# Regulations and Curriculum

## M. Sc. (Ag) in Agricultural Economics

*(Effective from Academic Session 2024-25 onwards)*

*Offered by*

## Department of Agricultural Economics & Agribusiness Management

FACULTY OF AGRICULTURE

**MAHARAJA SUHEL DEV STATE UNIVERSITY**
**AZAMGARH (U.P.)**

# Resolution

The meeting of the Board of Studies (BoS) of Agricultural Economics was held on July 18, 2024 at Maharaja Suhel Dev State University (Camp Office, DAV College), Azamgarh to consider and approve the *regulations* and *curriculum* for **M. Sc. (Ag) in Agricultural Economics** developed in accordance to the BSMA Committee of Indian Council of Agricultural Research, New Delhi. The following were present in the abovesaid meeting:

| S. No. | Name | Designation/Address | Capacity |
|---|---|---|---|
| 1. | Dr. Santosh Kumar Singh | Professor<br>S.D.J. P.G. College<br>Chandeshwar, Azamgarh, U. P. | Dean, Faculty of Agriculture |
| 2. | Dr. Sarvesh Kumar | Asstt. Professor<br>Dept. of Agril. Economics<br>S.D.J. P.G. College<br>Chandeshwar, Azamgarh, U. P. | Convenor |
| 3. | Dr. H. P. Singh | Professor & Head<br>Dept. of Agril. Economics<br>B. H. U. Varanasi, U. P. | External Member |
| 4. | Dr. O. P. Singh | Professor<br>Dept. of Agril. Economics<br>B. H. U. Varanasi, U. P. | External Member |
| 5. | Dr. Anil Kumar Singh | Asstt. Professor<br>Dept. of Agril. Economics<br>College of Agriculture<br>(ANDUAT), Kotwa, Azamgarh | External Member |

After a detailed discussion, the BoS of Agricultural Economics unanimously approved the proposed *regulations* and *curriculum* for **M. Sc. (Ag) in Agricultural Economics**. It is further recommended that it may be implemented as per the guidelines of the BSMA Committee of the Indian Council of Agricultural Research, New Delhi from 2024-25 onwards.

18.07.2024
**(Anil Kumar Singh)**
External Member

18/7/2024
**(O. P. Singh)**
External Member

18/7/24
**(H. P. Singh)**
External Member

18/7/24
**(Sarvesh Kumar)**
Convenor

18/07/24
**(Santosh Kumar Singh)**
Dean

# MAHARAJA SUHEL DEV STATE UNIVERSITY

POSTGRADUATE DEGREE PROGRAMME

## M.Sc. (Ag) in AGRICULTURAL ECONOMICS

CREDIT BASED SEMESTER SYSTEM
(Regulations)

[As per Broad Subject Matter Area (BSMA) Committees for Social Sciences constituted by the ICAR]

### 1. SYSTEM OF EDUCATION

1.1 The rules and regulations provided herein shall govern Master degree programme in **M. Sc. (Ag) in Agricultural Economics** offered by Department of Agricultural Economics & Agri-Business Management, Faculty of Agriculture at **Maharaja Suhel Dev State University, Azamgarh, U.P.**

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

### 2. COMMENCEMENT

These regulations shall come into force from the academic year **2024-25** onwards.

### 3. DEFINITIONS & ACADEMIC TERMS

**Chairperson** means a teacher of the major discipline proposed by the Head of Department through the Dean of the College and duly approved by the Director of Education/ Dean Post Graduate Studies (or as per the procedure laid down in the concerned University regulations) to act as the Chairperson of the Advisory Committee and also to guide the student on academic issues.

**Course** means a unit of instruction in a discipline carrying a specific number and credits to be covered in a semester as laid down in detail in the syllabus of a degree programme.

**Credit** means the unit of work load per week for a particular course in theory and/ or practical. One credit of theory means one class of one clock hour duration and one credit practical means one class of minimum two clock hours of laboratory work per week.

**Credit load** of a student refers to the total number of credits of all the courses he/ she registers during a particular semester.

**Grade Point (GP)** of a course is a measure of performance. It is obtained by dividing the per cent mark secured by a student in a particular course by 10, expressed and rounded off to second decimal place.

**Credit Point (CP)** refers to the Grade point multiplied by the number of credits of the course, expressed and rounded off to second decimal place.

**Grade Point Average (GPA)** means the total credit point earned by a student divided by total number of credits of all the courses registered in a semester, expressed and rounded off to second decimal place.

**Cumulative Grade Point Average (CGPA)** means the total credit points earned by a student divided by the total number of credits registered by the student until the end of a semester (all completed semesters), expressed and rounded off to second decimal place.

**Overall Grade Point Average (OGPA)** means the total credit points earned by a student in the entire degree programme divided by the total number of credits required for the P.G. degree, expressed and rounded off to second decimal place.

## 4. NAME OF PROGRAMME

The Postgraduate programme offered in the discipline of Agricultural Economics is **M.Sc. (Ag) in AGRICULTURAL ECONOMICS**

## 5. RESIDENTIAL REQUIREMENTS

The minimum and maximum duration of residential requirement for Masters' Programme shall be as follows:

| P.G. Degree Programme | Duration of Residential Requirement | |
|---|---|---|
| | Minimum | Maximum |
| M. Sc. (Ag) in Agricultural Economics | 2 Academic Years (4 Semesters) | 5 Academic Years (10 Semesters) |

In case a student fails to complete the degree programme within the maximum duration of residential requirement, his/ her admission shall stand cancelled. The requirement shall be treated as satisfactory in the cases in which a student submits his/ her thesis any time during the 4th semester of his/ her residentship at the University for Masters' programme.

## 6. ADMISSION

6.1 Eligibility for admission:

The candidates with FOUR years in B.Sc. Ag./ Horticulture / Agril. Marketing and Co-operation/ Forestry /B.Sc. (Hons.) Agriculture/B.Sc. Dairying/B.Sc. Dairying (Dairy Tech.)/ B. Tech. (Dairy Tech.)/ B. V. Sc. & AH/ B.Sc. (Animal Sciences) /B. F. Sc. degree with credit-based course programme.

6.2 Mode of admission: As per the University rules.

## 7. EVALUATION AND GRADING SYSTEM

i. There will be a 10-point grading system of evaluation.

ii. The candidates are required to pass separately in theory and practical examinations.

iii. In case of courses with only theory, minimum of 33 per cent marks (17 marks) in theory (external) conducted by the University is

essential.

iv. In case of courses with theory and practical, minimum of 33 per cent marks in theory and practical separately (17 marks each) are essential.

v. There is no minimum passing marks in internal examinations (Mid-term/assignment).

vi. To pass in a course/paper (major/minor/supportive/common), it is required to obtain 50 per cent (50 marks) of total marks (100 marks) assigned cumulatively (mid-term and external examinations) with minimum 33 per cent of marks assigned for external examinations (theory and/or practical) conducted by the University. Hence, Grade Point, GP, of 5.00 to pass in a course and an Overall Grade Point Average, OGPA, of 5.00 to award the M. Sc. (Ag) in Agricultural Economics shall be required mandatorily. A candidate failing to secure minimum OGPA 5.00 will not be considered for the award of degree and shall be declared as 'failed'.

vii. The minimum Semester Grade Point Average (G.P.A.) and Overall Grade Point Average (O.G.P.A.) for passing / promotion of a particular semester as well as degree course should not less than 5.00.

viii. To attain the final degree a student has to pass all the courses of each semester.

ix. If a student fails in course(s), he/she will get opportunities to pass the course(s) in consecutive academic years of that semester (course of odd semester in consecutive odd semester similarly course of even semester in consecutive even semester).

x. In any circumstance the student is to complete the degree Programme including all the repeat courses within the maximum of 10 Semesters.

xi. In special case or cases Vice-Chancellor will have to right to allow the separate examination schedule to clear the repeated course/courses for individual or group of individuals.

xii. Grading Scale:

| Degree | Percentage of Marks Obtained | Conversion into Points |
|---|---|---|
| All | 100 | 10 Points |
| | 90 to <100 | 9 to <10 |
| | 80 to <90 | 8 to <9 |
| | 70 to <80 | 7 to <8 |
| | 60 to <70 | 6 to <7 |
| | 50 to <60 | 5 to <6 |
| | <50 (Fail) | <5 |
| | Eg. 80.76 | 8.076 |
| | 43.60 | 4.360 |
| | 72.50 (but shortage in attendance) | Fail (1 point) |

| OGPA | Division |
|---|---|
| 5.000 – 5.999 | Pass |
| 6.000 – 6.999 | II division |
| 7.000 – 7.999 | I division |
| 8.000 and above | I division with distinction |

GPA = Total points scored / Total credits (for 1 semester)

CGPA = Σ Total points scored / Course credits

OGPA = Σ Total points scored (after excluding failure points)/ Course credits

% of Marks = OGPA x 100/10

## 8. ADVISORY SYSTEM

8.1 Advisory Committee

i. There shall be an Advisory Committee for every student consisting of not fewer than three members in the case of a candidate for Masters' degree with the Advisor as Chairperson. The Advisory Committee should have representatives from the major and minor fields amongst the members of the post-graduate faculty accredited for appropriate P.G. level research. However, in those departments where qualified staff exists but due to unavoidable reasons post-graduate degree programmes are not existing, the staff having post-graduate teaching experience of two years or more may be included in the Advisory Committee as member representing the minor.

ii. The Advisor should convene a meeting of the Advisory Committee at least once in a Semester. The summary record should be

communicated to the Head of Department, Dean/Principal of the College(s) of concerned.

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

8.2 Advisor/ Co-guide/ Member, Advisory Committee from other collaborating University/ Institute/ Organization

i. In order to promote quality post-graduate research and training in cutting edge areas, the University may enter into Memorandum of Understanding (MOU) with other Universities/ Institutions for conducting research. While constituting an Advisory Committee of a student, if the Chairperson, Advisory Committee feels the requirement of involving of a faculty member/ scientist of such partnering university/ Institute/ Organization, he/ she may send a proposal to this effect to the Dean along with the proposal for consideration of Student's Advisory Committee (SAC).

ii. The proposed faculty member from the partnering institution can be allowed to act as Chairperson/ Co-guide/ Member, SAC, by mutual consent, primarily on the basis of intellectual input and time devoted for carrying out the research work at the particular institution. The faculty member/ scientist of partnering institutions in the SAC shall become a temporary faculty member of the University by following the procedure approved by the Academic Council.

8.3 Changes in advisory committee

i. The proposal for changes in the advisory committee is to be sent to the Dean/Principal 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 affected 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.

## 9. RESEARCH PROPOSAL

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. The topic for thesis research for the students of Master's programme should be of such a nature as to indicate a student's potentialities for conducting research andto train him in research.

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

iii. Three copies of the research proposal in the prescribed format (to be developed by the department) should be sent to the Dean/Principal through the Head of the department for approval.

iv. The research work may begin at any time between semesters I and IV, but the thesis must be turned in by the conclusion of semester IV or within the date notified by the University.

## 10. SUBMISSION OF THESIS

i. The research credits registered in the last semester of postgraduate programme 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 ($4^{th}$) semester.

ii. If a postgraduate student has completed the thesis before the closure of the final semester, the Chairman can convene the advisory committee meeting and take decision on the submission of the thesis provided the student satisfies 75 per cent attendance requirement.

iii. Copy of the thesis to be sent for evaluation to the external examiner (one) should be submitted in paper pack.

iv. After incorporating the suggestions of the examiner, by which thesis is evaluated, and those received at the time of viva-voce, the thesis should be submitted to the University/College, as case may be, in hard bound copies (four copies) and soft copies (in PDF).

10.1 Grace period

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

i. 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.

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

iii. The Registrar 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.

## 11. EVALUATION OF THESIS

i. The thesis submitted in partial fulfillment of a Master's degree shall be evaluated by an external examiner nominated by the Controller of Examinations. However, the Dean/Principal may send panel of three examiners.

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

iii. The Chairman of the advisory committee shall communicate the date of final thesis viva-voce examination to the student and

advisory committee members within 15 days and the thesis final viva-voce examination shall be completed within one month from the date of receipt of the report from the external examiner.

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

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

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

## 12. REVISION OF THESIS

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

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

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

iii. 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.

# CURRICULUM

[As per Broad Subject Matter Area (BSMA) Committees for Social Sciences constituted by the ICAR]

## M. Sc. (Ag) in Agricultural Economics

Framework of the courses

| Courses | Credit Hrs. |
|---|---|
| **(i) Course work** | **40** |
| Major courses | 20 |
| Minor courses | 08 |
| Supporting courses | 06 |
| Common courses | 05 |
| Seminar | 01 |
| **(ii) Master's Research/Thesis** | **30** |
| **Total** | **70** |

# Categorical break-up of the courses

| S. No | Course code | Course title | Credits |
|---|---|---|---|
| | | **Major Courses** | |
| 1 | AEC-501 | Micro Economic Theory and Applications | 3(3+0) |
| 2 | AEC-502 | Agricultural Production Economics | 2(1+1) |
| 3 | AEC-503 | Agricultural Marketing and Price Analysis | 3(2+1) |
| 4 | AEC-504 | Macro Economics and Policy | 2(2+0) |
| 5 | AEC-505 | Econometrics | 3(2+1) |
| 6 | AEC-507 | Agricultural Finance and Project Management | 3(2+1) |
| 7 | AEC-508 | Linear Programming | 2(1+1) |
| 8 | AEC-509 | Research Methodology for Social Sciences | 2(1+1) |
| | | **Sub-total** | **20** |
| | | **Minor Courses** | |
| 1 | AEC-506 | Agricultural Development and Policy Analysis | 2(2+0) |
| 2 | AEC-511 | International Economics | 2(1+1) |
| 3 | AEC-513 | Natural Resource and Environmental Economics | 2(1+1) |
| 4 | AEC-516 | Rural Marketing | 2(2+0) |
| | | **Sub-total** | **8** |
| | | **Supportive Courses** | |
| 1 | STAT-502 | Statistical Methods for Applied Sciences | 3(2+1) |
| 2 | STAT 512 | Basic Sampling Techniques | 3(2+1) |
| | | **Sub-total** | **6** |
| | | **Common Courses** | |
| 1 | PGS-501 | Library and Information Services | 1(0+1) |
| 2 | PGS-502 | Technical Writing and Communications Skills | 1(0+1) |
| 3 | PGS-503 | Intellectual Property and its Management in Agriculture | 1(1+0) |
| 4 | PGS-504 | Basic Concepts in Laboratory Techniques | 1(0+1) |
| 5 | PGS-505 | Agricultural Research, Research Ethics and Rural Development Programmes | 1(1+0) |
| | | **Sub-total** | **5** |
| | PGSE-501 | **Master's Seminar** | **1** |
| | PGR 501 | **Master's Research/Thesis** | **30** |
| | | **Grand Total** | **70** |

# M. Sc. (Ag) in Agricultural Economics

## SEMESTER-WISE (I to II) DETAILED COURSE STRUCTURE

| Sem | Course Code | Course Title | Type of course | Credit Hrs. | Evaluation pattern | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Internal | | External | | Total |
| | | | | | MT | AS | TH | P | |
| 1st | AEC-501 | Micro Economic Theory and Applications | Major | 3(3+0) | 30 | 20 | 50 | - | 100 |
| | AEC-502 | Agricultural Production Economics | Major | 2(1+1) | 20 | - | 50 | 30 | 100 |
| | AEC-506 | Agricultural Development and Policy Analysis | Minor | 2(2+0) | 30 | 20 | 50 | - | 100 |
| | STAT-502 | Statistical Methods for Applied Sciences | Supportive | 3(2+1) | 20 | - | 50 | 30 | 100 |
| | PGS-501 | Library and information services | Common | 1(0+1) | - | - | - | 100 | 100 |
| | PGS-502 | Technical Writing and Communications Skills | | 1(0+1) | - | - | - | 100 | 100 |
| | | | **Sub-total** | **12** | | | | | |
| 2nd | AEC-503 | Agricultural Marketing and Price Analysis | Major | 3(2+1) | 20 | - | 50 | 30 | 100 |
| | AEC-504 | Macro Economics and Policy | Major | 2(2+0) | 30 | 20 | 50 | - | 100 |
| | AEC-511 | International Economics | Minor | 2(1+1) | 20 | - | 50 | 30 | 100 |
| | AEC-513 | Natural Resource and Environmental Economics | Minor | 2(1+1) | 20 | - | 50 | 30 | 100 |
| | STAT 512 | Basic Sampling Techniques | Supportive | 3(2+1) | 20 | - | 50 | 30 | 100 |
| | PGS-503 | Intellectual property and its management in agriculture | Common | 1(1+0) | 30 | 20 | 50 | - | 100 |
| | PGS-504 | Basic Concepts in Laboratory Techniques | | 1(0+1) | - | - | - | 100 | 100 |
| | | | **Sub-total** | **14** | | | | | |

*MT: Mid-term; AS: Assignment; TH: Theory; P: Practical*

# M. Sc. (Ag) in Agricultural Economics

## SEMESTER-WISE (III to IV) DETAILED COURSE STRUCTURE

| Sem | Course Code | Course Title | Type of course | Credit Hrs. | Evaluation Pattern | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Internal | | External | | Total |
| | | | | | MT | AS | TH | P | |
| 3rd | AEC-505 | Econometrics | Major | 3(2+1) | 20 | - | 50 | 30 | 100 |
| | AEC-507 | Agricultural Finance and Project Management | Major | 3(2+1) | 20 | - | 50 | 30 | 100 |
| | AEC-508 | Linear Programming | Major | 2(1+1) | 20 | - | 50 | 30 | 100 |
| | AEC-516 | Rural Marketing | Minor | 2(2+0) | 30 | 20 | 50 | - | 100 |
| | PGS-505 | Agricultural Research, Research Ethics and Rural Development Programmes | Common | 1(1+0) | 30 | 20 | 50 | - | 100 |
| | | | **Sub-total** | **11** | | | | | |
| 4th | AEC-509 | Research Methodology for Social Sciences | Major | 2(1+1) | 20 | - | 50 | 30 | 100 |
| | PGSE-501 | Seminar | Seminar | 1 | - | | - | - | 100 |
| | PGR-501 | Master's Research/Thesis | Thesis | 30 | Satisfactory | | | | |
| | | | **Sub-total** | **33** | | | | | |
| | | | **Grand Total (12+14+11+33)** | **70** | | | | | |

*MT: Mid-term; AS: Assignment; TH: Theory; P: Practical*

# COURSE CONTENTS

## M.Sc. (Ag) in Agricultural Economics

## MAJOR COURSES

**Course Title : Micro Economic Theory and Applications**
**Course Code : AEC-501**
**Credit Hours : 3+0**

**Theory**

**Block 1: Introduction to micro-economics**

**Unit 1: Basic Concepts: A review**

Scarcity and Choice; Production possibility frontier, Positive and normative economics; concepts of opportunity cost, Demand and Supply: determinants of individual demand/supply; demand/ supply schedule and demand/ supply curve; market versus individual demand/ supply; shifts in the demand/ supply curve

**Block 2- Insight of consumer, production and cost involved**

**Unit 1: Consumer Choice**

Cardinal Utility Approach – Ordinal Utility Approach -Budget sets and Preferences under different situations – Hicks and Slutsky income and substitution effects – Applications of Indifference curve approach – Revealed Preference Hypothesis – Consumer surplus – Derivation of Demand curve – Elasticity of demand – Demand and supply together; how prices allocate resources; controls on prices – price floor and price ceiling – applications in agriculture.

**Unit 2: Production and Cost**

Production functions: single variable - average and marginal product, variable proportions, stages of production. Two variables - isoquants, returns to scale and to a factor; factor prices; Technical progress; cost minimization and output maximization; Elasticity of substitution. Expansion path and the cost function Concept of economic cost; Short run and long run cost curves; increasing and decreasing cost industries; envelope curve; L-shaped cost curves; economies of scale; revenue and expenditure, elasticity and marginal revenue; Firm equilibrium and profit.

**Block 3: Overview of market**

**Unit 1: Market Forms**

Behaviour of profit maximizing firms and the production process - Perfect competition: Equilibrium of the market. Long run industry supply, applications: effects of taxes and subsidies; Monopoly: Equilibrium; supply; multiplant firm; monopoly power; deadweight loss; price discrimination; Monopolistic Competition: Product differentiation; equilibrium of the firm in the industry-with entry of new firms and with price competition. Comparison with pure competition. Duoploy: Cournot model and reaction curves; Stackelberg's model, Bertrand model; Oligopoly.

**Unit 2: Factor Markets**

Labour and land markets - basic concepts (derived demand, productivity of an input, marginal productivity of labour, marginal revenue product); demand for labour; input demand curves; shifts in input demand curves; competitive labour markets; Economic rent and quasi rent.

**Suggested Reading**


- Koutsoyiannis A. *Modern Micro Economics*. Macmillan Press Ltd
- Richard A. Bilas, *Micro Economic Theory*
- Leftwich Richard H. *The Price System and Resources Allocation*
- Allen CL. *A Frame Work of Price Theory*
- K. K. Dewett. *Modern Economic Theory*


**Course Title : Agricultural Production Economics**

**Course Code : AEC-502**

**Credit Hours : 1+1**

**Theory**

**Block 1: Introduction to Production Economics**

**Unit 1: Concepts of production economics**

Nature, scope and significance of agricultural production economics- Agricultural Production processes, character and dimensions-spatial, temporal - Centrality of production functions, assumptions of production functions, commonly used forms - Properties, limitations, specification, estimation and interpretation of commonly used production functions.

**Block 2: Factors and costs**

**Unit 1: Factors and theory of production**

Factors of production, classification, interdependence, and factor substitution - Determination of optimal levels of production and factor application - Optimal factor combination and least cost combination of production - Theory of product choice; selection of optimal product combination.

**Unit 2: Concepts of cost**

Cost functions and cost curves, components, and cost minimization - Duality theory – cost and production functions and its applications - Derivation of firm's input demand and output supply functions - Economies and diseconomies of scale.

**Block 3: Assessment**

**Unit 1: Dynamics of economic assessment**

Technology in agricultural production, nature and effects and measurement - Measuring efficiency in agricultural production; technical, allocative and economic efficiencies - Yield gap analysis-concepts-types and measurement - Nature and sources of risk, modeling and coping strategies.

**Practical**

- Different forms of production functions
- Specification, estimation and interpretation of production functions
- Returns to scale, factor shares, elasticity of production
- Physical optima-economic optima
- Least cost combination
- Optimal product choice
- Cost function estimation, interpretation
- Estimation of yield gap
- Incorporation of technology in production functions
- Measuring returns to scale-risk analysis.

**Suggested Reading**


- EO Heady. *Economics of Agricultural Production and resources use.*
- John P Doll and Frank Orazem. *Production Economics: Theory with application*
- Heady EO & Dillon JL. 1961. *Agricultural Production functions.* Kalyani Publishers, Ludhiana, India. 667 p.
- Baumol WG. 1973. *Economic theory and operations analysis.* Practice Hall of India Private Limited, New Dehli.626 p.

- Gardner BL & Rausser GC. 2001. *Handbook of Agricultural Economics* Vol. I Agricultural Production. Elsevier.
- Reddy S. Subba et al. Agricultural economics, Oxford & IBH Publishers, New Delhi.
- Raju V.T. and Rao DVS. Economics of Farm Production and Management, Oxford & IBH Publishers, New Delhi.
- Johal and Kapoor. Fundamentals of farm business management, Kalyani Publishers, New Delhi
- Shankhyayan PL. Introduction to the Economics of Agricultural Production, Prentice Hall of India Pvt. Ltd., New Delhi


**Course Title : Agricultural Marketing and Price Analysis**

**Course Code : AEC 503**

**Credit Hours : 2+1**

**Theory**

**Block 1: Introduction to Agricultural Marketing**

**Unit 1: Introduction to agricultural marketing**

New Concepts in Agricultural Marketing - Characteristic of Agricultural product and Production – Problems in Agricultural Marketing from Demand and Supply and Institutions sides. Market intermediaries and their role - Need for regulation in the present context - Marketable & Marketed surplus estimation. Marketing Efficiency - Structure Conduct and Performance analysis - Vertical and Horizontal integration - Integration over space, time and form- Vertical co-ordination.

**Block 2: Agricultural Markets**

**Unit 1: Aspects of agricultural marketing**

Different Forms of marketing: Co-operatives Marketing – APMC Regulated Marketing - Direct marketing, Farmer Producer Companies, e-NAM and marketing under e-NAM, e-marketing Contract farming and Retailing, Organized retailing - Supply Chain Management - State trading, Warehousing and other Government agencies -Performance and Strategies -Market infrastructure needs, performance and Government role - Value Chain Finance.

**Unit 2: Future marketing and government**

Introduction to Commodities markets and future trading - Basics of commodity futures - Operation Mechanism of Commodity markets – Price discovery - Hedging and Basis - Fundamental analysis - Technical

Analysis – Role of Government/SEBI in promoting commodity trading and regulatory measures.

**Block 3: Advances in Agricultural Marketing**

**Unit 1: Use of Information Technology**

Role of Information Technology and Market Intelligence in marketing of agricultural commodities, -electronic auctions (e-bay), e-Chaupals, Agmarknet and Domestic and EXport market Intelligence Cell (DEMIC).

**Unit 2: Dynamics of price**

Price forecasting – time series analysis – time series models – spectral analysis. Price policy and economic development – non-price instruments.

**Practical**

- Supply and demand elasticities in relation to problems in agricultural marketing.
- Price spread and marketing efficiency analysis.
- Marketing structure analysis through concentration ratios.
- Performance analysis of Regulated market and marketing societies. Analysis on contract farming and supply chain management of different agricultural commodities, milk and poultry products.
- Supply Chain Analysis - quantitative estimation of supply chain efficiency.
- Market Intelligence – Characters, Accessibility, and Availability Price forecasting.
- Online searches for market information sources and interpretation of market intelligence reports – commodity outlook.
- Technical Analysis for important agricultural commodities.
- Fundamental Analysis for important agricultural commodities.
- Presentation of the survey results and wrap-up discussion.

**Suggested Reading**


- Acharya SS & Agarawal NL. 2004. *Agricultural Marketing in India.* Oxford and IBH Publishing company Pvt. Ltd. New Delhi.
- Acharya SS & Agarawal NL. 1994. *Agricultural Prices-Analysis and Policy.* Oxford and IBH Publishing company Pvt. Ltd. New Delhi.
- Richard H Kohls and Joseph N. Uhl: *Marketing of Agricultural products* by Collier MacMillan International.

**Course Title** : **Macro Economics and Policy**
**Course Code** : **AEC-504**
**Credit Hours** : **2+0**

**Theory**

**Block 1: Conceptualizing Macro Economics**

**Unit 1: Introduction: Measurement and Concepts**

Basic concepts and scope of Macro-economics, National Income Accounting: Methods of measurement of key macro-economic aggregates, relationship of national income and other aggregates (with numerical exercises), real and nominal income

**Block 2: Theories of macroeconomics**

**Unit 1: Classical Macroeconomics**

Say's Law, Quantity Theory of Money, aggregate labour supply and demand of labour, Classical theory of determining output, wages and prices.

**Unit 2. Income And Spending: Keynesian Framework**

Simple Keynesian model of income determination; Keynesian Multiplier- aggregate spending, taxation, transfer payments, foreign spending, balanced budget; budget surplus (with numerical exercises).

**Block 3- Money, Consumption and Inflation Unit 1: Money, Interest and Income**

Goods market equilibrium-IS curve; Demand for Money, the Liquidity Preference Theory – Liquidity Trap; asset market equilibrium- LM curve; simultaneous equilibrium in goods and asset market- effect of fiscal and monetary policy

**Unit 2: Theories of Aggregate Consumption and Investment**

Absolute Income Hypothesis, Relative Income Hypothesis, Fisher's Inter-temporal Choice Model, Life-Cycle and Permanent Income Hypotheses; Profits and Accelerator Theory.

**Unit 3: Inflation and Unemployment**

Inflation: Nature, Effects and control; Types of inflation – demand pull, cost push- stagflation, core inflation, hyperinflation; Phillips curve.

**Suggested Reading**


- Stonier & Hegue. *A Text Book of Economic Theory*
- Samuelson PA. 1948. *Foundation of Economic Analysis.* Harvard University Press
- MC Vaish Allid. 1983. *Macro–Economics Theory*
- Gardner Ackley. 1961. *Macro–Economics Theory*: Macmillan, New York.
- TF Dernburg & DM Mcdougali-*Macro Economics*
- G. Sirkin – *Introduction to Macro–Economics Theory*
- RL Heibroker-*Understanding Macro–Economics*
- JK Mehta –*Macro Economics*
- Michael R Edgemand – *Macro-Economics: Theory & Policy*
- David' W Pearce –*The dictionary of modern Economics*
- K. K. Dewett. *Modern Economic Theory*
- Ahuja HL. *Macro economic theory*


**Course Title : Econometrics**

**Course Code : AEC 505**

**Credit Hours : 2+1**

**Theory**

**Block 1: Introduction to Econometrics**

**Unit 1: Introduction**

Relationship between economic theory, mathematical economics, models and econometrics, methodology of econometrics-regression analysis.

**Block 2: Classical Regression**

**Unit 1: Classical Linear Regression**

Basic two variable regression – assumptions estimation and interpretation approaches to estimation – OLS and their properties – extensions to multi-variable models-multiple regression estimation and interpretation.

**Unit 2: Breaking down of Classical assumptions**

Violation of assumptions – identification, consequences and remedies for Multicollinearity, heteroscedasticity, autocorrelation – data problems and remedial approaches – model misspecification.

**Block 3: Qualitative Variables**

**Unit 1: Qualitative variables and simultaneous equation models**

Use of dummy variables- Introduction to simultaneous equations- identification problem

**Practical**

- Single equation two variable model specification and estimation
- Hypothesis testing transformations of functional forms and OLS application
- Estimation of multiple regression model
- Testing and correcting specification errors
- Testing and managing Multicollinearity
- Estimation of regressions with dummy variables

**Suggested Reading**


- Greene WH. 2002. *Econometric Analysis*. Pearson Education.
- Johnston J and Dinardo J. 2000. *Econometric Methods*. Mc Graw-Hill.
- Koutseyianis, A. 1997. *Theory of Econometrics*. Barner & Noble.
- Maddala GS. 2002. *Econometrics*. Mc Graw-Hill.
- Pinndyck RS and Rubinfeld DL. 1990. *Econometric Models and Econometric Forecasts*.McGraw Hill.
- Mandani GMK. Introduction to Econometrics
- Acharya and Mandani. Applied econometrics for Agricultural Economists


**Course Title : Agricultural Finance and Project Management**

**Course Code : AEC 507**

**Credit Hours : 2+1**

**Theory**

**Block 1: Introduction to Agricultural Finance**

**Unit 1: Basic concepts: A Review**

Role and Importance of Agricultural Finance. Financial Institutions and credit flow to rural/priority sector. Agricultural lending – Direct and Indirect Financing - Financing through Co-operatives, NABARD and Commercial Banks and RRBs. District Credit Plan and lending to agriculture/priority sector. Micro-Financingand Role of MFI's - NGO's, and SHG's.

## Block 2: Credit and Financial Analysis

### Unit 1: Credit and its aspects

Lending to farmers – The concept of 3 C's, 7 P's and 3 R's of credit. Estimation of Technical feasibility, Economic viability and repaying capacity of borrowers and appraisal of credit proposals. Understanding lenders and developing better working relationship and supervisory credit system. Credit inclusions – credit widening and credit deepening.

### Unit 2: Financial analysis

Financial Decisions – Investment, Financing, Liquidity and Solvency. Preparation of financial statements - Balance Sheet, Cash Flow Statement and Profit and Loss Account. Ratio Analysis and Assessing the performance of farm/ firm.

## Block 3- Project and Risk Management

### Unit 1: Project Overview

Project Approach in financing agriculture. Financial, economic and environmental appraisal of investment projects. Identification, preparation, appraisal, financing and implementation of projects. Project Appraisal techniques – Undiscounted measures. Time value of money – Use of discounted measures - B-C ratio, NPV and IRR. Agreements, supervision, monitoring and evaluation phases in appraising agricultural investment projects. Net work Techniques – PERT and CPM.

### Unit 2: Risk and its Management

Risks in financing agriculture. Risk management strategies and coping mechanism. Crop Insurance programmes – review of different crop insurance schemes - yield loss and weather based insurance and their applications.

### Practical

- Development of Rural Institutional Lending;
- Branch expansion, demand and supply of institutional agricultural credit and Over dues and Loan waiving;
- An overview, Rural Lending Programmes of Commercial Banks, Lead Bank Scheme;
- Preparation of District Credit Plan, Rural Lending Programmes of Co-operativeLending Institutions;
- Preparation of financial statements using farm/firm level data, Farm credit appraisal techniques and farm financial analysis through financial statements;

- Performance of Micro Financing Institutions;
- NGO's and Self-Help Groups, Identification and formulation of investment projects;
- Project appraisal techniques – Undiscounted Measures and their limitations;
- Project appraisal techniques – Discounted Measures;
- Network techniques – PERT and CPM for project management;
- Case Study Analysis of an Agricultural project;
- Financial Risk and risk management strategies – crop insurance schemes;
- Financial instruments and methods – E banking, Kisan Cards and core banking.

**Suggested Reading**


- E Die Sollem H and Heady EO. (Ed.). *Capital and Credit Needs in Changing Agriculture*, Bauman.
- Hopkins A Barry, Peter Jo and Baker CB. *Financial Management in Agriculture.*
- Murray WG and Nelson AG. 1960. *Agricultural Finance.* Iowa State University
- Chanona C. 1969. *Agricultural Finance in India: Role of Commercial Banks.* Marketing and Economics Research Bureau, New Delhi.
- Gittinger JP. 1972. *Economic analysis of agricultural projects,* John Hopkins Univ. Press, Baltimore.
- Little IMD and JA Mirrless. 1974, *Project appraisal and planning for developing countries,*
  Oxford and IBH publishing Co. New Delhi.
- Arnold CH. 1972. *Project Evaluation, collected papers,* Macmillan.


**Course Title : Linear Programming**

**Course Code : AEC-508**

**Credit Hours : 1+1**

**Theory**

**Unit I**

Decision Making: Concepts of decision making, introduction to quantitative tools, introduction to linear programming, uses of LP in different fields, graphic solutionto problems, formulation of problems. Simplex Method: Concept of simplex Method, solving profit maximization and cost minimizations problems. Formulation of farms and non farm

problems as linear programming models and solutions.

**Unit III**

Extension of Linear Programming models: Variable resource and price programming, transportation problems, recursive programming, dynamic programming.

**Unit IV**

Game Theory- Concepts of game theory, two person constant sum, zero sum game, saddle point, mixed strategies, the rectangular game as solution to linear programming.

**Practical**

- Graphical and algebraic formulation of linear programming models.
- Solving of maximization and minimization problems by simplex method.
- Formulation of the simplex matrices for typical farm situations.

**Suggested Readings**


- Dorfman R. 1996. *Linear Programming and Economic Analysis.* McGraw Hill.
- Sharma SD. Operations Research – Theory, Methods & Applications, Kedarnath Ram Nath Publication, Meerut.
- Loomba NP. 2006 Linear Programming. Tata McGraw Hill


**Course Title : Research Methodology for Social Sciences**
**Course Code : AEC 509**
**Credit Hours : 1+1**

**Theory**

**Block 1: Concepts of research methodology**

**Unit 1: Concepts of research methodology**

Importance and scope of research in agricultural economics. Types of research –Fundamental vs. Applied. Concept of researchable problem – research prioritization – selection of research problem. Approach to research – research process.

**Block 2- Building up hypothesis and sample selection**

**Unit 1: Hypothesis: Framing and Testing**

Hypothesis – meaning – characteristics – types of hypothesis – review of literature setting of Course Objective and hypotheses – testing of

hypothesis.

**Unit 2: Sampling**

Sampling theory and sampling design – sampling error - methods of sampling – probability and non-probability sampling methods - criteria to choose. Projectproposals – contents and scope – different types of projects to meet different needs - trade-off between scope and cost of the study. Research design and techniques-Types of research design.

**Block 3- Data Collection and Analysis**

**Unit 1: Data Collection**

Data collection – assessment of data needs – sources of data collection – discussion of different situations. Mailed questionnaire and interview schedule – structured, unstructured, open ended and closed-ended questions. Scaling Techniques. Preparation of schedule – problems in measurement of variables in agriculture. Interviewing techniques and field problems - methods of conducting survey – Reconnaissance survey and Pre testing.

**Unit 2: Data Analysis**

Data coding, tabulation, cleaning. –Multivariate analysis –factor analysis' PCA' cluster analysis. Universal procedures for preparation of bibliography – writing of research articles.

**Practical**

- Exercises in problem identification.
- Project proposals – contents and scope.
- Formulation of Objective and hypotheses.
- Assessment of data needs – sources of data – methods of collection of data.
- Methods of sampling – criteria to choose – discussion on sampling under differentsituations.
- Scaling Techniques – measurement of scales.
- Preparation of interview schedule.
- Field testing. Method of conducting survey.
- Exercise on coding, editing, tabulation and validation of data.
- Preparing for data entry into computer.
- Hypothesis testing – Parametric and Non-Parametric Tests.
- Exercises on format for Thesis/ Report writing.

- Presentation of the results.

**Suggested Reading**


- Baker CB. *Research Methodology in Agricultural Economics*
- Cohen MR and Nagel R. *An Introduction to Logic and Scientific Method*
- Devey J Logic. *The Theory of Enquiry*
- Dhondhyal SP. *Social Science Research and Thesis Writing*
- Ezekiel M. *Correlation Analysis*
- Kothari CR. Research Methodology, New Adge International Publishers
- Heady EO. *Linear Programming Methods*
- Willson ER. *An Introduction to Scientific Research*
- Kumar A. 2008. *Research Methodology: A Survey*. Alts, New Delhi

# MINOR COURSES

**Course Title : Agricultural Development and Policy Analysis**
**Course Code : AEC-506**
**Credit Hours : 2+0**

**Theory**

**Block 1: Introduction**

**Unit 1: Introduction**

Role of agriculture in economic/ rural development – Evolution of thinking on agriculture and development; Agricultural development – meaning, stages and determinants – Population and food supply – need for sound agricultural policies

**Block 2: Theoretical Concepts**

**Unit 1: Theories of Agricultural Development**

Resource exploitation model- Conservation model- Location (Urban impact) model- Diffusion model- High pay-off input model-Induced Innovation Model- Agricultural R&D and Linkages

**Block 3: Performance and policies**

**Unit 1: Performance of Indian Agriculture**

Agrarian structure and land relations; trends in performance and productivity; agrarian structure and technology; credit, commerce and technology; capital formation; subsidies; pricing and procurement; Post Green Revolution agriculture; Production and productivity crisis in agriculture; Regional differences; Food Security, PDS system and Malnutrition.

**Unit 2: Agricultural Policy: Process and Implementation**

Instruments of Agricultural Policy; Process of agricultural policy formulation, implementation, Monitoring and Evaluation in India; Global experiences in participatory approach to Agricultural policy process; critical review of various elements of Indian agricultural policy- resource policies – credit policies – input and product marketing policies – price policies; WTO – Agreement on Agriculture; Planning models. Planning for utilization of resources and Indian Five Year Plans.

**Suggested Reading**


- Albert O. Hirschman 1958. *Strategy of Economic Development*. New Man Yale University
- Simon Kuznets 1965. *Economic Growth and Structures*. Oxford New Delhi.

- Das Gupta AK. 1965. *Planning and Economic Growth.* George Allen and Unwin London
- Robert E. Baldwin 1966. *Economic Development and Growth.* John Willey, New York

**Course Title : International Economics**
**Course Code : AEC 511**
**Credit Hours : 1+1**

**Theory**

**Block 1- Introduction**

**Unit 1: Concepts of International Economics**

Scope and Significance of International Economics – The role of trade- General Equilibrium in a Closed Economy (Autarky Equilibrium) – Equilibrium in a Simple Open Economy - Possibility of World Trade - Trade gains and Trade Equilibrium.

**Block 2- Models, Rate and Terms of Trade**

**Unit 1: Barriers to trade**

Tariff, Producer Subsidy, Export Subsidy, Import Quota and Export Voluntary Restraints- The Case of Small Country and Large Country Case.

**Unit 2: Models of trade**

Ricardian Model of Trade- Specific Factors Model- Heckscher - Ohlin Model - Trade Creation and Trade Diversion – Offer Curve - Export Supply Elasticity and Import Demand Elasticity – Comparative Advantage and Absolute Advantage.

**Unit 3: Rates and Terms of trade**

Official Exchange Rate and Shadow Exchange Rate - Walra's Law and Terms of Trade – Trade Blocks.

**Block 3- Institutions**

**Unit 1: Trades Institutions**

IMF, World Bank, IDA, IFC, ADB – International Trade agreements – UruguayRound – GATT – WTO.

**Practical**

- Producer's Surplus, Consumer's Surplus, National Welfare under Autarky and Free Trade Equilibrium with small and large country assumption.
- Estimation of Trade Gains
- Estimation of competitive and comparative measures like NPC, EPC, ERP andDRC

- Estimation of Offer Curve Elasticity
- Estimation of Effect of Tariff, Export Subsidy, Producer Subsidy, Import Quotaand Export Voluntary Restraints on National Welfare
- Estimation of Ricardian Model
- Estimation of Effect of Trade under Specific Factor Model
- Estimation of trade Equilibrium under Heckscher -Ohlin model

**Suggested Reading**


- Kindelberger and Joshi PK. 2016. *International Economics* AITBS Delhi-110051
- Brouwer F. *International Trade and Food Security*. LEI - Wageningen UR, The Netherlands.
- Dominick Salvatrore. International Economics, WILEY


**Course Title : Natural Resource and Environmental Economics**

**Course Code : AEC 513**

**Credit Hours : 1+1**

**Theory**

**Block 1- Introduction to natural resource and environmental economics Unit 1: Basic Foundation**

Concepts, Classification and Problems of Natural Resource Economics – Economy Environment interaction – The Material Balance principle, Entropy law-Resources Scarcity - Limits to Growth - Measuring and mitigating natural resource scarcity
– Malthusian and Recardian scarcity – scarcity indices - Resource Scarcity and Technical Change.

**Block 2- Insights of the subject**

**Unit 1: Theories and economics of natural resources**

Theory of optimal extraction renewable resources –economic models of oil extraction- efficiency - time path of prices and extraction - Hotelling's rule, Solow-Harwick's rule. Theory of optimum extraction exhaustible resources – economic forestry and fishery.

**Unit 2: Functioning of Market**

Efficiency and markets – market failures - externalities – types - property rights – transaction costs – Coase's theorem and its critique - public goods - commonproperty and open access resource management - Collective action.

**Block 3- Dealing with the issues and sustainability**

**Unit 1: Environmental Issues**

Environmental perspectives - biocentrism, sustainability, anthropocentrism - Environmental problems and quality of environment - Sources and types of pollution

-air, water, solid waste, land degradation – environmental and economic impacts - Economics of pollution control - efficient reduction in environmental pollution.

**Unit 2: Regulations**

Environmental regulation – economic instruments - pollution charges – Pigovian tax - tradable permits – indirect instruments – environmental legislations in India.

**Unit 3: Sustainability aspects**

Concept of sustainable development – Economic Perspective – Indicators of sustainability Relation between development and environment stress Environmental Kuznet's curve Environmental Accounting – resource accounting methods – Environmental Issues – climate change – likely impacts – mitigation efforts and international treaties.

**Practical**

- Exhaustible resource management – optimum rate of oil extraction.
- Renewable resource management – optimum harvest of Forestry/fishery.
- Exercise on pollution abatement-I.
- Exercise on pollution abatement-II.
- Concepts in valuing the environment.
- Taxonomy of valuation techniques.
- Productivity change method – substitute cost method – Hedonic price method –Travel cost method – Contingent valuation methods.
- Discount rate in natural resource management.
- Environment impact assessment
- Visit to Pollution Control Board.

**Suggested Reading**


- Pearce DW and Turner RK. *Economics of Natural Resource and Environment*
- Kwak J. *Economism: Bad Economics and the Rise of Inequality*
- Tietenberg T and Lewis L. *Environmental and Natural Resource Economics*
- Schwarz PM. *Energy Economics*

**Course Title** : **Rural Marketing**
**Course Code** : **AEC-516**
**Credit Hours** : **2+0**

**Theory**

**Block 1: Rural Marketing Environment**

**Unit 1: Rural Market Concept & Scope**

Concept, Definition and Scope of rural marketing, nature and characteristics of rural markets, potential of rural markets in India, rural V/S urban market.

**Unit 2: Environmental factors**

Socio-cultural, economic, demographic, technological and other environmental factors affecting rural marketing.

**Unit 3: Rural finance**

Concept, demand, banking model; Finance Schemes of NABARD, Other Schemes of State Govt, Central Govt.

**Unit 4: Rural consumer's behavior**

Behavior of rural consumers and farmers; buyer characteristics and buying behavior; customer relationship management, rural market research.

**Block 2: Rural Marketing Strategy**

**Unit 1: Rural Product strategy**

Marketing of consumer durable and non-durable goods and services in the rural markets with special reference to product planning; marketing mix, product mix.

**Unit 2: Pricing for rural markets**

Pricing policy and pricing strategy, distribution strategy, Rural retailing and modern store formats in rural areas.

**Unit 3: Promotion and communication strategy:**

Media Planning, Distribution channels, personal selling strategies in rural markets, innovations in rural marketing

**Suggested Reading**


- Krishnamacharyulu and Ramakrishnan. 2010. *Rural Marketing: Text and Cases*: PearsonEducation. 2nd edition
- Singh S. 2004. *Rural Marketing: Focus on Agricultural Inputs,* Vikas Publishing
- Kashyap P. 2011. *Rural Marketing*. Pearson Education
- Kumar D and Gupta P. 2017. *Rural Marketing: Challenges andOpportunities*. Sage Publications.

# SUPPORTIVE COURSES

**Course Title : Statistical Methods for Applied Sciences**

**Course Code : STAT 502**

**Credit Hours : 2+1**

**Theory**

**Unit I**

Box-plot, Descriptive statistics, Exploratory data analysis, Theory of probability, Random variable and mathematical expectation.

**Unit II**

Discrete and continuous probability distributions, Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, t and F distributions. Tests of significance based on Normal, chi-square, t and F distributions.

**Unit III**

Introduction to theory of estimation and confidence-intervals, Simple and multiple correlation coefficient, partial correlation, rank correlation, Simple and multiple linear regression model, test of significance of correlation coefficient and regression coefficients, Coefficient of determination, Fitting of quadratic models.

**Unit IV**

Non-parametric tests – sign, Wilcoxon, Mann-Whitney U-test, Run test for the randomness of a sequence. Median test.

**Unit V**

Introduction to ANOVA: One way and Two Way, Introduction to Sampling Techniques, Introduction to Multivariate Analysis, Transformation of Data.

**Practical**

- Exploratory data analysis, fitting of distributions ~ Binomial, Poisson, Negative Binomial, Normal.
- Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F.
- Confidence interval estimation and Correlation and regression analysis, fitting of Linear and Quadratic Model.

- Non-parametric tests. ANOVA: One way, Two Way, SRS.

**Suggested Reading**


1. Goon A.M, Gupta M.K and Dasgupta B. 1977. An Outline of Statistical Theory. Vol. I. The World Press.
2. Goon A.M, Gupta M.K. and Dasgupta B. 1983. Fundamentals of Statistics. Vol. I. The World Press.
3. Hoel P.G. 1971. Introduction to Mathematical Statistics. John Wiley.
4. Hogg R.V and Craig T.T. 1978. Introduction to Mathematical Statistics. Macmillan.
5. Morrison D.F. 1976. Multivariate Statistical Methods. McGraw Hill.
6. Hogg RV, McKean JW, Craig AT. 2012. Introduction to Mathematical Statistics 7th Edition.
7. Siegel S, Johan N & Casellan Jr. 1956. Non-parametric Tests for Behavior Sciences. John Wiley.
8. Anderson TW. 2009. An Introduction to Multivariate Statistical Analysis, 3rd Ed . John Wiley
9. http://freestatistics.altervista.org/en/learning.php.
10. http://www.statsoft.com/textbook/stathome.html.


**Course Title : Basic Sampling Techniques**

**Course Code : STAT 512**

**Credit Hours : 2+1**

**Theory**

Unit I

Concept of sampling, sample survey vs complete enumeration, planning of sample survey, sampling from a finite population.

Unit II

Simple random sampling with and without replacement, sampling for proportion, determination of sample size, inverse sampling, Stratified sampling.

Unit III

Cluster sampling, Multi-stage sampling, systematic sampling; Introduction to PPS sampling,

Unit IV

Use of auxiliary information at estimation, Ratio product and regression estimators. Double Sampling, sampling and non-sampling errors.

**Practical**

- Random sampling ~ use of random number tables, concepts of unbiasedness, variance, etc.;
- Simple random sampling, determination of sample size, inverse sampling, stratified sampling, cluster sampling and systematic sampling;
- Estimation using ratio and regression estimators;
- Estimation using multistage design, double sampling.

**Suggested Reading**


- Cochran WG. 1977. Sampling Techniques. John Wiley.
- Murthy MN. 1977. Sampling Theory and Methods. 2nd Ed. Statistical Publ. Soc., Calcutta.
- Singh D, Singh P and Kumar P. 1982. Handbook on Sampling Methods. IASRI Publ.
- Sukhatme PV, Sukhatme BV, Sukhatme S and Asok C. 1984. Sampling Theory of Surveys

with Applications. Iowa State University Press and Indian Society of Agricultural Statistics, New Delhi.

- Cochran WG. 2007. Sampling Techniques, 3rd Edition. John Wiley & Sons Publication

# COMMON COURSES

**Course Title : Library and information services**

**Course Code : PGS-501**

**Credit Hours: 0+1**

**Objective :**

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

**Practical :**

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

**Course Title : Technical writing and communications skills**

**Course Code : PGS-502**

**Credit Hours: 0+1**

**Objective**

To equip the students/ scholars with skills to write dissertations, research papers, etc. To equip the students/ scholars with skills to communicate and articulate in English (verbal as well as writing).

**Practical (Technical Writing)**

- Various forms of scientific writings- theses, technical papers, reviews, manuals, etc.;
- Various parts of thesis and research communications (title page,

authorship contents page, preface, introduction, review of literature, material and methods,experimental results and discussion);

- Writing of abstracts, summaries, précis, citations, etc.;
- Commonly used abbreviations in the theses and research communications;
- Illustrations, photographs and drawings with suitable captions; pagination,numbering of tables and illustrations;
- Writing of numbers and dates in scientific write-ups;
- Editing and proof-reading;
- Writing of a review article;
- Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuationmarks);
- Error analysis (Common errors), Concord, Collocation, Phonetic symbols andtranscription;
- Accentual pattern: Weak forms in connected speech;
- Participation in group discussion;
- Facing an interview;
- Presentation of scientific papers.

**Suggested Readings**


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

*Composition*. S. Chand & Co.

**Course Title: Intellectual property and its management in agriculture**

**Course Code: PGS-503**

**Credit Hours: 1+0**

**Objective**

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

**Theory**

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

**Suggested Readings**


1. Erbisch FH and Maredia K.1998. *Intellectual Property Rights in AgriculturalBiotechnology*. CABI.
2. Ganguli P. 2001. *Intellectual Property Rights: Unleashing Knowledge Economy*.McGraw-Hill.
3. *Intellectual Property Rights: Key to New Wealth Generation*. 2001. NRDC andAesthetic Technologies.
4. Ministry of Agriculture, Government of India. 2004. *State of Indian Farmer*. Vol.
   V. Technology Generation and IPR Issues. Academic Foundation.
5. Rothschild M and Scott N. (Ed.). 2003. *Intellectual Property Rights in AnimalBreeding and Genetics*. CABI.

6. Saha R. (Ed.). 2006. *Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies.* Daya Publ. House.
7. The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; The Biological Diversity Act, 2002.

**Course Title: Basic Concepts in Laboratory Techniques**
**Course Code: PGS-504**
**Credits: (0+1)**

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

**Practical**

- Safety measures while in Lab;
- Handling of chemical substances;
- Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets;
- Washing, drying and sterilization of glassware;
- Drying of solvents/ chemicals;
- Weighing and preparation of solutions of different strengths and their dilution;
- Handling techniques of solutions;
- Preparation of different agro-chemical doses in field and pot applications;
- Preparation of solutions of acids;
- Neutralisation of acid and bases;
- Preparation of buffers of different strengths and pH values;
- Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath;
- Electric wiring and earthing;
- Preparation of media and methods of sterilization;
- Seed viability testing, testing of pollen viability;
- Tissue culture of crop plants;
- Description of flowering plants in botanical terms in relation to taxonomy.

**Suggested Readings**

1. Furr AK. 2000. *CRC Hand Book of Laboratory Safety. CRC Press.*

2. Gabb MH and Latchem WE. 1968. *A Handbook of Laboratory Solutions. Chemical Publ. Co*

**Course Title: Agricultural research, research ethics and rural development programmes**

**Course Code: PGS-505**

**Credit Hours: 1+0**

**Objective**

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

**Theory**

**UNIT I**

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

**UNIT II**

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

**UNIT III**

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-

operatives, Voluntary Agencies/ Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

**Suggested Readings**


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


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