

PONDICHERRY UNIVERSITY



7th PG BOARD OF STUDIES IN AGRICULTURAL SCIENCES

DOCTORAL DEGREE PROGRAMME
REGULATIONS AND CURRICULUM
(Effective from 2023 - 24)

**PANDIT JAWAHARLAL NEHRU COLLEGE OF
AGRICULTURE
AND RESEARCH INSTITUTE (PAJANCOA&RI)
(A Government of Puducherry Institution)
KARAIKAL – 609 603**

**PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014**



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REGULATIONS

PONDICHERRY UNIVERSITY

PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND
RESEARCH INSTITUTE, KARAIKAL

DOCTORAL DEGREE PROGRAMME SEMESTER SYSTEM - RULES AND REGULATIONS 2023

01. SYSTEM OF EDUCATION

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

1.2 The duration of Doctoral programme is three academic years (6 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. The third year of study shall be the fifth and sixth semesters.

02. COMMENCEMENT

These regulations shall come into force from the academic year 2023-24.

03. 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 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 fulfilment of the postgraduate degree programme.
- 3.5 **'Curricula and syllabi'** refer to list of approved courses for Ph.D programmes wherein each course is identified with a 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** **'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 1+0 course (1 credit) means 1 hour theory per week
- 3.11** **'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.
- 3.12** **'Grade Point'** means the total marks in percentage obtained in a course divided by 10 and rounded to two decimals.
- 3.13** **'Credit Point'** means the grade point multiplied by the credit load of the course.
- 3.14** **'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.
- 3.15** **'Arrear examination'** is an examination written for the failed course by a student without undergoing regular classes in that course.
- 3.16** **'Transcript Card'** is the consolidated report of academic performance of a student issued by the University on completion of the curriculum fulfilment. The format of Transcript Card is furnished in *Annexure-1*.

04. DOCTORAL PROGRAMMES

The Doctoral programme offered in the College is as follows:

4.1 DOCTOR OF PHILOSOPHY [Ph.D.]

Ph.D. Agricultural Economics
Ph.D. Agronomy
Ph.D. Genetics and Plant Breeding
Ph.D. Soil Science
Ph.D. Vegetable Science

05. ADMISSION

5.1. Eligibility for admission:

- i. Candidates seeking admission to Doctoral degree programme should have a two year Master's degree from State Agricultural Universities (SAU) or from other institutes accredited by NAEAB (ICAR) alone are eligible to apply for the doctoral program.

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 Doctoral degree programme in this Institute.

iii. Prescribed minimum qualification from a recognized University for admission to Doctoral degree programme:

Requirement for Doctoral Degree

Sl. No.	Degree	Requirement for Doctoral degree programs
1.	Ph.D. Agricultural Economics	M.Sc. (Agri.) Agricultural Economics
2.	Ph.D. Agronomy	M.Sc. (Agri.) Agronomy
3.	Ph.D. Genetics & Plant Breeding	M.Sc. (Agri.) Plant Breeding and Genetics / M.Sc. (Agri.) Genetics and Plant Breeding / M.Sc. (Agri.) Plant Genetic Resources
4.	Ph.D. Soil Science	M.Sc. (Agri.) Soil Science / M.Sc.(Agri.) Soil Science and Agricultural Chemistry
5.	Ph.D. Vegetable Science	M.Sc. Vegetable Science/ M.Sc. (Hort.) Vegetable Science

5.2. Application for admission:

- i. Application for admission shall be made in the prescribed form to be downloaded from the website of the college (www.pajancoa.ac.in) after notification is issued to this effect.
- ii. The admissions shall be regulated and made in accordance with the admission rules and regulations in force.

5.3. Method of selection:

- i. The admission to the Doctoral Programme is based on the marks / rank obtained in ICAR's All India Entrance Examination (AIEEA) / ICAR's All India Competitive Examination (AICA-SRF (Ph.D.) /CUET.
- ii. Number of seats in each Ph.D. degree programme shall be decided as per availability of recognised Ph.D. guide.
- iii. Seats are reserved for candidates belonging to SC/ST, OBC as per the norms of Govt of Puducherry.

5.4. Admission procedure:

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

06. LANGUAGE REQUIREMENT

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

07. RESIDENTIAL REQUIREMENT

- i. The minimum and maximum duration of residential requirement for Ph.D. Programmes shall be as follows

Duration of Residential Requirement	
Minimum	Maximum
3 Academic Years (6 semesters)	7 Academic Years (14 Semesters)

Student may be allowed to discontinue temporarily only after completion of coursework

- ii. In case a student fails to complete the degree programme within the maximum duration of residential requirement, his/ her admission shall stand cancelled.

08. 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.

09. DISCONTINUANCE AND READMISSION

As per University Regulations.

10. ADVISORY COMMITTEE

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

10.2. Chairperson/Guide:

- i. The approved guides by the University only can be the guide for the students.
- ii. Every student shall have a Chairperson of the Advisory Committee who will be from his/her major field of studies.
- iii. The appointment of chairperson shall be made by the Head of the Department.
- iv. The Head of the department will allot the Doctoral students among the recognized guides.
- v. A teacher should have a **minimum of three years** of service before retirement for allotment of Doctoral students.
- vi. At any given time, a PG teacher shall not be a Chairperson of Advisory Committee (including Master's and Ph.D. programmes) for more than five students.

10.3. Chairperson/ Co-guide/ Member from other collaborating University/ Institute/ Organization:

- i. In case the Chairperson has less than 3 years of service he can be allowed to act as Co-guide / Member of the Advisory Committee.
- ii. The University / Institute may enter into Memorandum of Understanding (MOU) with other Universities / Institutions / Organizations for conducting research. However, to

include faculty of Pondicherry University to act as Co-guide / Member of the Advisory Committee Memorandum is not required.

- iii. 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 of a chairperson and three members. One member will be from the concerned department and other members from the related field of thesis research from other departments / discipline of the Post-graduate faculty accredited for appropriate P.G. level research. However, in those departments where qualified staff exists but due to unavoidable reasons Post-graduate degree programmes are not existing, the staff having Post-graduate teaching experience of two years or more may be included in the Advisory Committee as member.
- ii. External experts may be included as member/co-guide in the advisory committee based on the need and expertise of the member, without any financial commitment to the College so as to improve the quality of the thesis. The external expert member proposed should meet the minimum qualification required and the proposal is to be approved by the Dean.

10.5. Formation of advisory committee:

- i. For Doctoral Programme the advisory Committee Chairperson and members will be in the cadre of Professors, Associate Professor and Assistant Professors.
- ii. A proposal for the formation of the advisory committee (**Form 1**) of the student, shall be forwarded by the Head 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.

10.7. Absence of member during qualifying/final viva-voce examination:

- i. Conducting qualifying and 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 Doctoral student has to be conducted in the absence of one or two advisory committee members, permission to conduct the examination by co-opting another member in such contingencies should be obtained from the Dean in advance.
- iii. The co-opted member should be from the same department of the member who is not attending the examinations.
 - iv. In the absence of the Chairperson of advisory committee, respective Heads of Departments should act as Co-chairperson with prior permission of Dean.

10.8. Duties and responsibilities of the advisory committee:

- i. Drawing the student's academic plan for Doctoral 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 Doctoral course work (**Form 2**) drawn up by advisory committee shall be sent to the Dean before 55th working day 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 Doctoral student should complete a minimum of 100 credits as detailed below for award of the degree.

Credit Requirements

Details	Credits
i) Course Work	
Major Courses	12
Minor Courses	06
Supporting Courses	05
Seminar-2 nos. each 0+1 credit	02
ii) Thesis Research	75
Total Credits	100

13.2. Maximum credit load: A Doctoral student can register a maximum of **22 credits per semester** including seminar and research. However, research credits registered per semester shall not exceed **20 credits**.

13.3. Comprehensive qualifying examination and thesis: A Doctoral 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 Doctoral programme.
- ii. The extra credits registered will be accounted for calculation of OGPA.

14. ATTENDANCE REQUIREMENTS

14.1. A minimum of 80 per cent attendance separately in theory and practical of the concerned course is a must. However, the attendance may be condoned up to 10%, under extra-ordinary situation, by the Dean based on the genuineness of the case and upon the recommendation of the Advisory Committee and Head of the Department, 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.

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.

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.
- iv. For calculating 80 percent attendance the number of instructional days may be calculated only from the date of joining of the student for first year first semester only.
- v. The students failing to attend the classes / examinations on non-official ground will be treated as absent.
- vi. 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. In each course, examinations will be conducted for 100 marks as detailed below.

Examination	Courses with theory & practical	Courses with only theory
Term Paper	20	20
Final Theory Examination	60	80
Final Practical Examination	20	-
TOTAL	100	100

15.2. Final Theory Examination:

- i. An examination schedule prepared by the Dean 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 three hours.
- iii. The final theory examinations shall be **conducted and evaluated internally** by the course teacher.
- iv. Re-valuation/Re-totalling is not allowed for theory examinations.
- v. No re-examinations shall be allowed in the events of students' strike, boycott, walkouts, and medical grounds or what-so-ever may be the reason.

15.3. Postponement of Final Theory Examination:

Whenever the Government declares holidays on the dates of final examinations, the examinations that fall on the dates shall be postponed to the dates after the last examination as per the original examination schedule.

15.4. Final Practical Examination:

- i. The Head of the Department will announce the schedule of final practical examinations.
- ii. The final practical examinations shall be conducted after the completion of minimum of 96 working days.
- iii. Submission of bonafide practical records and term paper in complete form and certified by the Course Teacher is a pre-requisite for appearing in a practical examination failing which 'F' grade will be awarded.
- iv. The final practical examination of the course shall be conducted and evaluated by the course teacher.
- v. The duration of final practical examination shall be two and half hours.
- vi. The practical examination marks should be communicated to the Dean within ten days after the conduct of respective final practical examinations.

15.5. Arrear examination:

- i. Arrear examination is permitted for the final theory and final practical examination.
- ii. The students are permitted to write the arrear examinations along with the regular semester examination
- iii. The prescribed arrear examination fee should be paid on or before the specified date.
- iv. A student is permitted to write the final theory and practical examinations (Term paper marks shall be retained as such) only two times during 3 years duration excluding the regular final examination.
- v. 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 juniors as and when the course(s) are

offered with the permission of the University on payment of the prescribed Re-registration fee.

- vi. 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.

15.6. Late comer in Examinations:

- i. The students who are late by 30 minutes shall not be allowed to enter the examination hall.
- ii. Similarly, no student will be allowed to leave the examination hall within 30 minutes of the commencement of the examination.

15.7. All theory examinations shall be conducted in the Examination hall of the College. The student should necessarily come to the examination hall(s) with Identity card and hall tickets and produce the same to the examiner(s)/invigilator(s), failing which the student shall not be allowed to write the examinations.

15.8. Hall tickets:

- i. The students shall be issued with hall tickets for writing their final theory/practical examinations.
- ii. The PG coordinator of the concerned department shall prepare the hall tickets, get the approval of the Head of the Department and issue to the students.
- iii. In case of loss of hall tickets by the students, duplicate hall ticket shall be issued on payment of prescribed fine.
- iv. The students who have lost/missed their hall tickets shall apply to the Head of the Department for getting a duplicate hall ticket.

15.9. Evaluation of Course Work:

- 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. 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 % Attendance)
 - F - FAILED
 - RR - RE-REGISTRATION
 - RE - RE- EXAMINATION
 - EE - INCOMPLETE FOR REASONS OTHER THAN ATTENDANCE

15.10. Question paper pattern for theory examinations:

15.10.1. The question paper pattern for final theory examinations are indicated below:

Part	Type of question	Number of question	Number of questions to be answered	Mark per question	Total marks
Courses with theory and practical (1+1 or 2+1 courses) (60 Marks & 3 hours duration)					
A	Definitions/Concepts	12	10	1.0	10
B	Paragraph answers	7	5	4.0	20
C	Essay type answers (EITHER OR type) - One main question from each unit shall have one choice	5	5	6.0	30
	TOTAL				60
Courses with only theory (1+0 or 2+0 courses) Final Theory Examination (80 Marks & 3.0 hours duration)					
A	Definitions/Concepts	18	15	1.0	15
B	Paragraph answers	7	5	5.0	25
C	Essay type answers (EITHER OR type) - One main question from each unit shall have one choice.	5	5	8.0	40
	TOTAL				80

15.10.2. **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
Practical Field work / Lab Work / Written exam	20
Total	20

For conducting practical examinations, the type and number of questions can be decided by the course teacher.

15.11. 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.

15.12. Return of valued answer papers:

- i. The valued answer papers of final theory and practical examination 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 six months and then disposed off.
- iii. The same is applicable to arrear examination also.

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 Ph.D. Department shall send a panel of three examiners for conducting the comprehensive qualifying examination (**Form 4**).
- ii. The Controller of Examinations, shall nominate the external member from the panel for conducting qualifying examination of all the students of the department. However, the University can draw its own panel of examiners.
- iii. The panel of examiners for qualifying examinations shall be given by the Head of the Department 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 doctoral programme.
- ii. The controller of examination shall conduct the qualifying written examination.
- iii. The written examination shall be conducted for major courses only.
- iv. The question paper for the written examination shall be of 3 hours duration and each question need not be restricted to any particular topic in a course but it should be a comprehensive of the syllabus of each course.

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

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

16.4. Oral examination:

- i. Only those students who secure 'SATISFACTORY' grade in written qualifying examination shall be permitted to attend the oral qualifying examination
- ii. The advisory committee shall conduct the oral examination with one external examiner, who sets the question paper and evaluated the written qualifying examination.
- iii. The performance of the student(s) in the qualifying viva-voce examination shall be graded as "Satisfactory" or "Not satisfactory".
- iv. If the performance of the student is "Not Satisfactory" in the oral examination, he/she has to appear for the oral examination again.

16.5. 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 Chairperson 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 Doctoral 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.

16.6. Communication of results of qualifying examination:

- i. The Chairperson of the advisory committee shall act as Chairperson for the examination committee.
- ii. The Chairperson 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).

17. CREDIT SEMINAR

17.1. Seminar is compulsory for all the Doctoral students and each Doctoral student should register and present two seminars with 0+1 credit.

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

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 research.
- ii. The seminar topics are to be assigned to the students by the Chairperson 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% attendance in the semester in the presence of the Advisory committee, staff and Doctoral students of the concerned department.
- ii. The circular on the presentation of the seminars by the Doctoral 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 Chairperson 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 of Marks

Sl. No.	Description	Marks
1.	Synopsis of the Seminar	10.00
2.	Presentation	
	a) Introduction	05.00
	b) Style Clarity	10.00
	c) Sequence and Organization	05.00
	d) Topic Coverage	20.00
	e) Effective use of Audio Visual Aids	05.00
	f) Time Management	05.00
	g) Response to Question during discussion	10.00
3.	Report	30.00
	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.

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 area and 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 Doctoral programme should be of such a nature as to indicate a student's potentiality 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 Chairperson of the Advisory Committee shall accompany the thesis.

18.2. Research Colloquium:

- i. The research proposal has to be presented by the student in a colloquium organized by the Head of the department/Dean to get the opinion/ suggestions of the scientists of the concerned/other departments for improving it and approved by the Dean
- 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- Part A**). 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 students to monitor whether the student has 80% of attendance in research.
- iii. After completion of 80% attendance for research and on or before the last day of the semester, the advisory committee should evaluate the progress of research work as per the approved programme and monitoring register (**Proforma 6**) 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 subsequent semester with prior permission from the University. Until the completion of re-registered credits, the student should not be allowed to register for fresh block of research credits.

- c. SITUATION III:** The student could not complete the research work as per the approved programme of work for reasons beyond his/her control such as,
- Failure of crop.
 - 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' shall be awarded. The student has to

reregister the same block of research credits for which 'E' grade was awarded in the subsequent 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 cannot 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 cannot 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

19.1.

- i. The research credits registered in the last semester of Doctoral 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-4**.
- ii. If a Doctoral student has completed the thesis before the closure of the final semester, the Chairperson 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. During submission of thesis for external evaluation, it is mandatory to enclose certificate for plagiarism check under reference management (**Proforma 15**) as per UGC norms.
- iv. Copy of the thesis to be sent for evaluation should be submitted in paper pack.

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

19.2. Grace period:

- i. Students can avail a grace period up to three months for submission of thesis after the closure of final semester by paying prescribed fine.
- 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(s) 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 Department 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.

19.3. Re-registration and submission of thesis: The minimum of 80% 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. 3 years (6 semesters) and completed the minimum credit requirements with 80% attendance.

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

- **It is encouraged to publish minimum two research articles from the Doctoral thesis work.**
- Publication of two research articles should be made in UGC listed journals. The chairperson can also encourage the scholars to publish in high impact factor journals.

20. EVALUATION OF THESIS

20.1. The thesis submitted in partial fulfilment of a Doctoral degree shall be evaluated by two external examiners nominated by the Controller of Examinations, upon recommendation of the Dean, from a panel of five names of specialists (**Form 6**) in the particular field in India.

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

20.3. An oral examination (public defence) will be conducted by the Advisory Committee after the thesis is recommended by the external examiners besides the student should have carried out the corrections/suggestions made by the external examiners (**Form 8**). Public defence for doctoral students shall be conducted by the Chairperson of the advisory committee with the addition of one of the External Examiners nominated by the University on the working days in the presence of a **Proctor** appointed by the Dean to oversee the entire proceedings as a part of internal quality monitoring. The Heads of the Department shall nominate one Professor as a 'Proctor' from any Departments other than his department and it shall be approved by the Dean. In addition, the proctor has to sign in the public defence report. The Chairperson shall send the recommendations of the advisory committee along

with necessary certificate/documents in duplicate to the Dean. The thesis shall be finally accepted for the award only after the student satisfactorily completes a public defence.

20.4. The aims of the Ph.D thesis defence are to evaluate the candidate's academic competence, performance and his/her ability to interpret and discuss the undertaken research independently. The candidate is obliged to give a short lecture supporting his/her PhD thesis, publications and future research outlines. The final evaluation determines the candidate's academic results and conclusions i.e how clearly does he/she achieved the research objectives, solved the problems and obtained solutions; how logically the results are interpreted and further research possibilities outlined. Questions posed and clarification provided by the candidate during the defence gives an impression about the candidate's ability in academic debate.

20.5. The Chairperson shall send the recommendations of the advisory committee (**Form 7**) along with necessary certificate/documents in duplicate to the Dean. On the unanimous recommendation of the committee and with the approval of the University, the degree shall be awarded to the candidate.

20.6. The result declaration proposal will be sent by the Dean to the Controller of Examinations.

20.7. i. In case of difference of opinion on the acceptability of thesis for the award, the Controller of Examination may on the special recommendation of the advisory committee, refer the thesis for scrutiny and independent judgment to a third external expert chosen by him.

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

iii. If however, the opinion is still not uniform the degree shall not be awarded.

iv. In the above case, the advisory committee shall send their recommendation to the Dean within one month from the date of receipt of the thesis for scrutiny.

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 Dean.

ii. If the revision is recommended for repeating lab experiments, field trial etc., resubmission must be after a minimum 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. (**Form 8**)

22. FAILURE TO APPEAR FOR PUBLIC DEFENCE/NON-SUBMISSION OF THESIS AFTER PUBLIC DEFENCE

22.1. If a candidate fails to appear for public defence on the date fixed by the Chairperson the following are the time-frame and penalty.

The defence must be completed within **seven years from the date of** first registration for the degree program. An amount of penalty/ fine of Rs.5,000/-shall be levied to the candidate.

22.2. After successful completion of public defence if a student fails to submit the corrected version of the thesis within 15 days he/she shall be levied a fine of Rs. 5,000/- at the time of sending the proposal for result declaration.

23. RESULT NOTIFICATION

23.1. After the completion of each semester, the student shall be given the Report Card by the University.

24. MALPRACTICES IN EXAMINATION AND MISCONDUCT OF STUDENTS

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

24.2. The invigilator or the course teacher concerned shall report each case of unfair means with full details of evidence and written explanation of the student concerned to the Dean immediately.

24.3. The Dean shall take appropriate action on receipt of the report and the penalty may be as indicated below.

- i. Students found using unfair means during the final theory/practical examination will be deemed to have failed in all the courses in that semester and also debarred from the college for the next semester.
- ii. For using unfair means of a serious nature (which will be decided by committee nominated by the Dean) warranting higher penalties than those indicated in clauses **24.3 (i)** and **24.3 (ii)** the student may be debarred from the College for a period of two semesters or more or expelled permanently after obtaining the orders of the University. In such cases, the students concerned shall not be allowed to sit for the remaining examinations in the concerned course or other courses.
- iii. Details of each case together with all material evidence and recommendations of the Dean shall be communicated forthwith to the Registrar of the university. The Dean shall issue necessary orders and report each case falling under clauses **24.3 (i)**, **24.3 (ii)** and **24.3 (iii)** to the Registrar immediately.

24.4. Ragging rules: Students found involved in ragging or in any other misconduct, or on a report received from the affected student(s), the Dean shall immediately expel the concerned student(s) against whom the report is received from Hostel/College, for the current semester and the Dean shall further constitute a committee to probe and conduct enquiry into the matter and based on the report from the committee, shall pass the final orders on merit of the case within three working days. As per the order of the Supreme Court of India, the punishment for ragging may take the shape of (a) Withholding scholarships or other benefits (b) debarring from representation in events (c) withholding results (d) suspension or expulsion from hostel or mess and the like.

24.5. 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.

25. RECOGNITION OF DOCTORAL TEACHERS

25.1. The Dean normally recognizes teachers for offering courses to the students of Doctoral programme based on the request of teachers and the recommendation of Head of the department.

25.2. The recognized Ph.D. teachers shall offer courses to Doctoral 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.

25.3. **Teachers for Doctoral programme:** The following faculty shall be recognized as PG teachers for Doctoral programme

- i. Professors
- ii. Associate Professors
- iii. Assistant Professors: Persons having a Doctoral degree with five years of active experience in the concerned field.

25.4. 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**.

25.5. 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.

26. APPROVAL OF FINAL RESULTS, AWARD OF DEGREE AND ISSUE OF PROVISIONAL CERTIFICATES AND TRANSCRIPTS

26.1. Award of Degree:

- i. The Degree will be awarded during Annual Convocation conducted by the University to candidates who have satisfactorily completed all the graduation requirements.
- ii. The University shall issue a Provisional Degree Certificate to a candidate after having passed all provisional examinations.
- iii. Date of completion of degree programme shall be the date of final viva-voce examination/ public defence.

26.2. 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.

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

26.4. 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.

26.5. The Transfer Certificate and Conduct Certificate shall be issued by the Dean.

26.6. The Vice-Chancellor is empowered to withhold or cancel the Degree awarded when a mistake wilfully committed by the student is detected at a later date regarding the registration, OGPA and other requirements for successful completion of the degree programme.

26.7. Amending or Cancelling the Result: If it is established that the result of a candidate has been vitiated by malpractice, fraud or other improper conduct and that he/she has been a party to or connived at malpractice or improper conduct of another student, the Vice-Chancellor shall have the powers at any time to amend the results of such a candidate and to make such declaration as the Vice-Chancellor may deem necessary on that behalf including return of prize, scholarship money and debarring the candidate from the University for such periods as may be specified and to cancel the results of the candidate in such manner as the Vice-Chancellor may decide.

27. REMOVAL OF DIFFICULTIES:

27.1. If any difficulty arises in giving effect to the Provisions of these regulations, the Registrar/Dean may issue necessary orders which appear to him to be necessary or expedient for removing the difficulty.

27.2. Every order issued by the Registrar/Dean under this provision shall be laid before the Academic Council of the University immediately after the issuance.

27.3. Notwithstanding anything contained in the rules and regulations, the Board of Studies or Academic Council shall make changes whenever necessary.

**DETAILS ON FEE TO BE PAID BY THE STUDENT
(Other than admission fee and semester fee)**

Sl. No.	Particulars	Amount (Rs.)
1.	Late Registration fee	1000
2.	Re-registration fee with juniors	1000
3.	Duplicate hall ticket fee	200
4.	Fee for Transfer Certificate and Conduct Certificate	200
5.	Re-examination fee for comprehensive Qualifying Exam	5000
6.	Fee for availing grace period for submission of thesis a) Up to one month b) Up to three months	1000 2500
7.	Penalty for failure to appear for public defence	5000
8.	Penalty for late submission of thesis after public defence	5000
9.	Examination fee (per course) *	
10.	Improvement/ Re-examination fee (per course) *	
11.	Fee for Provisional Degree Certificate *	
12.	Fee for Transcript Card *	
13.	Fee for Degree Certificate *	
14.	Fee for Migration Certificate *	

* As fixed by the University from time to time

28. REGULATIONS GOVERNED BY PAJANCOA & RI

28.1. FEE STRUCTURE

- i) 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.
- ii) In the case of new admissions, the fees for the first semester should be paid at the time of admission.
- iii) For the remaining semesters, the fees should be paid on the date of registration of the semester.
- iv) Candidates who discontinue after admission are not eligible for refund of fees except caution money deposit.
- v) In case of a student who re-registers with junior batch, he/she has to pay the semester fees applicable to the junior batch in which he/she registers, besides the re-registration fee.

28.2. REGISTRATION

- i) All newly admitted candidates should register during the first semester of the programme. A candidate admitted to the Doctoral 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.

- ii) **In ABSENTIA** registration will not be permitted on any circumstances.
- iii) The Head of the Department and the PG coordinator shall help the student in selecting the courses for registration.
- iv) Admitted candidates shall register with the respective Department at the beginning of each semester and this should be completed within two working days.

28.2.1. Late registration:

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

28.2.2. 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

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

28.3. QUALIFYING EXAMINATION

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

28.4. MERIT SCHOLARSHIP/RESEARCH ASSISTANTSHIP

- i) PAJANCOA & RI fellowship shall be awarded to all the students who are admitted into the Ph.D programme based on allotment of Government fund. The students should be a resident of PAJANCOA & RI hostels. The award of fellowship is governed by the approved fellowship rules.
- ii) The Dean shall call for applications and sanction the scholarship every year.
- iii) The students availing any scholarship/fellowship are permitted to switch over to other fellowship/scholarship only one time during the course of study.

28.5. Student SRF:

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

28.6. GUIDELINES FOR HEADS OF THE DEPARTMENTS IN MONITORING PROGRESS OF DOCTORAL STUDENTS

28.6.1. Student records: The "Individual student" file (clip file) containing all the academic records of the student concerned with student's 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:

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

Sl. No.	Particulars	Time Schedule
1.	List of courses to be offered along with time table	A week before the commencement of each semester
2.	Course registration particulars	Within 10 working days from the date of commencement of each semester
3.	Mark lists after completing examinations	Within 10 days from the date of conduct of examinations

28.6.3. 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.

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

Sl. No.	Particulars	Time Schedule
1.	Formation of advisory committee (Form 1)	Within one month of the commencement of first semester
2.	Plan of course work (Form 2)	
3.	Programme of research work (Form 3)	Before the end of the semester in which the student registers the research credit for the first time or the commencement of the research work whichever is earlier.
4.	Proposal for qualifying examination (Form 4)	Two months before the completion of the course work.
5.	Qualifying examination result (Form 5)	The next day of the examination
6.	Panel of external examiners for	Three months before the probable date of

	thesis evaluation (Form 6)	submission of thesis
7.	Final viva-voce result (Form 7)	The next day of the examination
8.	Certificate for having carried out the suggestions of the external examiner and advisory committee (Form 8)	After receiving the evaluation report from the external examiner.

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

Form – 1

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

PROFORMA FOR FORMATION OF ADVISORY COMMITTEE

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

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

S.No.	Advisory committee	Name, designation and department	Date of Retirement	Signature
1.	Chairperson :			
2.	Co-Guide (If any) :			
3.	Member	1.		
		2.		
		3.		
4.	Additional member :			
5.	Reasons 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, KARAİKAL – 609 603**

PROFORMA FOR CHANGE IN ADVISORY COMMITTEE

(To be sent in triplicate)

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

	Name and designation	Date of retirement	Signature
a. Existing Chairperson/ Co-Guide/ member			
b. Proposed Chairperson/ Co-Guide member			

6. Reasons for change :

Signature of the student

Chairperson of the Advisory Committee

PG Coordinator

Head of the Department

DEAN

Form – 2

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

PROFORMA FOR PLAN OF COURSE WORK

(To be sent in triplicate before 55th working day during the first semester)

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

S. No.	Course No	Course Title	Credit Hour
		Major courses	
		Minor courses	
		Supporting 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
Chairperson		
Co-Guide (If any)		
Members	1.	
	2.	
	3.	

DEAN

Form – 3

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

PROFORMA FOR 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. Reg. 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
Chairperson		
Co-Guide(If any)		
Members	1.	
	2.	
	3.	

DEAN

Form – 3a

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

PROFORMA FOR CHANGE IN PROGRAMME OF RESEARCH

(To be sent in triplicate)

1. Name :
2. Reg. No. :
3. Degree :
4. Subject :
5. Reason for change :
6. Proposed change in the approved programme of research :
7. Number of credits completed so far under the approved programme :
8. a) Whether already earned credits are to be retained or to be deleted :
- b) If retained, justification :

Signature of the student

APPROVAL OF THE ADVISORY COMMITTEE

Advisory committee	Name	Signature
Chairperson		
Co-Guide (If any)		
Members	1.	
	2.	
	3.	

DEAN

Form – 4

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

PROFORMA FOR PROPOSAL OF QUALIFYING EXAMINATION

(To be sent in triplicate)

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

Sl. No.	Name	I.D. No.	OGPA

8. Panel of External examiners :

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

9. Remarks :

PG coordinator

Head of the Department

DEAN

Form – 5

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

PROFORMA FOR COMMUNICATION OF RESULTS OF
QUALIFYING EXAMINATION

(To be sent in triplicate)

1. Name of the student:
2. Reg. 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
Chairperson		
Co-Guide (If any)		
Members	1.	
	2.	
	3.	
External Examiner		

Signature of Chairperson
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

PROFORMA FOR PROPOSAL OF EXTERNAL EXAMINERS FOR THESIS EVALUATION

(To be sent in duplicate in Confidential cover)

1. Name of the student :
2. Reg. No. :
3. Degree :
4. Subject :
5. Thesis title :

6. Name of the Chairperson :
7. Panel of external examiners* :

Sl. No.	Name and Designation	Address with Contact No. and Email	Area of specialization
1.			
2.			
3.			
4.			
5.			

*Five external examiners should be given

8. Remarks :

**Signature of the Chairperson
of the advisory committee**

DEAN

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

PROFORMA FOR SENDING THE RESULT OF FINAL THESIS VIVA-VOCE EXAMINATION

(To be sent in duplicate)

1. Name of the student :
2. Reg. No. :
3. Degree :
4. Subject :
5. Thesis title as in final copy of the thesis :

6. Date and time of *viva-voce* :

7. Particulars of the External examiner(s) :
 who has/have evaluated the thesis

Name and Designation of the External Examiner	Remarks of the External Examiner
1.	RECOMMENDED /RECOMMENDED FOR REVISION /NOT RECOMMENDED
2.	RECOMMENDED /RECOMMENDED FOR REVISION /NOT RECOMMENDED

8. **Recommendation of the Examining committee present at the time of final *viva voce* examination:**

- a. Recommends/ does not recommend unanimously the award of degree
- b. The performance of the candidate in final *viva voce* is assessed as _____
 (very good/ good/ satisfactory/ not satisfactory)

Sl. No.	Capacity of examiner	Name in BLOCK letters	Signature
1.	Chairperson/Co-opted Chairperson*		
2.	Co-Guide		
3.	Member 1.		
	2.		
	3.		
4.	Additional member		
5.	External examiner		

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

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

Head of the Department

**Chairperson of the Examining committee/
 Advisory committee with designation**

Form – 8

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

**Certificate for having carried out the suggestions of the External Examiner and Advisory
committee**

(To be enclosed along with report of the public defense)

Certified that Thiru/Selvi/Tmt. _____

I.D. No. _____ has carried out all the corrections and suggestions as pointed
out by the external examiners (s) and the advisory committee and has submitted _____
copies of his/her Ph.D. thesis in hard bound cover and CD's.

**Signature of the Chairperson with
Designation**

Signature of the PG Coordinator

**Signature of the Head of the
Department**

Approved By

DEAN

SEAL OF THE
UNIVERSITY

Annexure – 1

Certificate Number:

PONDICHERY UNIVERSITY
Puducherry – 605 014
Doctoral Degree Programme

REPORT CARD

Name	:		Year of admission	:	
Registration No.	:		Semester	:	
Father's Name	:		Date of Registration	:	
Date of birth	:		Date of Start	:	
College	:	Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal	Date of Closure	:	

Sl. No.	Course Code	Course Title	Credit Hours	Grade Point	Credit Points

E- Incomplete F- Fail S- Satisfactory NS-Not Satisfactory

Credit Status	Upto Last Semester		Current Semester		Cumulative Status	
	Credit Hours	Credit Points	Credit Hours	Credit Points	Credit Hours	Credit Points
Courses completed						
GPA/OGPA						

Prepared by	Checked By	Asst. Registrar (Exams)	Controller of Examinations

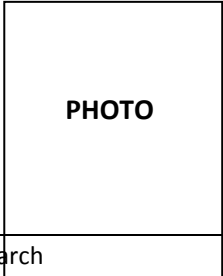
SEAL OF THE
UNIVERSITY

Annexure – 2

Certificate Number:

**PONDICHERRY UNIVERSITY, PUDUCHERRY – 605 014
TRANSCRIPT CARD**

Name :
Register No :
Father's Name :
Mother's Name :
Date of Birth :
Month & Year of Admission :
Month & Year of Passing :



Name & Address of College : Pandit Jawaharlal Nehru College of Agriculture & Research
Institute, Karaikal-609 603, U.T. of Pondicherry.

Name of University : Pondicherry University, R.V. Nagar, Kalapet, Puducherry 605014
Degree Programme : Ph.D. ()

Semester	Course No.	Title of the Paper	Credit Hours T+P	Grade point Obtained	Session

Reg. no:

Name:

* Non Credit Courses

S - Satisfactory

Title of the Thesis	:
Total Credit Hours	:
Total Credit Points Obtained	:
Overall Grade Point Average	:
Percentage	:
Class	:
Viva – Voce Completed on	:

Seal:

Date:

**Signature of
CONTROLLER OF EXAMINATIONS**

Classification of OGPA in 10.00 Point Scale.	
9.00 and above	First class with Distinction
8.00 to 8.99	First class
7.00 to 7.99	Second Class

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

STUDENT REGISTRATION CARD – Ph.D.

Name of the Student _____ Academic Year _____
 Registration No. _____ Semester _____
 Degree programme _____ Date of Registration _____
 Year of Admission _____ Date of Commencement _____

COURSES REGISTERED

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

Signature of the Student	Signature of the Chairperson	Signature of the Head of the Department	Coordinator of Examinations

APPROVED BY

**DEAN
PAJANCOA&RI
KARAİKAL**

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

LIST OF ENCLOSURES TO BE SUBMITTED ALONG WITH THESIS

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

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. Clearance certificate from Hostel
6. Clearance certificate from Library
7. Clearance certificate from Department
8. Clearance certificate from Staff advisor
9. Clearance certificate from Physical Education
10. Approved registration cards (One set)
11. Report cards (one set)
12. Course completion certificate (signed by Chairperson and HOD)
13. Attendance Certificate
14. Result of comprehensive qualifying examination
15. Permission and fee receipt for availing grace period, if any.
16. Certificate for Anti – Plagiarism (**Proforma 15**).
17. Two copies of paper bound thesis

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 – Four Numbers.
5. Soft copy the thesis in CD (cover to cover in PDF format) - Two Number.

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

**PROPOSAL FOR RECOGNITION OF TEACHERS FOR TEACHING/ GUIDING Ph.D.
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 Master's Programme
- b. Recognition as Guide for Doctoral 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

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

PROFORMA FOR REGISTRATION OF RESEARCH CREDITS

PART- A: PROGRAMME

Semester: _____ Year: _____ Date of registration: _____

1. Name of the student : _____
2. Reg. No. : _____
3. Total research credits completed so far : _____
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
Chairperson		
Members	1.	
	2.	
	3.	

(Approval may be accorded within 10 days of registration)

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

PROFORMA FOR EVALUATION OF RESEARCH CREDITS

PART - B EVALUATION

(Evaluation to be done before the closure of semester)

Date of closure of semester :

Date of evaluation :

1. Whether the research work has been carried out as per the approved programme :

2. If there is deviation specify the reasons :

1. Performance * :

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

APPROVAL OF THE ADVISORY COMMITTEE

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

Proforma-2

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

PERMISSION FOR LATE REGISTRATION

1. Name of the student :
2. Reg. 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
Chairperson :

Signature of the Chairperson

PG Coordinator

Head of the Department

DEAN

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

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

1. Name of the student :
2. Reg. No. :
3. Degree :
4. Subject :
5. OGPA of Master degree :
6. Name of the Chairperson :
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.
I am willing to abide by all the rules and regulations laid down by the College/University in this regard.

Date:

Signature of Student

Chairperson of the Advisory Committee

Head of the Department

DEAN

Proforma-4

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

ALLOTMENT OF STUDENTS UNDER JRF/SRF STUDENT FELLOWSHIP

(To be submitted to the Dean)

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

Principal Investigator

Head of the Department

Dean

List of Enclosures

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

Proforma-5

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

SPONSOR'S CONCURRENCE (PROFORMA)

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

Signature of the Sponsor

To

The DEAN,
PAJANCOA & RI,
Karaikal – 609 603.

Proforma-6

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

Proforma for Monitoring Register

Date of meeting	Review of the previous work that was assigned	Remarks of Chairperson	Work assigned for next week	Date on which the student has to report	Signature of the Student	Signature of the Chairperson

Proforma-7

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

Proforma for Obtaining Permission for Re-registration of credits

1. Name :
2. I.D No :
3. Department :
4. Campus :
5. Mention the current semester : Eg. III/IV/V etc.,
6. Re-registration is requested for the semester : IV/V/VI
7. Permission requested for re-registration of :
- (a) Course credits : Second/Third time
- (b) Seminar credits : Second/Third time
- (c) Research credits : Second/Third/Fourth time

Grade Obtained E/NS/EE	Reason for re-registration	Credit hours to be re-registered
-----------------------------------	-----------------------------------	---

Signature of Student

Chairperson

PG Coordinator

Head of the Department

DEAN

Encl: The following document to be enclosed if re-registration is requested for

Note:

* Example: For Fourth time request: Permission order that was obtained for re-registering third time

* If temporary discontinuance was a reason, then Dean orders to be enclosed.

* For re-registering research credits for second time, the HoD may approve.

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

PROFORMA FOR EVALUATION OF CREDIT SEMINAR

1. Name of the Student :
 2. Register No :
 3. Semester & Academic Year :
 4. Seminar Title :

Sl. No.	Description	Max. Marks	Marks Awarded
1.	Synopsis of the Seminar	10.00	
2.	Presentation		
	a) Introduction	05.00	
	b) Style Clarity	10.00	
	c) Sequence and Organization	05.00	
	d) Topic Coverage	20.00	
	e) Effective use of Audio Visual Aids	05.00	
	f) Time Management	05.00	
	g) Response to Question during discussion	10.00	
3.	Report	30.00	
	TOTAL	100	

Grade: _____

Date:

Signature

Proforma-9

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

DEPARTMENT OF _____

COURSE COMPLETION CERTIFICATE

This is to certify that Thiru./Selvi/Tmt. _____
Reg. No. _____ has completed all the course and research credit requirements
on _____ for the award of Ph.D. (Agri./Horti.) degree
in _____.

Professor and Head

**Signature of the Chairperson
(with Name and designation)**

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

JUSTIFICATION FOR LATE SUBMISSION OF THESIS (if applicable)

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

Signature of the student

11. Specific remarks and recommendation of:
the Chairperson

Signature of the Chairperson with designation

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

Signature of the Head of the Department

13. Approval of the Dean :

Signature of the Dean

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

PROFORMA FOR EVALUATION OF THESIS

Name of the degree programme: Ph.D. (Agri) in _____.

1. Name and Designation of the examiner :

2. Address of the Examiner:

Telephone/Mobile:

Fax:

E-mail:

3. Name of the candidate:

4. Reg. No.:

5. Title of the thesis:

6. Date of receipt of the thesis copy:

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

8. Examiner's recommendations choosing one:
of the following based on quality of thesis

- a. Recommended for award
- b. Recommended for revision

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

Date:

Official Seal:

Signature of the Examiner

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

Proforma-12

PONDICHERRY UNIVERSITY
PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE
AND RESEARCH INSTITUTE, KARAIKAL – 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 _____

Reg. 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 Ph.D. thesis in hard bound cover and **TWO** soft copies of thesis in PDF format in CDs.

Head of the Department

Signature of the Chairperson
with Name and designation

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

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

(To be sent in triplicate)

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

Date:

Signature of the Student

Specific Recommendations:

Chairperson Professor and Head

PERMISSION TO ATTEND THE SEMINAR/ SYMPOSIA

(to be issued by the Dean)

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

DEAN

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

APPLICATION FOR ISSUE OF CONDUCT AND TRANSFER CERTIFICATES

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

1. Name of the student :
2. Reg. No. :
3. Name of the Chairperson :
4. Designation of the Chairperson :
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.

Chairperson

PG Co-ordinator

Professor & Head

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

Proforma for Plagiarism Check

1	Name of the Student	
2	ID Number	
3	Degree	Doctoral
4	Title of the Thesis	
5	Department Name	
6	Campus	
7	Name of the Chairperson	
8	Total Word Count in the Document	
9	Initial Submission If No, If more than 5 times of submission,	Yes / No Provide the number of times plagiarism checked along with their plagiarism percent Provide the details of fine paid
10	Date of Submission	
11	Self-Plagiarism Exclusion Details (if published)	Kindly provide the links of your own publication (URL / DOI) to be excluded 1. 2.

Signature of the Student

Chairman / PG Coordinator / Head of the Department

Doctor of Philosophy (Ph.D.)

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

Credit Requirements

Particulars	Credits
(i) Course Work	
Major courses	12
Minor courses	06
Supporting courses	05
Seminar (2 number)	02
(ii) Thesis Research	75
TOTAL	100

SUPPORTING COURSES

Sl No.	Course Code	Course Title	Credits
01	MAT 601	Advanced Operations Research	2+1
02	STA 601	Applied Regression Analysis	2+1
03	STA 602	Multivariate Analysis for Applied Sciences	1+1
04	COM 601	Programming with R	1+1

MAT 601 Advanced Operations Research 2+1

Aim of the course

To provide an in depth knowledge in formulation of non -linear programming problems, integer programming, and Quadratic Programming. The application problems can be solved by using software packages.

Theory

Unit I

Formulating a nonlinear programming problem – unconstrained and constrained optimization problems – equality constraints - Lagrangian Multipliers-Hessian and bordered Hessian Matrices inequality constraints – Kuhn Tucker conditions.

Unit II

Linear programming -Definitions of primal and dual problems-Duality theorems, Complementary Slackness Theorem-Dual Simplex method – Economic interpolation of duality-Post-Optimal Analysis. Post-optimality Analysis-Changes in the objective function coefficients- Post-optimality Analysis Changes in the bi values- Post-optimality Analysis-Changes in the coefficients a_{ij} 's.

Unit III

Integer programming problems - Gomary's Cutting Plan method - Quadratic programming – Wolfe's modified simplex method- Beale's method. Goal programming problem – Formation and Algorithm- The weights method -The preemptive method

Unit IV

Markov Chains- Definition- Transition probability Matrices – Calculation of n step transition probabilities – Steady state conditions. Simulation – definition – Simulation models –generation of random numbers -Monte Carlo simulation – Application of simulation in queuing systems, maintenance problems, investment and budgeting.

Unit V

Dynamic programming problem- Formulation – Forward and backward, recursive methods- Discrete Dynamic Programming- Continuous Dynamic Programming. Software Packages for solving Operational Research problems

using MS Excel Solver, TORA, R, MATLAB, and other software packages.

Practical

Formulating a nonlinear programming problem - Problems in unconstrained and constrained optimization. Equality and inequality constraints - Kuhn Tucker conditions. Problems in Dual Simplex method – Economic interpolation of duality - Integer programming problems – Gomory's cutting plan method - Problems in quadratic programming, geometric programming– Dynamic programming – Forward and backward recursive methods. Markov decision problem. Transition probabilities – Transition matrices – n step transition probabilities – Steady state conditions – Simulation – definition – Simulation models - Monte Carlo simulation – generating random observations from uniform, exponential and normal probability distributions. Hands on sessions in MS Excel solver – GAMS – MATLAB and other software packages.

Learning Outcome

The students can acquire in depth knowledge in constrained and unconstrained optimization techniques. Also they obtain knowledge in linear and non-linear programming problems and they can solve the problems using software

Lecture Schedule

1. Formulating a non linear programming problem
2. Unconstrained optimization problems –functions of single variables
3. Unconstrained optimization problems –functions of several variables- Hessian Matrices
4. Constrained Optimization-Equality constraints –Lagrangian multipliers- Bordered Hessian matrices
5. Constrained Optimization –Inequality constraints with inequality constraints - Kuhn Tucker conditions
6. Linear programming – Definition of primal and dual
7. Duality theorems, Complementary Slackness Theorem
8. Dual simplex method
9. Economic interpolation of duality
10. Post-optimality Analysis-Changes in the objective function coefficients
11. Post-optimality Analysis-Changes in the b_i values
12. Post-optimality Analysis-Changes in the coefficients a_{ij} 's.
13. Integer programming problems -
14. Gomory's Cutting Plan method
15. Quadratic programming – Wolfe's modified simplex method
16. Quadratic programming – Beale's method.
17. Goal programming problem – Formation and Algorithm
18. The weights method
19. The preemptive method
20. Markov Chains – Definition - Transition probabilities
21. Calculation of n step transition probabilities and Steady State probabilities
22. Simulation definition – Simulation Models – Generation of Random numbers
23. Monte Carlo simulation

24. Application of simulation in queuing and inventory problems.
25. Application of simulation in maintenance and budgeting problems
26. Dynamic programming problem- Formulation – Forward and backward recursive methods
27. Discrete Dynamic Programming
28. Continuous Dynamic Programming
29. Stochastic Programming Problems.
30. Use of MS Excel solver in solving Optimization problems.
31. MATLAB ,GAMS and its features
32. MATLAB ,GAMS and its features
33. Features of other packages in solving OR problems

Practical Schedule

1. Unconstrained optimization problems –functions of single variables
2. Unconstrained optimization problems –functions several variables
3. Problems in Constrained Optimization-Equality constraints
4. Constrained Optimization –Inequality constraints with inequality constraints - Kuhn Tucker conditions
5. Problems in Dual simplex method
6. Integer programming problems - Gomary's cutting plan method
7. Quadratic programming Problems
8. Goal programming formation and solution
9. Discrete Dynamic programming problems
10. Continuous Dynamic programming problems
11. Markov chain-Construction of transition matrices - computation and steady state Probabilities
12. Simulation models- Monte Carlo simulation
13. Simulation in queuing and inventory problems
14. Simulation in maintenance and budgeting problems
15. Solving Use of MS Excel solver
16. Solution by GAMS and MATLAB
17. **Final practical examination**
 1. Fryer MJ and Greenman JV(1987)- Optimisation Theory Applications in OR and Economics, Edward Arnold, London
 2. Hamdy A. Taha (2002) -Operations Research (seventh edition) Prentice Hall of India Publisher, New Delhi.
 3. MJ. Fryer and JV Greenman (1987) Optimization Theory: Applications in OR and Economics, Edward Arnold
 4. Kanti Swarup, P.K Gupta, Man Mohan (1988) Operations Research (latest Edition) Sultan Chand & Sons educational publisher, New Delhi (latest edition).
 5. Michael D. Intriligator (1971), Mathematical Optimization and Economic Theory, Prentice- Hall of India Pvt Ltd., New Delhi

6. Don.T Phillips, Ravindran A. and James J.Solberg 1986 - Operations Research Principles and Practice

Suggested websites

1. http://en.wikipedia.org/wiki/Queueing_model
2. http://en.wikipedia.org/wiki/Dynamic_programming

Aim of the Course

To get depth knowledge and understanding of the linear and non-linear regression model and its limitations.

To learn how to develop regression model and check regression diagnostics and apply for the specific perspective data.

Theory**Unit I: Correlation Analysis**

Introduction to correlation analysis and its measures, Rank correlation, Testing of population correlation coefficients; Multiple and partial correlation coefficients and their testing.

Unit II: Regression Diagnostics

Problem of correlated errors; Auto correlation; Heteroscedastic models, Durbin Watson Statistics; Removal of auto correlation by transformation; Analysis of collinear data; Detection and correction of multi collinearity

Unit III: Regression analysis

Assumption and properties of regression coefficient - Method of least squares for curve fitting; Testing of regression coefficients and intercept. Coefficient of determination

Unit IV: Multiple Regression Analysis

Multiple and partial regressions - Diagnostic of multiple regression equation; Concept of weighted least squares; Various methods of selecting the best regression equation – Forward selection method, Backward elimination method, Stepwise regression

Unit V: Nonlinear Regression Analysis

Concept of nonlinear regression and fitting of quadratic, exponential and power curves; Economic and optimal dose, Orthogonal polynomial

Practical

Correlation coefficient and test of significance, Rank correlation. Regression analysis - Method of least squares for curve fitting - testing of hypothesis residuals and their applications in outlier detection; Handling of correlated errors, multi collinearity; - Multiple and partial regressions - Diagnostic of multiple regression equation Fitting of quadratic, exponential and power curves, fitting of orthogonal polynomials

Learning Outcome

After completion of this course the students will be able to

- Identify the relationship between the variables and solve problems involving simple and multiple linear regression.
- Select the best regression model and variables contributing to model.
- Carry out regression analysis for given data using different diagnostic measures, transformation.
- Fit linear and Non-linear regression curves and its implementation in real life situation

Lecture Schedule

1. Introduction to correlation analysis and its measures
2. Assumption and properties of correlation coefficient
3. Rank correlation
4. Testing of population correlation coefficients
5. Multiple correlation coefficients and their testing
6. Partial correlation coefficients and their testing
7. Correlation ratio
8. Auto correlation
9. Biserial correlation
10. Problem of correlated errors
11. Removal of auto correlation by transformation
12. Analysis of collinear data
13. Detection of multi collinearity and remedies
14. Correction of multi collinearity
15. Heteroscedastic models
16. Durbin Watson Statistics
17. Introduction to Regression analysis
18. Assumption and properties of regression coefficient
19. Method of least squares for curve fitting
20. Testing of regression coefficients
21. Interpretation of regression coefficient and intercept
22. Partial regressions
23. Multiple regression equation
24. Diagnostic of multiple regression equation
25. Concept of weighted least squares
26. Various methods of selecting the best regression equation - Forward selection method, Backward elimination method
27. Various methods of selecting the best regression equation - Stepwise regression
28. Concept of nonlinear regression
29. Fitting of quadratic curves
30. Fitting of exponential curves
31. Fitting of power curves
32. Economic and optimal dose
33. Orthogonal polynomial

Practical Schedule

1. Calculation of correlation coefficient

2. Calculation of partial correlation coefficient
3. Fitting of multiple linear regression equation
4. Testing of multiple linear regression coefficients
5. Calculation of Residuals and checking assumption of residuals
6. Outlier detection using residuals
7. Handling of correlated errors
8. Detection on multi-collinearity
9. Dealing with multi-collinearity
10. Detection on Autocorrelation
11. Detection on Heteroscedasticity
12. Estimation of linear model
13. Fitting of quadratic curves
14. Fitting of exponential curves
15. Fitting of power curves
16. Fitting of orthogonal polynomials
17. **Final practical examination**

Suggested Readings

1. David G. Kleinbaum, Lawrence L. Kupper, AzharNizam (2007). Applied Regression Analysis and Other Multivariable Methods (Duxbury Applied) 4th Ed.
2. Draper NR and Smith H. 1998. Applied Regression Analysis. 3 Ed. John Wiley.
3. Ezekiel M. 1963. Methods of Correlation and Regression Analysis. John Wiley
4. Kleinbaum DG, Kupper LL, Muller KE and Nizam A. 1998. Applied Regression Analysis and Multivariable Methods. Duxbury Press
5. Koutsoyiannis A. 1978. Theory of Econometrics. MacMillan
6. Kutner MH, Nachtsheim CJ and Neter J. 2004. Applied Linear Regression Models. 4th Ed. With Student CD. McGraw Hill
7. Chatterjee S, Hadi A and Price B.1999. Regression Analysis by Examples. John Wiley
8. Draper NR and Smith H. 1998. Applied Regression Analysis. 3rd Ed. John Wiley
9. David G. Kleinbaum, Lawrence L. Kupper, AzharNizam (2007). Applied Regression Analysis and Other Multivariable Methods (Duxbury Applied) 4th Ed
10. Draper NR and Smith H. 1998. Applied Regression Analysis. 3 Ed. John Wiley.

Suggested Websites

1. https://en.wikipedia.org/wiki/Regression_analysis
2. <http://home.iitk.ac.in/~shalab/course5.htm>

STA 602 Multivariate Analysis for Applied Sciences 1+1

Aim of the Course

- To learn and develop scientific view to deal with multidimensional datasets and its uses in the analysis of research data.

To understand the extensions of univariate techniques to multivariate frameworks and learn to apply dimension reduction techniques used in the data analysis.

Theory

Unit I: Multiple Regression Analysis

Multivariate statistical techniques – multiple linear regression – full model – stepwise regression – Step-up and step-down regression. Logit and Probit regression – two stage least squares – Canonical correlation.

Unit II: Principal Component and Factor Analysis

Principal component analysis – extraction of principal component – interpretation and uses – factor analysis – nature of factor analysis – basic concepts – assumptions of factor analysis – factor loadings – calculated rotated values – communalities – varimax rotation – quartimax rotation orthomax rotation

Unit III: Discriminant Function and Cluster Analysis

Discriminant function analysis – simple and multiple discriminant analysis – selection of variables – Cluster analysis – purpose of cluster analysis – hierarchical clustering – k means clustering dendrogram – interpretation of dendrogram.

Unit IV: Multi-Dimensional Scaling

Multi-dimensional scaling – method – metric and non-metric – interpretation.

Unit V: Reliability and Path Analysis

Reliability analysis – methods – split half method – Cronbach's Alpha – path analysis – path coefficients – direct and indirect effects – path diagram.

Practicals

Multivariate statistical techniques - Full model regression equation - fitting using software - analysis and interpretation. Stepwise regression analysis - Step up method, Step-down method – Stepwise regression analysis using software. Computation of Logit regression equation - two stage least square regression equation - Canonical correlation. Principal components analysis – deriving the components and its interpretation. Factor analysis - with varimax rotation - quartimax and other rotations. Discriminant analysis - simple discriminant analysis - Multiple discriminant analysis. Cluster analysis -k-means method - hierarchical clustering method and dendrogram. Multi- dimensional analysis - Split half method of reliability - Kornbach's Alpha. Path analysis.

Learning Outcome

After completion of this course the students will be able to

- Carry out an extensive exploratory multivariate analysis for a given multivariate

data.

- Interpret statistically the multivariate data through the various multivariate techniques.
- Carry out classification of given multivariate data.
- Solve problems involving multivariate normal distribution and to do good research in agricultural data.

Lecture Schedule

1. Multivariate techniques – introduction and basics – use of SYSTAT software
2. Full model regression equations – selection of variables – fitting – analysis and interpretation
3. Stepwise regression analysis – step up method
4. Stepwise regression analysis – step down method
5. Logit regression equation fitting and interpretation
6. Probit regression equation – fitting and interpretation
7. . Canonical correlations – computation and interpretation
8. Principal component analysis – deriving the components and its interpretation
9. Factor analysis – objective – designing and assumptions – various rotations
10. Deriving factors and assessment of overall fit – interpreting the factors
11. Discriminant analysis – classification of multivariate observations – principles – simple discriminant analysis – equation fitting
12. Multiple discriminant analysis – equation fitting
13. Cluster analysis – principles – steps in clustering – k – means method – hierarchical clustering method – dendrogram – interpreting the dendrogram
14. Multi dimensional analysis technique – method and interpretation
15. Reliability analysis – methods – split half method – Cronbach's Alpha
16. Path analysis – path coefficients – direct and indirect effects – construction of path diagram

Practical Schedule

1. Full model regression equations – fitting using software – analysis and interpretation
2. Stepwise regression analysis – step up method using software
3. Stepwise regression analysis – step down method using software
4. Computation of Logit regression equation
5. Computation of two stage least square regression equation
6. Computation of Canonical correlation
7. Principal components analysis – deriving the components and its interpretation
8. Factor analysis – with varimax rotation
9. Factor analysis – quartimax and other rotations
10. Discriminant analysis – simple discriminant analysis
11. Multiple discriminant analysis
12. Cluster analysis – k-means method
13. Cluster analysis – hierarchical clustering method and dendrogram
14. Multi dimensional analysis
15. Split half method of reliability – Kornbach's Alpha
16. Path analysis
17. **Final practical examination**

Suggested Readings

1. Anderson TW. 1984. An Introduction to Multivariate Statistical Analysis. 2nd Ed. John Wiley
2. Arnold SF. 1981. The Theory of Linear Models and Multivariate Analysis. John Wiley
3. Giri NC. 1977. Multivariate Statistical Inference. Academic Press
4. Johnson RA and Wichern DW. 1988. Applied Multivariate Statistical Analysis. Prentice Hall
5. Kshirsagar AM. 1972. Multivariate Analysis. Marcel Dekker.
6. Muirhead RJ. 1982. Aspects of Multivariate Statistical Theory. John Wiley.
7. Rao CR. 1973. Linear Statistical Inference and its Applications. 2nd Ed. John Wiley
8. Rencher AC. 2002. Methods of Multivariate Analysis. 2nd Ed. John Wiley
9. Srivastava MS and Khatri CG. 1979. An Introduction to Multivariate Statistics. North Holland

Suggested Websites

1. https://en.wikipedia.org/wiki/Multivariate_statistics
2. <https://online.stat.psu.edu/stat505/>
3. https://www.iiap.res.in/astrostat/School08/PennStateSchool08_LecNotes.pdf
4. <https://www.math.uci.edu/~htucker/LectureNotes/MultivariateAnalysis.PDF>
5. <http://i2pc.es/coss/Docencia/ADAM/Notes/MultivariateAnalysisSlides.pdf>
6. <http://www.statslab.cam.ac.uk/~pat/AppMultNotes.pdf>

Aim of the Course

To give an idea about programming in R software and learn how to use R for data visualization

Theory**Unit I**

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

Unit II

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()`;

Unit III

`install.packages()`, `library()`; Introduction to Machine Learning; Introduction to R package tensorflow Introduction to R package keras.

Unit IV

Rscript If, Else, Else If statements in R; For Loop and While Loop in R; R user defined Functions

Unit V

Scatter Plot, Bar Chart and Histogram in R; Data Visualization with R `ggplot2`; Publishing Data Visualizations with R Shiny;

Practical

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()`; `install.packages("tensorflow")`; `install.packages("keras")`; Rscript, If, Else, Else If statements in R; For Loop and While Loop in R; R user defined Functions; Scatter Plot, Bar Chart and Histogram in R; Data Visualization with R `ggplot2`; Publishing Data Visualizations with R Shiny;

Learning Outcome

The course will impart knowledge on how to analyze and visualize data using R programming

Lecture schedule

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

3. R Matrix- Create, Print, Add Column using `cbind()`, Add Row using `rbind()`, Slice using `[,]`;
4. R Data Frame - Create using `data.frame()`, Edit using `edit()`, Append using `cbind()`, `rbind()`, `select()`, `subset()`, sort using `order()`;
5. List in R - Create using `list()`, Select; Data Importing and Exporting in R Using `read.table()` and `write.table()`;
6. `install.packages()`, `library()`;
7. `install.packages("tensorflow")`;
8. `install.packages("keras")`;
9. Rscript
10. If, Else, Else If statements in R;
11. For Loop in R;
12. While Loop in R;
13. R user defined Functions
14. Scatter Plot, Bar Chart and Histogram in R;
15. Data Visualization with R `ggplot2`;
16. Publishing Data Visualizations with R Shiny;

Practical Schedule

1. R Console; R Vector creation using `c()`; R Assignment operators `= <-` ;
2. R Matrix- Create, Print, Add Column using `cbind()`,
3. Add Row using `rbind()`, Slice using `[,]`;
4. R Data Frame - Create using `data.frame()`, Edit using `edit()`, Append using `cbind()`, `rbind()`, `select()`, `subset()`, sort using `order()`;
5. List in R - Create using `list()`, Select; Data Importing and Exporting in R Using `read.table()` and `write.table()`;
6. `install.packages()`, `library()`;
7. `install.packages("tensorflow")`;
8. `install.packages("keras")`;
9. Rscript
10. If, Else, Else If statements in R;
11. For Loop in R;
12. While Loop in R;
13. R user defined Functions;
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**

Suggested Readings

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

Suggested Websites

1. RStudio.com Shiny Tutorial - <https://shiny.rstudio.com/tutorial/> - <https://shiny.rstudio.com/articles/>
2. R Interface to Tensorflow - <https://tensorflow.rstudio.com/>
3. R Interface to Keras - <https://keras.rstudio.com/>

Ph.D
Agricultural Economics

Ph.D. Agricultural Economics

Sl No.	Course code	Course Title	Cr. Hr.
I. Major courses (12 credits)			
01	AEC 601*	Advanced Micro-Economic Analysis	1+1
02	AEC 602*	Advanced Macro-Economic Analysis	2+0
03	AEC 603*	Advanced Applied Econometrics	2+1
04	AEC 604*	Advanced Production Economics	2+1
05	RPE 601*	Research and Publication Ethics	2+0
II. Minor Courses (6 credits)			
01.	AEC 605	Advanced Agricultural Marketing and Price Analysis	1+1
02.	AEC 606	Quantitative Development Policy Analysis	1+1
03.	AEC 607	Advanced Natural Resource Economics	1+1
04.	AEC 608	Environmental Economics	1+1
05.	AEC 609	International Trade Theories and Policy Applications	1+1
III. Supporting Courses (5 credits)			
IV. Seminar (2 credits)			
01	AEC 691	Doctoral Seminar	0+1
02	AEC 692	Doctoral Seminar	0+1
V. Thesis Research (75 credits)			
01	AEC 699	Doctoral Research	0+75

* Courses to be compulsorily registered

MAJOR COURSES

AEC 601*	ADVANCED MICRO ECONOMIC ANALYSIS	1+1
WHY THIS COURSE?		
<p>This Course enables the students to enrich the width and depth of their Knowledge horizon with respect to Micro-Economics. Further, the students would have an integrated view of the body of microeconomics and its relevance for economic policy, and have a working knowledge of the main analytical methods used to study micro economic problems.</p>		
OBJECTIVE		
<p>The main objective is to make the students comfortable with the models and arguments that the professional literature uses to describe and prescribe policy. In an effort to meet this goal, more focus would be on problem solving approach with practical application. Topics covered include an advanced treatment of consumer theory including duality in consumer theory, demand systems, and comparative static analysis; competitive market equilibrium; externalities and public goods; asymmetric information; and general equilibrium, welfare economics and social choice. In nutshell, this course presents key concepts from microeconomic theory at high level of abstraction – with an eye to policy analysis.</p>		
THEORY		
Unit I: Consumer Theory		
<p>Theory of consumer behaviour – Duality in consumer theory - expenditure function and indirect utility function - Measurement of Income Effect and Substitution Effect. Measurement of Changes in Consumers' Welfare – Consumer's Surplus, Compensating Variation and Equivalent Variation - Dynamic versions of demand functions – Integrability of demand functions. Demand Models – Linear Expenditure System and Almost Ideal Demand System. Applications of consumer theory –Household model and time allocation – Labour supply decisions by households.</p>		
Unit II: Market		
<p>Advanced treatment of Perfect competition – Monopoly, Monopolistic Competition and Oligopoly. Oligopoly models –Collusive and Non-collusive models of Oligopoly - Cournot solution, Bertrand's Duopoly Model, Chamberlin model, Stackleberg solution – Kinked Demand Curve.</p>		
Unit III: General Equilibrium		

General Equilibrium Theory - Conditions and Concepts -Mathematical derivations of conditions of General Equilibrium - General equilibrium with Production and Consumption. Walras' Law - Existence, Uniqueness and Stability of general competitive equilibrium - Walrasian general equilibrium.

Unit IV: Market Failure

Market failure - Incomplete markets - Asymmetric information – Principal - Agent problem –
 Adverse selection - Moral hazard. Externalities – Network externalities - Public goods –
 Optimal provision of public goods.

Unit V: Welfare Economics

Welfare Economics - Concepts, Problems, Approaches and Limitations of Welfare Economics,
 Pareto conditions of maximum welfare – Criteria for Social Welfare - Social Welfare functions,
 Social versus Private costs and benefits – Public Choice - Arrow's Impossibility Theorem.

PRACTICALS

Problems in consumer utility maximization – Estimation of income and substitution effects;
 Estimation of Consumer's surplus, equivalent variation and compensating variation. Estimation of
 demand models – Derivation and estimation of labour supply equations from household models.
 Comparative static analysis in consumption. Advanced problem solving in price determination
 under perfect competition, monopoly, oligopoly and monopolistic competition. Problems solving
 in General Equilibrium Theory and Welfare Economics. Problems in public goods provision.

LECTURE SCHEDULE

1	Theory of consumer behaviour – utility maximization – Derivation of demand function - Expenditure function and Indirect utility function. Duality in consumer theory – Roy's identity, Shephard's Lemma, Composite Commodity Theorem
2	Demand Decomposition – Hicks and Slutsky Decomposition - Income Effect and Substitution Effect. Measurement of Changes in Consumers' Welfare – Consumer's Surplus, Compensating Variation and Equivalent Variation
3	Comparative static analysis of changes in demand for commodities due to changes in prices and income. Integrability of demand functions
4	Dynamic versions of demand functions. Demand Models – Linear Expenditure System, Almost Ideal Demand System
5	Applications of consumer theory - Time allocation and household model – Labour-leisure model – Labour supply decisions of households
6	Price determination under perfect competition and monopoly – Price Discrimination - Measurement of welfare effects using comparative static analysis.
7	Oligopoly - Cournot solution, Bertrand's Duopoly Model, Chamberlin model and Stackleberg solution. Kinked Demand Curve – Equilibrium under Monopolistic Competition
8	Market failure - Incomplete markets - Externality problem – Network externality
9	Theory of Public goods – Optimal provision of pure and impure public goods.
10	Asymmetric information – Principal - Agent problem and Moral hazard.

11	General Equilibrium Theory - Conditions and Concepts, General equilibrium with Production and Consumption
12	Market equilibrium - Existence, Uniqueness, Stability of the market equilibrium. Walrasian general equilibrium model
13	General competitive equilibrium - definitions, Fixed-point theorem, existence, uniqueness and stability of general competitive equilibrium
14	Welfare Economics - Concepts, Problems, approaches and limitations of Welfare Economics
15	Pareto conditions of maximum welfare, Edgeworth box approach, Social Welfare functions – Sen's approach to social welfare
16	Applications of welfare economics – welfare effects of policies
PRACTICAL SCHEDULE	
1	Problems in consumer utility maximization
2	Estimation of income and substitution effects; Estimation of Consumer's surplus, equivalent variation and compensating variation
3	Estimation of demand models – Linear expenditure system
4	Estimation of demand models – Almost Ideal Demand System
5	Derivation and estimation of labour supply equations from household models
6	Solving problems in comparative static analysis of changes in demand for commodities due to changes in prices and income
7	Solving problems in price determination under perfect competition and monopoly
8	Solution concepts in game theory
9	Solving problems in oligopoly using Game theory models. Problem Solving in Monopolistic Competition
10	Market failure - Incomplete markets - Externality problem – Network externality. Public goods
11	Asymmetric information – Principal - Agent problem and Moral hazard - Transaction cost economics
12	General Equilibrium Theory - Conditions and Concepts, General equilibrium with Production and Consumption
13	Market equilibrium - Existence, Uniqueness, Stability of the market equilibrium. Walrasian general equilibrium mode
14	General competitive equilibrium - definitions, Fixed point theorem, existence, uniqueness and stability of general competitive equilibrium
15	Welfare Economics - Concepts, Problems, approaches and limitations of Welfare

	Economics
16	Applications of theory of welfare economics in structuring taxes, prices, investment, employment, international trade, and optimal pricing
17	Final practical examination
SUGGESTED READINGS	
1	Koutsoyiannis, A., 1973. "Modern Microeconomics, (London: The MacMillan Press Ltd.).
2	Chiang, Alpha C., 1981. Fundamental Methods of Mathematical Economics, New York: McGraw-Hill.
3	Henderson, J.M. and R.E. Quandt, 1958. Microeconomic Theory: A Mathematical Approach, New York: McGraw-Hill.
4	David .M.Kreps. 1990. <i>A Course in Microeconomic Theory</i> . Princeton Univ. Press.
5	Silberberg, E., and W.Suen, 2000. The Structure of Economics – A Mathematical Analysis, New York: McGraw-Hill Book Company.
6	Varian, Hal, R., 1992. Microeconomic Analysis, New York: W.W. Norton & Company.
7	Varian, Hal, R., 1999. Intermediate Microeconomics, New Delhi: Affiliated East-West Press.
8	Pindyck, Robert S. and Daniel L. Rubinfeld., 2017. Microeconomics, New Delhi: Pearson Publications.
SUGGESTED WEBSITES	
1	www.ocw.mit.edu
2	http://www.kevinhinde.com/
3	http://economicsonline.co.uk
4	http://economicsnetwork.ac.uk
5	http://www.econ.ucsb.edu/~tedb/eep/eep.html .
6	http://www2.econ.iastate.edu/classes/econ501/Hallam/
OUTCOME EXPECTED	
<p>After successful completion of the Course, the students will be able to understand Producer's equilibrium under different market structures and the strategies to attain them. Further, the students will be able to know the consequences of market failure and how to internalize the Externalities. The course also throws light on different approaches and limitations of Welfare Economics.</p>	

AEC 602*	ADVANCED MACRO - ECONOMIC ANALYSIS	2+0
WHY THIS COURSE?		
A deeper understanding of the conceptual and structural framework is imperative to develop vision of a student about how the knowledge of various macroeconomic models is applied in real economy.		
OBJECTIVE		
To understand the functioning of national economy, its history and models. The policies governing the modern economic system and concerned institutions.		
THEORY		
UNIT I: Review of Macroeconomics concepts		
Review of Macro Economics concepts - Comparative statics - Keynesian theory - Consumption Function and Theories of Consumption - Saving Function and Theories of Saving.		
UNIT II: IS - LM Dynamics		
Theories of Investment - Savings and Investment Equality - IS - LM Framework and its Extension - Demand for and Supply of Money-Monetary Policy in the static model – Inflation.		
UNIT III: Open Macroeconomic Models		
Stagflation and Supply side Economics - Theory of Unemployment - Phillips Curve controversy - Inflation, Productivity and distribution - Fiscal policy: Effectiveness and Problems.		
UNIT IV: Dynamic Macroeconomic Models		
Social Accounting Matrix Framework - General Equilibrium Analysis - Neo classical Macro Economics - Stochastic Macro Economics.		
UNIT V: Macroeconomic Institutions and Policies		
BOP & Adjustment Policies - Foreign Exchange Policy - Foreign sector : Capital and Current Account - Impact of WTO on Indian Economy - Impact of IMF & IBRD on Indian Economy - Review of Macro Economic Policies in India.		
LECTURE SCHEDULE		
1	Review of Macro Economics	
2	Comparative statics and Keynesian theory	
3	Consumption Function	
4	Theories of Consumption	

5	Saving Function
6	Theories of Savings
7	Theories of Investment
8	Savings and Investment Equality
9	IS – LM Framework
10	IS - LM Framework and its Extension
11	Demand for and Supply of Money
12	Monetary Policy in the static model
13	Inflation: Effects and control measures
14	Stagflation and Supply side Economics
15	Theory of Unemployment
16	Phillips Curve controversy – Inflation, Productivity and distribution
17	Fiscal policy: Effectiveness and Problems.
18	Effectiveness of Monetary Policy
19	Government's Budget Constraint and Fiscal Policy
20	Social Accounting Matrix Framework
21	SAM Extension
22	SAM and its Implications for Macro Economic Planning
23	General Equilibrium Analysis
24	Neo classical Macro Economics
25	Extension of Neo Classical Economics
26	Stochastic Macro Economics
27	Open Economy Macro Economics: Foreign Trade Multiplier
28	Balance of Payment
29	BOP Adjustment Policies
30	Foreign Exchange Rate
31	Foreign sector: Capital and Current Account
32	Review of Macro Policies in India -I
33	Review of Macro Economic Policies in India –II

SUGGESTED READINGS

1	Macro Economics: Theory and Policy : Willam H. Branson (Londan : Harper & Row Publishers, 1977)
2	Macro Economics: Theory and Policy : Gardner Ackely (Londan : Collier Macmillion Publishers, 1987)
3	Macro Economics: Theory and Policies Sixth edition : Richard T. Frogen (New Jessey: Prentice Hall Sixth edition International Inc., 1999)
4	Macro Economic Analysis: Edward Shapiro (New Delhi : Galgotia Publications Private Limited, 1989)
5	Macroeconomics: Eugene A.Diulio (Schaums' Outlines, 4 th Edition, 2006)
6	Stability with Growth: Macroeconomics, Liberalization and Development: Joseph Stigletz, Jose Antonio Oocampo, Shari Spiegel, Ricardo French-Davis and Deepak Nayyar (UN: ECLAC, 2006)
7	Economics: Paul. A. Samuelson and William D.Nordhaus (New Delhi: McGraw-Hill, 2004)

SUGGESTED WEBSITES

1	http://ocw.mit.edu/courses/economics/14-02-principles-of-macroeconomics-fall-2009/
2	http://www.uh.edu/~bsorensen/Macro_Lecture_Notes.pdf
3	http://www.econclassroom.com
4	http://www.getyourecon.com
5	http://www.cals.ncsu.edu/couse/are012/notes.html/

OUTCOME EXPECTED

After successful completion of this course the student will be able to-Figure out how policies are framed to safeguard the national economy. Understand the rationale behind the working of different economy.

AEC 603*	ADVANCED APPLIED ECONOMETRICS	2+1
WHY THIS COURSE?		
<p>The heart of any research is carrying out the model. The results obtained are crucial for the researchers. Thus this course acts as the centre point of building up analytical frame work of research. The students need to learn building up of models that will be used to test the hypothesis framed. Use different analysis depending upon the requirement and type of data.</p>		
OBJECTIVE		
<p>The course aims at providing quantitative econometric modeling skills and which the knowledge and command over analysis of data collected to get the desired result. Train the student in use of econometric models.</p>		
THEORY		
UNIT I: Review		
<p>Review of classical regression model Probabilities, conditional probabilities and regression models – review of hypothesis testing – restrictions on parameters – single equation techniques.</p>		
UNIT II: Concept of Least Squares		
<p>Ordinary least squares specification, Assumption and estimation – weighted least squares-generalized least squares – instrumental variables method - maximum likelihood method - errors in variables, non-linearity and specification tests – non-spherical error terms. Violation of OLS assumptions causes, Nature, Consequences and Remedy.</p>		
UNIT III: Dummy Variable		
<p>Dummy variables - Qualitative and truncated dependent variables - limited dependent variables –LPM, probit and logit models, their multinomial extensions.</p>		
UNIT IV: Models and Their Extensions		
<p>Autoregressive distributed lag models – panel data fixed and random effects models and their extensions. Spatial econometrics, Structural Equation method, Sample Selection model.</p>		
UNIT V: Simultaneous Equation Models		
<p>Simultaneous equation methods –identification – estimation by indirect least squares - 2SLS, FIML, SURE, 3SLS.</p>		
PRACTICALS		

Estimation of multiple regression model - GLS estimation methods - testing misspecification errors

– Testing and Managing multicollinearity, heteroscedasticity and autocorrelation - estimation of LPM, Logit and Probit models - comparing two regressions - Chow test - estimation of distributed lag models – panel data random and fixed effects models - Indirect least squares 2SLS, SURE, 3SLS, estimation of simultaneous equation models.

LECTURE SCHEDULE

1	Nature and scope of econometric models, single and systems of equations
2	Probabilities, conditional probabilities and regression modeling
3	Approaches to statistical inference and hypothesis testing
4	Desirable properties of estimators- small and large sample properties
5	Classical regression model, specification, assumptions and estimation
6	Variants of OLS – weighted, restricted regression models – use of dummy variables
7	Maximum likelihood approach to the estimation of regression models
8	Properties of OLS and statistical inference
9	Violations of OLS assumptions and Consequences
10	Generalized Least Squares Method (GLS)
11	Feasible generalized least squares (FGLS) to accommodate non-spherical error terms
12	Multicollinearity - Causes, Nature, Consequences and Remedy
13	Heteroscedasticity - Causes, Nature, Consequences and Remedy
14	Autocorrelation- Causes, Nature, Consequences and Remedy
15	Errors in variables and their accommodation - Specification Bias and specification tests
16	Limited dependent variables- Qualitative and truncated dependent variables in regression models
17	Specification and estimation of LPM, probit, tobit and logit models
18	Multinomial extensions of limited dependent variable models
19	Autoregressive and distributed lag models
20	Nerlovian Supply Response Model
21	Adaptive expectations, Koyack Model
22	Spatial Econometric models
23	Structural Equation and sample selection models
24	Specification of panel data models
25	Fixed effects and Random Effect model specification and estimation
26	Extensions of panel data models
27	Specification of simultaneous equation regression models
28	Structural models and reduced form models
29	Identification of simultaneous equation models.

30	Approaches to estimation of simultaneous equation models. Single equation approaches - Indirect least squares,
31	2SLS, Instrumental variables estimation
32	System approaches - SURE
33	3SLS and Interpretation of simultaneous equation models
PRACTICAL SCHEDULE	
1	Estimation of multiple regression model and GLS estimation method
2	Testing for specification errors
3	Statistical inference with parameter restrictions
4	Estimation in the presence of multicollinearity
5	Estimation in the presence of heteroscedasticity through FGLS
6	Estimation in the presence of autocorrelation through FGLS
7	Estimation of LPM and Logit models
8	Estimation of Probit and Tobit models
9	Tests of structural change-Chow tests and tests of Causation (Granger's test)
10	Estimation of supply response and distributed lag models
11	Estimation of fixed effects panel data model
12	Estimation of random effects panel data model
13	Identification of simultaneous equation models (SEM)
14	Estimation SEM through single equation methods, indirect least squares and 2 SLS
15	Estimation of SURE model
16	Estimation of simultaneous equations by system method-3SLS
17	Final practical examination
SUGGESTED READINGS	
1	Greene, W.H. 2002. Econometric Analysis. Pearson Education Pvt Ltd, Delhi, 2002.
2	Johnston, J. and Dinardo, J. 2000. Econometric Methods. McGraw-Hill.
3	Koutseyianis, A. 1997. Theory of Econometrics. Barner & Noble.
4	Harry. H.Kelejan, and Wallace E.Oates, Introduction to Econometrics - Principles and Applications" (NewYork: Harper and Row Pub.2001).
5	Maddala G.S., Econometrics (New York: McGraw Hill Book Co., 2002).
6	Maddala G.S. 1983. Limited Dependent and Qualitative Variables in Econometrics, Cambridge University Press.
7	Wooldridge, Jeffrey M. Econometric Analysis of Cross Section and Panel Data. MIT Press, 2001.
8	Gujarati, D., & Porter, D. (2008). Basic Econometrics. McGraw-Hill/Irwin.
9	Jeffrey M. Wooldridge, Introductory Econometrics, South-Western Publishing Co., 2000.
SUGGESTED WEBSITES	

1	http://www.oswego.edu/~kane/econometrics/stud_resources.htm
2	http://nickchk.com/econometrics.html
3	https://inomics.com/insight/top-youtube-channels-to-learn-econometrics-economics-
OUTCOME EXPECTED	
After successful completion of the course, the student will be able to analyze the data collected for testing the framed hypothesis. Get expertise in analytical framework.	

AEC 604*	ADVANCED PRODUCTION ECONOMICS	2+1
WHY THIS COURSE?		
<p>There is requirement of getting acquainted with decision making process in case of factors and products. The researcher needs to understand about working on production process and workout suitable suggestions to improve it.</p>		
OBJECTIVE		
<p>The course curriculum is designed to expose the scholars to advanced models in agricultural production decisions. To expose the scholars to advanced production economics principles and their applications; and to train the research scholars in advanced production economics tools for decision making and policy analysis. The course would also cover the analysis of production functions, its interpretation, decision making with multiple input use, factor sharing and decision making under risk and uncertainty.</p>		
THEORY		
UNIT I: Production Process		
<p>Agricultural Production process – Relationship between farm planning and production Economics</p> <ul style="list-style-type: none"> - Scope of agricultural production and planning-methods/procedures in agro-economic research and planning. 		
UNIT II: Production Functions and Characteristics		
<p>Production functions, components, assumptions, properties and their economic interpretation - Concepts of homogeneity, homotheticity, APP, MPP, elasticities of substitution and their economic relevance – Production relations – optimality – Commonly used functional forms nature, properties, limitations, estimation and interpretation linear, Spillman - Cobb Douglas, quadratic, multiplicative (power) functional forms - Translog, and transcendental functional forms - CES, production functional forms. Conceptual and empirical issues in specification, estimation and application of production functions- Analytical approaches to economic optimum - Economic optimum– determination of economic optimum with constant and varying input and output prices -</p> <p>Economic optimum with production function analysis - input use behaviour.</p>		
UNIT III : Decision Making in Production		

Decision making with multiple inputs and outputs – MRT and product relationship-cost of production and adjustment in output prices - Single input and multiple product decisions - Multi input, and multiproduct production decisions - Decision making with no risk - Cost of wrong decisions - Cost curves – Principles and importance of duality theory - Comparison of production, cost, and profit functions - Principles and derivation of demand and supply functions.

UNIT IV: Technology, Efficiency and Risk Management

Technology, input use and factor shares - Effect of technology on input use decomposition analysis- Factor shares-estimation methods- Economic efficiency in agricultural production – technical, allocative and economic efficiency – measurement Yield gaps analysis – concepts and measurement - Risk and uncertainty in agriculture –incorporation of risk and uncertainty in decision making – risk and uncertainty and input use level-risk programming.

UNIT V: Optimization through Programming

Programming techniques in agricultural production-Multiple Objective Programming (MOP) –
 Goal programming, Weighted sum and Compromise Programming – applications.

PRACTICALS

Estimation of different forms of production functions- Optimal input and product choice from estimated functions-Derivation of demand and supply functions and estimation. Estimation of cost function and interpretations-Optimal product and input choice under multi input and output system-Estimation of factor shares from empirical functions estimated-Estimating production functions incorporating technology changes: Decomposition analysis and incorporation of technology-Estimation of efficiency measures – Stochastic, probabilistic and deterministic frontier production functions-Risk programming – MOTAD-Quadratic programming-Simulation models for agricultural production decisions-Goal programming – Weighted, lexicographic and fuzzy goal Programming - Compromise programming.

LECTURE SCHEDULE

1	Agricultural Production Process – Production functions, components, assumptions, properties and their economic interpretation.
2	Concepts of homogeneity, homotheticity in production function. APP, MPP Elasticities of substitution and their economic relevance.
3	Mathematical analysis of input-output, input-input and product-product relationships
4	Optimality of production process - LDR
5	Commonly used functional forms, nature, properties, limitations, estimation and interpretation
6	Linear, Spillman and Cobb Douglas functional forms
7	Quadratic and Multiplicative (power) functional forms.
8	Translog, and transcendental functional forms

9	CES production function - form, properties and applications
10	Conceptual and empirical issues in specification, estimation and application of production functions
11	Economic optimum – determination of economic optimum with constant and varying input and output prices
12	Economic optimum with production function analysis - input use behaviour
13	Decision making with single input and multiple product decisions
14	Decision making with Multi input and multi production decisions
15	Decision making with no risk -Cost of wrong decisions – decision making with varying input supply and input use behaviour
16	Cost curves and cost functions– cost and production relationships
17	Principles and importance of duality theory
18	Comparison of production, cost, and profit functions
19	Principles and derivation of input demand and output supply functions
20	Technology, and input use -effect of technology on input use-decomposition analysis
21	Factor shares -estimation – accounting method – production function method
22	Concepts and measurement of efficiency in agricultural production – technical, allocative and economic efficiency
23	Measurement of technical efficiency – Stochastic frontier production function analysis
24	Measurement of technical efficiency - Data Envelopment Analysis (DEA) with bootstrapping
25	Yield gaps analysis – concepts and measurement
26	Risk and uncertainty in agriculture – incorporation of risk and uncertainty in decision making- Input use decisions under risk and uncertainty
27	Risk programming – MOTAD and Quadratic programming
28	Simulation techniques – importance in agricultural production decisions – types of simulations and applications
29	Multiple Objective Programming (MOP) – importance and applications in agricultural production
30	Multiple Objective Programming (MOP) – Estimation and interpretation of MOP
31	Goal programming – Weighted goal programming,
32	Lexicographic Goal programming and its applications
33	Compromise programming – importance and applications
PRACTICAL SCHEDULE	
1	Preparation of field data for empirical estimation of functional forms
2	Estimation of linear, quadratic, power, Spillman functions
3	Estimation of Translog and transcendental functions

4	Estimation of CES and VES production functions and interpretations
5	Optimal input and product choice from estimated functions
6	Derivation of input demand and output supply functions
7	Estimation of cost function and interpretations
8	Optimal product and input choice under multi input and output system
9	Estimation of factor shares from empirical functions estimated
10	Estimating production functions incorporating technology changes: Decomposition analysis and incorporation of technology
11	Estimation of efficiency measures – Stochastic, probabilistic and deterministic frontier production functions
12	Risk programming – MOTAD model
13	Risk programming – Quadratic programming
14	Simulation models for agricultural production decisions
15	Goal programming – Weighted, lexicographic and fuzzy goal programming
16	Compromise programming
17	Final practical examination
SUGGESTED READINGS	
1	Palanisami, K. P. Paramasivam and C. R. Ranganathan. Agricultural Production Economics: Analytical Methods and Applications, (New Delhi: Associated Publishing Co.), 2002.
2	David L. Debertin , Agricultural Production Economics, (New Jersey: Macmillan Publishing Company, second edition), 2012.
3	Heady E.O. Economics of Agricultural Production and resources use. Practice Hall of India.
4	Heady E.O. & Dillon, J L. 1961. Agricultural Production functions. Kalyani Publishers, Ludhiana, India. 667 p.
5	Baumol, W.G. 1973. Economic theory and operations analysis. Practice Hall of India Private Limited, New Dehli.626 p.
6	Gardner BL & Rausser GC. 2001. Handbook of Agricultural Economics Vol. I Agricultural Production. Elsevier.
7	Heady, Earl O., and John L.Dillon, Agricultural Production Functions” (Ames: Iowa State University Press), 2012.
SUGGESTED WEBSITES	
1	http://ocw.mit.edu/courses/economics
2	https://www.msu.edu/course/ECO/855
3	http://www.uky.edu/~deberti/prod/agprod5.pdf

4	http://www.csuchico.edu/ag/assets/documents/syllabi/ABUS/ABUS%20301%20AG%20production%20Econ%20Analysis.pdf
OUTCOME EXPECTED	
<p>After successful completion of the course, the student will be able to get familiar with different production functions and use them in practice and come out with useful decision. Workout the efficiency of the production process and use models for finding the optimum solution.</p>	

RPE 601*	RESEARCH AND PUBLICATION ETHICS	2+0
OVERVIEW		
<p>This course has total of 6 units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. Hands-on-sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, h-index, Impact Factor, etc) and plagiarism tools will be introduced in this course.</p>		
OBJECTIVE		
<p>The course is for awareness about the publication ethics and publication misconducts.</p>		
PEDAGOGY		
<p>Class room teaching, guest lectures, group discussions and practical sessions.</p>		
EVALUATION		
<p>Continuous assessments will be done through tutorials, assignments, quizzes and group discussions. Weightage will be given for active participation. Final written examination will be conducted at the end of the course.</p>		
THEORY		
Unit I: Philosophy and Ethics – Scientific Conduct		
<p>Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral philosophy, nature of moral judgements and reactions. Ethics with respect to science and research. Intellectual honesty and research integrity. Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP). Redundant publications: duplicate and overlapping publications, salami slicing. Selective reporting and misrepresentation of data.</p>		
Unit II: Publication Ethics		
<p>Publication Ethics: definition, introduction and importance. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice-versa, types. Violation of publication ethics, authorship and contributorship. Identification of publication misconduct, complaints and appeals. Predatory publishers and journals.</p>		

Unit III: Open access publishing

Open access publications and initiatives.

SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies.

Software tool to identify predatory publications developed by SPPU.

Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Unit IV: Publication misconduct

A. Group discussions

Subject specific ethical issues, FFP, authorship

Conflicts of interest.

Complaints and appeals: examples and fraud from India and abroad

B. Software tools

Use of plagiarism software like Turnitin, Urkund and other open source software tools.

Unit V: Databases and Research Metrics

A. Databases

Indexing databases.

Citation databases: Web of Science, Scopus, etc

B. Research Metrics

Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score.

Metrics: h-index, g index, i10 index, altmetrics.

References:

Bird, A. (2006). Philosophy of Science, Routledge.

MacIntyre, Alasdair (1967) A Short History of Ethics. London.

P.Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN: 978-9387480865.

National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to Responsible Conduct in Research: Third edition, National Academies Press.

Resnik, D.B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10. Retrieved from

<https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>

Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179.

<https://doi.org/10.1038/489179a> Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN: 978-81-939482-1-7.

http://www.insaindia.res.in/pdf/Ethics_Book.pdf

MINOR COURSES

AEC 605	ADVANCED AGRICULTURAL MARKETING AND PRICE ANALYSIS	1+1
WHY THIS COURSE?		
<p>The aim of production process is to sell the produce in the market and generate income. Markets serve as platform where this exchange takes place. Agriculture markets are different from other markets due to the nature of the commodity. Thus, it is important to develop a strong foundation of agricultural marketing, its components and issues. The student needs to know about the multi-pronged ways of marketing the produce, agencies involved. In this modern era, it is important to understand how technology is transforming this sector.</p>		
OBJECTIVE		
<p>The main objective of this course is to critically analyze the important marketing concepts, models, properties of agricultural commodity prices and forecasting, data collection and analysis using computer software in order to make policy decisions in the field of agricultural marketing.</p>		
THEORY		
Unit I: Agricultural Marketing Institutions		
<p>Importance of market analysis in the agricultural system - Role of various formal institutions in agricultural marketing – objectives and functions – measuring their efficiency – public-private-partnership – institutional arrangements. Successful case studies.</p>		
Unit II: Market Analysis		
<p>Multi market estimation – Supply response models – Market integration and price transmission – Supply / Value chain analysis.</p>		
Unit III: Introduction to Forecasting		
<p>Forecasting - Lag operators and difference equations – Stationary and stochastic processes – Unit roots and cointegration – Conditional heteroscedasticity - Price volatility estimation – ARCH models – GARCH models – Forecast evaluation.</p>		
Unit IV: Methods of Forecasting		
<p>Methods of forecasting – ARMA – ARIMA – SARIMA (Simulation and Prediction with Seasonal ARIMA models) – ARFIMA (Auto Regressive Fractional Integrated Moving Average Model).</p>		
Unit V: Application of Modern Techniques		
<p>Application of remote sensing data – big data analysis – Application of Artificial Intelligence tools – deep learning – Price forecasting - Price indices – construction and application.</p>		
PRACTICALS		
<p>Estimation of demand / Supply forecasting – Supply chain / Value chain analysis for different</p>		

commodities – Commodity models – Multi market estimation – Time series analysis – Market integration studies – Price discovery – Price volatility estimation – Commodity price forecasting.

LECTURE SCHEDULE

1	Various formal institutions in agricultural marketing – Objectives and functions – Measuring their efficiency
2	Multi market estimation – Fundamentals, Construction and Application
3	Multi-market model – IFPRI.
4	Supply response models – Theoretical frame work and building
5	Market integration – Unit roots and co integration – VECM approach
6	Price transmission – Fundamentals and Theoretical frame
7	Supply / value chain analysis for different commodities
8	Lag operators and difference equations – Construction and Application
9	Stationary and stochastic processes – Unit roots – Unit root test - Application
10	Cointegration – VECM approach
11	Price volatility estimation – ARCH and GARCH models – Theoretical frame work and building
12	Forecast evaluation
13	Methods of forecasting – Naïve models – MA, AR, ARMA – ARIMA (Box-Jenkins approach)
14	Application of remote sensing data- big data analysis
15	Application of Artificial Intelligence tools – deep learning – price forecasting
16	Price indices – Theoretical frame work – Construction and Application

PRACTICAL SCHEDULE

1	Estimation of demand elasticity and demand forecasting
2	Estimation of supply elasticity and supply forecasting
3	Market Equilibrium Analysis
4	Supply chain / value chain analysis different agricultural commodities, milk and poultry products
5	Chain Analysis - quantitative estimation of supply chain efficiency
6	Commodity models – Fundamentals, Construction, Estimation and Application
7	Multi market estimation - Fundamentals, Construction and Application
8	Time series analysis – Decomposition of time series data (daily, weekly, monthly and quarterly data)
9	Market integration – Simple correlation and Ravallion model analysis and interpretation
10	Market integration –. Granger Causality, Unit roots, ADF test, VECM estimation
11	Price discovery price volatility – ARCH models – GARCH models -other hybrid models Estimation
12	Forecasting – Naïve models – Single and Double Exponential Smoothing estimation
13	Price forecasting using– MA, AR, ARMA, ARIMA and Box-Jenkins estimation

14	Commodity price forecasting using software's - charts
15	Application of Difference equations in Agricultural Commodity model estimation
16	Application of remote sensing data in agricultural Marketing (current crop condition estimates) – Guest Lecture
17	Final practical examination
SUGGESTED READINGS	
1	Timmer, C.P. 1986. Getting Prices Right. Ithaca, N.Y.: Cornell University Press
2	Hallam, D. 1990. Econometric Modeling of Agricultural Commodity Markets. New York: Routledge
3	Goodwin, J.W. 1994. Agricultural Price Analysis and Forecasting. New York: Wiley
4	Martimort, D. ed. 1996. Agricultural Markets: Mechanisms, Failures, and Regulations. New York : Elsevier
5	Ferris, J.N. 1998. Agricultural Prices and Commodity Market Analysis. New York: McGraw-Hill
6	Schrimper, R.A. 2001. Economics of Agricultural Markets. London: Pearson
7	Tomek, W.G., and K.L. Robinson. 2003. Agricultural Product Prices. 4th ed. Ithaca, N.Y.: Cornell University Press
8	Nilabja Ghosh (2013) India's Agricultural Marketing-Market Reforms and Emergence of New Channels. Springer New Delhi- for new institutional arrangements in agricultural marketing, channel efficiency, PPP initiatives and case studies
SUGGESTED WEBSITES	
1	http://courses.cals.uidaho.edu/aers/agecon289/Index.htm
2	http://www.uky.edu/Classes/AEC/305-001/classppts/01.pdf
3	http://www.youtube.com/watch?v=1vixHc37DII
4	http://www.stanford.edu/group/FRI/indonesia/.../chapt4.fm
5	html http://www.Franciscovergara.Com/Pricecontrols.doc
6	http://www.docstoc.com
7	http://en.wikipedia.org/wiki/Market_structure
8	http://pdf.usaid.gov/pdf_docs/PNADL965.pdf
9	http://ageconsearch.umn.edu/handle/47883
10	http://faculty.quinnipiac.edu/charm/CHARM%20proceedings/.../160%20faria.pdf
OUTCOME EXPECTED	
<p>After the completion of this course the student will be able to-</p> <ul style="list-style-type: none"> • Understand the whereabouts of agricultural marketing. • Acquisition analytical skills in addressing the issues of agricultural marketing • Be familiar with the different forms of marketing in this sector. • Reap expertise in improving the performance of the marketing institutions • Gain expertise in market intelligence and price forecasting. 	

AEC 607	QUANTITATIVE DEVELOPMENT POLICY ANALYSIS	1+1
WHY THIS COURSE?		
<p>Policy reforms are inevitable. They are continuously required to deal with the loop holes of previous policy and control the present situation in a better manner. Reforms take place in both microeconomic and macroeconomic policies. The analysis of these policies help us to develop a framework for designing and implementing the policies.</p>		
OBJECTIVE		
<p>To develop expertise in understanding the rationale behind development of policies. Conceptualization of equilibrium and working out the economic implications of development policy.</p>		
THEORY		
Unit I: Overview of QDP		
<p>Policy framework – goals, value, beliefs and welfare maximization. Market – Policy and State – State vs Market – Failure of Policy – Failure of Markets - Rationale for Government Intervention. Role of Quantitative Policy Analysis.</p>		
Unit II: Demand and Supply Analysis		
<p>Demand analysis for policymaking – Alternative approaches to demand analysis – Policy implications. Supply response – Alternative approaches to measurement of supply response – Nerlovian models of supply response – Policy implications.</p>		
Unit III: Household Models		
<p>Household behaviour and policy analysis – Household models.</p>		
Unit IV: Partial Equilibrium Analysis		
<p>Partial equilibrium analysis – Concept of reference prices – Price distortions – indicators and impact. Transaction costs – Implications for efficiency and productivity – Institutional solutions - Multi market approach to policy analysis.</p>		
Unit V: General Equilibrium Analysis		
<p>Social Accounting Matrices and multipliers -- Computable General Equilibrium models to assess economy wide impact of policy changes.</p>		
PRACTICALS		
<p>Review of criteria for policy evaluation – Estimation of price elasticities – Review of estimation of complete demand systems – Estimation of Nerlovian supply Response model – Review of Household models – Specification and estimation of household models – Partial equilibrium analysis – Input-output table – Social Accounting Matrix – Construction of a SAM – computation of Multipliers – Multi Market Analysis – Review of Computable General Equilibrium Models.</p>		

LECTURE SCHEDULE	
1	Policy framework – goals, value, beliefs and welfare maximization
2	Approaches to Development theory: Market, Policy and State
3	Rationale for Government Intervention
4	Role of Quantitative Policy Analysis
5	Demand analysis for policymaking
6	Alternative approaches to demand analysis – Policy implications.
7	Supply response- Alternative approaches to measurement of supply response
8	Nerlovian models of supply response – Policy implications
9	Household behavior and policy analysis – Household models
10	Partial equilibrium analysis
11	Concept of reference prices – Price distortions – indicators and impact
12	Transaction costs – Implications for efficiency and productivity
13	Institutional solutions
14	Multi market approach to policy analysis
15	Social Accounting Matrices and multipliers
16	Computable General Equilibrium models to assess economy wide impact of policy changes
PRACTICAL SCHEDULE	
1	Review of criteria for policy evaluation
2	Technological change and factor substitutability
3	Estimation of price elasticities for policy analysis-I
4	Estimation of price elasticities for policy analysis-II
5	Review of estimation of complete demand systems
6	Estimation of Nerlovian supply Response model
7	Review of Household models
8	Specification and estimation of household models
9	Estimation of household response to price incentives
10	Partial equilibrium analysis – Input-output table
11	Social Accounting Matrix – Construction of a SAM
12	Computation of Multipliers
13	Multi Market Analysis
14	Policy analysis with multi market analysis
15	Review of Computable General Equilibrium Models
16	Policy analysis through CGE models
17	Final practical examination

SUGGESTED READINGS	
1	Kindleberger, P. Charles, "Economic Development" (London :(McGraw Hill International Book Company), 1977.
2	Ghatak Subrata and Ken Ingersent, "Agriculture and Economic Development" (New Delhi: Select Book Service Syndicate), 1984.
3	Chenery. H and T.N. Srinivasan eds., (1988), Hand book of Development Economics, (Amsterdam: North-Holland).
4	Ellis Frank, "Agricultural Policies in Developing Countries" (New York : Cambridge University Press), 1992.
5	John, and J. Walley (1992), Applied General Equilibrium (New York: Cambridge University Press).
6	Sadoulet Elizabeth and Alain de Janvry (1995), Quantitative Development Policy Analysis, (London: The John Hopkins University Press).
7	Eicher, K.C., and John M. Staatz, "International Agricultural Development". (Baltimore: The Johns Hopkins University Press), 1998.
8	Meier, M. Gerald and Stiglitz J.E. (2001), Frontiers of Development Economics- the future perspective, (New York: Oxford University Press).
9	Fischer Gerald, J. Miller and Mara S. Sidney, eds, Handbook of Public Policy Analysis: Theory, Politics and Methods (Boca Raton, Fla.: CRC Press, 2007).
10	Shoven Neck, Reinhard; Christian Richter and Peter Mooslechner, "Quantitative Economic Policy", Essays in Honour of Andrew Hughes Hallett (Eds), 2008.
SUGGESTED WEBSITES	
1	http://www.lib.cam.ac.uk/
2	http://www.grlc.vic.gov.au/content/collection-development-policy
3	http://library2.jfku.edu/about/cd_policy.html
4	http://www.mga.edu/library/policies.aspx
5	http://www.libs.uga.edu/colldev/cdpolicy.html
OUTCOME EXPECTED	
<p>After the completion of the course, the student will be able to conceptualize policy framework. Get acquainted with analyzing the policy and work out corrective solutions.</p>	

AEC 607	ADVANCED NATURAL RESOURCE ECONOMICS	1+1
WHY THIS COURSE?		
<p>Agriculture is concerned with human interaction with natural resources for producing and consuming basic human necessities. In the course of these activities humans exploit various natural resources often in ways that are not sustainable in the long run. In this context, the students of agricultural economics need a systematic understanding of problems facing natural resource exploitation and its relationship with the economy and society. Hence this course is designed to provide a systematic understanding of the resource dynamics, depletion and methods for optimal intertemporal allocation of scarce natural resources.</p>		
OBJECTIVE		
<p>This course explores how to apply principles of economics to identify the causes, consequences, and ways of dealing with natural resource problems. The primary objective is to develop students' skills in using economic concepts to analyze contemporary issues associated natural resource uses and policies. The major topics covered in this course include:</p> <ul style="list-style-type: none"> • Defining inter temporal (dynamic) economic efficiency and other criteria for evaluating natural resource use and policy. • Application of optimal control / dynamic programming methods to design optimal resource extraction policies over time. The resources covered include exhaustible mineral resources, renewable resources such as fisheries, forests, and water resources. • Examining sources of inefficiency in the exploration of natural resources. • Property rights issues in natural resource management and • Issues concerning the nexus between economic development, poverty and natural resource degradation. 		
THEORY		
Unit I: Dynamics of Natural Resources		
<p>Natural resources - Definition - characteristics and classification. Stock dynamics of renewable and non-renewable resources. Equation of motion for renewable and non-renewable resources.</p> <p>Fundamental equation of renewable resources.</p>		
Unit II: Efficiency in Natural Resource Use		

Growth curves of fishery and forest resources. The role of time preference in natural resource use. Simple two-period model of optimal use of renewable and non-renewable resources. Advanced models of optimal resource use – Static Vs. dynamic efficiency in natural resource use Applications of dynamic programming and optimal control.

Unit III: Natural Resource use in Agriculture

Economics of groundwater use - optimal extraction of groundwater. Analytical and numerical solutions for optimal inter-temporal allocation of natural resources. Optimal harvesting of single rotation and multiple rotation forests. Optimal management of fishery.

Unit IV: Open Access and Common Property Resource Management

Property rights in natural resources and their implication for conservation and management of natural resources. Management of common property natural resources – Institutional arrangements for conservation and management of common pool fishery, groundwater and forestry resource. Local and global commons.

Unit V: Natural Resource Scarcity, Resource Degradation, Resource Pricing and Valuation

Resource scarcity – Resource curse hypothesis - Natural resource degradation – Poverty and resource degradation – Natural resource accounting - Pricing and valuation of natural resources – Natural resources policy. Forestry policies – Irrigation water management policies.

PRACTICALS

Derivation of the fundamental equation of renewable resources-Estimation of growth curves and stock dynamics for fishery and forestry resources. Simple two period problem of optimal resource use – Numerical solution for simple two-period model of dynamic efficiency in natural resource extraction. Multi-period dynamic efficiency –Solving dynamic natural resource harvesting problems. Using analytical solution procedures for solving natural resource management problems – Optimal control.

LECTURE SCHEDULE

1	Natural resources - definition - characteristics and classification
2	Stock dynamics of non-renewable resources - Equation of motion for renewable - Hotelling’s Rule – Derivation and interpretation
3	Analysis of the impact of changes in interest rate, stock quantity, demand, and prices on extraction pattern of non-renewable resources
4	Stock dynamics of renewable -Equation of motion for renewable resources
5	Static Vs. dynamic efficiency in natural resource use – Steady state equilibrium
6	Derivation of Fundamental equation of renewable resources
7	Growth curves of fishery resources
8	Open access vs. private property equilibrium
9	Simple two-period model of optimal use of non-renewable resources

10	Simple two-period model of optimal use of renewable resources
11	Optimal inter temporal allocation of natural resources – Non-renewable resources.
12	Optimal harvesting of single rotation and multiple rotation forests and old-growth forests
13	Optimal management of fishery
14	Optimal extraction of groundwater
15	Economics of biodiversity
16	Role of property rights in natural resources and their implication for conservation and management of natural resources and management of common property resources
PRACTICAL SCHEDULE	
1	Mathematical modeling of natural resource problems
2	Estimation of growth curves and stock dynamics for fishery and forestry resources. Simple two period problem of optimal resource use
3	Numerical solution for simple two-period model of dynamic efficiency in natural resource extraction
4	Multi-period dynamic efficiency-Problem solving
5	Solving dynamic natural resource harvesting problems – Fisheries problem
6	Solving dynamic natural resource harvesting problems – Timber harvesting problem
7	Solving dynamic natural resource harvesting problems – groundwater extraction problem.
8	Solving dynamic natural resource harvesting problems – Mineral harvesting problem.
9	Using analytical solution procedures for solving natural resource management problems – Water allocation problem
10	Natural resource accounting – Problem solving
11	Analysis of water conservation and water allocation problems
12	Cooperative game theory problems in common pool natural resource management
13	Non-cooperative game theory problems in common pool natural resource management
14	Impact of wealth inequality on common pool natural resource management – Problems
15	Comparative analysis of open access, common property and private property equilibrium in natural resource exploitation
16	Natural resource valuation – Valuation techniques
17	Final practical examination
SUGGESTED READINGS	
1	Clark, C.W., Mathematical Bioeconomics: The Optimal Management of Renewable Resources” (New York: John wiley and Sons), 1976.
2	Fisher, A.C., Resource and Environmental Economics, (Cambridge: Cambridge University Press), 1981.
3	Chiang, Alpha C., Elements of Dynamic Optimization, (Illinois: Waveland Press), 1992.

4	Baland, J-M. and J.P. Platteau, Halting Degradation of Natural Resources: Is There a Role for Rural Communities? Oxford: Clarendon Press and FAO, 1996.
5	Carlson, G.A., J. Miranowski and D. Zilberman, Agricultural and Environmental Resource Economics, Oxford: Oxford University Press, 1998.
6	Conrad, J.M. and Clark, C.W. Natural Resource Economics: Notes and Problems (Cambridge: Cambridge University Press).
7	Prato, T. Natural Resource and Environmental Economics, Ames: Iowa State University Press, 1998.
8	Conrad, J.M., Resource Economics, Cambridge: Cambridge University Press, 1999.
9	Stern, T. Policy Instruments for Environmental and Natural Resource Management, (Washington, D.C.: Resources for the Future), 2003.
SUGGESTED WEBSITES	
1	www.rff.org
2	http://spot.colorado.edu/~kaplan/econ3535/econ3535.html , from where link can be established for eText at : chrome://epubreader/content/reader.xul?id=1
3	http://www.pearsonhighered.com/tietenberg/
4	www.env-econ.net/
5	http://personal.strath.ac.uk/r.perman/enviro7.htm
6	http://personal.strath.ac.uk/r.perman/EERclassnotes.htm
OUTCOME EXPECTED	
<p>The students will get a thorough and comprehensive exposure to natural resource problems, the issues confronting optimal management, resource scarcity and overexploitation problems. They will also be conversant with the optimal management of natural resources using optimal control models. The students will become capable of using EXCEL Solver for solving optimal control problems.</p>	

AEC 608	ENVIRONMENTAL ECONOMICS	1+1
WHY THIS COURSE?		
<p>Economics not only deals with transaction taking place between human beings within and across national boundaries. Each economic activity has a price to pay to the environment. The activity causes loss to the environment in various ways. Thus, as a student of economics it is necessary to work out the costs and returns in terms of losses to environment while carrying out these development/production activities.</p>		
OBJECTIVE		
<p>To understand the economic outcomes of environmental degradation. Make students proficient in decision making regarding environment protection, resource use, and conservation policy.</p>		
THEORY		
UNIT I : Overview of Environmental Economics		
<p>Environmental pollution as a consequence of market failure - Causes and consequences of market failure - Externalities - Public goods and externalities - Economics of pollution – Private vs. Social cost of environmental pollution – Property rights, environment and development – Theory of environmental policy.</p>		
UNIT II: Economic Assessment		
<p>Environmental cost benefit analysis - Non-market valuation of environmental resources (WTP / WTA) - Environment, market and social welfare.</p>		
UNIT III : Developmental Aspects		
<p>Economic growth and environmental cost - Growth oriented economic policies and their environmental impacts - Population and environmental quality - poverty and environmental degradation.</p>		
UNIT IV: Accounting, Policies and Regulation Environment		
<p>Ecology and environmental accounting - Environmental pollution with respect to water and air - Land and forest resources related environmental pollution - Coastal externalities - Urbanization and environment - Basic approaches to environmental policy (Tax, subsidy, pollution permits etc.) Green taxes.</p>		
UNIT V: Environmental Issues		
<p>Economics of global warming, climate change and emission trading - Environment, international trade and development.</p>		

PRACTICALS

Contemporary global environmental global environmental issues, movement, policies, programmes, laws and other regulatory mechanisms - Criteria for evaluating the environment related projects and review of Environmental Impact Assessment (EIA) techniques – Recreation demand models of environmental valuation - Contingent valuation techniques - Environmental Resource Accounting Techniques - Discussion on the techniques dealing with air pollution and review of case studies on air pollution and its impacts - forest environment and wild life conservation - Green GDP and Green house insurance - Practical considerations and comparison of instruments of environmental policy - Non-point source pollution control methodologies - Environment in macroeconomic modeling - Meta-analysis, economic valuation and environmental economics - Multi-criteria methods for quantitative, qualitative and fuzzy evaluation problems related to environment - Input output analysis, technology and the environment - Computable general equilibrium models for environmental economics and policy analysis

LECTURE SCHEDULE

1	Environmental pollution as a consequence of market failure
2	Causes and consequences of market failure- Property rights, CPR and open access resources
3	Externalities – Private good, Public goods, club goods and externalities
4	Economics of Environmental goods - Private vs. Social Benefits and Private vs. Social Costs
5	Environment and development - Theory of environmental policy- Coase Theorem and Environmental Kuznets Curve.
6	Environmental cost benefit analysis
7	Total Economic Valuation of Environmental goods
8	Revealed Preference methods and Stated Preference methods
9	Environment, market and social welfare
10	Link between Population, Poverty and environmental quality
11	Environmental pollution with respect to Land and Water
12	Coastal externalities - Urbanization and environment
13	Polluter Pay Principle-Pigouvian taxes, Green taxes, Tradable Pollution Permits
14	Economics of Climate Change
15	History of Climate Agreements and Climate Funding
16	Carbon Trading

PRACTICAL SCHEDULE

1	Contemporary global environmental issues, movement, policies, programmes, laws and other regulatory mechanisms
2	Criteria for evaluating the environment related projects and review of Environmental Impact Assessment (EIA) techniques

3	Contingent valuation techniques –WTP &WTA
4	Recreation demand models of environmental valuation
5	Review of case studies dealing with hedonic models
6	Environmental Resource Accounting Techniques
7	Case studies on Tradable pollution permits and carbon trading
8	Visit to problem sites to quantify the economic, environmental and ecological consequences of water pollution
9	Discussion on the techniques dealing with air pollution and review of case studies on air pollution and its impacts
10	Green GDP measurement
11	Practical considerations and comparison of instruments of environmental policy
12	Non-point source pollution control methodologies
13	Environment in macroeconomic modeling
14	Meta-analysis, economic valuation and environmental economics
15	Climate change impact assessment models
16	Case studies on carbon, water footprints estimation
17	Final practical examination
SUGGESTED READINGS	
1	Hackett SC. 2001. Environmental and Natural Resource Economics: Theory, Policy and the Sustainable Society. M.E. Sharpe, Armonk, NY.
2	Hartwick JM &Olewiler ND. 1998. The Economics of Natural Resource Use. 2 nd Ed Addison-Wesley Educational Publ.
3	Kerr JM, Marothia DK, Katar Singh, Ramasamy C & Bentley WR. 1997. Natural Resource Economics: Theory and Applications in India. Oxford & IBH.
4	Pearce DW & Turner K. 1990. Economics of Natural Resources and the Environment. John Hopkins Univ. Press.
5	Prato T. 1998. Natural Resource and Environmental Economics. Iowa State Univ. Press. Sengupta R. 2000. Ecology and Economy, an Indian Perspective. Oxford Univ. Press.
6	Tietenberg T. 2003. Environment and Natural Resource Economics. 6th Ed. Addison Wesley.
7	Bromley, W. Daniel, “The Hand Book of Environmental Economics” (Madison: Black Well Publications), 2005.
8	Nick Hanley, Jason F. Shogran and Ben White, “Environmental Economics in Theory and Practice”, (Delhi : Mc Millan, India),2e. 2009.
9	Timothy C. Haab and Kenneth E. Mc Connell, “Valuing Environmental and Natural Resources – The econometrics of Non market valuation” (Edward Elgar Publishing Limited, UK), 2003.
10	Dixon, John A., Louise Fallon Scura, Richard A Carpenter and Paul B. Sherman, “Economic Analysis of Environmental Impacts of development projects” (London : Earth scan Publications Ltd.), 2013

11	Kenry turner, David prance, Ian Batsman and Johns Hopkins “Environmental Economics: An Elementary Introduction” 2013
12	The Economics of the Environment and Natural Resources Author(s):R. Quentin Grafton, Wiktor Adamowicz, Diane Dupont, Harry Nelson, Robert J. Hill, Steven Renzetti
SUGGESTED WEBSITES	
1	https://www.env-econ.net/recommended_reading/
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470755464
3	https://www.worldscientific.com/doi/suppl/10.1142/6980/suppl_file/6980_chap01.pdf
4	https://www.worldscientific.com/doi/suppl/10.1142/6980/suppl_file/6980_chap02.pdf
5	https://www.worldscientific.com/doi/suppl/10.1142/6980/suppl_file/6980_chap08.pdf
OUTCOME EXPECTED	
After the successful completion of the course, the student will be able to understand the concept of pollution and externalities caused by economic activity. Work out the economics of productions activities in terms of losses to environment. Learn about accounting of environmental costs and other issues related.	

AEC 609	INTERNATIONAL TRADE THEORIES AND POLICY APPLICATIONS	1+1
WHY THIS COURSE?		
In the modern world, there is trade across national boundaries and one economy has effect on the other. Getting familiar with the trade theories and its policy applications would result in better understanding of the national economy and its influence upon the world trade.		
OBJECTIVE		
The goal is to provide the students with background experience and tools for future analysis in international economic problems and trade policies.		
THEORY		
Unit I: International Trade Theories - An Introduction		
Why do Nations Trade: Classical Theory - Ricardian Model of Trade - Factor Price Equalization Theorem - Stolper – Samuelson Theorem - The Rybczynski Theorem - The Heckscher Ohlin Theorem – New Trade Theory (NTT) – Contributions by Paul Krugman.		
Unit II: Trade Equilibrium		
Walras's Law and Trade Equilibrium - Factor Price and Factor Proportions of the Firm in Open Economy – Scitovsky's Social Indifference Curves – Factor Mobility – Equilibrium under NTT.		
Unit III : Barriers to Trade		
Trade Indifference Curves - Economics of Scale, Imperfect Competition and Trade- International Trade in the presence of product differentiation- Theory of Protection: Tariffs and Other Barriers to Trade – Arguments for Protection – Regional Blocks – FTA/ RTA.		
Unit IV: Trade Dynamics		
Sources of Economic Growth - Standard Model of Trade and Economic Growth - Kaldors Theory of Export Led Growth - Prebisch and Singer Effects - Terms of Trade – Trade and income distribution.		
Unit V: Trade Policy Applications		
Markets for foreign exchange - Exchange rates – Balance of Payment, FDI and Exchange Rate relationships – Prices adjustment and exchange rate determination - fixed/ flexible exchange rate regime – Recent events in IMF relations. - Agri. Export Policy of India.		
PRACTICALS		
Welfare analysis of trade – Direction and Pattern of trade - Gravity Models - Introduction to partial and general equilibrium models - Analyzing the effect of trade policies both under Partial and General Equilibrium cases-- Empirical estimation of Partial and General Equilibrium Models of Trade - Application of Multi-market and CGE Models to trade - Standard Model of Trade and Economic Growth - Exchange Rate determination under fixed / flexible exchange rate regime. RTA/ FTA analysis.		

LECTURE SCHEDULE

1	Classical Theory of trade revisited – causes for nations to trade
2	Welfare implications under different trade models
3	Contributions by New Trade Theory – scope and implications
4	General equilibrium analysis under open & closed economy
5	Factor mobility and international trade
6	Imperfect competition & returns to scale – trade implications
7	Trade protective measures – impact of tariff measures
8	Trade protective measures – impact of non-tariff measures
9	Trade blocks – impact of RTA/ FTA – case studies
10	Trade creation & trade diversion – direction of trade
11	Terms of trade & income distribution
12	Models of Trade & economic growth - arguments
13	Demand & supply of foreign exchange
14	Balance of Payments, Foreign Direct Investment & exchange rate relationships
15	Trends in IMF relations
16	Impact of WTO agreements

PRACTICAL SCHEDULE

1	Welfare analysis under open & closed economy
2	Direction of trade – Constant Market Share (CMS) approach
3	Direction of trade – Gravity trade models
4	Tariff implications on small country assumptions
5	Tariff implications on large country assumptions
6	Welfare implications under classical trade models
7	Welfare implications under new trade models
8	Effect of trade policies – partial equilibrium setting – I
9	Effect of trade policies – partial equilibrium setting – II
10	Effect of trade policies – general equilibrium setting – I
11	Effect of trade policies – general equilibrium setting – II
12	Terms of trade & income estimation
13	Exchange rate determination – fixed regime
14	Exchange rate determination – flexible regime
15	Empirical estimation of FDI, BoP & exchange rate relationships
16	Empirical estimation of RTA/FTA
17	Final practical examination

SUGGESTED READINGS

1	Dennis R. Apple yard and Alfred J. Field Jr. 1995, International Economics – Trade, Theory and Policy, (Chicago: Irwin).
2	James P.Houck, 1992. Elements of Agricultural Trade Policies, (Wave Land Press, Inc, Illinois)
3	Miltiades Chacholiades, 1985. International Trade Theory and Policy, (McGraw-Hill Book Company, London).
4	Feenstra C.Robert.2006. Advanced International Trade: Theory and Evidences. Princeton, NJ. Princeton University Press.
5	Krugman, Paul and Maurice Obstfeld. 2003. International Economics: Theory and Policy. 6 th Edition. Boston,MA: Addison Wesley.
SUGGESTED WEBSITES	
1	http://internationalecon.com/Trade/Tch5/Tch5.php
2	http://ocw.mit.edu/courses/economics/14-581-international-economics-i-spring-2013/
3	http://catalog.flatworldknowledge.com/catalog/editions/suranovic-international-economics-theory-and-policy-1-0

OUTCOME EXPECTED

After successful completion of the course, the student will be able to understand how trade theories influence the existing pattern of international trade, factor use and trade competitiveness and associated consequences.
