

# PONDICHERRY UNIVERSITY



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

**Ph.D. AGRICULTURAL ECONOMICS  
REGULATIONS AND CURRICULUM  
(Effective from 2022 – 23)**

**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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IN  
AGRICULTURAL ECONOMICS**

**11.03.2022**

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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 2022**

### **01. SYSTEM OF EDUCATION**

1.1 The rules and regulations provided herein shall govern Doctoral degree programme (Ph.D. in Agriculture) 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. SHORT TITLE AND COMMENCEMENT**

These regulations shall be called “***PAJANCOA&RI Doctoral degree Academic Rules and Regulations 2022.***” They shall come into force from the academic year 2022-23 and will be applicable to the students admitted from the academic year 2022-23.

### **03. DEFINITIONS**

3.1 ‘**University**’ means the Pondicherry University, a Central University, Puducherry.

3.2 ‘**College**’ means the Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA&RI), Karaikal

3.3 ‘**Department**’ means a department in the college as notified by the competent authority/Dean

3.4 ‘**Vice-Chancellor**’ means the Vice-Chancellor of the Pondicherry University

3.5 ‘**Registrar**’ means the Registrar of the Pondicherry University

3.6 ‘**Dean**’ means the Dean of Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA&RI), Karaikal

3.7 ‘**Head of the Department (HOD)**’ means the head of the academic department of PAJANCOA&RI as notified by the competent authority/Dean.

3.8 ‘**Teacher**’ means a teacher of PAJANCOA&RI.

3.9 ‘**PG Coordinator**’ means a teacher of the department who has been nominated by the Head of the Department with the approval of Dean to coordinate the Doctoral degree programme in the department. The coordinator looks after registration, time table preparation, regulation of credit load, preparation of class grade charts, maintenance of individual student’s files, etc.

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

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

3.12 ‘**Curriculum**’ is a group of courses and other specified requirements for the fulfilment of the Doctoral degree programme.

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

3.14 **'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.

3.15 **'Major Course'** means the subject (Department/discipline) in which the student takes admission.

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

3.17 **'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.

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

*Explanation:* A 1+1 course (2 credits) means 1 hour theory and 3 hours practical per week.

A 0+1 course (1 credit) means 3 hours practical per week

A 1+0 course (1 credit) means 1 hour theory per week

3.19 **'Credit Load'** of a student during a semester is the total number of credits of all the courses a student registers during that particular semester.

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

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

3.22 **'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.

3.24 **'Reappearance examination'** is an examination written for the failed courses by a student without undergoing regular class / course.

3.25 **'Class Grade Chart'** means a grade chart prepared by the Controller of Examinations indicating marks obtained by a student belonging to a particular class. The format of Class Grade Chart is furnished in **Annexure-1**.

3.26 **'Report Card'** means a report of grades, credit points and OGPA obtained by a student in a particular semester. The format of Report Card is furnished in **Annexure-2**.

3.27 **'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-3**.

## 04. DOCTORAL PROGRAMMES

The Doctoral programme offered in the College is as follows:

### 4.1 DOCTORAL OF PHILOSOPHY [Ph.D.]

Ph.D. Agricultural Economics.

## 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 universities recognized by UGC/ICAR.

ii. Candidate who has undergone the course credit system with an OGPA of 3.00 out of 4.00 or 7.00 out of 10.00 or 70 percent aggregate alone is eligible to apply for Doctoral degree programme in this Institute. However, this will not apply to SC/ST candidates/State Department nominees/ In-service candidates. A pass in the concerned degree is the eligibility criteria for SC/ST candidates to apply.

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

### **Discipline Requirement for Doctoral Degree**

Sl. No.	Doctoral degree programs and eligibility
1.	M.Sc.(Ag.) in Agricultural Economics

#### **5.2. Full time program:**

All full time research scholars shall undergo course work for two semesters as prescribed by the Department. Duration of the program will be for **three** years.

#### **5.3. Part Time Program:**

The part time program will be offered to the in-service candidates / Research Scholars of externally funded research projects. The candidates of this University should route their application through HOD and Dean. The duration of the program will be of **4 years**. The in-service candidates / Research Scholars of externally funded research projects will be permitted to register the Ph.D. program by course work and they have to undergo one year course work by utilizing any eligible leave for that period.

#### **5.4. External Registration**

The duration of the program will be of 4 years. The following are the additional conditions for registration for a Ph.D. program under external category

1. The candidates must register under a chairman/guide who is a member of the Teaching Faculty of this Department.
2. The candidate should be working as Asst. Professor/Associate Professor/Professor or in equivalent positions on permanent basis in a recognized college/Banks/Institutions where facilities for carrying out research work are available or working as research assistants in private or government institutions having research and development facilities and who fulfill the eligibility conditions.
3. The candidate should have a recognized co-guide in parent department of the organization. The co-guide may be from other colleges / organization located from the same place if such persons are not available in the parental organizations.
4. The candidate shall undergo the course of the required credits during 1 year of the program in PAJANCOA&RI Campus. He / She shall carryout the research at his / her parental organization for the entire period of the program.

5. NOC (No Objection Certificate) is to be produced from the employer of the institution /Organization where he / she is working and attached along with the application ii. Co-guide acceptance letter should be also be enclosed with the application form.
6. External scholars are required to mark attendance maintained by the chairman/co-guide for a minimum compulsory period of 30 days for annum during their period of research.
7. External scholars are requested to visit PAJANCOA & RI campus and discuss with the Advisory Committee and also to visit the campus at the end of every semester on a specified date to appear before the Advisory Committee for review of the progress of their research work.
8. The attendance certificate signed by the chairman/co-guide shall be sent to the Dean through the respective Head of the Department at the time of submission of thesis.

### **5.5. 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](http://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.

### **5.6. Method of selection:**

- i. Candidates shall be required to be present on the specified date for a written test at their own expenses. If selected, they should come prepared to pay fees and get admitted immediately.
- ii. The students will be ranked based on total marks scored by them in the categories mentioned below

### **Category Weightage of marks (%)**

OGPA in Master's degree programme	60
Entrance	30
Awards/Medals obtained	5
Service/Publications	5
<b>Total</b>	<b>100</b>

- iii. Written test with objective type (multiple choices) questions in the specific subject will be of one hour duration.
- iv. All the original certificates for which attested copies have been enclosed with the application must be produced for verification at the time of written test. Candidates who fail to produce original certificates will not be allowed to write entrance test.
- vi. **Seats are reserved for candidates belonging to scheduled Castes/Scheduled Tribes/Other Backward Classes as per the norms of Government of Puducherry.**
- vii. One seat of the total sanctioned strength, is reserved for the in-service candidate of Government of Puducherry.

### **5.7. Admission procedure:**

- i. The admission is based on the merit category of the candidates and availability of vacancies at the time of counselling.
- ii. All admissions made by this Institute are provisional and subject to the approval of the University.
- iii. The candidates who have offered admission should report to the college on or before the due date mentioned failing which their right of admission is forfeited.

## **06. FEE STRUCTURE**

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

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

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

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

6.5 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 re-registration fee.

## **07. 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.

## **08. RESIDENTIAL REQUIREMENT**

8.1 The minimum residential requirement for Doctoral degree shall be three academic years (six semesters) within the maximum period of four academic years (eight semesters) from the date of admission.

### **8.2 Extension of residential requirement:**

- i. If any student fails to complete the programme within the maximum time limit, the Dean can decide and give an extension for a period of one year (two semesters) over and above the maximum period of three years for Doctoral degree.
- ii. Academic Council may consider extension of another one year (two semesters) based on the merit of individual case. The Academic Council shall not have the powers to grant further extension of time.
- iii. Students who fail to complete even after two years of extension may seek readmission on their own accord.
- iv. For getting extension of time beyond the normal period, the student shall apply in the proforma prescribed by the Dean.



## 09. REGISTRATION

9.1 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 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.

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

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

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

### 9.5 **Late registration:**

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

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

### 9.6 **Registration cards:**

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

ii. The Chairman, PG coordinator and Head of the Department are responsible to furnish the registration particulars of the students with their signature in the Registration card to the Dean.

iii. The Dean shall approve the registration cards.

iv. The approved quadruplicate 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

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

## 10. DISCONTINUANCE AND READMISSION

10.1 Students who discontinue their studies before completing the degree with written permission from the Dean shall be re-admitted to the degree programme, provided that the student should have completed the course work and qualifying exam before such discontinuance. However the period of such discontinuance should not exceed four semesters for Doctoral degree.

10.2 i. After completion of course work and qualifying examination a student is eligible to discontinue temporarily his/her research programme only once within 3 academic years (6 semesters) for Doctoral programme.

ii. For every semester the student has to obtain prior written permission from Dean for temporary discontinuation. If the discontinuation period exceeds two semesters the student has to forego the research credits already registered and register afresh with revised programme.

iii. In the case of field experiments or laboratory experiments in which continuity is essential for research and if a student temporarily discontinues in the middle without completing the

experiments, then the entire experiment should be repeated even if the discontinuation period does not exceed two semesters.

10.3 The students who discontinue the course without prior permission of the Dean shall not be allowed to re-register and may have to seek readmission on their own accord.

10.4 Dean can permit the students to temporarily discontinue the programme before completion of course work and qualifying exam based on genuine medical grounds only as special case.

10.5 i. A Doctoral student joining the studies after discontinuation should pay the fees of the existing semester in which he/she joins instead of old rates of the fees of discontinued semesters.

ii. A penal charge equal to tuition fees will be collected from Doctoral students for each discontinued semester.

## **11. ADVISORY COMMITTEE**

11.1 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.

### **11.2 Chairman/Guide:**

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

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

iii. The appointment of chairman 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. A Chairman of the Advisory Committee who is on transfer can continue to guide a student provided the student should have completed 75% of the total credits for Ph.D. on the day of transfer.

vii. Normally there should not be more than four Doctoral students at any one time under a guide.

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

### **11.3 Members:**

i. The advisory committee shall comprise of a chairman and three members. One member will be from the concerned department and other members from the related field of thesis research in other departments.

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

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

### **11.4 Formation of advisory committee:**

i. For Doctoral Programme the advisory Committee chairman and members will be in the cadre of Professors and Associate Professors.

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

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

#### **11.5 Changes in advisory committee:**

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

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

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

#### **11.6 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 Chairman of advisory committee, respective Heads of Departments should act as Co-chairman with prior permission of Dean.

#### **11.7 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.

### **12. 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 the commencement of the mid semester examination during the first semester.

### **13. 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.

## 14. CREDIT REQUIREMENTS

14.1 **Minimum credit requirement:** A Doctoral student should complete a minimum of 100 credits as detailed below for award of the degree.

### Credit Requirements

Details	Doctoral Program-Credits
<b>Course Work</b>	
Major Subjects	12
Minor Subjects	06
Supporting Subjects	05
Seminar-2 nos. each 0+1 credit	02
Research	75
<b>Total Credits</b>	<b>100</b>

14.2 **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 should not exceed **20 credits**.

14.3 **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.

#### 14.4 Extra Credits:

- Over and above the prescribed minimum credit requirements, extra course credits up to a maximum of six can be registered for Doctoral programme.
- The extra credits registered will be accounted for calculation of OGPA.

## 15. ATTENDANCE REQUIREMENTS

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

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

#### 15.3 Calculation of Attendance

##### a) THEORY:

- 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.
- The mid-semester examinations are normally conducted during class hours.
- The attendance for mid semester examination shall be counted as a theory class for calculating attendance.

## **b) PRACTICAL:**

i. Number of practical classes conducted for a course from the first instructional day as per the time table to the last practical class of that semester is to be construed as the total number of practical classes conducted by the course teacher.

ii. The final practical examination will be conducted after the completion of 96 working days as per the schedule.

iii. The attendance for practical examination shall not be counted for calculating the attendance for practical.

15.4 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.

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

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

## **16. EVALUATION OF STUDENT'S PERFORMANCE**

### **16.1 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 70:30 respectively.

ii. The student should secure a minimum of 50 per cent marks in theory as well as in practical to secure a pass.

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

<b>Examination</b>	<b>Courses with theory &amp; practical</b>	<b>Courses with only theory</b>	<b>Courses with only practical</b>
Mid-semester Examination	30	30	30
Final Theory Examination	40	60	-
Final Practical Examination	20	-	60
Term Paper	10	10	10
<b>TOTAL</b>	<b>100</b>	<b>100</b>	<b>100</b>

### **16.2 Mid Semester Examination:**

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

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

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

- iv. The Head of the Department with the help of the concerned PG coordinator shall prepare and announce the schedule of mid-semester examinations.
- v. The mid-semester examinations shall be conducted from the 56<sup>th</sup> working day of the semester.
- vi. The mid-semester examination shall be conducted and evaluated internally by the concerned course teacher(s).
- vii. The mid-semester examination mark list should be sent by the course teacher to the office of the Dean within ten days from the date of conduct of mid semester examination.

### **16.3 Missing Examination:**

- i. Missing examination shall be permitted only for mid-semester examination in deserving cases on the recommendation of the course teacher/Chairman and Head of the department and on prior approval by the Dean.
- ii. The missing tests are not allowed for final theory and final practical examinations.
- iii. The student shall write, in advance, to the Dean through the Chairman, Ph.D. coordinator and Head of the Department stating the reason for missing the mid semester examination(s). Based on the recommendation of the Chairman, Ph.D. coordinator and the Head of the Department the Dean shall permit the student for missing the mid-semester examination(s).
- iv. A student missing mid-semester examination(s) with prior approval of the Dean shall be permitted to take up missing examination of the particular course, subject to payment of the prescribed missing examination fee for each missing mid semester examination.
- v. Students deputed for official programmes of the College/University are exempted from paying the fee for missing test.
- vi. Such missing examinations should be completed outside regular class hours within 15 working days after the respective examinations.
- vii. Attendance will not be given for taking up missing examinations.

### **16.4 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 two and half hours for courses with theory and practical (40 marks) or three hours for courses with only theory (60 marks).
- iii. The final theory examinations shall be conducted and evaluated externally by the University. There will be two valuations (one internal examiner and one external examiner). If deviation between two valuation is more than 15 per cent of the max. marks of the theory exam, third valuation will be done. The average marks of the nearest two valuations will be taken as the mark scored by the candidate.
- 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.

### **16.5 Postponement of Final Theory Examination:**

- i. 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.
- ii. The Controller of Examinations can postpone the final theory examination(s) on account of a natural calamity such as heavy rain, cyclone, earth quake, tsunami, etc. The examinations that fall on the dates of such natural calamities shall be postponed to the dates after the last examination as per the original examination schedule.

### **16.6 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. For conducting final practical examination in each course, an *external examiner* (faculty of the Department other than the course teacher) shall be nominated by the Head of the Department and the course teacher will be the *internal examiner*.
- v. In the event of external / internal examiner nominated for practical examination could not conduct the examination, then the Head of the Department shall nominate an alternative examiner to conduct practical examination.
- vi. The duration of final practical examination shall be three hours.
- vii. The practical examinations shall be jointly conducted by the internal and external examiners with mutual co-operation.
- viii. They shall evaluate the candidates appearing at the examination according to their performance and the mark sheets so prepared shall be signed by both the examiners.
- ix. The practical examination marks should be communicated to the Dean within ten days after the conduct of respective final practical examinations.

### **16.7 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 as and when conducted with the permission of University.
- 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 (Mid semester marks and 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.

### **16.8 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.

16.9 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.

### **16.10 Hall tickets:**

- i. The students shall be issued with separate hall tickets for writing their mid semester examinations and 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.

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

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

E - INCOMPLETE (Lack of 80 % Attendance)

F - FAILED

RR - RE-REGISTRATION

RE - RE- EXAMINATION

EE - INCOMPLETE FOR REASONS OTHER THAN ATTENDANCE

**16.12 Question paper pattern for theory examinations:** The question paper pattern for theory examinations is indicated below:

Part	Type of question	Number of questions	Number of questions to be answered	Mark per question	Total marks
<b>Mid-semester Examination (30 Marks &amp; 1 hour duration)</b>					
A	Objective*	30	30	0.5	15
B	Definitions/Concepts	18	15	1.0	15
<b>TOTAL</b>					<b>30</b>
<b>Final Theory Examination for courses with theory and practical (1+1 or 2+1 courses) (40 Marks &amp; 2.5 hours duration)</b>					
A	Definitions/Concepts	12	10	1.0	10
B	Paragraph answers	7	5	3.0	15
C	Essay type answers	5	3	5.0	15
<b>TOTAL</b>					<b>40</b>
<b>Final Theory Examination for courses with only theory (1+0 or 2+0 courses) 60 Marks &amp; 3 hours duration)</b>					
A	Definitions/Concepts	18	15	1.0	15
B	Paragraph answers	7	5	3.0	15
C	Essay type answers	8	6	5.0	30
<b>TOTAL</b>					<b>60</b>

\* Questions may be Fill-up the blanks, Choose the best option, True / False or Match the following type



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

Details	Courses with Theory and Practical	Courses with only Practical
Practical Field work / Lab Work / Written exam	20	60
Term Paper	10	10
<b>Total</b>	<b>30</b>	<b>70</b>

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

**16.14 Term Paper:**

- Submission of a term paper by the students is a must.
- The term paper topics shall be assigned by the course teacher. Term papers should cover a wide range of subjects within the course limits.
- The term paper shall be evaluated by the course teacher.

**16.15 Return of valued answer papers:**

- The valued answer papers of mid-semester and final 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.
- The answer paper should be retained by the course teacher for six months and then disposed off.
- Evaluated final theory papers have to be retained upto six months by the concerned course teacher after the conduct of examination and then disposed off.
- The same is applicable to arrear examination also.

**17. COMPREHENSIVE QUALIFYING EXAMINATION**

- 17.1 i. Only those Doctoral students who successfully completed the comprehensive qualifying examination will be admitted to candidacy of the degree.
- The qualifying examination consists of written and oral examination and the students should be allowed to appear in the examination only after completion of 80% course work.
  - The qualifying examination shall be conducted only in the major courses as per the norms given below

Major Courses - One paper  
Question paper setting - External  
Evaluation of answer book - External  
Qualifying marks - 60%  
Viva Voce - External  
Grading - Satisfactory/Unsatisfactory

**17.2 Selection of examiner:**

- The Head of the concerned Ph.D. Department shall send a panel of three examiners for conducting the qualifying examination (**Form 4**).
- The Controller of Examinations, on the recommendation of the Dean, shall nominate the external member from the panel for conducting qualifying examination of all the students of the department.

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.

### **17.3 Written examination:**

- i. Normally the qualifying examination shall be completed before the end of fifth semester of the Doctoral programme.
- ii. The Dean will conduct the qualifying written examination by getting question papers from appointed external examiner(s).
- iii. The written examination will be conducted for major courses only.
- iv. The question paper for the written examination will 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
<b>TOTAL</b>					<b>100</b>

### **17.4 Oral (Viva-voce) examination:**

- i. The advisory committee shall conduct the oral examination with one external member who shall be a specialist in the subject from outside the University.
- ii. The Controller of Examinations, on the recommendation of the Dean, shall nominate the external member as described in 17.2 ii.

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

### **17.6 Communication of results of qualifying examination:**

- i. The chairman of the advisory committee shall act as chairman for the examination committee.
- ii. The chairman of the advisory committee shall be responsible for communicating the results of the examination to the Controller of Examinations in the prescribed format (**Form 5**).

### **17.7 Failure/absence in qualifying examination:**

- i. A student is permitted to write the qualifying examination only three times including the regular attempt.
- ii. When a student fails or absents for the qualifying examination, he/she may apply again for permission to appear for re-examination to the Dean with the recommendation of the chairman of the advisory committee and Head of the Department.
- iii. A student who applies for re-examination should attend written examination and viva-voce after paying the necessary re-examination fee.
- iv. Re-examination shall not take place earlier than three months after the previous qualifying examination and it will be conducted by the advisory committee as previously indicated.

- 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 should not be evaluated unless he/she successfully completes the qualifying examination.

## 18. CREDIT SEMINAR

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

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

### 18.3 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 Chairman at the beginning of the semester in which he/she registers seminar credits and the progress made by the student should be monitored.

### 18.4 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 Chairman and the other to the department.
- iv. The performance of the student in the credit seminar has to be evaluated for 100 marks by three faculty members of the Department. 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
<b>TOTAL</b>		<b>100</b>

18.5 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.

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

## 19. THESIS RESEARCH

### 19.1. 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 potentialities for conducting research and to train him in research.
- iv. The thesis shall be on a topic falling within the field of the major specialization and shall be the result of the student's own work.
- v. A certificate to this effect duly endorsed by the chairman of the Advisory Committee shall accompany the thesis.

### 19.2 Research Colloquium:

- i. The research proposal has to be presented by the student in a colloquium organized by the Head of the department to get the opinion/ suggestions of the scientists of the concerned/other departments for improving it.
- ii. Three copies of the research proposal in the prescribed format (**Form 3**) should be sent to the Dean through the Head of the department for approval before the end of the semester in which the student has registered research credits for the first time or before taking up the field / laboratory experiments whichever is earlier.

### 19.3 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 research credits in the subsequent semester. If the student is awarded 'NOT SATISFACTORY' he/she has to reregister the same research credits in the subsequent semester.
  - b. **SITUATION II:** The student has not secured the minimum attendance of 80 percent.

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,

1. Failure of crop

2. Non-incidence of pests or disease or lack of such necessary experimental conditions.

3. Non-availability of treatment materials like planting materials chemicals, etc.

4. Any other impeding / unfavourable situation for satisfying the advisory committee. Under the said situations (II & III) Grade 'E' should be awarded. The student has to re – register the same research credits for which 'E' grade was awarded in the following semester with prior permission from Dean. In the remarks column of the registration card, 'second time' has to be mentioned and until the completion of reregistered credits, the student should not be allowed to register for fresh research credits. In the class grade chart, it should be mentioned that 'E' grade was awarded due to 'lack of attendance' or 'want of favourable experimental conditions'.

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 in the class grade chart the 'second time' should be mentioned.

e. **SITUATION V:** If a student secures 'F' grade in course work and cannot complete qualifying examination till the end of final semester/grace period, 'E' grade should be awarded for final block of research credits registered in final semester. He/she has to re-register the same block of research credits in the next semester and attend the qualifying exam when conducted.

**19.4 Re-registration of research credits:** Students have to obtain prior permission of the Dean for reregistering the research credits. However, the Dean can permit the registration of research credit only three times. Permission for registration beyond third time and upto  $n+n+1$  years shall be given by the academic council. In case a student fails to complete the degree programme within the maximum duration of  $n+n+1$  years, his/her admission shall stand cancelled. The **Proforma 7** is to be filled for obtaining permission for re-registration of research credits.

## 20. SUBMISSION OF THESIS

20.1 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-5**.

ii. If a Doctoral student has completed the thesis before the closure of the final semester, the chairman can convene the advisory committee meeting and take decision on the submission of the thesis provided the student satisfies 80 per cent attendance requirement.

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

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

### 20.2 Grace period:

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

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.

**20.3 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.

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

- **It is mandatory to publish minimum two research articles from the Doctoral thesis work.**
- Publication of two research articles should be made with **NAAS rating (more than 6.0 for Biological Sciences/Engineering division and more than 4.5 for social sciences)**. However, the journal should not be listed in the UGC predatory list. The chairperson can also encourage the scholars to publish in high impact journals (Thompson Reuters).
- During thesis submission (while sending to external examiners), student should submit at least one published article and acceptance letter along with manuscript for the second article.
- At the time of result declaration student should submit a copy of two published articles for issuing provisional degree certificate.

## **21. EVALUATION OF THESIS**

**21.1** The thesis submitted in partial fulfillment 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.

**21.2** 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.

**21.3** An oral examination (public defense) 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 defense for doctoral students shall be conducted by the Chairman of the advisory committee only on the working days (not on Saturday) 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 the Directorate and it shall be approved by the Dean. In addition the proctor has to sign in the public defense report. The Chairman 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 defense.

**21.4** The aims of the Ph.D thesis defense 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 defense given an impression about the candidate's ability in academic debate.

21.5 The chairman 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.

21.6 The result declaration proposal will be sent by the Dean to the Registrar through the Controller of Examinations.

21.7 i. In case of difference of opinion on the acceptability of thesis for the award, the Dean 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.

## **22. REVISION OF THESIS**

22.1 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.

22.2 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**)

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

## **23. FAILURE TO APPEAR FOR FINAL VIVA-VOCE/NON SUBMISSION OF THESIS AFTER VIVA-VOCE**

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

23.1 The re-viva must be completed within **four years from the date of** first registration for Doctoral programmes. The prescribed penalty/fine (or) actual re-viva voce cost, whichever is higher must be charged to the candidate.

23.2. When a student exceeded the residential requirement of four years for Doctoral programmes and later obtained the approval of academic council for late submission but fails to appear for final viva-voce, the student must complete the re-viva voce within six calendar months from the date of communication of appointment of external examiner for conducting final viva-voce to the chairman by Dean. However, the penalty as indicated in Rule 23.1 has to be paid.

23.3 After successful completion of thesis final viva voce if a student fails to submit the corrected version of the thesis within 15 days he/she will be levied a fine at the time of sending the proposal for result declaration.

## **24. RESULT NOTIFICATION**

24.1 After the completion of each semester, the student shall be given the statement of marks by the Controller of Examinations.

24.2 The transcript card will be prepared by Controller of Examinations.

24.3 The result declaration proposal will be sent by the Dean to the Registrar through Controller of Examinations.

## **25. RESEARCH ASSISTANTSHIP (Student SRF/JRF):**

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

25.2 The Ph.D. coordinator of the concerned department will be an additional member of the committee.

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

25.4 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.

## **26. MALPRACTICES IN EXAMINATION AND MISCONDUCT OF STUDENTS**

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

26.2 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.

26.3 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 mid-semester examination(s) will be debarred from the college for the remaining period of semester and deemed to have failed in all the courses during the semester.

ii. 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.

iii. 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 **26.3 (i)** and **26.3 (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.

iv. 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 **26.3 (i)**, **26.3 (ii)** and **26.3 (iii)** to the Registrar immediately.

**26.4 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.

**26.5 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.

## **27. RECOGNITION OF DOCTORAL TEACHERS**

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

27.2 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 extraordinary circumstances demand for offering other courses.

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

**27.4 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 Ph.D. degree with 3 years of active experience in the concerned field (or) Persons having a Doctoral degree with five years of active experience in the field

**27.5 Guides for Doctoral programme:** PG Teachers after handling three PG courses are eligible to guide Ph.D. students.

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

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

## **28. GUIDELINES FOR HEADS OF THE DEPARTMENTS IN MONITORING PROGRESS OF DOCTORAL STUDENTS**

**28.1. 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:

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

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

28.3 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.

28.4 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 <b>(Form 1)</b>	Within one month of the commencement of first semester
2.	Plan of course work <b>(Form 2)</b>	Before the commencement of mid semester examination in the first semester
3.	Programme of research work <b>(Form 3)</b>	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 <b>(Form 4)</b>	Two months before the completion of the course work.
5.	Qualifying examination result <b>(Form 5)</b>	The next day of the examination
6.	Panel of external examiners for thesis evaluation <b>(Form 6)</b>	Three months before the probable date of submission of thesis
7.	Final viva-voce result <b>(Form 7)</b>	The next day of the examination
8.	Certificate for having carried out the suggestions of the external examiner and advisory committee <b>(Form 8)</b>	After receiving the evaluation report from the external examiner.

28.5 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.

## **29. APPROVAL OF FINAL RESULTS, AWARD OF DEGREE AND ISSUE OF PROVISIONAL CERTIFICATES AND TRANSCRIPTS**

### **29.1 Award of Degree:**

- i. The Degree for Ph.D. degree programme shall be awarded during Annual Convocation conducted in the College under the seal of 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.

**29.2 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.

**29.3 Class Ranking:** In calculation of Class equivalent for OGPA the following classification will be adopted.

<b>OGPA</b>	<b>Class</b>
9.00 and above	First class with Distinction
8.00 to 8.99	First class
7.00 to 7.99	Second Class

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

### **29.5 Approval of final results for Certificates and Transcripts:**

- i. The Vice-Chancellor shall approve the final results.
- ii. The Registrar shall issue Provisional Certificates, Transcripts and Migration Certificates to the Candidates.
- iii. 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 and countersigned by the Registrar.
- iv. 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.

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

**29.7** 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.

**29.8 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.

### 30. REMOVAL OF DIFFICULTIES:

30.1 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.

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

30.3 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.	Missing mid-semester examination fee (per course)	1000
3.	Re-registration fee with juniors	1000
4.	Duplicate hall ticket fee	200
5.	Fee for Transfer Certificate and Conduct Certificate	200
6.	Re-examination fee for Qualifying Exam	5000
7.	Fee for availing grace period for submission of thesis a) Up to one month b) Up to three months	1000 2500
8.	Penalty for re-viva voce examination for thesis	5000
9.	Fee for late submission of thesis after final viva-voce	5000
10.	Examination fee (per course) *	
11.	Improvement/ Re-examination fee (per course) *	
12.	Revaluation fee (per course) *	
13.	Re-totaling fee (per course) *	
14.	Fee for Provisional Degree Certificate *	
15.	Fee for Transcript Card *	
16.	Fee for Degree Certificate *	
17.	Fee for Migration Certificate *	

\* As fixed by the University from time to time

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.	Chairman	:		
2.	Co-Guide (If any)	:		
3.	Member	1.		
		2.		
		3.		
3.	Additional member	:		
4.	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, KARAIKAL – 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 :

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

6. Reasons for change :

**Signature of the student**

**Chairman of the Advisory Committee**

**PG Coordinator**

**Head of the Department**

**DEAN**

Form – 2

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

**PROFORMA FOR PLAN OF COURSE WORK**

(To be sent in triplicate before the commencement  
of mid semester examination in 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
Chairman		
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**

<b>Advisory committee</b>	<b>Name</b>	<b>Signature</b>
Chairman		
Co-Guide(If any)		
Members	1.	
	2.	
	3.	

**DEAN**



Form – 3a

**PONDICHERRY 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**

<b>Advisory committee</b>	<b>Name</b>	<b>Signature</b>
Chairman		
Co-Guide (If any)		
Members	1.	
	2.	
	3.	

**DEAN**

Form – 4

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

**PONDICHERRY 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**

	<b>Name in BLOCK letters</b>	<b>Signature</b>
Chairman		
Co-Guide (If any)		
Members	1.	
	2.	
	3.	
External Examiner		

**Signature of chairman  
with name and designation**

**PG Coordinator**

**Head of the Department**

**DEAN**

Form – 6

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

**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 chairman :
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 Chairman  
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.	Chairman/Co-opted Chairman*		
2.	Co-Guide		
3.	Member 1.		
	2.		
	3.		
4.	Additional member		
5.	Co-opted member*		

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

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

**Head of the Department**

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

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 Chairman with  
Designation**

**Signature of the PG Coordinator**

**Signature of the Head of the  
Department**

**Approved By**

**DEAN**

## Annexure – 1

SEAL OF THE UNIVERSITY	<b>PONDICHERRY UNIVERSITY</b> <b>Puducherry – 605 014</b> <b>CLASS GRADE CHART</b>
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Degree Programme: Ph.D.

Name of the Institute: Pandit Jawaharlal Nehru College of Agriculture and Research Institute,  
Karaikal

Course No.	Course Title	Credit Hours

Year of admission:

Start of semester:

Semester:

Closure of semester:

Reg. No.	Name	Attendance	THEORY			Practicals (20/90)	Term Paper (10)	TOTAL MARKS (100)	Grade Points (10)
			Mid sem (30)	Final (40/60)	Total (70/90)				

E- Incomplete

F- Fail

S- Satisfactory

NS-Not Satisfactory

Grade	>9.00	8 to 8.99	7 to 7.99	'F' grade	'E' grade	Class GPA
No. of students						

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

SEAL OF THE  
UNIVERSITY

Annexure – 2

Certificate Number:

# PONDICHERRY 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 – 3

**Certificate Number:**

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

<b>Name</b>	:
<b>Register No</b>	:
<b>Father's Name</b>	:
<b>Mother's Name</b>	:
<b>Date of Birth</b>	:
<b>Month &amp; Year of Admission</b>	:
<b>Month &amp; Year of Passing</b>	:

**PHOTO**

**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. ( )

[illegible]


Reg. no:

Name:

\* Non Credit Courses

S - Satisfactory

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

Seal:

Date:

Signature of  
**CONTROLLER OF EXAMINATIONS**

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<b>Classification of OGPA in 10.00 Point Scale.</b>	
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, KARAIKAL – 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 Chairman	Signature of the Head of the Department	Coordinator of Examinations

APPROVED BY

**DEAN**  
**PAJANCOA&RI**  
**KARAIKAL**

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

**LIST OF ENCLOSURES TO BE SUBMITTED ALONG WITH  
THESIS**

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

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

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

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

**PONDICHERRY UNIVERSITY**  
**PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE**  
**AND RESEARCH INSTITUTE, KARIAKAL – 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, KARIAKAL – 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 for :

4. Research credits registered during the semester :

5. Programme of work for this semester :

(list out the items of research work to be undertaken during the semester)

i)

ii)

iii)

iv)

**APPROVAL OF THE ADVISORY COMMITTEE**

<b>Advisory committee</b>	<b>Name</b>	<b>Signature</b>
Chairman		
Members	1.	
	2.	
	3.	

(Approval may be accorded within 10 days of registration)

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

<b>Advisory committee</b>	<b>Name</b>	<b>Signature</b>
Chairman		
Members	1.	
	2.	
	3.	

Proforma-2

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

**PERMISSION FOR LATE REGISTRATION**

1. Name of the student :
2. 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  
Chairman :

**Signature of the Chairman**

**Ph.D. Coordinator**

**Head of the Department**

**DEAN**



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

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

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

**Undertaking by the student:**

- i. I am willing to avail the proposed fellowship under the scheme entitled\_\_\_\_\_.
- ii. If I leave in the middle of the tenure of the fellowship, I am willing to repay the fellowship availed with 6% penal interest or any levy/fine imposed by the College/University.
- iii. I am fully aware that in case of campus transfer due the award of the fellowship that I have to lose the research credits already registered.
- iv. I am fully aware that there is no guarantee for the continuation of the courses, which I currently undergo, in the other campus to which I am likely to be transferred.
- v. I am willing to abide by all the rules and regulations laid down by the College/University in this regard.

**Date:**

**Signature of Student**

**Chairman of the Advisory Committee**

**Head of the Department**

**DEAN**

Proforma-4

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

**ALLOTMENT OF STUDENTS UNDER JRF/SRF STUDENT FELLOWSHIP**  
(To be submitted to the Dean)

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

**Principal Investigator**

**Head of the Department**

**Dean**

**List of Enclosures**

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

Proforma-5  
**PONDICHERRY UNIVERSITY**  
**PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE**  
**AND RESEARCH INSTITUTE, KARIAKAL – 609 603**

**SPONSOR'S CONCURRENCE (PROFORMA)**

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

**Signature of the Sponsor**

To

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

Proforma-6

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

**Proforma for Monitoring Register**

<b>Date of meeting</b>	<b>Review of the previous work that was assigned</b>	<b>Remarks of Chairman</b>	<b>Work assigned for next week</b>	<b>Date on which the student has to report</b>	<b>Signature of the Student</b>	<b>Signature of the Chairman</b>

Proforma-7

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

**Proforma for Obtaining Permission for Re-registration of credits**

Name :  
I.D No :  
Department :  
Campus :  
Mention the current semester : Eg. III/IV/V etc.,  
Re-registration is requested for the semester : IV/V/VI  
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

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

**Signature of Student**

**Chairman**

**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, KARIAKAL – 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	
	<b>TOTAL</b>	<b>100</b>	

Grade: \_\_\_\_\_

Date:

Signature

Proforma-9

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

**DEPARTMENT OF \_\_\_\_\_**

**COURSE COMPLETION CERTIFICATE**

This is to certify that Thiru./Selvi/Tmt. \_\_\_\_\_

Reg. No. \_\_\_\_\_ has completed all the course and research credit requirements

on \_\_\_\_\_ for the award of Ph.D. (Agri.) degree

in \_\_\_\_\_.

**Professor and Head**

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

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

**JUSTIFICATION FOR LATE SUBMISSION OF THESIS (if applicable)**

1. Name of the student :
2. 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 chairman

**Signature of the Chairman 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, KARIAKAL – 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, KARIAKAL – 609 603**

**DEPARTMENT OF \_\_\_\_\_**

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

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

Certified that Thiru./Selvi./Tmt \_\_\_\_\_ 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 Chairman**  
**with Name and designation**

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

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

(To be sent in triplicate)

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

Date:

Signature of the Student

**Specific Recommendations:**

**Chairman Professor and Head**

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**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, KARIAKAL – 609 603**

**APPLICATION FOR ISSUE OF CONDUCT AND TRANSFER CERTIFICATES**

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

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

**Date:**

**Signature of the Student**

**Recommendations:**

Certified that the conduct and characters of

Mr/Ms. \_\_\_\_\_ were \_\_\_\_\_

during the period of his/her studies. The certificates may be issued accordingly.

**Chairman**

**Ph.D. Co-ordinator**

**Professor & Head**

Proforma-15

**PONDICHERRY UNIVERSITY  
PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE  
AND RESEARCH INSTITUTE, KARIAKAL – 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 Chairman	
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**

**Signature of the PG Coordinator**

**Signature of the Head of the Department**

# **COURSE CURRICULA & SYLLABI**

**PONDICHERRY UNIVERSITY**  
**PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH**  
**INSTITUTE, KARAIKAL – 609603**  
**DEPARTMENT OF AGRICULTURAL ECONOMICS**  
**Ph.D. Agricultural Economics Syllabus – 2022**

<b>CODE</b>	<b>COURSE TITLE</b>	<b>Credit hours</b>
<b>Major Courses (12 Credits)</b>		
AEC 601*	Advanced Micro-Economic Analysis	1+1
AEC 602*	Advanced Macro-Economic Analysis	2+0
AEC 603*	Advanced Applied Econometrics	2+1
AEC 604*	Advanced Production Economics	2+1
RPE 601*	Research and Publication Ethics	2+0
	<b>Total Credits</b>	<b>9+3</b>
<b>Minor Courses (06 Credits)</b>		
AEC 605	Advanced Agricultural Marketing and Price Analysis	1+1
AEC 606	Quantitative Development Policy Analysis	1+1
AEC 607	Advanced Natural Resource Economics	1+1
AEC 608	Environmental Economics	1+1
AEC 609	International Trade Theories and Policy Applications	1+1
	<b>Total Credits</b>	<b>5+5</b>
<b>Supporting Courses (05 Credits)</b>		
MAT 601	Advanced Operations Research	2+1
STA 601	Multivariate Analysis for Applied Sciences	1+1
COM 601	Programming with R	1+1
	<b>Total Credits</b>	<b>4+3</b>
AEC 660	<b>DOCTORAL SEMINAR I</b>	<b>0+1</b>
AEC 661	<b>DOCTORAL SEMINAR II</b>	<b>0+1</b>
AEC 662	<b>DOCTORAL RESEARCH</b>	<b>0+75</b>
	<b>Total Credit Requirement</b>	<b>100</b>

\* = Compulsory Course

## COURSE CURRICULA AND SYLLABI

### DESCRIPTION OF TERMINOLOGIES

Major Courses	The subject (department / discipline), in which a student takes admission.
Minor Courses	The subject closely related to a student's major Subject.
Supporting courses	The subject not related to the major subject but relevant for students research work or necessary for building his/her overall competence.

### CREDIT REQUIREMENTS

Course Work	Doctoral Programme
Major Subjects	12
Minor Subjects	06
Supporting Subjects	05
Seminar	02
Research	75

- Students are permitted to register a maximum of 22 credits per semester.
- Research credits registered per semester should not exceed 20 credits.
- Students are permitted to appear for comprehensive examination upon completion of 80% of course credits separately for major and minor.
- Students are permitted to register research credits upon completion of 80% of course credits.



## MAJOR COURSES

AEC 601*	ADVANCED MICRO ECONOMIC ANALYSIS	1+1
<b>WHY THIS COURSE?</b>		
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.		
<b>OBJECTIVE</b>		
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.		
<b>THEORY</b>		
<b>Unit I: Consumer Theory</b>		
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.		
<b>Unit II: Market</b>		
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.		
<b>Unit III: General Equilibrium</b>		
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.		

<b>Unit IV: Market Failure</b>	
Market failure - Incomplete markets - Asymmetric information – Principal - Agent problem – Adverse selection - Moral hazard. Externalities – Network externalities - Public goods – Optimal provision of public goods.	
<b>Unit V: Welfare Economics</b>	
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.	
<b>PRACTICALS</b>	
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.	
<b>LECTURE SCHEDULE</b>	
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	<b>Mid semester examination</b>
9	Market failure - Incomplete markets - externality problem – Network externality
10	Theory of Public goods – Optimal provision of pure and impure public goods.
11	Asymmetric information – Principal - Agent problem and Moral hazard.

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 model
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	Pareto conditions of maximum welfare, Edgeworth box approach, Social Welfare functions – Sen’s approach to social welfare
17	Applications of welfare economics – welfare effects of policies
<b>PRACTICAL SCHEDULE</b>	
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	<b>Final practical examination</b>

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	<a href="http://www.ocw.mit.edu">www.ocw.mit.edu</a>
2	<a href="http://www.kevinhinde.com/">http://www.kevinhinde.com/</a>
3	<a href="http://economicsonline.co.uk">http://economicsonline.co.uk</a>
4	<a href="http://economicsnetwork.ac.uk">http://economicsnetwork.ac.uk</a>
5	<a href="http://www.econ.ucsb.edu/~tedb/eep/eep.html">http://www.econ.ucsb.edu/~tedb/eep/eep.html</a> .
6	<a href="http://www2.econ.iastate.edu/classes/econ501/Hallam/">http://www2.econ.iastate.edu/classes/econ501/Hallam/</a>
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
<b>WHY THIS COURSE?</b>		
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.		
<b>OBJECTIVE</b>		
To understand the functioning of national economy, its history and models. The policies governing the modern economic system and concerned institutions.		
<b>THEORY</b>		
<b>UNIT I: Review of Macroeconomics concepts</b>		
Review of Macro Economics concepts - Comparative statics - Keynesian theory - Consumption Function and Theories of Consumption - Saving Function and Theories of Saving.		
<b>UNIT II: IS - LM Dynamics</b>		
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.		
<b>UNIT III: Open Macroeconomic Models</b>		
Stagflation and Supply side Economics - Theory of Unemployment - Phillips Curve controversy - Inflation, Productivity and distribution - Fiscal policy: Effectiveness and Problems.		
<b>UNIT IV: Dynamic Macroeconomic Models</b>		
Social Accounting Matrix Framework - General Equilibrium Analysis - Neo classical Macro Economics - Stochastic Macro Economics.		
<b>UNIT V: Macroeconomic Institutions and Policies</b>		
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.		
<b>LECTURE SCHEDULE</b>		
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	<b>Mid semester examination</b>
18	Fiscal policy: Effectiveness and Problems.
19	Effectiveness of Monetary Policy
20	Government's Budget Constraint and Fiscal Policy
21	Social Accounting Matrix Framework
22	SAM Extension
23	SAM and its Implications for Macro Economic Planning
24	General Equilibrium Analysis
25	Neo classical Macro Economics
26	Extension of Neo Classical Economics
27	Stochastic Macro Economics
28	Open Economy Macro Economics: Foreign Trade Multiplier
29	Balance of Payment
30	BOP Adjustment Policies
31	Foreign Exchange Rate
32	Foreign sector: Capital and Current Account
33	Review of Macro Policies in India -I
34	Review of Macro Economic Policies in India –II

<b>SUGGESTED READINGS</b>	
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 <sup>th</sup> 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)
<b>SUGGESTED WEBSITES</b>	
1	<a href="http://ocw.mit.edu/courses/economics/14-02-principles-of-macroeconomics-fall-2009/">http://ocw.mit.edu/courses/economics/14-02-principles-of-macroeconomics-fall-2009/</a>
2	<a href="http://www.uh.edu/~bsorensen/Macro_Lecture_Notes.pdf">http://www.uh.edu/~bsorensen/Macro_Lecture_Notes.pdf</a>
3	<a href="http://www.econclassroom.com">http://www.econclassroom.com</a>
4	<a href="http://www.getyourecon.com">http://www.getyourecon.com</a>
5	<a href="http://www.cals.ncsu.edu/couse/are012/notes.html/">http://www.cals.ncsu.edu/couse/are012/notes.html/</a>
<b>OUTCOME EXPECTED</b>	
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.	

<b>AEC 603*</b>	<b>ADVANCED APPLIED ECONOMETRICS</b>	<b>2+1</b>
<b>WHY THIS COURSE?</b>		
<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>		
<b>OBJECTIVE</b>		
<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>		
<b>THEORY</b>		
<b>UNIT I: Review</b>		
<p>Review of classical regression model Probabilities, conditional probabilities and regression models – review of hypothesis testing – restrictions on parameters – single equation techniques.</p>		
<b>UNIT II: Concept of Least Squares</b>		
<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>		
<b>UNIT III: Dummy Variable</b>		
<p>Dummy variables - Qualitative and truncated dependent variables - limited dependent variables –LPM, probit and logit models, their multinomial extensions.</p>		
<b>UNIT IV: Models and Their Extensions</b>		
<p>Autoregressive distributed lag models – panel data fixed and random effects models and their extensions. Spatial econometrics, Structural Equation method, Sample Selection model.</p>		
<b>UNIT V: Simultaneous Equation Models</b>		
<p>Simultaneous equation methods –identification – estimation by indirect least squares - 2SLS, FIML, SURE, 3SLS.</p>		
<b>PRACTICALS</b>		
<p>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.</p>		



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	<b>Mid semester examination</b>
18	Specification and estimation of LPM, probit, tobit and logit models
19	Multinomial extensions of limited dependent variable models
20	Autoregressive and distributed lag models
21	Nerlovian Supply Response Model
22	Adaptive expectations, Koyack Model
23	Spatial Econometric models
24	Structural Equation and sample selection models
25	Specification of panel data models
26	Fixed effects and Random Effect model specification and estimation
27	Extensions of panel data models
28	Specification of simultaneous equation regression models
29	Structural models and reduced form models
30	Identification of simultaneous equation models.
31	Approaches to estimation of simultaneous equation models. Single equation approaches - Indirect least squares,
32	2SLS, Instrumental variables estimation
33	System approaches - SURE
34	3SLS and Interpretation of simultaneous equation models

<b>PRACTICAL SCHEDULE</b>	
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	<b>Final practical examination</b>
<b>SUGGESTED READINGS</b>	
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.
<b>SUGGESTED WEBSITES</b>	
1	<a href="http://www.oswego.edu/~kane/econometrics/stud_resources.htm">http://www.oswego.edu/~kane/econometrics/stud_resources.htm</a>
2	<a href="http://nickchk.com/econometrics.html">http://nickchk.com/econometrics.html</a>
3	<a href="https://inomics.com/insight/top-youtube-channels-to-learn-econometrics-economics-">https://inomics.com/insight/top-youtube-channels-to-learn-econometrics-economics-</a>
<b>OUTCOME EXPECTED</b>	
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
<b>WHY THIS COURSE?</b>		
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.		
<b>OBJECTIVE</b>		
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.		
<b>THEORY</b>		
<b>UNIT I: Production Process</b>		
Agricultural Production process – Relationship between farm planning and production Economics - Scope of agricultural production and planning-methods/procedures in agro-economic research and planning.		
<b>UNIT II: Production Functions and Characteristics</b>		
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 - Economic optimum with production function analysis - input use behaviour.		
<b>UNIT III : Decision Making in Production</b>		
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.		

<b>UNIT IV: Technology, Efficiency and Risk Management</b>	
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.	
<b>UNIT V: Optimization through Programming</b>	
Programming techniques in agricultural production-Multiple Objective Programming (MOP) – Goal programming, Weighted sum and Compromise Programming – applications.	
<b>PRACTICALS</b>	
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.	
<b>LECTURE SCHEDULE</b>	
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	<b>Mid semester examination</b>
18	Principles and importance of duality theory
19	Comparison of production, cost, and profit functions
20	Principles and derivation of input demand and output supply functions
21	Technology, and input use -effect of technology on input use-decomposition analysis
22	Factor shares -estimation – accounting method – production function method
23	Concepts and measurement of efficiency in agricultural production – technical, allocative and economic efficiency
24	Measurement of technical efficiency – Stochastic frontier production function analysis
25	Measurement of technical efficiency - Data Envelopment Analysis (DEA) with bootstrapping
26	Yield gaps analysis – concepts and measurement
27	Risk and uncertainty in agriculture – incorporation of risk and uncertainty in decision making- Input use decisions under risk and uncertainty
28	Risk programming – MOTAD and Quadratic programming
29	Simulation techniques – importance in agricultural production decisions – types of simulations and applications
30	Multiple Objective Programming (MOP) – importance and applications in agricultural production
31	Multiple Objective Programming (MOP) – Estimation and interpretation of MOP
32	Goal programming – Weighted goal programming,
33	Lexicographic Goal programming and its applications
34	Compromise programming – importance and applications
<b>PRACTICAL SCHEDULE</b>	
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	<b>Final practical examination</b>
<b>SUGGESTED READINGS</b>	
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.
<b>SUGGESTED WEBSITES</b>	
1	<a href="http://ocw.mit.edu/courses/economics">http://ocw.mit.edu/courses/economics</a>
2	<a href="https://www.msu.edu/course/ECO/855">https://www.msu.edu/course/ECO/855</a>
3	<a href="http://www.uky.edu/~deberti/prod/agprod5.pdf">http://www.uky.edu/~deberti/prod/agprod5.pdf</a>
4	<a href="http://www.csuchico.edu/ag/assets/documents/syllabi/ABUS/ABUS%20301%20AG%20production%20Econ%20Analysis.pdf">http://www.csuchico.edu/ag/assets/documents/syllabi/ABUS/ABUS%20301%20AG%20production%20Econ%20Analysis.pdf</a>
<b>OUTCOME EXPECTED</b>	
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.	

RPE 601*	RESEARCH AND PUBLICATION ETHICS	2+0
<b>OVERVIEW</b>		
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.		
<b>OBJECTIVE</b>		
The course is for awareness about the publication ethics and publication misconducts.		
<b>PEDAGOGY</b>		
Class room teaching, guest lectures, group discussions and practical sessions.		
<b>EVALUATION</b>		
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.		
<b>THEORY</b>		
<b>Unit I: Philosophy and Ethics – Scientific Conduct</b>		
<p>Introduction to philosophy: definition, nature and scope, concept, branches.</p> <p>Ethics: definition, moral philosophy, nature of moral judgements and reactions.</p> <p>Ethics with respect to science and research.</p> <p>Intellectual honesty and research integrity.</p> <p>Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP).</p> <p>Redundant publications: duplicate and overlapping publications, salami slicing.</p> <p>Selective reporting and misrepresentation of data.</p>		
<b>Unit II: Publication Ethics</b>		
<p>Publication Ethics: definition, introduction and importance.</p> <p>Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.</p> <p>Conflicts of interest.</p> <p>Publication misconduct: definition, concept, problems that lead to unethical behavior and vice-versa, types.</p> <p>Violation of publication ethics, authorship and contributorship.</p> <p>Identification of publication misconduct, complaints and appeals.</p> <p>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](http://www.insaindia.res.in/pdf/Ethics_Book.pdf)



## MINOR COURSES

AEC 605	ADVANCED AGRICULTURAL MARKETING AND PRICE ANALYSIS	1+1
<b>WHY THIS COURSE?</b>		
<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>		
<b>OBJECTIVE</b>		
<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>		
<b>THEORY</b>		
<b>Unit I: Agricultural Marketing Institutions</b>		
<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>		
<b>Unit II: Market Analysis</b>		
<p>Multi market estimation – Supply response models – Market integration and price transmission – Supply / Value chain analysis.</p>		
<b>Unit III: Introduction to Forecasting</b>		
<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>		
<b>Unit IV: Methods of Forecasting</b>		
<p>Methods of forecasting – ARMA – ARIMA – SARIMA (Simulation and Prediction with Seasonal ARIMA models) – ARFIMA (Auto Regressive Fractional Integrated Moving Average Model).</p>		
<b>Unit V: Application of Modern Techniques</b>		
<p>Application of remote sensing data – big data analysis – Application of Artificial Intelligence tools – deep learning – Price forecasting – Price indices – construction and application.</p>		
<b>PRACTICALS</b>		
<p>Estimation of demand / Supply forecasting – Supply chain / Value chain analysis for different commodities – Commodity models – Multi market estimation – Time series analysis – Market integration studies – Price discovery – Price volatility estimation – Commodity price forecasting.</p>		

<b>LECTURE SCHEDULE</b>	
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	<b>Mid – semester examination</b>
10	Stationary and stochastic processes – Unit roots – Unit root test - Application
11	Cointegration – VECM approach
12	Price volatility estimation – ARCH and GARCH models – Theoretical frame work and building
13	Forecast evaluation
14	Methods of forecasting – Naïve models – MA, AR, ARMA – ARIMA (Box-Jenkins approach)
15	Application of remote sensing data- big data analysis
16	Application of Artificial Intelligence tools – deep learning – price forecasting
17	Price indices – Theoretical frame work – Construction and Application
<b>PRACTICAL SCHEDULE</b>	
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) – <b>Guest Lecture</b>
17	<b>Final practical examination</b>
<b>SUGGESTED READINGS</b>	
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
<b>SUGGESTED WEBSITES</b>	
1	<a href="http://courses.cals.uidaho.edu/aers/agecon289/Index.htm">http://courses.cals.uidaho.edu/aers/agecon289/Index.htm</a>
2	<a href="http://www.uky.edu/Classes/AEC/305-001/classppts/01.pdf">http://www.uky.edu/Classes/AEC/305-001/classppts/01.pdf</a>
3	<a href="http://www.youtube.com/watch?v=1vixHc37DII">http://www.youtube.com/watch?v=1vixHc37DII</a>
4	<a href="http://www.stanford.edu/group/FRI/indonesia/.../chapt4.fm">http://www.stanford.edu/group/FRI/indonesia/.../chapt4.fm</a> .
5	html <a href="http://www.Franciscovergara.Com/Pricecontrols.doc">http://www.Franciscovergara.Com/Pricecontrols.doc</a>
6	<a href="http://www.docstoc.com">http://www.docstoc.com</a>
7	<a href="http://en.wikipedia.org/wiki/Market_structure">http://en.wikipedia.org/wiki/Market_structure</a>
8	<a href="http://pdf.usaid.gov/pdf_docs/PNADL965.pdf">http://pdf.usaid.gov/pdf_docs/PNADL965.pdf</a>
9	<a href="http://ageconsearch.umn.edu/handle/47883">http://ageconsearch.umn.edu/handle/47883</a>
10	<a href="http://faculty.quinnipiac.edu/charm/CHARM%20proceedings/.../160%20faria.pdf">http://faculty.quinnipiac.edu/charm/CHARM%20proceedings/.../160%20faria.pdf</a>
<b>OUTCOME EXPECTED</b>	
<p>After the completion of this course the student will be able to-</p> <ul style="list-style-type: none"> <li>• Understand the whereabouts of agricultural marketing.</li> <li>• Acquisition analytical skills in addressing the issues of agricultural marketing</li> <li>• Be familiar with the different forms of marketing in this sector.</li> <li>• Reap expertise in improving the performance of the marketing institutions</li> <li>• Gain expertise in market intelligence and price forecasting.</li> </ul>	

<b>AEC 607</b>	<b>QUANTITATIVE DEVELOPMENT POLICY ANALYSIS</b>	<b>1+1</b>
<b>WHY THIS COURSE?</b>		
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.		
<b>OBJECTIVE</b>		
To develop expertise in understanding the rationale behind development of policies. Conceptualization of equilibrium and working out the economic implications of development policy.		
<b>THEORY</b>		
<b>Unit I: Overview of QDP</b>		
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.		
<b>Unit II: Demand and Supply Analysis</b>		
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.		
<b>Unit III: Household Models</b>		
Household behaviour and policy analysis – Household models.		
<b>Unit IV: Partial Equilibrium Analysis</b>		
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.		
<b>Unit V: General Equilibrium Analysis</b>		
Social Accounting Matrices and multipliers -- Computable General Equilibrium models to assess economy wide impact of policy changes.		
<b>PRACTICALS</b>		
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.		

<b>LECTURE SCHEDULE</b>	
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	<b>Mid semester examination</b>
9	Nerlovian models of supply response – Policy implications
10	Household behavior and policy analysis – Household models
11	Partial equilibrium analysis
12	Concept of reference prices – Price distortions – indicators and impact
13	Transaction costs – Implications for efficiency and productivity
14	Institutional solutions
15	Multi market approach to policy analysis
16	Social Accounting Matrices and multipliers
17	Computable General Equilibrium models to assess economy wide impact of policy changes
<b>PRACTICAL SCHEDULE</b>	
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	<b>Final practical examination</b>

<b>SUGGESTED READINGS</b>	
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.
<b>SUGGESTED WEBSITES</b>	
1	<a href="http://www.lib.cam.ac.uk/">http://www.lib.cam.ac.uk/</a>
2	<a href="http://www.grlc.vic.gov.au/content/collection-development-policy">http://www.grlc.vic.gov.au/content/collection-development-policy</a>
3	<a href="http://library2.jfku.edu/about/cd_policy.html">http://library2.jfku.edu/about/cd_policy.html</a>
4	<a href="http://www.mga.edu/library/policies.aspx">http://www.mga.edu/library/policies.aspx</a>
5	<a href="http://www.libs.uga.edu/colldev/cdpolicy.html">http://www.libs.uga.edu/colldev/cdpolicy.html</a>
<b>OUTCOME EXPECTED</b>	
<p>After the completion of the course, the student will be able to conceptualize policy framework.</p> <p>Get acquainted with analyzing the policy and work out corrective solutions.</p>	

AEC 607	ADVANCED NATURAL RESOURCE ECONOMICS	1+1
<b>WHY THIS COURSE?</b>		
<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>		
<b>OBJECTIVE</b>		
<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"> <li>• Defining inter temporal (dynamic) economic efficiency and other criteria for evaluating natural resource use and policy.</li> <li>• 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.</li> <li>• Examining sources of inefficiency in the exploration of natural resources.</li> <li>• Property rights issues in natural resource management and</li> <li>• Issues concerning the nexus between economic development, poverty and natural resource degradation.</li> </ul>		
<b>THEORY</b>		
<b>Unit I: Dynamics of Natural Resources</b>		
<p>Natural resources - Definition - characteristics and classification. Stock dynamics of renewable and non-renewable resources. Equation of motion for renewable and non- renewable resources. Fundamental equation of renewable resources.</p>		
<b>Unit II: Efficiency in Natural Resource Use</b>		
<p>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.</p>		

<b>Unit III: Natural Resource use in Agriculture</b>	
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.	
<b>Unit IV: Open Access and Common Property Resource Management</b>	
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.	
<b>Unit V: Natural Resource Scarcity, Resource Degradation, Resource Pricing and Valuation</b>	
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.	
<b>PRACTICALS</b>	
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.	
<b>LECTURE SCHEDULE</b>	
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	<b>Mid-semester examination</b>
10	Simple two-period model of optimal use of non-renewable resources
11	Simple two-period model of optimal use of renewable resources
12	Optimal inter temporal allocation of natural resources – Non-renewable resources.
13	Optimal harvesting of single rotation and multiple rotation forests and old-growth forests
14	Optimal management of fishery
15	Optimal extraction of groundwater



16	Economics of biodiversity
17	Role of property rights in natural resources and their implication for conservation and management of natural resources and management of common property resources
<b>PRACTICAL SCHEDULE</b>	
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	<b>Final practical examination</b>
<b>SUGGESTED READINGS</b>	
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	Sterner, T. Policy Instruments for Environmental and Natural Resource Management, (Washington, D.C.: Resources for the Future), 2003.
<b>SUGGESTED WEBSITES</b>	
1	<a href="http://www.rff.org">www.rff.org</a>
2	<a href="http://spot.colorado.edu/~kaplan/econ3535/econ3535.html">http://spot.colorado.edu/~kaplan/econ3535/econ3535.html</a> , from where link can be established for eText at : <a href="chrome://epubreader/content/reader.xul?id=1">chrome://epubreader/content/reader.xul?id=1</a>
3	<a href="http://www.pearsonhighered.com/tietenberg/">http://www.pearsonhighered.com/tietenberg/</a>
4	<a href="http://www.env-econ.net/">www.env-econ.net/</a>
5	<a href="http://personal.strath.ac.uk/r.perman/enviro7.htm">http://personal.strath.ac.uk/r.perman/enviro7.htm</a>
6	<a href="http://personal.strath.ac.uk/r.perman/EERclassnotes.htm">http://personal.strath.ac.uk/r.perman/EERclassnotes.htm</a>
<b>OUTCOME EXPECTED</b>	
<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>	

<b>AEC 608</b>	<b>ENVIRONMENTAL ECONOMICS</b>	<b>1+1</b>
<b>WHY THIS COURSE?</b>		
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.		
<b>OBJECTIVE</b>		
To understand the economic outcomes of environmental degradation. Make students proficient in decision making regarding environment protection, resource use, and conservation policy.		
<b>THEORY</b>		
<b>UNIT I : Overview of Environmental Economics</b>		
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.		
<b>UNIT II: Economic Assessment</b>		
Environmental cost benefit analysis - Non-market valuation of environmental resources (WTP / WTA) - Environment, market and social welfare.		
<b>UNIT III : Developmental Aspects</b>		
Economic growth and environmental cost - Growth oriented economic policies and their environmental impacts - Population and environmental quality - poverty and environmental degradation.		
<b>UNIT IV: Accounting, Policies and Regulation Environment</b>		
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.		
<b>UNIT V: Environmental Issues</b>		
Economics of global warming, climate change and emission trading - Environment, international trade and development.		

<b>PRACTICALS</b>	
Contemporary 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	
<b>LECTURE SCHEDULE</b>	
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	<b>Mid-semester examination</b>
10	Environment, market and social welfare
11	Link between Population, Poverty and environmental quality
12	Environmental pollution with respect to Land and Water
13	Coastal externalities - Urbanization and environment
14	Polluter Pay Principle-Pigouvian taxes, Green taxes, Tradable Pollution Permits
15	Economics of Climate Change
16	History of Climate Agreements and Climate Funding
17	Carbon Trading
<b>PRACTICAL SCHEDULE</b>	
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	<b>Final practical examination</b>
<b>SUGGESTED READINGS</b>	
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
<b>SUGGESTED WEBSITES</b>	
1	<a href="https://www.env-econ.net/recommended_reading/">https://www.env-econ.net/recommended_reading/</a>
2	<a href="https://onlinelibrary.wiley.com/doi/book/10.1002/9780470755464">https://onlinelibrary.wiley.com/doi/book/10.1002/9780470755464</a>
3	<a href="https://www.worldscientific.com/doi/suppl/10.1142/6980/suppl_file/6980_chap01.pdf">https://www.worldscientific.com/doi/suppl/10.1142/6980/suppl_file/6980_chap01.pdf</a>
4	<a href="https://www.worldscientific.com/doi/suppl/10.1142/6980/suppl_file/6980_chap02.pdf">https://www.worldscientific.com/doi/suppl/10.1142/6980/suppl_file/6980_chap02.pdf</a>
5	<a href="https://www.worldscientific.com/doi/suppl/10.1142/6980/suppl_file/6980_chap08.pdf">https://www.worldscientific.com/doi/suppl/10.1142/6980/suppl_file/6980_chap08.pdf</a>
<b>OUTCOME EXPECTED</b>	
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
<b>WHY THIS COURSE?</b>		
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.		
<b>OBJECTIVE</b>		
The goal is to provide the students with background experience and tools for future analysis in international economic problems and trade policies.		
<b>THEORY</b>		
<b>Unit I: International Trade Theories - An Introduction</b>		
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.		
<b>Unit II: Trade Equilibrium</b>		
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.		
<b>Unit III : Barriers to Trade</b>		
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.		
<b>Unit IV: Trade Dynamics</b>		
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.		
<b>Unit V: Trade Policy Applications</b>		
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.		
<b>PRACTICALS</b>		
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	<b>Mid semester examination</b>
10	Trade blocks – impact of RTA/ FTA – case studies
11	Trade creation & trade diversion – direction of trade
12	Terms of trade & income distribution
13	Models of Trade & economic growth - arguments
14	Demand & supply of foreign exchange
15	Balance of Payments, Foreign Direct Investment & exchange rate relationships
16	Trends in IMF relations
17	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	<b>Final practical examination</b>



<b>SUGGESTED READINGS</b>	
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 <sup>th</sup> Edition. Boston,MA: Addison Wesley.
<b>SUGGESTED WEBSITES</b>	
1	<a href="http://internationalecon.com/Trade/Tch5/Tch5.php">http://internationalecon.com/Trade/Tch5/Tch5.php</a>
2	<a href="http://ocw.mit.edu/courses/economics/14-581-international-economics-i-spring-2013/">http://ocw.mit.edu/courses/economics/14-581-international-economics-i-spring-2013/</a>
3	<a href="http://catalog.flatworldknowledge.com/catalog/editions/suranovic-international-economics-theory-and-policy-1-0">http://catalog.flatworldknowledge.com/catalog/editions/suranovic-international-economics-theory-and-policy-1-0</a>
<b>OUTCOME EXPECTED</b>	
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.	

## SUPPORTING COURSES

MAT 601	ADVANCED OPERATIONS RESEARCH	2+1
<b>WHY THIS COURSE?</b>		
The course provides an in depth knowledge of various advanced techniques in operations research which are widely used in Management and Economics.		
<b>OBJECTIVE</b>		
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.		
<b>THEORY</b>		
<b>Unit I</b>		
Formulating a nonlinear programming problem – unconstrained and constrained optimization problems – equality constraints - Lagrangian Multipliers-Hessian and bordered Hessian Matrices inequality constraints – Kuhn Tucker conditions.		
<b>Unit II</b>		
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.		
<b>Unit III</b>		
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		
<b>Unit IV</b>		
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.		
<b>Unit V</b>		
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.		

<b>PRACTICALS</b>	
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 – Gomary’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.	
<b>LECTURE SCHEDULE</b>	
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	Gomary’s Cutting Plan method
15	Quadratic programming – Wolfe’s modified simplex method
16	Quadratic programming – Beale’s method.
17	<b>Mid semester examination</b>
18	Goal programming problem – Formation and Algorithm
19	The weights method
20	The preemptive method
21	Markov Chains – Definition - Transition probabilities
22	Calculation of n step transition probabilities and Steady State probabilities
23	Simulation definition – Simulation Models – Generation of Random numbers

24	Monte Carlo simulation
25	Application of simulation in queuing and inventory problems.
26	Application of simulation in maintenance and budgeting problems
27	Dynamic programming problem- Formulation – Forward and backward recursive methods
28	Discrete Dynamic Programming
29	Continuous Dynamic Programming
30	Stochastic Programming Problems.
31	Use of MS Excel solver in solving Optimization problems.
32	MATLAB ,GAMS and its features
33	MATLAB ,GAMS and its features
34	Features of other packages in solving OR problems
<b>PRACTICAL SCHEDULE</b>	
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	<b>Final practical examination</b>
<b>SUGGESTED READINGS</b>	
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
<b>SUGGESTED WEBSITES</b>	
1	<a href="http://en.wikipedia.org/wiki/Queueing_model">http://en.wikipedia.org/wiki/Queueing_model</a>
2	<a href="http://en.wikipedia.org/wiki/Dynamic_programming">http://en.wikipedia.org/wiki/Dynamic_programming</a>
<b>OUTCOME EXPECTED</b>	
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.	

<b>STA 601</b>	<b>MULTIVARIATE ANALYSIS FOR APPLIED SCIENCES</b>	<b>1+1</b>
<b>WHY THIS COURSE?</b>		
<ul style="list-style-type: none"> <li>To learn and develop scientific view to deal with multidimensional datasets and its uses in the analysis of research data.</li> <li>To understand the extensions of univariate techniques to multivariate frameworks and learn to apply dimension reduction techniques used in the data analysis.</li> </ul>		
<b>OBJECTIVE</b>		
<p>This course lays the foundation of Multivariate data analysis. Most of the data sets in agricultural sciences are multivariate in nature. The exposure provided to multivariate data structure, multinomial and multivariate normal distribution, estimation and testing of parameters, various data reduction methods would help the students in having a better understanding of agricultural research data, its presentation and analysis.</p>		
<b>THEORY</b>		
<b>Unit I : Multiple regression analysis</b>		
<p>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.</p>		
<b>Unit II : Principal component and Factor analysis</b>		
<p>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.</p>		
<b>Unit III : Discriminant function and Cluster Analysis</b>		
<p>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.</p>		
<b>Unit IV : Multi-dimensional scaling</b>		
<p>Multi-dimensional scaling – method – metric and non-metric – interpretation.</p>		
<b>Unit V : Reliability and Path analysis</b>		
<p>Reliability analysis – methods – split half method – Cronbach's Alpha – path analysis – path coefficients – direct and indirect effects – path diagram.</p>		
<b>PRACTICALS</b>		
<p>Multivariate statistical techniques - Full model regression equation - fitting using software - analysis and interpretation. Stepwise regression analysis - Step up method, Step-down method - Stepwise</p>		

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.

#### 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	<b>Mid semester examination</b>
10	Factor analysis – objective – designing and assumptions – various rotations
11	Deriving factors and assessment of overall fit – interpreting the factors
12	Discriminant analysis – classification of multivariate observations – principles – simple discriminant analysis – equation fitting
13	Multiple discriminant analysis – equation fitting
14	Cluster analysis – principles – steps in clustering – k – means method – hierarchical clustering method – dendrogram – interpreting the dendrogram
15	Multi dimensional analysis technique – method and interpretation
16	Reliability analysis – methods – split half method – Cronbach’s Alpha
17	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	<b>Final practical examination</b>
<b>SUGGESTED READINGS</b>	
1	Anderson TW. 1984. An Introduction to Multivariate Statistical Analysis. 2nd Ed. John Wiley. 1334.
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.
<b>SUGGESTED WEBSITES</b>	
1	<a href="https://en.wikipedia.org/wiki/Multivariate_statistics">https://en.wikipedia.org/wiki/Multivariate_statistics</a>
2	<a href="https://online.stat.psu.edu/stat505/">https://online.stat.psu.edu/stat505/</a>
3	<a href="https://www.iap.res.in/astrostat/School08/PennStateSchool08_LecNotes.pdf">https://www.iap.res.in/astrostat/School08/PennStateSchool08_LecNotes.pdf</a>
4	<a href="https://www.math.uci.edu/~htucker/LectureNotes/MultivariateAnalysis.PDF">https://www.math.uci.edu/~htucker/LectureNotes/MultivariateAnalysis.PDF</a>
5	<a href="http://i2pc.es/coss/Docencia/ADAM/Notes/MultivariateAnalysisSlides.pdf">http://i2pc.es/coss/Docencia/ADAM/Notes/MultivariateAnalysisSlides.pdf</a>
6	<a href="http://www.statslab.cam.ac.uk/~pat/AppMultNotes.pdf">http://www.statslab.cam.ac.uk/~pat/AppMultNotes.pdf</a>
<b>OUTCOME EXPECTED</b>	
<p>After completion of this course the students will be able to</p> <ul style="list-style-type: none"> <li>• Carry out an extensive exploratory multivariate analysis for a given multivariate data.</li> <li>• Interpret statistically the multivariate data through the various multivariate techniques.</li> <li>• Carry out classification of given multivariate data.</li> <li>• Solve problems involving multivariate normal distribution and to do good research in agricultural data.</li> </ul>	



COM 601	PROGRAMMING WITH R	1+1
<b>WHY THIS COURSE?</b>		
This course is all about programming in R, which is mainly used for statistical analysis. R is state of the art in terms of programming language oriented towards data science. Learning this gives idea for handling agricultural data.		
<b>OBJECTIVE</b>		
The objective of this course is to give an idea about programming in R software and learn how to use R for data visualization		
<b>THEORY</b>		
<b>Unit I:</b>		
R Console; R Data types; R Vector creation using <code>c()</code> ; R Assignment operators = <code>&lt;-</code> ; R Arithmetic Operators; R Logical Operators; R Relational Operators;		
<b>Unit II:</b>		
R Matrix- Create, Print, Add Column using <code>cbind()</code> , Add Row using <code>rbind()</code> , Slice using <code>[ , ]</code> ; R Data Frame - Create using <code>data.frame()</code> , Edit using <code>edit()</code> , Append using <code>cbind()</code> , <code>rbind()</code> , <code>select()</code> , <code>subset()</code> , sort using <code>order()</code> ; List in R - Create using <code>list()</code> , Select; Data Importing and Exporting in R Using <code>read.table()</code> and <code>write.table()</code> ;		
<b>Unit III:</b>		
<code>install.packages()</code> , <code>library()</code> ; Introduction to Machine Learning; Introduction to R package tensorflow Introduction to R package keras		
<b>Unit IV:</b>		
Rscript If, Else, Else If statements in R; For Loop and While Loop in R; R user defined Functions;		

<b>Unit V:</b>	
Scatter Plot, Bar Chart and Histogram in R; Data Visualization with R ggplot2; Publishing Data Visualizations with R Shiny;	
<b>PRACTICALS</b>	
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;	
<b>LECTURE SCHEDULE</b>	
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	<b>Mid-semester Examination</b>
9	install.packages("keras");
10	Rscript
11	If, Else, Else If statements in R;
12	For Loop in R;
13	While Loop in R;
14	R user defined Functions;
15	Scatter Plot, Bar Chart and Histogram in R;
16	Data Visualization with R ggplot2;
17	Publishing Data Visualizations with R Shiny;

<b>PRACTICAL SCHEDULE</b>	
1	R Console; R Vector creation using <code>c()</code> ; R Assignment operators = <- ;
2	R Matrix- Create, Print, Add Column using <code>cbind()</code> ,
3	Add Row using <code>rbind()</code> , Slice using <code>[ , ]</code> ;
4	R Data Frame - Create using <code>data.frame()</code> , Edit using <code>edit()</code> , Append using <code>cbind()</code> , <code>rbind()</code> , <code>select()</code> , <code>subset()</code> , sort using <code>order()</code> ;
5	List in R - Create using <code>list()</code> , Select; Data Importing and Exporting in R Using <code>read.table()</code> and <code>write.table()</code> ;
6	<code>install.packages()</code> , <code>library()</code> ;
7	<code>install.packages("tensorflow")</code> ;
8	<code>install.packages("keras")</code> ;
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 <code>ggplot2</code> ;
16	Publishing Data Visualizations with R Shiny;
17	<b>Final Practical Examination</b>
<b>SUGGESTED READINGS</b>	
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
<b>SUGGESTED WEBSITES</b>	
1	RStudio.com Shiny Tutorial - <a href="https://shiny.rstudio.com/tutorial/">https://shiny.rstudio.com/tutorial/</a> - <a href="https://shiny.rstudio.com/articles/">https://shiny.rstudio.com/articles/</a>
2	R Interface to Tensorflow - <a href="https://tensorflow.rstudio.com/">https://tensorflow.rstudio.com/</a>
3	R Interface to Keras - <a href="https://keras.rstudio.com/">https://keras.rstudio.com/</a>
<b>Expected Outcome</b>	
The course will impart knowledge on how to analyze and visualize data using R programming	