No.2
17. Rachel Garden Council Staff. 1992. Basic Guide to Pesticides: Their characteristics and hazards.
18. Garner, W.T., Honeycut, R.C. and Nigg, H.N. 1986. Evaluation of Pesticides in ground water. American Chemical Society, Washington DC.

SAC 515 LAND DEGRADATION AND RESTORATION 1+0

Theory

Unit I

Type, factors and processes of soil/land degradation and its impact on soil productivity, including soil fauna, biodegradation and environment.

Unit II

Land restoration and conservation techniques - erosion control, reclamation of salt-affected soils; mine land reclamation, afforestation, organic products.

Unit III

Extent, diagnosis and mapping of land degradation by conventional and modern RS-GIS tools;

Unit IV

Monitoring land degradation by fast assessment, modern tools,

Unit V

Land use policy, incentives and participatory approach for reversing land degradation; global issues for twenty first century.

References

1. Biswas TD & Narayanasamy G. (Eds.). 1996. *Soil Management in Relation to Land Degradation and Environment. Bull. Indian Soc. Soil Sci.17,* New Delhi.
2. Doran JW & Jones AJ. 1996. *Methods of Assessing Soil Quality.* Soil Science Society of America, Madison.
3. Greenland DJ & Szabolcs I. 1994. *Soil Resilience and Sustainable Land Use.* CABI.
4. Lal R, Blum WEH, Vailentine C & Stewart BA. 1997. *Methods for Assessment of Soil Degradation.* CRC Press.
5. Sehgal J & Abrol IP. 1994. *Soil Degradation in India - Status and Impact*. Oxford & IBH.

SAC 516 PLANT CHEMISTRY AND NUTRITION 2+1

Theory

Unit I

Essential nutrients for plant growth - nutrient requirement of crops - soil solution - mobility of nutrients from soil to plant root - mechanisms of ion absorption and uptake - factors affecting nutrient absorption - nutrient transport.

Unit II

Biosynthesis and utilization of proximate constituents in cereals, pulses, oilseeds, fibre crops, sugarcane, fruits and vegetables, tuber crops, narcotics, beverages and medicinal plants.

Unit III

Chemistry of terpenes, alkaloids, pigments, harmones and vitamins.

Unit IV

Deficiencies, critical levels and toxicities of plant nutrients - Interaction of macro, secondary and micronutrients in plants.

Unit V

Chemical changes during germination, growth and maturity - Influence of soil and environmental conditions, organic manures, fertilizers and pesticides on the quality of crop produce - Quality of forage crops and grasses - storage of crop produces - post harvest changes in cereals, pulses, oilseeds, sugarcane, fruits and vegetables - nutritive values of important crop produce.

Practical

Analysis of plant samples - estimation of proximate constituents ca, mg and trace elements -estimation of carbohydrates - proteins - oils and fats, crude fibres - analysis of sugars in cane juice - assessment of quality of feeds and forage crops - estimation of sugars, vitamin in fruits and vegetables - estimation of alkaloids and tannin - estimation of toxin in feeds and forage crops -tissue test - identification of deficiency and toxicity symptoms.

References

1. Onslow, M.W. 1976. Principles of Plant Biochemistry. Prentice Hall INC., New York.
2. Harris (RJC), Ed. 1982. Protein Biosynthesis. Academic Press, London.
3. Russel, E.J. 1965. Plant Nutrition and Crop Production. Tata-McGraw Hill, New Delhi
4. Russel, E.J. 1989. Soil Conditions and Plant Growth. Tata-McGraw Hill, New Delhi.
5. Black, C.A. 1968. Soil - Plant Relationships. John Wiley & Sons, New York.
6. Kanwar, JS (Ed.). 1976. Soil Fertility: Theory and Practice, ICAR, New Delhi

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.

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.