# PONDICHERRY UNIVERSITY PUDUCHERRY – 605 014



# 6<sup>th</sup> PG BOARD OF STUDIES IN AGRICULTURAL SCIENCES

# M.Sc. (Agri.) Agronomy REGULATIONS AND CURRICULUM

(Effective from 2022-23 batch onwards)



PANDITJAWAHARLAL NEHRU COLLEGE OF AGRICUL AND RESEARCH INSTITUTE (PAJANCOA&RI) (A Government of Puducherry Institution) KARAIKAL – 60

# PONDICHERRY UNIVERSITY PUDUCHERRY – 605 014

# REGULATIONS AND CURRICULAM

# for

# M.Sc. (Agriculture/Horticulture)

(Effective from 2022-23)

# REGULATIONS

# **PONDICHERRY UNIVERSITY** POSTGRADUATE DEGREE PROGRAMME (Agriculture/Horticulture)

# **SEMESTER SYSTEM – REGULATIONS**

#### 1. SYSTEM OF EDUCATION

- 1.1 The rules and regulations provided herein shall govern Masters degree programmes [M.Sc. (Agri.) or M.Sc. (Hort.)] 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 **2022-23** 

## 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 midsemester 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. Among the listed courses, the core courses compulsorily to be registered shall be given '\*' mark.

- 3.8 'Minor Course' means the course closely related to a student's major subject.
- 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 **'Common course'** means a course which is compulsorily registered by the postgraduate student for the completion of postgraduate degree programme. The marks obtained by the student in a common course will also be taken into account for calculating OGPA.

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

- 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 common courses, that a student register during that particular semester.
- 3.13 **'Grade Point'** means the total marks in percentage obtained in a course divided by 10 and rounded to two decimals.
- 3.14 **'Credit Point' means** the grade point multiplied by the credit load of the course.
- 3.15 **'Overall Grade Point Average (OGPA)'** means the total credit point of the courses completed by the student divided by total credits of the courses studied. The OGPA is to be worked out by rounding to nearest two decimals.
- 3.16 **'Arrear examination'** is an examination written for the failed course by a student without undergoing regular classes in that course.
- 3.17 **'Transcript Card'** is the consolidated report of academic performance of a student issued by the University on completion of the curriculum fulfillment. The format of Transcript Card is furnished in *Annexure-1*.

#### 4. **POSTGRADUATE PROGRAMMES**

The list of various postgraduate programmes offered in various dicipline of the College is as follows:

M.Sc. (Agri.) Agricultural Economics
M.Sc. (Agri.) Entomology
M.Sc. (Agri.) Agronomy
M.Sc. (Agri.) Genetics and Plant Breeding
M.Sc. (Agri.) Soil Science
M.Sc. (Hort.) Vegetable Science

# 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. Whereas, for SC/ST/PWD candidates the said requirement is an OGPA of 2.50 out of 4.00 or 6.00 out of 10.00 or 60 per cent aggregate. However, this will not apply to State Department 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:

SI.No.	Discipline	Requirement for Master's Degree			
1.	Agricultural Economics	B.Sc.(Ag./Hort./Agrl. Marketing and			
		Cooperation/Forestry) or B.Sc.(Hons)			
		Agriculture/Horticulture/ Agrl. Marketing			
		and Cooperation/Forestry			
2.	Agronomy	B.Sc. (Ag.) or B.Sc.(Hons) Agriculture			
3.	Entomology	B.Sc.(Ag./Hort./Forestry/Sericulture) or			
		B.Sc. (Hons) Agriculture/Horticulture/			
		Forestry / Sericulture			
4.	Genetics and Plant Breeding	B.Sc.(Ag./Hort./Forestry) or			
		B.Sc. (Hons) Agriculture/Horticulture/			
		Forestry or B.Tech. (Biotechnology)			
5.	Soil Science	B.Sc.(Ag./Hort) or B.Sc. (Hons)			
6.	Horticulture (Vegetable Science)	Agriculture/Horticulture			

#### 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	50
Entrance	50
Total	100

iii. Written test with objective type (multiple choices) questions in the specific subject will be of one and half hour duration. A minimum of 50% (25 marks) is must for considering the candidate for admission. However, in case of SC/ST candidates, a minimum of 40% (20 marks) is must for considering the candidate for admission into that category. Note: If a SC/ST candidate seeks admission under other categories a minimum of 50% (25 marks) in entrance test is must

- 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 <u>five academic years (ten semesters)</u> from the date of admission.
- 7.2 In case a student fails to complete the degree programme within the maximum duration of residential requirement (five years), his/her admission shall stand cancelled.

#### 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. At any given time, a PG teacher shall not be a chairman of Advisory Committee (including Master's and Ph.D. programmes) for more than five students.

## 10.3 Chairman/ Co-guide/ Member from other collaborating University/ Institute/ Organization:

- i. The University / Institute may enter into Memorandum of Understanding (MOU) with other Universities / Institutions / Organizations for conducting research.
- ii. The proposed faculty member from the partnering institution can be allowed to act as Co-guide / Member of Student Advisory Committee

# Note: In special cases the proposed faculty member from the partnering institution can be allowed to act as Chairperson.

#### 10.4 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. Staff having UG teaching experience of four years or more may be included as the members of the Student Advisory Committee.
- 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.

#### 10.5 **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.

#### 10.6 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.

## 10.7 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 coopting 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.

#### 10.8 **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 70 credits as detailed below for award of the Master's degree.

Details	<b>Minimum Credits</b>
Major courses	20
Minor courses	08
Supporting courses	06
Common courses*	05
Seminar	01
Research	30
TOTAL	70

\* List of Common courses

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	1+0
	agriculture	
PGS 504	Basic Concepts in Laboratory techniques	0+1
PGS 505	Agricultural research, research ethics and rural	1+0
	development programmes	

- 13.2 **Maximum credit load:** A postgraduate student can register a maximum of 22 credits per semester including common courses, seminar and research. However, research credits registered per semester should not exceed 15.
- 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.

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

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

#### 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 56<sup>th</sup> 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 midsemester 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 prerequisite 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 *internalexaminer*.
- 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 5 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 theo	ry and practic	al (1+1 or 2+1 co	ourses)			
	(20 M	arks & 1 hour	duration)				
А	Objective*	20	20	0.5	10		
В	Definitions/Concepts	12	10	1.0	10		
	TOTAL				20		
	Courses with only theory (1+0 or 2+0 courses)						
	(30 Ma	arks & 1½ hou	r duration)				
А	Objective*	30	30	0.5	15		
В	Definitions/Concepts	18	15	1.0	15		
	TOTAL				30		
Courses with only practical (0+1 courses)							
(30 Marks & 1½ hour duration)							
А	Objective*	30	30	0.5	15		
В	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

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 M	arks & 2.5 hc	ours duration)				
А	Objective (MCQ's only)	20	20	0.5	10		
В	Definitions/Concepts	12	10	1.0	10		
С	Paragraph answers	7	5	2.0	10		
D	Essay type answers	5	5	4.0	20		
	( <u>EITHER OR </u> type) - One						
	main question from each						
	unit shall have one choice						
	TOTAL				50		
	Courses with only theory (1+0 or 2+0 courses)						
	<b>Final Theory Examina</b>	ation (60 Mar	ks & 3.0 hours du	, ration)			
Α	Objective (MCQ's only)	20	20	0.5	10		
В	Definitions/Concepts	18	15	1.0	15		
C	Paragraph answers	7	5	2.0	10		
D	Essay type answers	5	5	5.0	25		
	( <u>EITHER OR </u> type) - One						
	main question from each						
	unit shall have one choice.						
	TOTAL				60		

15.8.2 The question paper	pattern	final theory	(external)	examinations	are indicated below:
13.0.2 me question paper	pattern	mar theory	(CALCI Hal)	chaimations	

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 (2.5 hrs)	60 (3 hrs)
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
А	Paragraph answers	7	5	5	25
В	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.

#### 165 **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 reregistered 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 can not complete qualifying examination till the end of final semester, 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 qualifying examination.
- f. SITUATION VI: If a student secures 'F' grade in one or more course(s) and can not complete the course(s) till the end of final semester, the research credits registered in the final semester shall not be evaluated unless he/she successfully completes the course(s) in which he/she secures 'F' grade. The research credits registered by the student in the final semester shall be evaluated within 15 days from the date of declaration of result of the failed course(s). If the student fails to complete the course even in 1+2 attempts, 'E' grade shall be awarded for the research credits registered in the final semester and the student has to re-register the same block of research credits along with the re-registration of failed courses, with the approval of the University
- 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).
- v. During submission of thesis for external evaluation, it is mandatory to enclose

certificates for plagiarism check and reference management (Proforma-12). Maximum of 20% plagiarism is permitted.

#### 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. The thesis final viva-voce examination shall be completed within three 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 vivavoce, 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 **five 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.

SI.	Particulars	Time Schedule
NO.		
1	Formation of advisory	Within one month of the commencement
	committee <b>(Form 1)</b>	of first semester
2	Plan of course work	Before the commencement of mid
	(Form 2)	semester examination in the first semester
3	Programme of research work	Before the end of the semester in which
	(Form 3)	the student registers the research credit for
		the first time or the commencement of the
		research work whichever is earlier.
4	Proposal for qualifying	Two months before the completion of the
	examination (Form 4)	course work.
5	Qualifying examination result	Immediately
	(Form 5)	
6	Panel of external examiners	Three months before the probable date of
	for thesis evaluation (Form 6)	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 (<u>www.pajancoa.ac.in</u>) 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.

i)	Date of registration	:
ii)	Date of qualifying examination	:
iii)	Due date for thesis submission	:
iv)	Date of submission of thesis	:
v)	Date of viva-voce	:
vi)	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

SI.No.	Particulars	Time Schedule
1	List of courses to be offered	A week before the commencement of each
	along with time table	semester
2	Course registration particulars	Within 10 working days from the date of
		commencement of each semester
3	Time table for mid-semester	A week before the scheduled date for the
	examinations	examinations notified in the academic
		calendar
4	Mark lists after completing	Within 10 days from the date of conduct of
	examinations	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 AGRICUL/TURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

# FORMATION OF ADVISORY COMMITTEE

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

- Name of the student :
   Registration No. :
   Degree :
   Subject :
- 5. Advisory committee :

SI.	Advisory	Name, Designation and	Date of	Signature
No.	Committee	Department	Retirement	
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 AGRICUL/TURE 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)

Name of the student
 Registration No.
 Degree
 Subject
 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

# 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

# Form – 3a PONDICHERRY UNIVERSITY

# PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICUL/TURE AND RESEARCH INSTITUTE, KARAIKAL – 609 603

CHANGE IN PROGRAMME OF RESEARCH

(To be sent in triplicate)

Name	:
Registration No.	:
Degree	:
Subject	:
Reason for change	:
Proposed change in the approved	: programme of research
Number of credits completed so far	: under the approved programme
a) Whether already earned credits are	: to be retained or to be deleted
b) If retained, justification	:
	Registration No. Degree Subject Reason for change Proposed change in the approved Number of credits completed so far a) Whether already earned credits are 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

# Form – 4 PONDICHERRY UNIVERSITY

# PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICUL/TURE 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	:

 List of PG students appearing for qualifying examination

SI. No.	Name	Registration No.	OGPA

:

8. Panel of External examiners :

SI. 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)

- Name of the student 1. : 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\*

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

\*Three external examiners should be given

8. Remarks

.

Signature of the Chairman of the advisory committee

# 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 <i>viva-voce</i>	:	
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)

SI. 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
# DETAILS ON FEE TO BE PAID BY THE STUDENT

SI. 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	*

(Other than admission fee and semester fee)

\* 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**

SI. 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

- 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.	

# 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

# 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** 

# 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	:	Rsp.m
8.	Amount of contingent grant	:	Rsp.a.
9.	Amount of T.A. provided	:	Rsp.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	:	Rsp.m.
c.	Amount of contingent grant	:	Rsp.a.
d.	Amount of T.A. Provided	:	Rsp.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	ı./Selvi/Tn	nt						
Registration No		has	completed	all	the	course	and	resea	arch
credit requirements	on				for	the	awa	ard	of
		de	egree.						

**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	:	
11.	Specific remarks and recommendation of the Chairman	:	Signature of the student
			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**

Nam	e 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

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

Proforma-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

# 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		
1. 2	Pogistration No	•	
2.	Department & College		
5.	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	:	
с.	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			
Junein			

#### **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.

# **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

Proforma-12

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

#### CERTIFICATE FOR HAVING CARRIED OUT PLAGIARISM CHECK

1	Name of the Student	
2	Registration Number	
3	Degree	
4	Title of the Thesis	
5	Name of the Chairman	
6	Total Word Count in the Document	
7	Initial Submission	Yes / No
	If No	Provide the number of times plagiarism checked along with their plagiarism percent
8	Date of Submission	

Signature of the Student

#### Signature of the Chairman/Chairperson

Signature of the Head of the Department

#### COURSE CURRICULA AND SYLLABI

## **DESCRIPTION OF TERMINOLOGIES**

Major Course	The subject of Department or discipline in which the student takes
	admission. Among the listed courses, the core courses compulsorily
	to be registered shall be given '*' mark
Minor Course	The course closely related to a student's major subject
Supporting Course	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
Common course	Course which is compulsorily registered by the postgraduate student
	for the completion of postgraduate degree programme. The marks
	obtained by the student in a common course will also be taken into
	account for calculating OGPA

# **Credit Requirements**

	Particulars		Credits
(i)	Course Work		
	Major courses		20
	Minor courses		08
	Supporting courses		06
	Common courses		05
	Seminar		01
(ii)	Thesis Research		30
		TOTAL	70

## **COMMON COURSES**

SI No.	Course Code	Course Title		
1	PGS 501	Library and Information Services	0+1	
2	PGS 502	Technical Writing and Communication Skill	0+1	
3	PGS 503	Intellectual Property and its Management in Agriculture		
4	PGS 504	Basic Concepts in Laboratory Techniques		
5	PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	1+0	

## PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

#### AIM OF THE COURSE

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

#### PRACTICAL

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

#### PRACTICAL SCHEDULE

- 1. Introduction to library and its services
- 2. Role of libraries in education, research and technology transfer;
- 3. Classification systems and organization of library
- 4. Sources of information- Primary Sources, Secondary Sources and Tertiary Sources
- 5. Intricacies of abstracting and indexing services
- 6. Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.);

- 7. Tracing information from reference sources;
- 8. Literature survey

# 9. Mid-Semester

- 10. Citation techniques/Preparation of bibliography;
- 11. Use of CD-ROM Databases,
- 12. Online Public Access Catalogue and other computerized library services
- 13. Online Public Access Catalogue and other computerized library services
- 14. Use of Internet including search engines and its resources
- 15. Use of Internetincluding search engines and its resources
- 16. E-resources access methods.
- 17. Final practical examination

## PGS 502 TECHNICAL WRITING AND COMMUNICATION SKILLS 0+1

## **AIM OF THE COURSE**

To equip the students with skills *Viz.,* writing of dissertations, research papers, etc. andto communicate and articulate in English (verbal as well as writing)

## PRACTICAL

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

# PRACTICAL SCHEDULE

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

#### 9. Mid -semester examination

- 10. Technical Writing- reviews, manuals
- 11. Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion)
- 12. Writing of abstracts, summaries, précis, citations etc
- 13. Commonly used abbreviations in the theses and research communications
- 14. Illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustration
- 15. Writing numbers and dates in scientific write-ups
- 16. Editing and proof-reading, writing of a review article.

## 17. Final practical examination

#### SUGGESTED READING

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

# PGS 503 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN 1+0 AGRICULTURE

#### AIM OF THE COURSE

The main objective of this course is to equip students and stakeholders with knowledge of Intellectual Property Rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

#### 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 READING

- 1. Erbisch FH and Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
- 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.
- 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 (For Social Science)

#### PRACTICAL

Use of R / SPSS / equivalent for Frequency distribution, Summarization and tabulation of data, F test, Correlation, Pearson Correlation, Spearman Correlation, ANOVA, ANCOVA

Use of R / SPSS / equivalent for Regression: Simple, Multiple Linear regression, Estimation of regression by OLS & MLE method, Logit, Probit, Stepwise regression, Coefficient of determination

Use of R / SPSS / equivalent for Kolmogorov-Smirnov test, Wilcoxon signed rank test, Mann-Whitney U, Kruskal-Wallis, McNemar's test

Use of R / SPSS / equivalent for Discriminant analysis - fitting of discriminant functions, identification of important variables, Factor analysis. Principal component analysis - obtaining principal component.

Use of R / SPSS / equivalent for Analysis of time series data - AR, MA, ARIMA models

## SUGGESTED READING

- 1. Anderson CW & Loynes RM. 1987. The Teaching of Practical Statistics. John Wiley.
- 2. Atkinson AC. 1985. Plots Transformations and Regression. Oxford University Press.
- 3. Chambers JM, Cleveland WS, Kleiner B & Tukey PA. 1983. Graphical Methods for Data Analysis. Wadsworth, Belmount, California.
- 4. Chatfield C & Collins AJ. 1980. Introduction to Multivariate Analysis. Chapman & Hall.
- 5. Chatfield C. 1983. Statistics for Technology. 3 rd Ed. Chapman & Hall.
- 6. Chatfield C. 1995. Problem Solving: A Statistician's Guide. Chapman & Hall.
- 7. Cleveland WS. 1985. The Elements of Graphing Data. Wadsworth, Belmont, California.
- 8. Ehrenberg ASC. 1982. A Primer in Data Reduction. John Wiley.
- 9. Erickson BH & Nosanchuk TA. 1992. Understanding Data. 2 nd Ed. Open University Press, Milton Keynes.
- 10. Snell EJ & Simpson HR. 1991. Applied Statistics: A Handbook of GENSTAT Analyses. Chapman & Hall
- 11. Sprent P. 1993. Applied Non-parametric Statistical Methods. 2 nd Ed. Chapman & Hall.
- 12. Tufte ER. 1983. The Visual Display of Quantitative Information. Graphics Press, Cheshire, Conn.
- 13. Velleman PF & Hoaglin DC. 1981. Application, Basics and Computing of Exploratory Data Analysis. Duxbury Press.
- 14. Weisberg S. 1985. Applied Linear Regression. John Wiley.
- 15. Wetherill GB. 1982. Elementary Statistical Methods. Chapman & Hall.
- 16. Wetherill GB.1986. Regression Analysis with Applications. Chapman & Hall.
- 17. Learning Statistics: http://freestatistics.altervista.org/en/learning.php.
- 18. Free Statistical Soft wares: http://freestatistics.altervista.org/en/stat.php.
- **19.** Statistics Glossary http://www.cas.lancs.ac.uk/glossary\_v1.1/main.html

#### PGS 504

## BASIC CONCEPTS IN LABORATORY TECHNIQUES (For Plant Sciences)

#### **AIM OF THE COURSE**

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

#### PRACTICAL

#### Unit I

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.

#### Unit II

Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions. Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values.

#### Unit III

Preparation of different agro-chemical doses in field and pot applications. Principles and handling techniques of Chromatography.

#### Unit IV

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

#### Unit V

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

#### PRACTICAL SCHEDULE

- 1. Safety measures while in Lab; Handling of chemical substances
- 2. Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micro pipettes and vaccupets
- 3. Washing, drying and sterilization of glassware
- 4. Drying of solvents/chemicals
- 5. Weighingandpreparationofsolutionsofdifferentstrengthsandtheirdilution
- 6. Handling techniques of solution; Preparation and neutralisation of acid and bases
- 7. Preparation of buffers of different strengths and pH values

#### 8. Mid semester examination

9. Preparationofdifferentagro-chemicaldosesinfieldandpotapplications (Herbicides and Fertilizers)

- 10. Preparationof different agro-chemical doses infield and pot applications (Pesticides)
- 11. Principles and Handling techniques of Chromatography.
- 12. Use and handling of microscope, laminar flow, vacuum pumps viscometer, thermometer, magnetic stirrer, micro-ovens, incubator, sand bath, water bath, oil bath etc.
- 13. Preparation of media and methods of sterilization
- 14. Seed viability testing, testing of pollen viability
- 15. Tissue culture of crop plants. Description of flowering plants in botanical term sin relation to taxonomy
- 16. Specific methodologies of each discipline concerned.
- 17. Final Practical Examination

#### SUGGESTED READING

- 1. FurrAK.2000.CRC Hand Book of Laboratory Safety. CRC Press.
- Gabb MH and Latchem WE.1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

# PGS 505 AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL 1+0 DEVELOPMENT PROGRAMMES

#### **AIM OF THE COURSE**

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

# THEORY

#### Unit I

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions.

#### Unit II

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.

#### Unit III

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

## Unit IV

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.

## Unit V

Integrated Rural Development Programme (IRDP) Panchayat Raj Institutions, Cooperatives, Voluntary Agencies/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

# LECTURE SCHEDULE

- 1. History of agriculture in brief; Global agricultural research system: need, scope, opportunities
- 2. Role in promoting food security, reducing poverty and protecting the environment
- 3. National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions
- 4. Consultative Group on International Agricultural Research (CGIAR); International Agricultural Research Centres (IARC)
- 5. Partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels
- 6. International fellowships for scientific mobility.
- 7. Research ethics: research integrity, research safety in laboratories
- 8. Welfare of animals used in research, computer ethics, standards and problems in research ethics.

# 9. Mid semester examination

- 10. Social trends on research ethics, adequate codes of conduct to regulate researchactivity
- 11. Concept and connotations of rural development, rural development policies and strategies.
- 12. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme
- 13. Special group Area Specific Programme
- 14. Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Cooperatives, Voluntary Agencies/ Non-Governmental Organisations.
- 15. Critical evaluation of rural development policies and programmes
- 16. Constraints in implementation of rural policies and programmes
- 17. Final Examination.

# SUGGESTED READING

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.

## SUPPORTING COURSES

SI No.	Course Code	Course Title	Credits
1	COM 501	R and Python Programming	2+1
2	MAT 501	Mathematics For Agricultural Economics	2+1
3	STA 501	Statistical Methods for Applied Sciences	2+1
4	STA 502	Design of Experiments	2+1

#### COM 501 R AND PYTHON PROGRAMMING 2+1

#### WHY THIS COURSE?

This course is all about R which is mainly used for statistical analysis while Python provides a more general approach to data science. R and Python are state of the art in terms of programming language oriented towards data science. Learning both of them gives an idea for handling agricultural data.

#### **AIM OF THE COURSE**

The objective of the course is partly to give an introduction to python and software R and how to handle data analysis using R.

#### THEORY

#### Unit I

Introduction to Python – Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Reading Input, Print Output, Type Conversions - Control Flow Statements, Looping Statements, Functions - Built-In Functions, Commonly Used Modules, Packages - Strings and Lists – Iterators.

#### Unit II

Regular Expression - pattern matching and searching using regex - validations using regular expressions - Exception handling - Python Database Interaction - SQL Database connection using python - Creating, Reading, storing and searching information on tables.

#### Unit III

R Console; R Data types; R Vector creation using c (); R Assignment operators = <- ; R Arithmetic Operators; R Logical Operators; R Relational Operators;

#### Unit IV

R Matrix- Create, Print, Add Column using cbind (), Add Row using rbind (), Slice using [,]; R Data Frame - Create using data.frame (), Edit using edit (), Append using cbind (), rbind (), select (), subset (), sort using order (); List in R - Create using list (), Select; Data

Importing and Exporting in R Using read. table () and write. table (); install. packages (), library

## Unit V

R script If, Else, Else If statements in R; For Loop and While Loop in R; Scatter Plot, Bar Chart and Histogram in R; Data Visualization with R ggplot2; Publishing Data Visualizations with R Shiny;

## PRACTICALS

Implementation of Control Flow Statements, Looping Statements, Functions, Regular Expression, pattern matching and searching using regex. Validations using regular expressions. Python Database Interaction - SQL Database connection using python. Creating, Reading, storing and searching information on tables. R Console; R Vector creation using c(); R Assignment operators = <- ; R Matrix- Create, Print, Add Column using cbind(), Add Row using rbind(), Slice using [, ]; R Data Frame - Create using data.frame(), Edit using edit(), Append using cbind(), rbind(), select(), subset(), sort using order(); List in R - Create using list(), Select; Data Importing and Exporting in R Using read.table() and write.table(); install.packages(), library(); Rscript, If, Else, Else If statements in R; For Loop and While Loop in R; Scatter Plot, Bar Chart and Histogram in R; Data Visualization with R ggplot2; Publishing Data Visualizations with R Shiny;

## LECTURE SCHEDULE

## Unit I

- 1 Introduction to Python Identifiers, Keywords, Statements and Expressions
- 2 Operators, Precedence and Associativity, Data Types
- 3 Reading Input, Print Output, Type Conversions
- 4 Control Flow Statements, Looping Statements
- 5 Functions Built-In Functions, Commonly Used Modules, Packages
- 6 Strings and Lists
- 7 Iterators

#### Unit II

- 8 Regular Expression
- 9 Pattern matching and searching using regex
- 10 Validations using regular expressions
- 11 Exception handling
- 12 Python Database Interaction SQL Database connection using python
- 13 Creating, Reading, storing and searching information on tables.

#### Unit III

- 14 R Console; R Data types; R Vector creation using c();
- 15 R Assignment operators = <- ;
- 16 R Arithmetic Operators;
- 17 Mid semester examination

- 18 R Logical Operators;
- 19 R Relational Operators;

# Unit IV

- 20 R Matrix- Create, Print,
- Add Column using cbind(), Add Row using rbind(), Slice using [,];
- 22 R Data Frame Create using data.frame (), Edit using edit(), Append using cbind (), rbind(),
- 23 Select (), subset(), sort using order();
- 24 List in R Create using list(), Select;
- 25 Data Importing and Exporting in R Using read.table() and write.table();
- 26 install. packages(), library();

# Unit V

- 27 Rscript
- 28 If, Else in R
- 29 Else If statements in R;
- 30 For Loop in R;
- 31 While Loop in R;
- 32 Scatter Plot, Bar Chart and Histogram in R;
- 33 Data Visualization with R ggplot2
- 34 Publishing Data Visualizations with R Shiny;

# PRACTICAL SCHEDULE

- 1 Implementation of Control Flow Statements, Looping Statements, Functions
- 2 Regular Expression
- 3 Pattern matching and searching using regex
- 4 Validations using regular expressions
- 5 Python Database Interaction SQL Database connection using python
- 6 Creating, Reading, storing and searching information on tables
- 7 R Console; R Vector creation using c(); R Assignment operators = <- ;
- 8 R Matrix- Create, Print, Add Column using cbind (), Add Row using rbind (), Slice using [,];
- 9 R Data Frame Create using data. frame (), Edit using edit(), Append using cbind (), rbind (), select (), subset (), sort using order();
- 10 List in R Create using list(), Select; Data Importing and Exporting in R Using read.table () and write. Table ();
- 11 Install. packages(), library(); Rscript,
- 12 If, Else, Else If statements in R;
- 13 For Loop in R; While Loop in R;
- 14 Scatter Plot, Bar Chart and Histogram in R;
- 15 Data Visualization with R ggplot2;
- 16 Publishing Data Visualizations with R Shiny;
- 17 Final practical examination

## LEARNING OUTCOME

This course will impart knowledge on how to interpret and analyze data using R and Python programming.

## SUGGESTED READING

- 1 Michael J. Crawley (2013). The R Book. 2nd Edition. John Wiley.
- 2 Robert Gentleman (2008). R Programming For Bioinformatics. Chapman and Hall/CRC
- 3 Brian S. Everitt and Torsten Hothorn (2009). A Handbook of Statistical Analyses Using R. Second Edition. Chapman and Hall/CRC
- 4 Bassi, S. (2017). Python for bioinformatics. Chapman and Hall/CRC.

## SUGGESTED WEBSITES

- 1 https://www.python.org/doc/
- 2 https://www.r-project.org/other-docs.html
- 3 https://www.r-exercises.com/
- 4 RStudio.com Shiny Tutorial https://shiny.rstudio.com/tutorial/ https:// shiny. rstudio.com /articles/

## MAT 501 MATHEMATICS FOR AGRICULTURAL ECONOMICS 2+1

#### WHY THIS COURSE?

This course provides a strong quantitative basis for the students to understand various Micro and Macroeconomic concepts

#### **AIM OF THE COURSE**

This course exposure student of Agricultural Economics to calculus and its applications in Agricultural Economics. It covers applications of Differential calculus, Integral calculus and Differential equations. This course provides a strong quantitative basis for the students to understand various Micro and Macro economic concepts.

#### THEORY

#### Unit I

Matrices – types - algebra of matrices. Determinants – properties - solution of simultaneous equations. Inverse of a matrix. Caylay Hamilton theorem- Eigen values and Eigen vectors.

#### Unit II

Definition and examples of variables and functions- basic theorems on limits and continuity (without proof). Revision of methods of differentiation. Maxima and minima of single. Application of differentiation - Elasticity of demand in terms of differentiation.

Average and marginal functions. Cost and Revenue curves- relationship. Conditions for profit maximization, Effects of taxation and subsidy.

#### Unit III

Revision of Partial differentiation - Maxima and minima of several variables with and without constraints -Marginal demands, partial elasticitics and utility analysis. Theory of consumer behavior- Rate of commodity substitution, Maximization of utility – slut sky equation (Income and substitution effects). Production functions and their mathematical properties- Isoquants and Ridge lines- Least cost combination – Constrained profit Maximization- Properties of linear homogenous functions- Euler's theorem.

#### Unit IV

Definite integrals, methods of integration definite integral; - Capital formation. Present value of continuous equal income stream. Consumer's and producer's surplus.

#### Unit V

Differential equations-meaning-types of differential equations-order and degree of the differential equations-formation and solution of first order and first degree linear differential equations. Solution of linear homogeneous equations. Applications in Micro economics – Utility and Demand analysis- Cost functions, Market equilibrium Harood Domor model, basic neo classic models, Solow models Domar debit models and some further applications.

#### PRACTICALS

Problems in algebra of matrices and determinants, simultaneous equation, eigen values and eigen vectors, simple differentiation, maxima and minima for single variables. Application of differentiation in Agricultural Economics. Simple problems in partial differentiation & Maxima and minima for several variables, Maxima and minima for several variables with constraints-Lagrange's method, Application of partial differentiation in agricultural economics, simple integral, calculation of consumer's and producer's surplus, formation of differential equation, solution of first order and first degree linear differential, solution of linear homogeneous equations.

#### LECTURE SCHEDULE

#### Unit I

- 1 Matrices types of matrices, Algebra of matrices and determinant
- 2 Inverse of a matrix, Solution of simultaneous linear equations
- 3 Caylay Hamilton theorem
- 4 Eigen Values and Eigen Vector

#### Unit II

- 5 Definition and examples of variables and functions
- 6 Basic theorems on limits and continuity (without proof).
- 7 Revision and Simple Problems in differentiation

- 8 Maxima and minima of function of single with out constraints
- 9 Definitions of Elasticity, Total average and Marginal cost curve relations
- 10 Total average and Marginal Revenue curves Conditions for profit maximization

# Unit III

- 11 Revision and Simple Problems in partial differentiation.
- 12 Maxima and minima of function of several variables without constraints
- 13 Maxima and minima of function of several variables with constraints -Lagrange's Multiplier's method
- 14 Partial elasticties and utility Analysis Theory of consumer behavior
- 15 Rate of commodity substitution
- 16 Mid semester examination
- 17 Maximization of utility
- 18 Slutsky equation (Income and substitution effects).
- 19 Production functions and their mathematical properties
- 20 Isoquants and Ridge lines
- 21 Least cost combination Constrained profit Maximization
- 22 Properties of linear homogeneous functions Euler's theorem

# Unit IV

- 23 Definite integrals and their geometrical applications
- 24 Capital formation Capital growth equation
- 25 Present value of continuous equal income stream
- 26 Calculations of consumer's and producer's surplus

# Unit V

- 27 Solution of first order differential equations and Homogeneous
- 28 Linear differential equation with constant coefficients
- 29 Applications in Micro economics Utility and Demand analysis
- 30 Applications in Micro economics Cost functions, , Market equilibrium
- 31 Applications in Macro growth economics Dynamic multiplier models
- 32 Applications in Macro growth economics Harood Domor model
- 33 Applications in Macro growth economics Basic neo classic models
- 34 Applications in Macro growth economics Solow models Domar debit models

# PRACTICAL SCHEDULE

- 1 Simple Problems in Matrices, Inverse Matrix
- 2 Problems in Solution of simultaneous linear equations
- 3 Problems in cayley Hamilton
- 4 Problems in Eigen value and Eigen verctor
- 5 Simple Problems in Differentiation
- 6 Maximum and minimum of function of single variables without constraints
- 7 Problems in Elasticity, Total average and Marginal cost/Revenue curves

- 8 Problems in Marginal demands, Partial elasticties and utility Analysis.
- 9 Simple Problems in partial differentiation
- 10 Maximum and minimum of function of several variables without constraints
- 11 Maximum and minimum of function of several variables with constraints
- 12 Problems in Maximization of utility and slut sky equation (Income and substitution effects) and Constrained profit Maximization
- 13 Homogeneous functions and Euler's theorem on homogenous functions
- 14 Problems in Definite integrals geometrical applications
- 15 Calculations of consumer's and producer's surplus
- 16 Problems in Homogeneous, Linear differential equations
- 17 Final practical examination

# LEARNING OUTCOME

Students can get exposure in basic knowledge in set theory, cost curve, supply curves and asticity with the applications in Agricultural Economics. Students can know to solve macro and micro economic models. Also this course provides a strong quantitative basis for the students to understand various Micro and Macro economic concepts

## SUGGESTED READING

- 1 Metha, B.C. and Madani, G.M.K. (Reprint2008) Mathematics for Economists, Sultan Chand & Sons Educational Publishers, New Delhi.
- 2 ArumugamS. And Thangapandi Isaac (2002), Advanced Calculus, New Gamma Publishing house, Chennai.

# SUGGESTED WEBSITES

- 1 http://en.wikipedia.org/wiki/Set\_theory mathworld.wolfram.com /Newtons Divided Difference Interpolation Formula.html
- 2 http://en.wikipedia.org/wiki/Taylor\_series

# STA 501STATISTICAL METHODS FOR APPLIED SCIENCES2+1

#### WHY THIS COURSE?

- This course will help the students
- To study the exploratory data analysis
- To understand the various probability distributions and their application in their respective fields
- To perform the parametric and non-parametric tests based on the data
- To learn the relationship of the variables using correlation and regression techniques

#### AIM OF THE COURSE

The students would be exposed to concepts of statistical methods and statistical inference that would help them in understanding the importance of statistics. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure to presentation of data, probability distributions, parameter estimation, parametric and non-parametric tests, selection of sampling techniques and correlation, regression and ANOVA techniques.

#### THEORY

#### Unit I

Descriptive Statistics: Measure of Central Tendency, Measure of Dispersion, Skewness and Kurtosis for raw data only. Graphical and Diagrammatical representation: Bar Chart, Pie Chart, Frequency curve, Box Plot. Theory of Probability: axioms and properties, Addition and Multiplication Theorems on probability, Random Variable and Mathematical Expectation.

#### Unit II

Discrete and continuous probability distribution: Binomial, Poisson, Normal Distribution. Sampling theory: Population, parameter, sample and statistics; Sampling, need for sampling; Probability sampling: Simple random sampling (SRS), stratified random sampling, systematic sampling, cluster sampling; Non Probability sampling: Purposive and judgment sampling.

#### Unit III

Sampling distribution: Standard error and its uses, chi-square, t and F distributions. Theory of Estimation: Point Estimation, properties of good estimators; Properties of good estimators – unbiasedness, consistency, efficiency and sufficiency. Interval estimation: confidence limit, confidence interval. Test of significance based on Normal, t, F and Chisquare distributions.

#### Unit IV

Correlation and Regression: Correlation, types of correlation, pearson's correlation, testing the significance of correlation coefficient, rank correlation. Simple linear regression: assumption and fitting of simple linear regression, testing and interpretation of regression coefficient, coefficient of determination. Multiple linear regression and testing of coefficients.

#### Unit V

Introduction to ANOVA: One Way and Two way ANOVA. Non-parametric test: Sign test, Wilcoxon Test, Mann-Whitney U-test, Run test for the randomness of the sequence, Median test, Kruskalwallis test, Friedman's test.

## PRACTICAL

Descriptive Statistics: Measure of central tendency, Measure of dispersion, Skewness and Kurtosis for raw data. Graphical and diagrammatical representation, Problems on Binomial, Poisson, Normal Distribution. Confidence interval estimation, Large sample test – testing mean and proportion, t-Test for single mean and two means, F-test for two variance, Test based on chi-square distributions. Correlation and Regression analysis. One Way ANOVA and Two way ANOVA. Non Parametric test: Wilcoxon Test, Mann-Whitney U-test, Run test for the randomness of the sequence, Median test, Kruskalwallis test, Friedman's test

## LECTURE SCHEDULE

## Unit I

- 1 Descriptive Statistics: Measure of central tendency for raw data
- 2 Descriptive Statistics: Measure of dispersion for raw data
- 3 Skewness and Kurtosis for raw data
- 4 Graphical and diagrammatical representation Bar Chart, Pie Chart, frequency curve, Box Plot
- 5 Theory of Probability: axioms and properties, Addition and Multiplication Theorems on probability
- 6 Random Variable and Mathematical Expectation

## Unit II

- 7 Discrete distribution: Binomial distribution
- 8 Discrete distribution: Poisson distribution
- 9 Continuous probability distribution: Normal Distribution
- 10 Sampling theory: Population, parameter, sample and statistics; Sampling, need for sampling
- 11 Probability sampling: Simple random sampling (SRS) with and without replacement
- 12 Probability sampling: stratified random sampling and its method of allocation, Systematic sampling, cluster sampling
- 13 Non Probability sampling: Purposive and judgment sampling

# Unit III

- 14 Sampling distribution: Standard error and its uses, chi-square, t and F distributions
- 15 Theory of Estimation: Point Estimation, Properties of good estimators: unbiasedness, consistency, efficiency and sufficiency
- 16 Interval estimation: confidence limit, confidence interval for single and two sample mean (t and Z)
- 17 Mid Semester Examination
- 18 Test of significance based on Normal distribution
- 19 Test of significance based on t distribution
- 20 Test of significance based on F distribution
21 Test of significance based on chi-square distributions

# Unit IV

- 22 Correlation, Types of correlation, Pearson's correlation and its properties
- 23 Rank correlation
- 24 Simple linear regression: assumption and fitting of simple linear regression
- 25 Testing and interpretation of regression coefficient, coefficient of determination
- 26 Multiple linear regression model Matrix approach and
- 27 Testingthe significance of correlation coefficient and regression coefficients, coefficient of determination

# Unit V

- 28 Introduction to ANOVA: One Way ANOVA
- 29 Two way ANOVA
- 30 Introduction to Non-parametric test: Sign test
- 31 Wilcoxon Test, Mann-Whitney U-test
- 32 Run test for the randomness of the sequence, Median test
- 33 Kruskalwallis test
- 34 Friedman's test

# PRACTICAL SCHEDULE

- 1 Descriptive Statistics: Measure of central tendency, Measure of dispersion, Skewness and Kurtosis for raw data.
- 2 Graphical and diagrammatical representation Bar Chart, Pie Chart, frequency curve, Box Plot
- 3 Problems on Binomial distribution, Poisson distribution
- 4 Problems on Normal Distribution
- 5 Confidence interval estimation for single and two sample mean (t and Z)
- 6 Large sample test testing mean and proportion of single and two sample
- 7 t-Test for single mean, two means (paired t-test)
- 8 t-Test for two means (independent t-test), F-test for two variance
- 9 Test of significance based on chi-square distributions
- 10 Correlation and testing of correlation coefficient
- 11 Regression analysis and testing the significance of regression coefficient
- 12 One Way ANOVA and Two way ANOVA
- 13 Wilcoxon Test, Mann-Whitney U-test
- 14 Run test for the randomness of the sequence, Median test
- 15 Kruskalwallis test
- 16 Friedman's test
- 17 Practical Examination

# LEARNING OUTCOME

After successful completion of the course the students will be able to understand the exploratory data analysis, sampling and probability distribution, perform parametric and non parametric tests, well versed with regression and correlation analysis.

## SUGGESTED READING

- Goon A M, Gupta MK and Das Gupta B. 1983. Fundamentals of Statistics. Vol.
  I. The World Press.
- 2 Hoel PG. 1971. Introduction to Mathematical Statistics. John Wiley
- 3 Hogg RV and Craig TT. 1978. Introduction to Mathematical Statistics. Macmillan
- 4 Robert V. Hogg, Joseph W. McKean, Allen T. Craig (2012). Introduction to Mathematical Statistics (7th Edition)
- 5 Siegel S, Johan N and Casellan Jr. 1956. Non-parametric Tests for Behavior Sciences. John Wiley
- 6 Gupta. S.P, 2005, Statistical Methods, Sultan Chand & Sons, New Delhi
- 7 Rangaswamy, R, 2009, A text book of Agricultural Statistics, New Age International (P) Ltd., New Delhi.
- 8 K.P. Dhamu and K. Ramamoorthy, 2007, Statistical Methods, Agrobios (India), Jodhpur.
- 9 R. GangaiSelvi and C. Kailasam, 2017, Applied Statistics, Kalyani Publishers, New Delhi.

## SUGGESTED WEBSITES

- 1 https://online.stat.psu.edu/statprogram/statistical%20methods
- 2 https://home.iitk.ac.in/~kundu/Statistical-Methods.pdf
- 3 https://www.nature.com/subjects/statistical-methods
- 4 https://sccn.ucsd.edu/~arno/mypapers/statistics.pdf
- 5 https://www.sciencedirect.com/book/9780123749703/statistical-methods

# STA 502DESIGN OF EXPEREIEMNTS2+1

## AIM OF THE COURSE

Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to various Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

# THEORY

# Unit I

Need for designing of experiments, Characteristics of good design. Basic principles of designs- randomization, replication and local control. Uniformity trails, size and shape of plots and blocks – determination of optimum plot size.

## Unit II

Analysis of Variance, Data Transformation – Logrithmic, angular and square root transformation. Multiple comparison procedures – Least significant difference and Duncan's multiple range test. Completely randomized design, randomized block design and Latin square design.

## Unit III

Factorial Experiments: 2<sup>n</sup> and 3<sup>n</sup> factorial experiments, analysis using regular method, Yates algorithm (2<sup>n</sup>, upto three factors), Asymmetric factorial experiments (upto three factors). orthogonality and partitioning of degrees of freedom. Concept of confounding in symmetric factorial experiments, complete and partial confounding. Split plot and strip plot designs.

## Unit IV

Missing plot techniques in randomized block design and Latin square designs. Analysis of covariance.

## Unit V

Balanced Incomplete Block Design (BIBD), Partially Balanced Incomplete Block Design (PBIBD), Lattice design, alpha design: concept, randomization procedure, analysis and interpretation. Introduction to resolvable designs and their applications. Combined analysis. Response surface design.

## PRACTICAL

Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law, Analysis of data obtained from CRD, RBD, LSD; Analysis of factorial experiments; Analysis of covariance; Analysis with missing data; Data transformation - Split plot and strip plot designs - Analysis of data obtained from BIBD, PBIBD.

# LECTURE SCHEDULE

## Unit I

- 1. Introduction to principles of Experimental designs; need for designing of experiments
- 2. Characteristics of good design
- 3. Basic principles of designs- randomization, replication and local control.
- 4. Uniformity trails, size and shape of plots and blocks determination of optimum plot size

## Unit II

- 5. Analysis of Variance
- 6. Data Transformation Logrithmic and angular transformation
- 7. Square root transformation
- 8. Multiple comparison procedures Least significant difference and Duncan's multiple range test

- 9. Completely randomized design: Layout, randomization, analysis, advantage and disadvantage
- 10. Randomized block design: Layout, randomization, analysis, advantage and disadvantage
- 11. Latin square design: Layout, randomization, analysis, advantage and disadvantage
- 12. Introduction to Factorial Experiments and its type

## Unit III

- 13. 2<sup>n</sup> factorial experiments using regular method (up to three factors)
- 14. 3<sup>n</sup> factorial experiments using regular method (up to three factors)
- 15. Yates algorithm: 2<sup>n</sup> factorial experiments (up to three factors)
- 16. Asymmetric factorial experiments (up to three factors)

## **17. Mid Semester Examination**

- 18. Orthogonality : orthogonal Latin squares, Mutually orthogonal Latin squares (MOLS)
- 19. Partitioning of degrees of freedom
- 20. Concept of confounding in symmetric factorial experiments (in 2<sup>3</sup> factorial), advantage and disadvantage
- 21. Complete and Partial confounding (in 2<sup>3</sup> factorial)
- 22. Split plot designs: Layout, Randomization, Analysis, Advantage, Disadvantage.
- 23. Strip plot designs: Layout, Randomization, Analysis, Advantage, Disadvantage

## Unit IV

- 24. Missing plot techniques in randomized block design one and two missing observation
- 25. Missing plot techniques in Latin square designs. one missing observation
- 26. Analysis of covariance (with one covariate)

## Unit V

- 27. Balanced Incomplete Block Design (BIBD) concept, randomization procedure
- 28. Balanced Incomplete Block Design (BIBD) analysis and interpretation
- 29. Partially Balanced Incomplete Block Design (PBIBD): concept, randomization procedure, analysis and interpretation.
- 30. Introduction to Lattice design: Square lattice design, randomization, analysis and their application
- 31. Introduction to Alpha design: concept, randomization procedure, analysis and interpretation.
- 32. Introduction to resolvable designs and their applications.
- 33. Concepts of Combined analysis.
- 34. Response surface design and application: second order response surface design

# PRACTICAL SCHEDULE

- 1. Uniformity trial data analysis
- 2. Formation of plots and blocks
- 3. Fairfield Smith Law

- 4. Analysis of data obtained from CRD
- 5. Analysis of data obtained from RBD
- 6. Analysis of data obtained from LSD
- 7. Data transformation: logarithmic, angular transformation
- 8. Square root transformations
- 9. Analysis with missing data (RBD one missing value only)
- 10. Analysis of factorial experiments symmetrical
- 11. Analysis of factorial experiments symmetrical
- 12. Split plot design
- 13. Strip plot design
- 14. Analysis of covariance in case of RBD
- 15. Analysis of data generated from a BIB design
- 16. Analysis of data generated from a PBIB design
- 17. Final practical examination

# SUGGESTED READING

- 1. Cochran WG and Cox GM. 1957. Experimental Designs. 2nd Ed. John Wiley.
- 2. Dean AM and Voss D. 1999. Design and Analysis of Experiments. Springer.
- 3. Douglas C. Montgomery (2012). Design and Analysis of Experiments, 8th Ed. John Wiley.
- 4. Federer WT. 1985. Experimental Designs. MacMillan.
- 5. Fisher RA. 1953. Design and Analysis of Experiments. Oliver & Boyd.
- 6. Nigam AK and Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments. IASRI Publ.
- 7. Pearce SC. 1983. The Agricultural Field Experiment: A Statistical Examination of Theory and Practice. John Wiley
- 8. Gomez, K.A. and Gomez, A.A., 1993, Statistical Procedures for Agricultural Research, John Wiley & Sons, New Delhi.
- 9. Rangaswamy, R, 2009, A text book of Agricultural Statistics, New Age International (P) Ltd., New Delhi.
- 10. K.P. Dhamu and K. Ramamoorthy, 2007, Statistical Methods, Agrobios (India), Jodhpur.

# SUGGESTED WEBSITES

- 1. www.drs.icar.gov.in
- 2. https://www.moresteam.com/toolbox/design-of-experiments.cfm
- 3. https://www.coursera.org/specializations/design-experiments
- 4. https://online.stat.psu.edu/statprogram/stat503
- 5. https://www.labmanager.com/laboratory-technology/online-resources-for-experim ental-design-21103

# M.Sc. (Agri.) Agronomy

M.Sc.	(Agri.)	Agronomy
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SI No.	Course code	Course Title	Cr. Hr.	
Major co	Major courses			
1.	Agron 501*	Modern Concepts in Crop Production	3+0	
2.	Agron 502*	Principles and Practices of Soil Fertility and Nutrient Management	2+1	
3.	Agron 503*	Principles and Practices of Weed Management	2+1	
4.	Agron 504*	Principles and Practices of Water Management	2+1	
5.	Agron 505	Conservation Agriculture	1+1	
6.	Agron 506	Agronomy of Cereals and Pulses	2+0	
7.	Agron 507	Agronomy of Oilseed, Fibre and Sugar Crops	2+1	
8.	Agron 508	Agronomy of Medicinal, Aromatic and Underutilized Crops	2+1	
9.	Agron 509	Agronomy of Fodder and Forage Crops	2+1	
10.	Agron 510	Agrostology and Agro-forestry	2+1	
11.	Agron 511	Cropping System and Sustainable Agriculture	2+0	
12.	Agron 512	Dryland Farming and Watershed Management	2+1	
13.	Agron 513	Principles and Practices of Organic Farming	2+1	
Seminar	and Research			
1.	Agron 591	Master's seminar	1+0	
2.	Agron 599	Master's research	30	
	* Courses to be	e compulsorily registered		
Minor co	ourses offered			
1.	AGM 502	Fundamentals of Agricultural Meteorology	2+1	
2.	AGM 509	Weather forecasting	2+1	

# SEMESTER WISE DISTRIBUTION OF COURSES

## SEMESTSER I

SI.No.	Course No.	Course Title	Credits	
١.	Major Courses to be registered		9	
11.	Minor Courses to be registered			
111.	I. Supporting Course			
1	STA 501	Statistical Methods for Applied Sciences	2+1	
IV.	. Common Courses			
1	PGS 501	Library and Information Services	0+1	
2	PGS 503	Intellectual Property and its Management in Agriculture	1+0	
3	PGS 504	Basic Concepts in Laboratory Techniques	0+1	

## SEMESTSER II

SI.No.	Course No.	Course Title	Credits
Ι.	Major Courses to be registered		11
11.	Minor Courses to be registered		2 or 3
111.	I. Supporting Course		
1	STA 502	Design of Experiments	2+1
IV. Common Courses			
1	PGS 502	Technical Writing and Communication Skill	0+1
2	PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	1+0

# SEMESTER III

SI.No.	Course No.	Course Title	Credits
1	Agron 591	Master's Seminar	0+1
2	Agron 599	Master's Research	0+15

# SEMESTER IV

SI.No.	Course No.	Course Title	Credits
1	Agron 599	Master's Research	0+15

#### AIM OF THE COURSE

To teach the basic concepts of soil management and crop production

# THEORY

#### Unit I

History and Development of crop production – Ecology and Principles of ecology – Climatological and geo-ecological zonation of India – Crop growth factors and their influence in crop production.

#### Unit II

Crop Growth - Growth analysis – Quantitative agro-biological principles and inverse yield nitrogen law -Mitscherlich yield equation, its interpretation and applicability – Baule unit -Crop response production functions - determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and integrated nutrient management

#### Unit III

Physiology of grain yield in cereals - Optimization of plant population and planting geometry – Concept of ideal plant type and crop modelling for desired crop yield.

#### Unit IV

Scientific principles of crop production – Cropping system and evaluation – Concept of soil plant relations - Yield and environmental stress - Use of growth hormones and regulators for better adaptation in stressed condition.

#### Unit V

Integrated farming systems, organic farming and resource conservation technologies; modern concepts of tillage; dry farming; precision agriculture. Modern crop production concepts: Aeroponic, Hydroponic, Smart farming, Robotic and terrace farming - use of GIS, GPS and remote sensing protected agriculture – Good Agriculture Practices.

#### LECTURE SCHEDULE

- 1. History and development of Agriculture
- 2. Ecology and Principles of Ecology for crop production
- 3. Climatological zonation of India
- 4. Ecological Zonation of India
- 5. Internal factors of crop growth
- 6. Climate factors and crop growth Solar radiation

- 7. Climate factors and crop growth Light
- 8. Climate factors and crop growth Light
- 9. Climate factors and crop growth Temperature
- 10. Climate factors and crop growth RH, Rainfall
- 11. Climate factors and crop growth Wind speed, Atmospheric gases etc
- 12. Edaphic factors and crop growth Soil air, temperature, Soil moisture
- 13. Edaphic factors and crop growth Soil organic matter, Soil Mineral matter
- 14. Physiographic and Biological factors of crop production
- 15. Crop growth and development Growth rate General growth pattern Types of growth
- 16. Growth analysis
- 17. Growth analysis
- 18. Growth laws Mitscherlich, Spillman, Baule
- 19. Agrobiology, Inverse yield N law, N constant
- 20. Crop response production functions
- 21. Nutrient needs and yield potential
- 22. Balanced nutrition and INM
- 23. Physiology of grain yield
- 24. MID SEMESTER EXAMINATION
- 25. Plant population and plant geometry
- 26. Ideal plant types
- 27. Crop modelling Crop growth models, irrigation models
- 28. Crop modelling Yield estimation models, nutrient models
- 29. Scientific principles of crop production
- 30. Cropping systems and farming systems
- 31. Cropping system indices and evaluation indices
- 32. Soil Plant relations
- 33. Stress Types of stress and management of stress
- 34. Integrated farming systems Principles and concepts
- 35. Integrated farming systems Resource recycling
- 36. Organic farming Principles, concepts and Practices
- 37. Resource conservation technologies
- 38. Modern concepts of tillage
- 39. Dry farming definition and concepts
- 40. Dry farming Resource conservation practices
- 41. Precision farming Principles and concepts
- 42. Precision farming GPS, GIS and Remote sensing
- 43. Smart farming Principles, concepts and Practices
- 44. Aeroponics
- 45. Hydroponics
- 46. Terrace farming

- 47. Protected cultivation
- 48. Good Agriculture Practices

## LEARNING OUTCOME

Basic knowledge on soil management and crop production

## SUGGESTED READING

- 1. Balasubramaniyan Pand Palaniappan SP.2001.*Principles and Practices of Agronomy.* Agrobios.
- 2. Fageria NK. 1992. *Maximizing Crop Yields*. Marcel Dekker.
- Havlin JL, Beaton JD, Tisdale SL and Nelson WL.2006. Soil Fertility and Fertilizers.7<sup>t</sup> Ed. Prentice Hall.
- 4. Paroda R.S.2003. Sustaining our Food Security. Konark Publ.
- 5. Reddy SR.2000. *Principles of Crop Production*. Kalyani Publ.
- Sankaran S and Mudaliar TVS. 1997. Principles of Agronomy. The Bangalore Printing & Publ.
- 7. Singh SS. 2006. *Principles and Practices of Agronomy*. Kalyani Publ.
- 8. Alvin PT and Kozlowski TT (ed.).1976. *Ecophysiology of Tropical Crops.* Academia Publ., New York.
- 9. Gardner PP, Pearce GR and Mitchell RL. 1985. *Physiology of Crop Plants.* Scientific Publ. Jodhpur.
- 10. Lal R. 1989. Conservation till age for sustainable agriculture: Tropics versus Temperate Environments Advances in Agronomy 42:85 -197.
- 11. Wilsie C R.1961. Crop Adaptation and Distribution. Euresia Publ., New Delhi.

# AGRON 502 PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND 2+1 NUTRIENT MANAGEMENT

## **AIM OF THE COURSE**

To impart knowledge of fertilizers and manures as sources of plant nutrients and apprise about the integrated approach of plant nutrition and sustainability of soil fertility.

# THEORY

# Unit I

Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth.

## Unit II

Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

## Unit III

Organic farming - basic concepts and definitions. Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management. Soil less cultivation.

## Unit IV

Commercial fertilizers; composition, relative fertilizer value and cost; fertilizer mixtures and grades; Nano-fertilizers and their use; crop response to different nutrients, residual effects and fertilizer use efficiency; agronomic, chemical and physiological, methods of increasing fertilizer use efficiency; nutrient interactions.

## Unit V

Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic nutrients; economics of fertilizer use; integrated nutrient management.

# PRACTICALS

- Determination of soil pH and soil EC
- •Determination of soil organic C
- •Determination of available N, P, K and S of soil
- Determination of total N, P, K and S of soil
- Determination of total N, P, K, S in plant
- Computation of optimum and economic yield

# LECTURE SCHEDULE

- 1. Soil fertility Past records on development of concept of soil fertility
- 2. Soil fertility and productivity Definitions and factors affecting
- 3. Relation between nutrient supply and crop growth
- 4. Features of good soil management
- 5. Problems of supply and availability of major nutrients
- 6. Problem of supply and availability of minor nutrients
- 7. Basics of mineral nutrition Criteria of essentiality of nutrients.
- 8. Essential plant nutrients and their classification
- 9. Functions and deficiency symptoms of major nutrients
- 10. Functions and deficiency symptoms of minor nutrients
- 11. Nitrogen cycle N inputs and N losses

- 12. Nitrogen cycle N-transformations: Mineralization, nitrification, immobilization and ammonium fixation
- 13. Soil Phosphorus P cycle, Q-I relationship, Capacity factor
- 14. P fractions in soil Solution P, Soil organic P and Soil inorganic P
- 15. P fixation Meaning, factors influencing and ways to reduce P fixation
- 16. Soil potassium sources, dynamic of K in soil, K fixation

## **17. MID-SEMESTER EXAMINATION**

- 18. Organic farming basic concepts and definitions, Principles and components, advantages and limitations
- 19. Organic manures Preparation of FYM and compost
- 20. Concentrated organic manures and green manures
- 21. Preparation of vermicompost
- 22. Recycling of organic wastes and residue management
- 23. Soil less cultivation Nutrient management
- 24. Commercial fertilizers composition, relative fertilizer value; fertilizer mixtures and grades;
- 25. Nano-fertilizers and their use.
- 26. Crop response to different nutrients residual effects
- 27. Fertilizer use efficiency agronomic, chemical and physiological; methods of increasing fertilizer use efficiency
- 28. Nutrient interactions
- 29. Time and methods of manures and fertilizers application
- 30. Foliar application Concept, advantages and limitations
- 31. Relative performance of organic and inorganic nutrients; economics of fertilizer use
- 32. Integrated nutrient management

## PRACTICAL SCHEDULE

- 1. Basics of analytical chemistry
- 2. Soil sampling and processing
- 3. Determination of soil pH
- 4. Determination of soil EC
- 5. Determination of soil organic carbon
- 6. Determination of total N in soil
- 7. Determination of available N in soil
- 8. Determination of available P in soil
- 9. Determination of available K in soil
- 10. Determination of available S in soil
- 11. Collection, processing and digestion of plant samples for nutrient analysis
- 12. Determination of total N in plant samples
- 13. Determination of total P in plant samples
- 14. Determination of total K in plant samples

- 15. Determination of total S in plant samples
- 16. Computation of physical and economic optimum of nutrients

# **17. FINAL PRACTICAL EXAMINATION**

## LEARNING OUTCOME

Basic knowledge on soil fertility and management.

## SUGGESTED READING

- Havlin JL, Beaton JD, Tisdale SL and Nelson WL. 2006. Soil Fertility and Fertilizers. 7<sup>th</sup> Ed. Prentice Hall.
- 2. Yawalkar KS, Agrawal JP and Bokde S. 2000. Manures and Fertilizers. Agri-Horti Publ.
- 3. Brady NC and Weil RR. 2002. *The Nature and Properties of Soils*. 13th Ed. Pearson Edu.
- 4. Fageria NK, Baligar VC and Jones CA. 1991. *Growth and Mineral Nutrition of Field Crops.* Marcel Dekker.
- 5. Prasad R and Power JF. 1997. *Soil Fertility Management for Sustainable Agriculture*. CRC Press.

## AGRON 503 PRINCIPLES AND PRACTICES OF WEED MANAGEMENT 2+1

# **AIM OF THE COURSE**

To familiarize the students about the weeds, herbicides and methods of weed control.

# THEORY

## Unit I

Weed biology and ecology and classification, crop-weed competition including allelopathy; principles and methods of weed control and management; Classification of weeds; weed indices, weed shift in different eco-systems

## Unit II

Herbicides introduction and history of their development; classification based on chemical, application and selectivity; mode and mechanism of action of herbicides. Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures, sequential application of herbicides, herbicide combination and rotation.

# Unit III

Weed control through use of nano-herbicides and bio -herbicides, myco-herbicides bio-agents, and allelochemicals; movement of herbicides in soil and plant., Degradation of

herbicides in soil and plants; herbicide resistance, residue, persistence and management; development of herbicide resistance in weeds and crops and their management.

#### Unit IV

Weed management in major crops and cropping systems: alien, invasive and parasitic weeds and their management; weed shifts in cropping systems; aquatic and perennial weed control; weed control in non-crop area.

#### Unit V

Integrated weed management; recent development in weed management- robotics, use of drones and aeroplanes, organic etc., cost; benefit analysis of weed management.

#### PRACTICALS

Identification of important weeds of different crops, Preparation of a weed herbarium, weed survey in crops and cropping systems, crop-weed competition studies, weed indices calculation and interpretation with data, calculation of herbicide requirement preparation of spray solutions of herbicides for high and low-volume sprayers, Use of various types of spray pumps and nozzles and calculation of swath width, Economics of weed control, Herbicide residue analysis in plant and soil. Bioassay of herbicide residues,

# LECTURE SCHEDULE

- 1. Weed biology and ecology
- 2. Classification of weeds
- 3. Crop-weed competition
- 4. Allelopathy and allelochemicals
- 5. Principles and methods of weed management
- 6. Weed indices, weed shift in different eco-systems
- 7. Herbicides introduction and history of their development
- 8. Classification based on chemical, application and selectivity
- 9. Mode and mechanism of action of herbicides
- 10. Herbicide structure activity relationship
- **11**. Factors affecting the efficiency of herbicides, herbicide formulations.
- 12. Herbicide mixtures, herbicide combinations, sequential application and rotation
- 13. Weed control through use of nano-herbicides
- 14. Weed control through use of bio-herbicides, myco-herbicides and bio-agents
- 15. Movement of herbicides in soil and plants
- 16. Degradation of herbicides in soil and plants

## **17. MID SEMESTER EXAMINATION**

- **18**. Herbicide resistance mechanisms
- 19. Development of herbicide resistance in weeds and crops
- 20. Herbicide residue, persistence and management
- 21. Weed management in major crops and cropping systems

- 22. Alien and invasive weeds and their management
- 23. Parasitic weeds and their management
- 24. Weed shifts in cropping systems
- 25. Management of aquatic weeds
- 26. Management of perennial weeds
- 27. Weed management in non-cropped area
- 28. Integrated weed management
- 29. Recent developments in weed management- robotics
- 30. Use of drones, aeroplanes in weed management
- 31. Organics in weed management
- 32. Cost: benefit analysis of weed management

# **PRACTICAL SCHEDULE**

- 1. Identification, characterization and classification of important terrestrial weeds
- 2. Identification, characterization and classification of important aquatic weeds
- 3. Preparation of a weed herbarium
- 4. Weed survey in crops and cropping systems
- 5. Crop-weed competition studies
- 6. Weed indices calculation and interpretation with data
- 7. Calculation of herbicide requirement
- 8. Preparation of spray solutions of herbicides for high and low-volume sprayers
- 9. Use of various types of spray pumps and nozzles
- 10. Calculation of swath width using different nozzles
- 11. Working out weed control efficiencies of different weed management practices.
- 12. Economics of weed control
- **13**. Herbicide residue analysis in plant
- 14. Herbicide residue analysis in soil
- 15. Bioassay of herbicide residue
- 16. Herbicide resistance assessment
- **17. PRACTICAL EXAMINATION**

## LEARNING OUTCOME

Basic knowledge on weed identification and control for crop production.

## SUGGESTED READING

- 1. Boger, Peter. Wakabayashi. Ko, Hirai, Kenji (Eds,).2002. Herbicide Classes in. Development. Mode of Action, Targets, Genetic Engineering, Chemistry. Springer.
- 2. Chauhan B and Mahajan G. 2014. Recent Advances in Weed Management. Springer.
- 3. Das TK. 2008. Weed Science: Basics and Applications, Jain Brothers (New Delhi).
- 4. Fennimore. Steven A and Bell, Carl. 201-1. Principles of Weed Control. -11th Ed, California Weed Sci. Soc.

- 5. Gupta OF, 2007. Weed Management, L: Principles and Practices, 2nd Ed.
- 6. Dugulan, Mithila (EA). 2017. Biology, Physiology and Molecular Biology of Weeds. CRC Press
- Monaco Td, Weller SC and Ashton FM. 2014. Weed Science Principles and Practices, Wiley
- 8. Fowles SH and Shaner DL. 2001. Herbicide Resistance and World Grains, CRC Press.
- 9. Walia L S. 2006. Weed Management, Kalyani
- 10. Zimdahl RL. (ed). 2018, Integrated Weed Management for Sustainable Agriculture, B. D.Sri. Publ.

# AGRON 504 PRINCIPLES AND PRACTICES OF WATER 2+1 MANAGEMENT

#### **AIM OF THE COURSE**

To teach the principles of water management and practices to enhance the water productivity

#### THEORY

#### Unit I

Water and its role in plants; Irrigation: definition and objectives, water resources and irrigation development in India, Tamil Nadu and Puducherry. Major irrigation projects, extent of area and crops irrigated in India, Tamil Nadu and Puducherry.

#### Unit II

Field water cycle, water movement in soil and plants; transpiration; soil-water-plant relationships, water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition. Water availability and its relationship with nutrient availability and losses.

#### Unit III

Crop water requirement - estimation of ET and effective rainfall. Soil, plant and meteorological factors determining water needs of crops; Irrigation scheduling, depth and methods of irrigation; micro irrigation systems; deficit irrigation; fertigation; management of water in controlled environments and polyhouses. Automated irrigation system. Irrigation efficiency and water use efficiency.

#### Unit IV

Quality of irrigation water and management of saline water for irrigation. Water management of the major crops and cropping systems. Water management of crops under climate change. Hydroponics.

#### Unit V

Excess of soil water and plant growth; water management in problem soils; drainage requirement of crops and methods of field drainage, their layout and spacing. Soil moisture conservation, water harvesting, rain water management and its utilization for crop production.

#### PRACTICALS

Estimation of soil moisture content - Determination of field capacity by field method and pressure plate apparatus - Determination of PWP by Sunflower pot culture method and pressure plate apparatus - Determination of infiltration rate by ring method - Determination of saturated / unsaturated hydraulic conductivity - Measurement of matric potential using gauge and tensiometer - Determination of Maximum water holding capacity of soil -Determination of ET - Determination of crop water requirement – Estimation of upward flux of water using tensiometer and from depth ground water table - Water flow measurement using different devices / observation at field level; calculation of irrigation efficiency -Determination of irrigation water requirement of crops and effective rainfall - Designing and working out cost economics for drip and sprinkler irrigation - Determination of soil-moisture characteristics curve - Study of fertigation equipment and practicing fertigation - Study of the quality of irrigation water

## THEORY LECTURE SCHEDULE

- 1. Irrigation Definition. Role of water in plants and crop production need for irrigation and importance of irrigation in India
- Water resources of India, Tamil Nadu and Puducherry. The demand from different sectors. Availability of water resources for different sectors. Projections for next 25 years
- 3. History of irrigation in India irrigation projects major projects further scope for water resource conservation and storage.
- 4. Area and crop irrigated in India, Tamil Nādu and Puducherry potentials and achievable
- 5. Soil water relationship soil type soil physical characteristics and water relations particles texture, structure, adhesion, density, porosity, capillarity
- Components of soil mineral, organic matter, water and air Role of organic matter in the physical properties - its role in improving water relations. Soil depth and water relations.
- Soil water movement theories and laws Soil water and plant relationship absorption - conductance and loss - factors affecting it - soil, plant and atmospheric factors.
- 8. Loss of water from soil and plant evaporation, transpiration and ET transpiration dynamism transpiration efficiency transpiration co-efficient

- 9. Plant stress causes for stress in plants plant responses to stress indications of stress in plants crop adaptations methods to overcome moisture stress
- 10. Water availability and its relationship with nutrient availability and loss
- 11. Water needs of crop factors affecting the water requirement of crops
- 12. Methods in estimating the water requirement of crop.
- 13. Scheduling of irrigation criteria for scheduling irrigation
- 14. Scheduling irrigation based on climatological approach; Crop coefficient
- 15. Method of irrigation surface and sub-surface methods advantages and disadvantages
- 16. Overhead and micro-irrigation sprinkler irrigation suitability components operations advantages and disadvantages
- $17.\,\textbf{MID}\,\textbf{SEMESTER}\,\textbf{EXAMINATION}$
- 18. Drip irrigation suitability components layout operation advantages and disadvantages
- 19. Special and advanced methods of irrigation –Surge irrigation, cablegation; Deficit irrigation.
- 20. Concept of fertigation- fertilizer type suitability method of applying fertilizer through irrigation water fertigation under sub surface method
- 21. Irrigation under controlled environment glass houses green house poly house netted house pot watering sprinkling pipe irrigations
- 22. IE and WUE definition and concept methods to improve
- 23. Quality of irrigation water standards use of poor quality water for irrigation and its management
- 24. Irrigation management for field crops
- 25. Irrigation management for horticultural crops
- 26. Water management for cropping systems
- 27. Water management of crops under climate change.
- 28. Water management in hydroponics.
- 29. Water and irrigation management for problem soils non drainable, undulating, saline and alkali soils.
- 30. Excess soil water causes and effect on soil and plants; tolerance of plants for water stagnated environment
- 31. Drainage surface and subsurface methods layout drainage requirement for different crops
- 32. Soil moisture conservation water harvesting Rain water management and its utilization for crop production

# PRACTICAL SCHEDULE

- 1. Estimation of soil moisture content
- 2. Determination of field capacity by field method and pressure plate apparatus

- 3. Determination of PWP by Sunflower pot culture method and pressure plate apparatus
- 4. Determination of infiltration rate by ring method
- 5. Determination of saturated / un saturated hydraulic conductivity
- 6. Measurement of matric potential using gauge and tensiometer
- 7. Determination of Maximum water holding capacity of soil
- 8. Determination of ET. Determination of crop water requirement
- 9. Estimation of upward flux of water using tensiometer and from depth ground water table
- 10. Calculation of irrigation efficiency
- 11. Water flow measurement using different devices / observation at field level
- 12. Determination of irrigation water requirement of crops and effective rainfall
- 13. Designing and working out cost economics for drip and sprinkler irrigation
- 14. Determination of soil-moisture characteristics curve
- 15. Study of fertigation equipment and practicing fertigation
- 16. Assessment of the quality of irrigation water
- 17. PRACTICAL EXAMINATION

## LEARNING OUTCOME

Basic knowledge on water management for optimization of crop yield

# SUGGESTED READING

- 1. Panda S.C. 2003. Principles and Practices of Water Management. Agrobios.
- 2. Reddy S.R. 2000. Principles of Crop Production. Kalyani publishers.
- 3. Singh Pratap and Maliwal PL. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publ.
- 4. Lenka D. 1999. Irrigation and Drainage. Kalyani publishers.
- 5. Michael AM. 1978. Irrigation: Theory and Practice. Vikas Publ.
- 6. Majumdar DK. 2014. Irrigation Water Management: Principles and Practice. PHI publishers.
- 7. Mukund Joshi. 2013.A Text book of Irrigation and Water Management. Kalyani publishers.

# AGRON 505 CONSERVATION AGRICULTURE 1+1

# AIM OF THE COURSE

To impart knowledge of conservation of agriculture for economic development.

# THEORY

## Unit I

Conservation agriculture – Historical background and present concept – global experiences – present status in India – Conventional and conservation agriculture systems, sustainability concerns, Loss of soil and water – Conservation.

## Unit II

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

## Unit III

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

# Unit IV

CA in agro forestry systems, rainfed/dryland regions

## Unit V

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

# PRACTICALS

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

## LECTURE SCHEDULE

- 1. Conservation Agriculture History and Background of Agriculture
- 2. Global scenario of Agriculture Types of farming
- 3. Conventional Agriculture systems Concepts, Practices and Limitations
- 4. Soil loss and conservation
- 5. Water loss and conservation
- 6. Sustainability Definition
- 7. Agro-forestry, Rainfed, Dryland farming
- 8. Conservation Agriculture systems
- 9. MID SEMESTER EXAM
- 10. Nutrient Management in CA
- 11. Weed Management in CA
- 12. Climate change Mitigation C sequestration -
- 13. Soil health parameters Measure of soil health
- 14. Adoption and constraints of CA
- 15. Economic aspects of CA

16. Future of Agriculture

# PRACTICAL SCHEDULE

- 1. Field/ Pot culture experimentation on Conservation Agriculture and Conventional Agriculture
- 2. Estimation of Soil pH, EC
- 3. Estimation of Soil Organic carbon
- 4. Estimation of soil microbial load
- 5. Estimation of soil physical parameters hydraulic conductivity
- 6. Estimation of soil physical parameters Water holding capacity
- 7. Estimation of aggregate stability
- 8. Weed seed bank estimation
- 9. Calibration of sowing equipment
- 10. Estimation of soil loss
- 11. Estimation of soil available N
- 12. Estimation of soil available P
- 13. Estimation of soil available K
- 14. Assessment of soil health
- 15. Energy estimation in CA
- 16. Economics of CA
- **17. PRACTICAL EXAMINATION**

# LEARNING OUTCOME

Experience on the knowledge of various types of conservation of agriculture.

# SUGGESTEDREADING

- 1. ArakeriH. R and Roy D.1984. *Principles of Soil Conservation and Water Management* Oxford & IBH.
- Bisht JK, Meena VS, Mishra PK and Pattanayak A. 2016. Conservation Agriculture-An approach to combat climate change in Indian Himalaya. Publisher: Springer Nature. Doi: 10f1007/978-981-10-2558-7.
- 3. Dhruvanarayana VV. 1993. Soil and Water Conservation Research in India. ICAR.
- 4. FAO. 2004. Soil and Water Conservation in Semi-Arid Areas. Soil u Bull., Paper57.
- 5. Gracia-TorresL, Benites I, Martinez Vilela A and Holgado Cabera A. 2003. Conservation Agriculture-Environment Farmer experiences, innovations Socioeconomic policy.
- Muhammad Fand Kamdambot HMS. 2014. Conservation Agriculture. Publisher: Springer Cham Heidelberg, New York Dordrecht London .Doi:10.1007/978-3-319-11620-4.
- 7. Yellamanda Reddy T and Sankara Reddy GH.1992. *Principles of Agronomy.* Kalyani Publ.

AGRON 506

#### **AIM OF THE COURSE**

To impart knowledge of crop husbandry of cereals and pulse crops.

#### THEORY

#### Unit I

Origin and history, area and production, classification, improved varieties, adaptability. climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of **Kharif cereals** – Rice, Maize, Sorghum, Bajra, Finger Millet, Minor millets.

#### Unit II

Origin and history, area and production, classification, improved varieties, adaptability. climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of **Rabi cereals** –Wheat, Barley, Oats, Rye, Triticale.

#### Unit III

Origin and history, area and production, classification, improved varieties, adaptability. climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of **Kharif pulses** –Pigeon pea, Green gram, Black gram, Cowpea, Soybean, Lathyrus.

#### Unit IV

Origin and history, area and production, classification, improved varieties, adaptability. climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of **Rabi pulses** – Chick pea, Lentil, Peas, Horse gram, Rajmash.

#### Unit V

Cereal and Pulse based cropping system, Present trends and future thrust, low cost and cost effective techniques, problem and prospects of cereals and pulse production; Mechanization in cereal and pulse production.

#### LECTURE SCHEDULE

- 1. Rice Origin and history, area and production, classification, Physiology
- 2. Rice Improved varieties, adaptability, climate, soil and water requirements
- 3. Rice Cultural requirements, nutrition and quality components.
- 4. Rice Handling and processing of the produce

- 5. Maize- Origin and history, area and production, classification, physiology, economic importance, improved varieties, adaptability, climate, soil and water requirements
- 6. Maize Cultural requirements, nutrition and quality components, handling and processing
- 7. Sorghum Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 8. Bajra Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 9. Finger millet Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 10. Minor millets Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 11. Wheat Origin and history, area and production, classification, physiology, economic importance, improved varieties, adaptability, climate, soil and water requirements
- 12. Wheat Cultural requirements, nutrition and quality components, handling and processing
- Barley Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 14. Oats Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 15. Rye and Triticale Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 16. Pigeonpea Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing

#### **17. MID SEMESTER EXAMINATION**

- 18. Green gram Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 19. Black gram Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing

- 20. Cowpea- Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 21. Soybean and Lathyrus Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing.
- 22. Chick pea- Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 23. Lentil and Peas Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 24. Horse gram and Rajmah Origin and history; area and production; classification, physiology, economic importance, improved varieties, adaptability; climate, soil, water and cultural requirements; nutrition and quality components; handling and processing
- 25. Cereal and Pulse based cropping systems
- 26. Present trends and future thrust in cereal production
- 27. Low cost and cost effective techniques in cereal production
- 28. Problems and prospects of cereal production
- 29. Present trends and future thrust in pulse production
- 30. Low cost and cost effective techniques in pulse production
- 31. Problems and prospects of pulse production
- 32. Mechanization in cereal and pulse production

# LEARNING OUTCOME

Basic knowledge on cereals and pulse growing in the country

# SUGGESTED READING

- Ahlawat, I.P.S., Om Prakash and G.S. Saini. 1998. Scientific Crop Production in India. Rama publishing House, Meerut
- 2. Das NR. 2007. Introduction to Crops of India. Scientific Publ.
- 3. Hunsigi G & Krishna KR. 1998. Science of Field Crop Production. Oxford & IBH.
- 4. ICAR. 1996. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.
- 5. Jeswani LM & Baldev B. 1997. Advances in Pulse Production Technology. ICAR.
- 6. Khare D & Bhale MS. 2000. Seed Technology. Scientific Publ.
- 7. Palaniappan, SP.1995.Agricultural Inputs and Environment. Scientific Publishers, Jodhpur., pp.445
- 8. Pal M, Deka J & Rai RK. 1996. Fundamentals of Cereal Crop Production. Tata McGrawHill.

- 9. Prasad, Rajendra. 2002. Text Book of Field Crop Production. ICAR.
- 10. Rathore, P.S. 2002. Techniques and Management of Field Crop Production. Agrobios (India)., Jodhpur., pp.525.
- 11. Singh. S.S. 1997. Crop management under irrigated and rainfed conditions. Kalyani Publishers
- 12. Singh C, Singh P & Singh R. 2003.Modern Techniques of Raising Field Crops. Oxford& IBH.
- 13. Yadav DS. 1992. Pulse Crops. Kalyani Publishers

#### AGRON 507 AGRONOMY OF OILSEED, FIBRE AND SUGAR CROPS 2+1

#### AIM OF THE COURSE

To teach the crop husbandry of oilseed, fiber and sugar crops

## THEORY

#### Unit I

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing of the produce for maximum production of **Rabi oilseeds** — Rapeseed and mustard, Linseed and Niger

#### Unit II

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing of the produce for maximum production of **Kharif oilseeds** - Groundnut, Sesame, Castor. Sunflower. Soybean and Safflower

#### Unit III

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing of the produce for maximum production of **Fibre crops** - Cotton, Jute, Ramie and Mesta.

#### Unit IV

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing of the produce for maximum production of **Sugar crops** — Sugarbeet and Sugarcane.

#### Unit V

Oilseed, fibre and sugar crops based cropping system, low cost and cost-effective techniques and mechanization in Oilseed, fibre and sugar crop production

## PRACTICALS

Planning and layout of field/pot experiments ; seed treatment practices in oilseed, fibre and sugar crops; phenology and growth characters of oilseeds, fibres and sugarcane; Determination of cane maturity and calculation on purity percentage, recovery percentage and sucrose content in cane juice; Intercultural operations in oilseed, fibre and sugar crops; Judging maturity in oilseed and fibre crops; Estimation of fibre quality parameters; Working out growth indices and harvest index of oilseed, fibre and sugar crops; Estimation of crop yield; Working out cost of cultivation of oilseed, fibre and sugar crops; Determination of oil content in oilseeds and computation of oil yield; seed production techniques in various crops

# LECTURE SCHEDULE

- 1. Oilseeds Introduction importance of oilseeds- area, production and productivity of oilseeds role of oilseeds in Indian Economy.
- Rapeseed and mustard –Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing
- 3. Linseed and Niger Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing.
- 4. Groundnut Origin and history, area and production, classification, improved varieties, physiology, adaptability
- 5. Groundnut Climate, soil, water and cultural requirements, nutrition, quality component, handling and processing
- 6. Sesame Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing
- 7. Sunflower Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing
- 8. Castor -Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing.
- 9. Soybean and Safflower Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing.
- 10. Fibre crops Area, production, productivity Demand, supply and marketability of Cotton, Jute and Mesta.
- 11. Cotton Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil and water requirements.

- 12. Cotton Cultural requirements, nutrition, quality component, handling and processing
- 13. Jute Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil and water requirements
- 14. Jute Cultural requirements, nutrition, quality component, handling and processing
- 15. Ramie-Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing.
- 16. Mesta Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing

## 17. MID-SEMESTER EXAMINATION

- 18. Sugarcane Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil and water requirements
- 19. Sugarcane Cultural requirements, nutrition, quality component, handling and processing
- 20. Sugarcane Quality consideration and by product utilization
- 21. Sugarcane Ratoon management techniques
- 22. Sugar beet Origin and history, area and production, classification, improved varieties, physiology, adaptability, climate, soil and water requirements.
- 23. Sugar beet- Cultural requirements, nutrition, quality component, handling and processing.
- 24. Oilseeds based cropping system
- 25. Low-cost and cost-effective techniques in oilseed crop production.
- 26. Mechanization in oilseed crop production.
- 27. Fibre crops based cropping system
- 28. Low-cost and cost-effective techniques in fibre crop production.
- 29. Mechanization in fibre crop production.
- 30. Sugar crops based cropping system
- 31. Low-cost and cost-effective techniques in sugar crop production.
- 32. Mechanization in sugar crop production.

## PRACTICAL SCHEDULE

- 1. Planning and layout of field/pot experiments
- 2. Study of seed treatment practices in oilseed and fibre crops
- 3. Study of phenology and growth characters of groundnut, sunflower, sesame, cotton, jute and sugarcane
- 4. Cutting of sugarcane setts, sett treatment and methods of planting
- 5. Determination of cane maturity and calculation on purity percentage, recovery percentage and sucrose content in cane juice
- 6. Intercultural operations in oilseed, fibre and sugar crops

- 7. Judging of physiological maturity in oilseed and fibre crops
- 8. Estimation of fibre quality parameters
- 9. Working out harvest index of oilseed, fibre and sugar crops
- 10. Working out growth indices LAI, LAD, CGR, RGR and NAR
- 11. Estimation of crop yield on the basis of yield attributes
- 12. Working out cost of cultivation of oilseed crops
- 13. Working out cost of cultivation of fibre crops
- 14. Working out cost of cultivation of sugar crops
- 15. Determination of oil content in oilseeds and computation of oil yield
- 16. Study of seed production techniques in various crops
- 17. FINAL PRACTICAL EXAMINATION

# LEARNING OUTCOME

Basic knowledge on production of oil seed, sugar and fibre crops.

## SUGGESTED READING

- 1. Das NR. 2007. Introduction to Crops of India. Scientific Publ.
- 2. Das PC. 1997. Oilseed Crops of India. Kalyani.
- 3. Lakshmikantam N. 1983. Technology in Sugarcane Growing. 2nd Ed. Oxford & IBH.
- 4. Singh. S.S. 1988. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
- 5. Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.
- 6. Singh SS. 1998. Crop Management. Kalyani.
- 7. Chomehalow, N. and P. Laosuwan. (1995). Soybean in Asia. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi and FAO, Bangkok.
- 8. Weian, E.A.1983. "Oilseed Crops". Longman Group Ltd., London and New York.
- 9. Cotton Physiology. 1991. Indian Council of Agrl. Research, New Delhi.
- 10. Hand Book of Agriculture. 2006. Indian Council of Agrl. Research, New Delhi.
- 11. Hunsigi, G. 1993. Production of Sugarcane Theory and Practice, Springer Verlag, Berlin.
- 12. Monograph on Cotton. 1996. Indian Council of Agrl. Research, New Delhi.
- 13. Rajendra Prasad. 2004. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.
- 14. Thind, S.K. 2007. Advances in cotton physiology, Satish serial publishing house New Delhi.

AGRON508

# AGRONOMY OF MEDICINAL, AROMATIC AND 2 UNDER UTILIZED CROPS

#### **AIM OF THE COURSE**

To acquaint students about different medicinal, aromatic and underutilized field crops, their package of practices and processing.

## THEORY

#### Unit I

Importance of medicinal and aromatic plants in human health, national economy and related industries, Classification of medicinal and aromatic plants according to botanical characteristics and their uses, Export potential of medicinal and aromatic plants Indigenous technical knowledge (ITK) practices of medicinal and aromatic plants.

#### Unit II

Climate and soil requirements; cultural practices; yield and important constituents of medicinal plants - Mulhati, Isabgol, Rauwolfia, Poppy, Aloe vera, Satavar, Stevia, Safed Musli, Kalmegh, Asaphoetida, Nuxvomica, Rosadle, etc.

#### Unit III

Climate and soil requirements; cultural practices; yield and important constituents of aromatic plants - Citronella, Palmarosa, Mentha, Basil, Lemon grass, Rose, Patchouli, Geranium.

#### Unit IV

Climate and soil requirements; cultural practices; yield of under-utilized crops - Rice bean, Lathyrus, Sesbania, Cluster bean, French bean, Fenugreek, Grain Amaranth, Coffee, Tea and Tobacco.

#### Unit V

Postharvest handling – drawing, processing, grading, packing and storage, value addition and quality standards in herbal products.

#### PRACTICALS

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

## LECTURE SCHEDULE:

- 1. Importance of medicinal and aromatic plants in human health, national economy and related industries,
- 2. Classification of medicinal and aromatic plants according to botanical characteristics and their uses,

2+1

- 3. Export potential of medicinal and aromatic plants
- 4. Indigenous technical knowledge (ITK) practices of medicinal and aromatic plants
- 5. Mulhati Climate and soil requirements; cultural practices; yield and important constituents
- 6. Isabgol Climate and soil requirements; cultural practices; yield and important constituents
- 7. Rauwolfia Climate and soil requirements; cultural practices; yield and important constituents
- 8. Poppy Climate and soil requirements; cultural practices; yield and important constituents
- 9. Aloe vera Climate and soil requirements; cultural practices; yield and important constituents
- 10. Stevia Climate and soil requirements; cultural practices; yield and important constituents
- 11. Satavar Climate and soil requirements; cultural practices; yield and important constituents
- 12. Safed Musli Climate and soil requirements; cultural practices; yield and important constituents
- 13. Kalmegh Climate and soil requirements; cultural practices; yield and important constituents
- 14. Rosadle Periwinkle Climate and soil requirements; cultural practices; yield and important constituents
- 15. Asaphoetida Climate and soil requirements; cultural practices; yield and important constituents
- 16. Nuxvomica Climate and soil requirements; cultural practices; yield and important constituents

# **17. MID SEMESTER EXAMINATION**

- 18. Citronella, Palmarosa and Lemon grass Climate and soil requirements; cultural practices; yield and important constituents
- 19. Mentha Climate and soil requirements; cultural practices; yield and important constituents
- 20. Basil Climate and soil requirements; cultural practices; yield and important constituents
- 21. Rose Climate and soil requirements; cultural practices; yield and important constituents
- 22. Patchouli Climate and soil requirements; cultural practices; yield and important constituents
- 23. Geranium Climate and soil requirements; cultural practices; yield and important constituents
- 24. Rice bean, Lathyrus and French bean Climate and soil requirements; cultural practices; yield

- 25. Sesbania and Cluster bean Climate and soil requirements; cultural practices; yield
- 26. Fenugreek Climate and soil requirements; cultural practices; yield
- 27. Grain Amaranth Climate and soil requirements; cultural practices; yield
- 28. Coffee Climate and soil requirements; cultural practices; yield
- 29. Tea Climate and soil requirements; cultural practices; yield
- 30. Tobacco Climate and soil requirements; cultural practices; yield
- 31. Postharvest handling drawing, processing, grading, packing and storage of medicinal plants
- 32. Value addition and quality standards in herbal products

# PRACTICAL SCHEDULE

- 1. Identification of crops based on morphological and seed characteristics
- 2. Raising crop cafeteria of medicinal, aromatic and under-utilized plants
- 3. Treatment of seed/ Vegetative propagule of medicinal, aromatic and under-utilized plants
- 4. Main field preparation and Sowing/ planting for medicinal, aromatic and underutilized plants
- 5. Observation on growth parameters of medicinal, aromatic and under-utilized plants
- 6. Nutrient management of medicinal, aromatic and under-utilized plants
- 7. Weed management in medicinal, aromatic and under-utilized plants
- 8. Water management in medicinal, aromatic and under-utilized plants
- 9. Observation on yield attributes and yield estimation of medicinal, aromatic and under-utilized plants
- 10. Plant protection measures in management in medicinal, aromatic and under-utilized plants
- 11. Harvesting of medicinal, aromatic and under-utilized plants
- 12. Postharvest handling of medicinal, aromatic and under-utilized plants
- 13. Economics of medicinal, aromatic and under-utilized plants
- 14. Quality characters in medicinal and aromatic plants
- 15. Methods of analysis of essential oil and other chemicals of importance in medicinal and aromatic plants.
- 16. Visit to medicinal plant farm / park, essential oil extraction unit and market outlet
- 17. FINAL PRACTICAL EXAMINATION

# LEARNING OUTCOME

Acquainted with various MAP and their commercial base for developing entrepreneurship.

# SUGGESTED READING

- 1. Chadha KL and Gupta R. 1995. Advances in Horticulture. Vol. II. Medicinal and Aromatic Plants. Malhotra Publ.
- 2. Das NR. 2007. Introduction to Crops of India. Scientific Publ.

- 3. Handa SS. 1984. Cultivation and Utilization of Medicinal Plants. RRL, CSIR, Jammu.
- 4. Hussain A. 1984. Essential Oil Plants and their Cultivation. CIMAP, Lucknow.
- 5. Hussain A. 1993. Medicinal Plants and their Cultivation. CIMAP, Lucknow.
- 6. ICAR 2006. Hand Book of Agriculture. ICAR, New Delhi.
- 7. Kumar N, Khader Md. Abdul, Rangaswami JBM & Irulappan 1997. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford & IBH.
- 8. Prajapati ND, Purohit SS, Sharma AK and Kumar T. 2003. A Hand Book of Medicinal Plants: A Complete Source Book. Agrobios.
- 9. Sharma R. 2004. Agro-Techniques of Medicinal Plants. Daya Publ. House.

# AGRON 509 AGRONOMY OF FODDER AND FORAGE 2+1 CROPS

## AIM OF THE COURSE

To teach the crop husbandry of different forage and fodder crops along with their processing.

# THEORY

# Unit I

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops like sorghum, maize, bajra. guar, cowpea, oats, barley, berseem, senji, lucerne, etc.

## Unit II

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grassesliine, Napier grass, Panicum, Lasiuras, Cenchrus, etc.

# Unit III

Year-round fodder production and management, preservation and utilization of forage and pasture crops.

## Unit IV

Principles and methods of hay and silage making; chemical and biochemical changes. nutrient losses and factors affecting quality of hay and silage; use of physical and chemical enrichments and biological methods for improving nutrition; value addition of poor quality fodder. Fodder production through hydroponics. Azolla cultivation.

# Unit V

Economics of forage cultivation uses and seed production techniques of important Fodder crops.

# PRACTICALS

Practical training of farm operations in raising fodder crops; Canopy measurement, yield. Leaf: Stem ratio and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose and IVDMD, etc. of various fodder and forage crops; Anti-quality components like HCN in sorghum and such factors in other crops; Hay and silage making and economics of their preparation.

# LECTURE SCHEDULE

- 1. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of sorghum
- 2. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of maize
- 3. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of bajra and guar
- 4. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of cow pea and oats
- 5. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of barley and berseem
- 6. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of *senji* and lucerne
- 7. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of Napier grass
- 8. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of *Panicum*
- 9. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of *Lasiuras*
- 10. Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of *Cenchrus*
- 11. Importance of year-round fodder production
- 12. Management techniques of fodder production
- 13. Benefits of fodder production
- 14. Preservation of forage
- 15. Utilization of forage
- 16. Preservation of pasture crops
- 17. MID SEMESTER EXAMINATION
- 18. Utilization of pasture crops
- 19. Principles and methods of hay making

- 20. Principles and methods of silage making
- 21. Chemical and biochemical changes in hay and silage making
- 22. Nutrient losses of hay and silage
- 23. Factors affecting quality of hay and silage
- 24. Use of physical and chemical enrichments for improving nutrition
- 25. Biological methods for improving nutrition
- 26. Value addition of poor quality fodder
- 27. Fodder production through hydroponics
- 28. Azolla cultivation
- 29. Economics of forage cultivation
- 30. Uses and seed production techniques fodder maize
- 31. Uses and seed production techniques fodder sorghum
- 32. Uses and seed production techniques of fodder Bajra

# PRACTICAL SCHEDULE

- 1. Practical training of farm operations in raising fodder crops
- 2. Canopy measurement of raising fodder crops
- 3. Yield of raising fodder crops
- 4. Leaf: Stem ratio of raising fodder crops
- 5. Estimation of crude protein in various fodder and forage crops
- 6. Estimation of NDF in various fodder and forage crops
- 7. Estimation of ADF in various fodder and forage crops
- 8. Estimation of lignin in various fodder and forage crops
- 9. Estimation of silica in various fodder and forage crops
- 10. Estimation of cellulose in various fodder and forage crops
- 11. Estimation of IVDMD in various fodder and forage crops
- 12. Anti-quality components -HCN in sorghum
- 13. Anti-quality factors in other fodder and forage crops
- 14. Hay making
- 15. Silage making
- 16. Economics of hay and silage making
- 17. PRACTICAL EXAMINATION

# LEARNING OUTCOME

Acquainted with various fodder and forage crops and their commercial base for developing entrepreneurship

# SUGGESTED READING

- 1. Chatterjee BN. 1989. Forage Crop Production Principles and Practices. Oxford & IBH.
- 2. Das NR. 2007. Introduction to Crops of India. Scientific Publ.
- 3. Narayanan TR and Dabadghao PM. 1972. Forage Crops of India. ICAR.
- 4. Singh P and Srivastava AK. 1990. Forage Production Technology. IGFRI, Jhansi.

- 5. Singh C, Singh P and Singh R. 2003. *Modern Techniques of Raising Field Crops*. Oxford & IBH.
- 6. Tejwani KG. 1994. Agroforestry in India. Oxford & IBH

## AGRON 510 AGROSTOLOGY AND AGRO-FORESTRY 2+1

## AIM OF THE COURSE

To teach crop husbandry of different forage, fodder and agroforestry crops/trees along with their processing

## THEORY

## Unit I

Agrostology: definition and importance; principles of grassland ecology: grassland ecology – community, climax, dominant species, succession, biotype, ecological status of grasslands in India, grass cover of India; problems and management of grasslands.

#### Unit II

Importance, classification (various criteria), scope, status and research needs of pastures; pasture establishment, their improvement and renovation-natural pastures, cultivated pastures; common pasture grasses.

#### Unit III

Agroforestry: definition and importance; agro-forestory systems, agri-silviculture, silvipasture, agrisilvipasture, agrihorticulture, aquasilviculture, alley cropping and energy plantation.

## Unit IV

Crop production technology in agro-forestory and agrostology system; silvipastoral system: meaning and importance for wasteland development; selection of species, planting methods and problems of seed germination in agro-forestry systems.

## Unit V

Irrigation and manuring in agro-forestry systems, associative influence in relation to above ground and underground interferences; lopping and coppicing in agroforestry systems; social acceptability and economic viability, nutritive value of trees; tender operation; desirable tree characteristics.

## PRACTICAL

• Preparation of charts and maps of India showing different types of pastures and
agro-forestry systems

- Identification of seeds and plants of common grasses, legumes and trees of economic
- Importance with reference to agro-forestry
- Seed treatment for better germination of farm vegetation
- Methods of propagation/ planting of grasses and trees in silvipastoral system
- Fertilizer application in strip and silvipastroal systems
- After-care of plantation
- Estimation of protein content in loppings of important fodder trees
- Estimation of calorie value of wood of important fuel trees
- Estimation of total biomass and fuel wood
- Economics of agro-forestry
- Visit to important agro-forestry research stations

# LECTURE SCHEDULE

- 1. Agrostology definition and importance
- 2. Principles of grassland ecology
- 3. Grassland ecology community, climax, dominant species, succession, biotype
- 4. Ecological status of grasslands in India
- 5. Grass cover of India
- 6. Problems and management of grasslands
- 7. Pastures Importance, classification (various criteria)
- 8. Pastures scope, status and research needs
- 9. Pasture establishment
- 10. Pasture improvement and renovation-natural pastures
- 11. Cultivated pastures
- 12. Common pasture grasses
- 13. Agroforestry definition and importance
- 14. Agroforestory systems
- 15. Agrisilviculture, silvipastureagrisilvipasture
- 16. Agrihorticulture, aquasilviculture
- **17. MID-SEMESTER EXAMINATION**
- 18. Alley cropping
- 19. Energy plantation
- 20. Crop production technology in agro-forestory
- 21. Crop production technology in agrostology system
- 22. Meaning and importance of silvipastoral system
- 23. Silvipastoral system for wasteland development
- 24. Silvipastoral system: selection of species, planting methods
- 25. Problems of seed germination in agro-forestry systems
- 26. irrigation and manuring in agro-forestry systems

- 27. Agro-forestry systems: associative influence in relation to above ground and underground interferences
- 28. Lopping and coppicing in agroforestry systems
- 29. Social acceptability and economic viability of agro-forestry systems
- 30. Nutritive value of trees
- 31. Tender operation
- 32. Desirable tree characteristics

# PRACTICAL SCHEDULE

- 1. Preparation of charts and maps of India showing different types of pastures
- 2. Preparation of charts and maps of India showing different agro-forestry systems
- 3. Identification of seeds and plants of common grasses in pastures
- 4. Identification of seeds and plants of common legumes in pastures
- 5. Identification of seeds and plants of common trees of economic importance with reference to agro-forestry
- 6. Seed treatment for better germination of farm vegetation
- 7. Methods of propagation/ planting of grasses
- 8. Methods of propagation/ planting of trees in silvipastoral system
- 9. Fertilizer application in strip and silvipastroal systems
- 10. Irrigation practices for agro-forestry systems
- 11. After-care of plantation
- 12. Estimation of protein content in loppings of important fodder trees
- 13. Estimation of calorie value of wood of important fuel trees
- 14. Estimation of total biomass and fuel wood
- 15. Economics of agro-forestry systems
- 16. Visit to important agro-forestry research stations
- **17. FINAL PRACTICAL EXAMINATION**

# LEARNING OUTCOME

Basic knowledge on agro forestry, forage crops and their utility

- 1. Chatterjee BN and Das PK. 1989. *Forage Crop Production. Principles and Practices.* Oxford & IBH.
- 2. Dabadghao PM and Shankaranarayan KA. 1973. The Grass Cover in India. ICAR.
- 3. Dwivedi AP. 1992. Agroforestry- Principles and Practices. Oxford & IBH.
- 4. Indian Society of Agronomy. 1989. *Agroforestry System in India. Research and Development,* New Delhi.
- 5. Narayan TR and Dabadghao PM. 1972. Forage Crop of India. ICAR, New Delhi.

# AGRON 511 CROPPING SYSTEM AND SUSTAINABLE 2+0 AGRICULTURE

### **AIM OF THE COURSE**

To acquaint the students about prevailing cropping systems in the country and practices to improve their productivity.

### THEORY

### Unit I

Cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment. of land use.

### Unit II

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

### Unit III

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

#### Unit IV

Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system. Advanced nutritional tools for big data analysis and interpretation.

### Unit V

Plant ideotypes for drylands; plant growth regulators and their role in sustainability. Artificial Intelligence- Concept and application.

### THEORY LECTURE SCHEDULE

- 1. Cropping systems -Definition and Concepts
- 2. Importance of cropping systems
- 3. Indices of cropping systems
- 4. Management of physical resources in cropping systems
- 5. Management of soil and water in cropping systems
- 6. Assessment of land use in cropping systems
- 7. Concept of sustainability in cropping systems
- 8. Concept of sustainability in farming systems

- 9. Scope and objectives of cropping systems and farming systems
- 10. Production potential under monoculture cropping
- 11. Production potential under multiple cropping
- 12. Production potential under sequential cropping and alley cropping
- 13. Production potential under intercropping,
- 14. Mechanism of yield advantage in intercropping systems
- 15. Above and below ground interactions and allelopathic effects
- 16. Competition relations; multi-storied cropping
- 17. MID SEMESTER EXAMINATION
- 18. Yield stability in intercropping
- 19. Role of non-monetary inputs
- 20. Role of low- cost technologies
- 21. Research needs on sustainable agriculture
- 22. Crop diversification for sustainability
- 23. Role of organic matter in maintenance of soil fertility
- 24. Crop residue management
- 25. Fertilizer use efficiency
- 26. Concept of fertilizer use in intensive cropping system
- 27. Advanced nutritional tools for big data analysis and interpretation
- 28. Plant ideotypes for drylands
- 29. Plant growth regulators and their role in sustainability auxin and gibberellins
- 30. Plant growth regulators and their role in sustainability cytokinin, ethylene and abscisic acid
- 31. Concept of artificial Intelligence
- 32. Application of artificial Intelligence

# LEARNING OUTCOME

Basic knowledge on cropping system for sustainable agriculture.

- 1. Panda SC.2017. Cropping systems and Sustainable agriculture. Agrobios (India).
- 2. Panda SC. 2014. Cropping and Farming Systems. Agrobios (India).
- 3. Palaniappan SP and Sivaraman K. 1996. Cropping systems in the tropics: Principles and management. New age International (P), New Delhi.
- 4. Reddy SR. 2000. Principles of Crop Production. Kalyani publishers.
- 5. Sankaran S and Mudaliar TVS. 1997. Principles of Agronomy. The Bangalore Printing & Publ. Co.
- 6. Singh SS. 2006. Principles and Practices of Agronomy. Kalyani.
- 7. Tisdale, S.L., Nelson, W.L., Beaton, J.D. and Havlin, J.L. (1995)
- 8. Soil Fertility and Fertilizer. 5th Edition, Prentice-Hall of India, New Delhi, 684 p.

#### AGR512 DRYLAND FARMING AND WATERSHED MANAGEMENT

#### **AIM OF THE COURSE**

To teach the basic concepts and practices of dry land farming and soil moisture conservation.

#### THEORY

#### Unit I

Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture.

#### Unit II

Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of droughts, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions.

#### Unit III

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

#### Unit IV

Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); anti-transpirants; soil and crop management techniques, seeding and efficient fertilizer use.

#### Unit V

Concept of watershed resource management, problems, approach and components

### PRACTICALS

Method of Seed Priming; Determination of moisture content for germination of important dryland crops; Determination of Relative Water Content and Saturation Deficit of Leaf; Moisture stress effects and recovery behaviour of important crops; Estimation of Potential ET by Thornthwaite method; Estimation of Reference ET by Penman Monteith Method; Classification of climate by Thornthwaite method (based on moisture index, humidity index and aridity index); Classification of climate by Koppen Method; Estimation of water balance by Thornthwaite method; Estimation of water balance by FAO method; Assessment of drought; Estimation of length of growing period; Estimation of probability of

2+1

rain and crop planning for different drought condition; Spray of anti-transpirants and their effect on crops; Water use efficiency; Visit to dryland research stations and watershed projects.

# LECTURE SCHEDULE

- 1. Definition, concept and characteristics of Dry farming in Tamil Nadu and India dry land versus rainfed farming- History development, significance and dimension of dry land agriculture in India.
- 2. Dry farming past progress and future prospects Problems, constraints and prospects of dry land agriculture in India.
- 3. Major soil types in dry farming, soil related constraints and their management
- 4. Climatic characteristics rainfall climatology, rainfall types, quantity, distribution on crop production
- 5. Constraints limiting crop production in dry land agriculture, climate related production constraints in dry lands and their effects on crop production.
- 6. Drought- Definition, types, effect on crop production and management.
- 7. Characterization of environment for water availability in dry land agriculture
- 8. Dry climates classification
- 9. Crop planning and management options for erratic and aberrant weather conditions.
- 10. Crop adaptions to dry growing conditions Drought, drought tolerance mechanisms, physiology of drought.
- 11. Drought management strategies in dry land agriculture.
- 12. Efficient crops and cropping systems for dry land regions of India and contingent crop planning under aberrant weather situations
- 13. Preparation of appropriate crop plans for dry land areas.
- 14. Moisture stress development and effect of moisture stress, plant stress physiology and their implication in dry land agriculture.
- 15. Concepts of tillage and its importance in dry land agriculture for resource conservation.
- 16. Tillage in relation to weed control and moisture conservation.

# **17. MID SEMESTER EXAM**

- 18. Agronomic management technologies in dry lands methods of sowing, crop stand establishment Fertilizer use
- 19. Soil fertility management reasons for poor fertility scope and benefits of fertilizer use concepts in fertilizer management- time and method of application of fertilizers
- 20. Integrated nutrient management in dry land agriculture.
- 21. Soil and moisture conservation in dry lands and hilly regions.
- 22. In–situ moisture conservation Agronomic, mechanical and biological measures.
- 23. Runoff farming water harvesting techniques recycling of runoff water.
- 24. Methods for controlling runoff and evaporation, evapotranspiration, use of mulches and anti-transpirants

- 25. Role of anti-transpirants in dryland agriculture.
- 26. Rainwater harvesting, management, controlling runoff, evaporation
- 27. Integrated dry land technology for important dry land crops
- 28. Resource characterization in dry regions alternate land use planning, agro forestry, farm forestry
- 29. Watershed development approach and practices steps in watershed management and components
- 30. Integrated farming system resource recycling
- 31. Farm mechanization and improved dry land agricultural implements.
- 32. Research and training needs, future trends

# PRACTICAL SCHEDULE

- 1. Methods of seed priming
- 2. Determination of moisture content for germination of important dryland crops
- 3. Determination of Relative Water Content and Saturation Deficit of Leaf
- 4. Moisture stress effects and recovery behaviour of important crops
- 5. Estimation of potential ET by Thornthwaite method
- 6. Estimation of Reference ET by Penman Monteith method
- 7. Classification of climate by Thornthwaite method (Based on moisture index, humidity index and aridity index)
- 8. Classification of climate by Koppen method
- 9. Estimation of water balance by Thornthwaite method
- 10. Estimation of water balance by FAO method
- 11. Determination of agricultural drought
- 12. Calculating of length of growing period, runoff and soil moisture loss
- 13. Estimation of probability of rainfall and crop planning for different drought condition
- 14. Spray of anti-transpirants and their effect on crops
- 15. Study on WUE of different dry land crops
- 16. Visit to dryland research stations and watershed projects

# **17. FINAL PRACTICAL EXAMINATION**

# LEARNING OUTCOME

Basic knowledge on dry land farming and soil moisture conservation

- 1. Dhruv Narayan VV. 2002. Soil and Water Conservation Research in India. ICAR.
- 2. Govindan K. and Thirumurugan, V. (2012). Principles and practice of Dryland Agriculture. Kalyani Publishers, Chennai. pp. 1-279.
- 3. Jat, M. L., S. R., Bhakar, S. K., Sharma and Kothari, A. K. (2016). Dryland Technology. 2nd Edition, Scientific Publishers, India. pp. 1-703.
- 4. Nagar, S. (2015). Integrated Watershed Management in Rainfed Agriculture. Scitus Academic publishing, USA. pp. 1-298.

- Narayanan.AL.2021. Introductory Agrometeorology published by Brillion Publishing.22B/5 Ground floor, Desh Bandhu Gupta Road, Karol Bagh, New Delhi 110005. ISBN: 978-93-86658-32-6 p153.
- 6. Narayanan. AL. 2015. Principles of Applied Agricultural Meteorology, Sri Velan Pathipagam, Chidambaram.
- 7. Oswal. M.C. (2016). Watershed Management (for Dryland Agriculture). Associated Publishing Company. India. pp. 1-201.
- 8. Pradeep, S. (2014). Dryland Agriculture. Discovery Publishing House Pvt. Ltd, New Delhi. pp. 1-278.
- 9. Rao SC and Ryan J. 2007. Challenges and Strategies of Dryland Agriculture. Scientific Publ.
- 10. Rayees Ahamad Shah. (2017). Rainfed Agriculture and Watershed management. Kushal publications, Varanasi. pp. 1-290.
- 11. Reddy S.R and Prabhakara Reddy, G. (2018). Rainfed Agriculture and Watershed management. Kalyani Publications, New Delhi. pp. 1-290.
- 12. Reddy TY. 2018. Dryland Agriculture Principles and Practices, Kalyani publishers
- 13. Widtsoe, J. A. (2012). Dry Farming for Sustainable Agriculture. Agrobios (India), Jodhpur. pp. 1-467.

### AGRON 513 PRINCIPLES AND PRACTICES OF ORGANIC FARMING 2+1

### AIM OF THE COURSE

To study the principles and practices of organic farming for sustainable crop production.

### THEORY

### Unit I

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

#### Unit II

Biodiversity and its conservation, Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota, efficient microorganisms and decomposition of organic residues, earthworms and vermicompost, green manures, bio-fertilizers and biogas technology.

#### Unit III

ITK practices, Biodynamic agriculture, Zero budget natural farming, Farming systems, selection of crops and crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.

## Unit IV

Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides, Organic livestock management, Quality standards of organic products.

# Unit V

Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy.

## PRACTICALS

- Method of making compost by aerobic method
- Method of making compost by anaerobic method
- Method of making vermicompost
- Identification and nursery raising of important agro-forestry trees and trees for shelter belts
- Efficient use of biofertilizers, technique of treating legume seeds with Rhizobium cultures, use of Azotobacter, Azospirillum, and PSB cultures in field
- Visit to a biogas plant
- Visit to an organic farm
- Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms

# LECTURE SCHEDULE

- 1. Organic farming concept, definition, characteristics, ill effects of green revolution technology
- 2. History of organic farming Global and Indian Scenario of organic farming
- 3. Relevance of organic farming to India and global agriculture and future prospects
- 4. Principles of organic agriculture
- 5. Organic farming and sustainable agriculture
- 6. Selection and conversion of land, Soil and water management land use, conservation tillage;
- 7. Shelter zones, hedges, pasture management, agro-forestry.
- 8. Biodiversity Types, importance and its conservation
- 9. Organic farming and water use efficiency;
- 10. Soil fertility management in organic farming on farm and off farm sources
- 11. Nutrient recycling, recycling of organic residues, organic manures, green manures
- 12. Composting Aerobic and Anaerobic methods
- 13. Soil biota and efficient microorganisms
- 14. Earthworms and vermicompost
- 15. Bio-fertilizers and biogas technology.
- 16. Indigenous technical knowledge practices
- **17. MID SEMESTER EXAMINATION**

- 18. Different forms of organic farming
- 19. Biodynamic agriculture, zero budget natural farming
- 20. Integrated farming systems in different ecosystems
- 21. Selection of crops and crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.
- 22. Ecofriendly weed management practices
- 23. Ecofriendly disease management practices
- 24. Ecofriendly insect pest management practices
- 25. Organic livestock management
- 26. Quality standards of organic products
- 27. Inspection, certification, NPOP guidelines
- 28. Certification agencies Crop production standards
- 29. Labeling and accreditation procedures
- 30. Marketing and export potential of organic produce
- 31. Organic farming and national economy.
- 32. Socio-economic impacts of organic farming

## PRACTICAL SCHEDULE

- 1. Method of making compost by aerobic method
- 2. Method of making compost by anaerobic method
- 3. Method of making vermicompost
- 4. Method of making biodynamic preparations
- 5. Acquiring skill in ITK based preparations
- 6. Acquiring skill in seed treatment techniques in organic farming
- Acquiring skill in efficient use of biofertilizers and biocontrol agents' technique of treating legume seeds with Rhizobium cultures, use of Azotobacter, Azospirillum, and PSB cultures in field
- 8. Acquiring skill in organic nutrient management practices
- 9. Acquiring skill in ecofriendly weed management practices
- 10. Acquiring skill in ecofriendly pest management practices
- 11. Acquiring skill in ecofriendly disease management practices
- 12. Identification and nursery raising of important agro-forestry trees and trees for shelter belts
- 13. Visit to a biogas plant/Vermicompost unit
- 14. Acquiring skill on post- harvest management practices in organic farming
- 15. Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms
- 16. Visit to organic farm, certification authorities and organic market outlet
- **17. FINAL PRACTICAL EXAMINATION**

### LEARNING OUTCOME

Basic knowledge on organic farming for sustainable agriculture and development of entrepreneurship on organic inputs

- 1. Ananthakrishnan TN. (Ed.). 1992. Emerging Trends in Biological Control of Phytophagous
- 2. *Insects*. Oxford & IBH.
- 3. Gaur AC. 1982. *A Manual of Rural Composting*, FAO/UNDP Regional Project Document, FAO.
- 4. Joshi M. 2016. New Vistas of Organic Farming. Scientific Publishers
- 5. Lampin N. 1990. Organic Farming. Press Books, lpswitch, UK.
- 6. Palaniappan SP and Anandurai K. 1999. Organic Farming Theory and Practice. ScientificPubl.
- 7. Rao BV Venkata. 1995. Small Farmer Focused Integrated Rural Development: Socioeconomic
- 8. Environment and Legal Perspective: Publ.3, ParisaraprajnaParishtana, Bangalore.
- 9. Reddy MV. (Ed.). 1995. Soil Organisms and Litter Decomposition in the Tropics. Oxford &IBH.
- 10. Sharma A. 2002. Hand Book of Organic Farming. Agrobios.
- 11. Singh SP. (Ed.). 1994. *Technology for Production of Natural Enemies.* PDBC, Bangalore.
- 12. Subba Rao NS. 2002. Soil Microbiology. Oxford & IBH.
- 13. Trivedi RN. 1993. A Text Book of Environmental Sciences, Anmol Publ.
- 14. Veeresh GK, Shivashankar K and Suiglachar MA. 1997. Organic Farming and Sustainable
- 15. Agriculture. Association for Promotion of Organic Farming, Bangalore.
- 16. WHO. 1990. Public Health Impact of Pesticides Used in Agriculture. WHO.
- 17. Woolmer PL and Swift MJ. 1994. *The Biological Management of Tropical Soil Fertility*. TSBF & Wiley.

# **Minor courses offered**

### AGM 502 FUNDAMENTALS OF AGRICULTURAL METEOROLOGY 2+1

### **AIM OF THE COURSE**

To impart theoretical and practical knowledge of physical processes occurring in atmosphere and techniques used in meteorology.

### THEORY

### Unit I

Meaning and scope of agricultural meteorology; components of agricultural meteorology; role and responsibilities of agricultural meteorologists.

### Unit II

Importance of meteorological parameters in agriculture; efficiency of solar energy conversion into dry matter production; meteorological factors in photosynthesis, respiration and net assimilation; basic principles of water balance in ecosystems; soil-water balance models and water production functions.

#### Unit III

Crop weather calendars; weather forecasts for agriculture at short, medium and long-range levels; agromet advisories, preparation, dissemination and economic impact analysis; use of satellite imageries in weather forecasting; synoptic charts and synoptic approach to weather forecasting.

#### Unit IV

Concept, definition, types of droughts and their causes; prediction of drought; crop water stress index, crop stress detection; air pollution and its influence on vegetation, meteorological aspects of forest fires and their control.

### Unit V

Climatic change, greenhouse effect, CO<sub>2</sub> increase, global warming and their impact on agriculture; climate classification, agro-climatic zones and agro-ecological regions of India.

### PRACTICALS

Preparation of crop weather calendars; Development of simple regression models for weather, pest and disease relation in different crops; Preparation of weather based agro-advisories; Use of automated weather station (AWS)

### LECTURE SCHEDULE

1. Agricultural meteorology- Definition

- 2. Meaning and scope of agricultural meteorology;
- 3. Components of agricultural meteorology; role and responsibilities of agricultural meteorologists.
- 4. Importance of meteorological parameters in agriculture; Atmosphere -vertical strata
- 5. Solar radiation-efficiency of solar energy conversion into dry matter production;
- 6. Meteorological factors in photosynthesis, respiration and net assimilation;
- 7. Basic principles of water balance in ecosystems
- 8. Soil-water balance models and water production functions.
- 9. Temperature- effects- role in crop production
- 10. Soil temperature -role in crop growth
- 11. Humidity- vapour pressure-SVP-AVP
- 12. Rainfall- monsoons of India
- 13. Crop weather calendars
- 14. Weather forecasts for agriculture at short, medium and long-range levels;
- 15. Agromet advisories, preparation, dissemination and economic impact analysis
- 16. IMD-NCMRWF-GKMS in weather forecast
- **17. MID-SEMESTER EXAMINATION**
- 18. Use of satellite imageries in weather forecasting
- 19. Synoptic charts and synoptic approach to weather forecasting.
- 20. Concept, definition, types of droughts and their causes
- 21. Prediction of drought; crop water stress index, crop stress detection
- 22. Flood- role in crop growth
- 23. Air pollution and its influence on vegetation
- 24. Water & soil pollution -effects
- 25. Evaporation-ET-PET effects on crop growth
- 26. Meteorological aspects of forest fires and their control.
- 27. Climatic change, greenhouse effect, CO<sub>2</sub> increase
- 28. Global warming and their impact on agriculture;
- 29. Climate classification types
- 30. Climate classification details and methods
- 31. Agro-climatic zones of India, Tamil Nadu
- 32. Agro-ecological regions of India.

# PRECTICAL SCHEDULE

- 1. Agromet observatory-layout -details.
- 2. Study on observational time of weather data
- 3. Measurement of solar radiation
- 4. Measurement of air temperature
- 5. Measurement of soil temperature
- 6. Measurement of rainfall
- 7. Measurement of wind velocity & direction

- 8. Measurement of evaporation
- 9. Measurement of grass minimum temperature & dewfall
- 10. Measurement of relative humidity
- 11. Study of clouds
- 12. Preparation of crop weather calendars
- 13. Development of simple regression models for weather, pest and disease relation in different crops.
- 14. Preparation of weather based agro-advisories
- 15. Use of automated weather station (AWS)
- 16. Visit to IMD station
- 17. PRACTICAL EXAMINATION

### LEARNING OUTCOME

Basic knowledge on meteorology and climatology, physical laws governing atmosphere and monsoon.

### SUGGESTED READING

- 1. Bishnoi OP. 2007. Principles of Agricultural Meteorology. Oxford Book Co.
- 2. Kakde JR. 1985. Agricultural Climatology. Metropolitan Book Co.
- 3. Mahi and Kingra. 2014. Fundamentals of agrometeorology. Kalyani publishers.
- 4. Mavi HS and Tupper. 2004. Principles and applications of climate studies in agriculture. CRC Press
- 5. Narayanan.AL.2021. Introductory Agrometeorology published by Brillion Publishing.22B/5 Ground floor, DeshBandhu Gupta Road, Karol Bagh, New Delhi 110005.ISBN: 978-93-86658-32-6 p153.
- 6. Narayanan.AL. 2015. Principles of Applied Agricultural Meteorology, Sri Velan Pathipagam, Chidambaram.ISBN:93-81236-27-7.p.
- 7. Varshneya MC and Pillai PB. 2003. Text Book of Agricultural Meteorology. ICAR.

### AGM 509 WEATHER FORECASTING 2+1

### AIM OF THE COURSE

To impart theoretical and practical knowledge of forecasting techniques used for weather prediction and preparation of agro-advisories.

### THEORY

### Unit I

Weather forecasting system: definition, scope and importance; types of forecasting: short, medium and long-range; study of synoptic charts with special reference to location of highs and lows, jet streams, synoptic features and weather anomalies and zones of thermal

advection and interpretation of satellite pictures of clouds in visible and infra-red range; weather forecasting network.

### Unit II

Approaches for weather forecasts: methods of weather forecasts - synoptic, numerical prediction, statistical, analogue, persistence and climatological approach, nanotechnological approach, Indigenous Technical Knowledge (ITK) base- signals from flora, fauna, insects, birds, animal's behaviour; various methods of verification of location-specific weather forecast.

#### Unit III

Special forecasts: special forecasts for natural calamities such as drought, floods, high winds, cold (frost) and heat waves, hail storms, cyclones and protection measures against such hazards.

#### Unit IV

Modification of weather hazards: weather modification for agriculture; scientific advances in artificial rain making, hail suppression, dissipation of fog and stratus clouds, modification of severe storms and electric behaviour of clouds.

#### Unit V

Weather based advisories: interpretation of weather forecasts for soil moisture, farm operations, pest and disease development and epidemics, crops and livestock production; preparation of weather-based advisories and dissemination.

### PRACTICALS

Exercise on weather forecasting for various applications; Preparation of weatherbased agro-advisories based on weather forecast using various approaches and synoptic charts.

#### LECTURE SCHEDULE

- 1. Definition of weather and climate
- 2. Forecasting ideology- Need- History
- 3. Weather forecasting system: definition, scope and importance;
- 4. Types of forecasting
- 5. Nowcasting-Needs-role in Agriculture
- 6. Short range weather forecast
- 7. Medium range weather forecast
- 8. Long-range and seasonal climate forecast
- 9. Study of synoptic charts with special reference to location of highs and lows, jet streams, synoptic features
- 10. Weather anomalies and zones of thermal advection
- 11. Interpretation of satellite pictures of clouds in visible and infra-red range;
- 12. Weather forecasting network-WMO-IMO-National centres- importance

- 13. IMD-AMFU-GKMS-DAMU activities
- 14. Approaches for weather forecasts: methods of weather forecasts
- 15. Synoptic, numerical weather prediction, statistical, analogue, persistence
- 16. Climatological approach, nanotechnological approach -Almanac studies

# **17. MID SEMESTER EXAMINATION**

- 18. Indigenous Technical Knowledge (ITK) base- signals from flora, fauna, insects, birds, animals behaviour;
- 19. Various methods of verification of location-specific weather forecast.
- 20. Special forecasts for natural calamities such as drought, floods
- 21. Special forecast for High winds, cold (frost) and heat waves, hail storms
- 22. Special forecast for cyclones and protection measures.
- 23. Modification of weather hazards
- 24. Weather modification for agriculture
- 25. Scientific advances in artificial rain making, hail suppression
- 26. Dissipation of fog and stratus clouds, modification of severe storms and electric behaviour of clouds.
- 27. Weather based advisories-Farmers -participatory-forecast.
- 28. Interpretation of weather forecasts for soil moisture, farm operations,
- 29. Interpretation of weather forecasts for pest and disease development and epidemics,
- 30. Interpretation of weather forecasts for crops and livestock production;
- 31. Preparation of weather based advisories and dissemination.
- 32. Dissemination of weather forecast- Methodologies-Media.

# PRACTICAL SCHEDULE

- 1. Weather forecasting
- 2. Forecasting procedures for various applications
- 3. Spatial and temporal variation in weather observations and its impact in weather forecasting.
- 4. Institutes and system of weather forecast.
- 5. Role of synoptic chart on weather forecast
- 6. Weather based agro advisory-preparation
- 7. Various approaches of weather forecast
- 8. IMD-AMFU activities in weather forecasting
- 9. GKMS activities in weather forecasting
- 10. DAMU activities in weather forecasting
- 11. Role of AIR in weather forecasting
- 12. Dissemination through mobile App Meghdoot
- 13. Websites in weather forecasting
- 14. Visit to AIR for weather forecasting
- 15. Visit to IMD, DWRS stations.
- 16. Visit to RMC, Chennai
- 17. PRACTICAL EXAMINATION

### LEARNING OUTCOME

Enhancing knowledge on weather forecast and its use

- Narayanan.AL.2021. Introductory Agrometeorology published by Brillion Publishing.22B/5 Ground floor, Desh Bandhu Gupta Road, Karol Bagh, New Delhi 110005.ISBN: 978-93-86658-32-6 p153.
- 2. Narayanan. AL.2015. Principles of Applied Agricultural Meteorology, Sri Velan Pathipagam, Chidambaram.ISBN:93-81236-27-7.p.
- 3. Ram Sastry AA. 1984. Weather and Weather Forecasting. Publication Division, GOI, New Delhi.
- 4. Singh SV, Rathore LS and Trivedi HKN. 1999. A Guide for Agrometeorological Advisory Services. Department of Science and Technology, NCMRWF, New Delhi.
- 5. Watts A. 2005. Instant Weather Forecasting. Water Craft Books.
- 6. Wegman and Depriest. 1980. Statistical Analysis of Weather Modification Experiments. Amazon Book Co.