DEPARTMENT OF AGRICULTURAL ECONOMICS

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

(As per the Recommendation of 5th Deans Committee's)

M. Sc. (Ag.) in AGRICULTUAL ECONOMICS
Course Structure - At a Glance

S N.	Course No.	Course Title	Cr Hr's
A.	**CORE COURSES (12 Credits)**		
1.	AEC - 501	MICRO ECONOMIC THEORY AND APPLICATIONS	2 (2+0)
2.	AEC - 502	MACRO ECONOMICS AND POLICY	2 (2+0)
3.	AEC - 503	AGRICULTURAL MARKETING & PRICE ANALYSIS	3 (2+1)
4.	AEC - 504	RESEARCH METHODOLOGY FOR SOCIAL SCIENCES	2 (1+1)
5.	AEC - 505	ECONOMETRICS	3 (2+1)
B.	**OPTIONAL COURSES (08 Credits)**		
6.	AEC - 506	EVOLUTION OF ECONOMIC THOUGHT	1 (1+0)
7.	AEC - 507	AGRICULTURAL PRODUCTION ECONOMICS	2 (1+1)
8.	AEC - 508	LINEAR PROGRAMMING	2 (1+1)
9.	AEC - 509	AGRICULTURAL FINANCE AND PROJECT MANAGEMENT	3 (2+1)
10.	AEC - 510	INTERNATIONAL ECONOMICS	2 (1+1)
11.	AEC - 511	INSTITUTIONAL ECONOMICS	1 (1+0)
12.	AEC - 512	AGRICULTURAL DEVELOPMENT POLICY ANALYSIS	2 (2+0)
13.	AEC - 513	NATURAL RESOURCE AND ENVIRONMENTAL ECONOMICS	2 (1+1)
14.	AEC - 514	INTELLECTUAL PROPERTY MANAGEMENT	1 (1+0)
15.	AEC - 515	COMPUTER APPLICATIONS FOR AGRICULTURAL ECONOMICS	3 (2+1)
16.	AEC - 516	RURAL MARKETING	2 (2+0)
17.	AEC - 517	COMMODITY FUTURES TRADING	2 (2+0)
18.	AEC - 518	MATHEMATICS METHODS FOR SCIENCS	2 (2+0)
19.	AEC - 519	STATISTICS METHODS FOR SCIENCES	3 (2+1)
20.	AEC - 520	APPLIED REGRESSION ANALYSIS	3(2+1)
21.	AEC - 521	EXPERIMENTAL DESIGNS	3(2+1)
22.	AEC - 522	SAMPLING TECHNIQUES	3(2+1)
23.	AEC -523	DATA ANALYSIS STATISTICAL PACKAGES	3(2+1)
21.	AEC - 599	SEMINAR	1 (0+1)
22.	AEC - 600	RESEARCH WORK (THESIS)	20 (0+20)

Total Credit from Major Discipline : **20**
Total Credit from Minor Discipline : **09**
Total Credit from Supporting Discipline : **05**
Total Credit for Seminar : **01**
Total Credits for Research Work (Thesis Work) : **20**
Total Non Credit Courses (Compulsory) ***: 06***
Total Credit Required for M. Sc. (Ag.) Degree : **55**

(A). CORE COURSES

AEC - 501 MICRO ECONOMIC THEORY AND APPLICATIONS 2 (2 + 0)

Objective

This course is intended to provide an overview of microeconomic theory and its applications. The course starts with the theory of consumer behaviour consisting of consumer's utility maximization problem and demand theory. It intends to provide fundamental concepts and models in the theory of production and costs and sets out to provide a basic understanding of price and / or output determination under different types of market structures including factor markets. This course will also expose the students to the theory of general equilibrium and welfare economics.

Theory

Theory of Consumer Behaviour - Cardinal Utility Approach - Ordinal Utility Approach - Income effect and substitution effect - Applications of Indifference curve approach - Revealed Preference Hypothesis - Consumer surplus - Derivation of Demand curve - Elasticity of demand.

Theory of Production - Production functions - Returns to scale and economies of scale - Technical progress - Theory of Costs - Cost curves - Profit maximization and cost minimization - Derivation of supply curve - Law of Supply - Producers' surplus.

Market Equilibrium - Behavior of Firms in Competitive Markets - Perfect Competition - Effect of Taxation and Subsidies on market equilibrium - Monopoly - Monopolistic - Oligopoly - Theory of Factor Markets.

General Equilibrium Theory - Welfare Economics - Pareto Optimality - Social welfare criteria - Social Welfare functions.

Suggested Readings

David M Kreps 1990. *A Course in Microeconomic Theory*. Princeton University Press.
Dewitt KK. 2002. *Modern Economic Theory*. Sultan Chand & Co.
Henderson JM & Quandt RE. 2000. *Microeconomic Theory: A Mathematical Approach*. McGraw-Hill.
Koutsoyiannis A. 2003. Modern Microeconomics. The Macmillan Press.
Silberberg E & Suen W. 2001. *The Structure of Economics - A Mathematical Analysis*. McGraw-Hill.
Varian Hal R. 1999. *Intermediate Microeconomics*. Affiliated East-West Press.

AEC - 502 MACRO ECONOMICS AND POLICY 2 (2 + 0)

Objective

Macro economics and Policy course is intended to expose the students to macroeconomic concepts and theory, the application of the macro economic theory, and implication of the macroeconomic policies.

Theory

Nature and Scope of Macro Economics - Methodology and Keynesian Concepts National Income - Concepts and measurement - Classical theory of Employment and Say's Law -Modern theory of Employment and Effective Demand.

Consumption function - Investment and savings - Concept of Multiplier and Accelerator - Output and Employment - Rate of interest - Classical, Neo classical and Keynesian version - Classical theory Vs Keynesian theory - Unemployment and Full employment.

Money and classical theories of Money and Price - Keynesian theory of money and Friedman Restatement theory of money - Supply of Money - Demand for Money -Inflation: Nature, Effects and control.

IS & LM frame work - General Equilibrium of product and money markets - Monetary policy - Fiscal policy - Effectiveness of Monetary and Fiscal policy - Central banking.

Business cycles - Balance of Payment - Foreign Exchange Rate determination.

Suggested Readings

Ahuja HL. 2007. *Macroeconomics: Theory and Policy*. S. Chand & Co.
Eugene A Diulio 2006. *Macroeconomics*. 4th Ed. Schaums' Outlines.
Gardner Ackely 1987. *Macro Economic: Theory and Policy*. Collier Macmillan.
Dornbusch. 2006. *Macroeconomics*. McGraw Hill Publication

AEC - 503 AGRICULTURAL MARKETING AND PRICE ANALYSIS 3 (2 + 1)

Objective

To impart adequate knowledge and analytical skills in the field of agricultural marketing issues, and enhance expertise in improving the performance of the marketing institutions and the players in marketing of agricultural commodities.

Theory

Review of 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 coordination.

Marketing Co-operatives - APMC Regulated Markets - Direct marketing, Contract farming and Retailing - Supply Chain Management - State trading, Warehousing and other Government agencies -Performance and Strategies - Market infrastructure needs, performance and Government role - Value Chain Finance.

Role of Information Technology and telecommunication in marketing of agricultural commodities - Market research - Market information service - electronic auctions (e-bay), e-Chaupals, Agmarket and Domestic and Export market Intelligence Cell (DEMIC) - Market extension.

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

Theory of storage - 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 in promoting commodity trading and regulatory measures.

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. 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 Readings

Purecell WD & Koontz SR. 1999. *Agricultural Futures and Options: Principles and Strategies*. 2nd Ed. Prentice-Hall.
Rhodes VJ. 1978. *The Agricultural Marketing System*. Grid Publ., Ohio.
Shepherd SG & Gene AF. 1982. *Marketing Farm Products*. Iowa State Univ. Press.
Singhal AK. 1986. *Agricultural Marketing in India*. Annual Publ., New Delhi.

AEC - 504 RESEARCH METHODOLOGY FOR SOCIAL SCIENCES 2 (1 + 1)

Objective

To expose the students to research methodology used in social sciences. The focus will be on providing knowledge related to research process, data collection and data analysis.

Theory

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.

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

Sampling theory and sampling design - sampling error - methods of sampling - probability and non-probability sampling methods - criteria to choose. Project proposals - 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.

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.

Coding editing - tabulation - validation of data. Tools of analysis - data processing. Interpretation of results - Preparing research report / thesis - 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 different situations. 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 Readings

Black TR. 1993. *Evaluating Social Science Research - An Introduction***.** SAGE Publ.
Creswell JW. 1999. *Research Design - Qualitative and Quantitative Approaches.* SAGE Publ.
Dhondyal SP. 1997. *Research Methodology in Social Sciences and Essentials of Thesis Writing*. Amman Publ. House, New Delhi.
Kothari CR. 2004. *Research Methodology - Methods and Techniques***.** Wishwa Prakashan, Chennai.
Rao KV. 1993. *Research Methodology in Commerce and Management***.** Sterling Publ., New Delhi.
Singh AK. 1993. *Tests, Measurements and Research Methods in Behavioural Sciences***.** Tata McGraw-Hill.
Venkatasubramanian V. 1999. *Introduction to Research Methodology in Agricultural and Biological Sciences*. SAGE Publ.

AEC - 505 ECONOMETRICS 3 (2 + 1)

Objective

The Course Objective of the course is to impart knowledge on econometric tools to the students of agricultural economics. Training in econometrics will help the student to analyze the economic problem by applying quantitative techniques.

Theory

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

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

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

Use of dummy variables - limited dependent variables - specification, estimation and interpretation.

Simultaneous equation models - structural equations - reduced form equations - identification and approaches to estimation.

Practical

Single equation two variable model specification and estimation - hypothesis testing - transformations of functional forms and OLS application-estimation of multiple regression model - hypothesis testing - testing and correcting specification errors - testing and managing Multicollinearity - testing and managing heteroscedasticity - testing and managing autocorrelation - estimation of regressions with dummy variables - estimation of regression with limited dependent variable - identification of equations in simultaneous equation systems.

Suggested Readings

Gujarati DN. 2003. *Basic Econometrics*. McGraw Hill.
Johnson AG Jr., Johnson MB & Buse RC. 1990. *Econometrics - Basic and Applied.* MacMillan.
Kelejan HH & Oates WE. 1994. *Introduction to Econometrics Principles and Applications*. Harper and Row Publ.
Koutsoyianis A. 1997. *Theory of Econometrics*. Barner & Noble.
Maddala GS. 1992. *Introduction to Econometrics*. MacMillan.
Maddala GS. 1997. *Econometrics.* McGraw Hill.
Pindyck RS & Rubinfeld DL. 1990. *Econometrics Models and Econometric Forecasts*. McGraw Hill.

(B). OPTIONAL COURSES

AEC - 506 EVOLUTION OF ECONOMIC THOUGHT 1 (1 + 0)

Objective

To introduce the students to the evolution of economic thought over a period of time, the background of emanation of thoughts and approaches, as acts of balancing and counter balancing events and criticisms. The course will also in a comprehensive way help the students to know and appreciate the contributions of the Galaxy of Economists.

Theory

Approaches for the study of history of economic thought - Absolutist vs. Relativist approaches - Evolution of Economic Thought vs. Economic History. Ancient economic thought - medieval economic thought - mercantilism - physiocracy - Forerunners of Classical Political Economy.

Development of Classical Thoughts (Adam Smith, Robert Malthus and David Ricardo) - Critics of Classical Thoughts - Socialist critics - Socialist and Marxian Economic Ideas - Austrian School of Thought - Origins of Formal Microeconomic Analysis - William Stanley Jevons, Cournot and Dupuit.

The birth of neoclassical economic thought - Marshall and Walras - General Equilibrium Theory - Welfare Theory - Keynesian economics.

The Era of globalization - Experiences of developing world - Rigidity of the past vs. emerging realism. The changing path of international Institutions to economic growth and development approaches.

Economic Thought in India - Naoroji and Gokhale - Gandhian Economics - Economic thought of independent India - Nehru's economic philosophy - Experiences of the Structural adjustment programmes of the post liberalization era.

Suggested Readings

Blaug M. 1964. *Economic Theory in Retrospect*. Heineman.
Blaug M. 1986. *Economic History and the History of Economic Thought*. Wheatsheaf Books, Brighton.
Ekelund RB & Hebert RF. 1975. *A History of Economic Theory and Methods*. McGraw-Hill.
John Mills A. 2002. *Critical History of Economics: Missed Opportunities*. Palgrave Macmillan.
Screpanti E & Zamagni S. 1995. *An Outline of the History of Economic Thought*. Clarendon Press, Oxford.

AEC - 507 AGRICULTURAL PRODUCTION ECONOMICS 2 (1 + 1)

Objective

To expose the students to the concept, significance and uses of agricultural production economics.

Theory

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.

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.

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.

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 through linear programming.

Suggested Readings

Beattie BR & Taylor CR. 1985. *The Economics of Production*. John Wiley & Sons.
Doll JP & Frank O. 1978. *Production Economics - Theory and Applications*. John Wiley & Sons.
Gardner BL & Rausser GC. 2001. *Handbook of Agricultural Economics*. Vol. I. *Agricultural Production*. Elsevier.
Heady EO. *Economics of Agricultural Production and Resource Use*. Prentice - Hall.
Sankayan PL. 1983. *Introduction to Farm Management*. Tata Mc Graw Hill.

AEC - 508 LINEAR PROGRAMMING 2 (1 + 1)

Objective

The Course Objective of the course is to impart knowledge of Linear programming techniques.

Theory

Decision Making - Concepts of decision making, introduction to quantitative tools, introduction to linear programming, uses of LP in different fields, graphic solution to 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.

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

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

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 & Economic Analysis*. McGraw Hill.
Loomba NP.2006. *Linear Programming*. Tata McGraw Hill.
Shenoy G. 1989. *Linear Programming-Principles & Applications*. Wiley Eastern Publ.
Vaserstein. 2006. *Introduction to Linear Programming*. Pearson Education Publication

AEC - 509 AGRICULTURAL FINANCE AND PROJECT MANAGEMENT 3 (2 + 1)

Objective

The Course Objective of the course is to impart knowledge on issues related to lending to priority sector credit management and financial risk management. The course would bring in the various appraisal techniques in project - investment of agricultural projects.

Theory

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-Financing and Role of MFI's - NGO's, and SHG's.

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.

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.

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.

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-operative Lending 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 Readings

Dhubashi PR. 1986. *Policy and Performance - Agricultural and Rural Development in Post Independent India*. Sage Publ.

Gittinger JP 1982. *Economic Analysis of Agricultural Projects***.** The Johns Hopkins Univ. Press.

Gupta SC. 1987. *Development Banking for Rural Development*. Deep & Deep Publ.

Little IMD & Mirlees JA. 1974. *Project Appraisal and Planning for Developing Countries***.** Oxford & IBH Publ.

Muniraj R. 1987. *Farm Finance for Development*. Oxford & IBH Publ.

AEC - 510 INTERNATIONAL ECONOMICS 2 (1 + 1)

Objective

The expected outcome of this course will be creating awareness among the students about the role of International Economics on National welfare.

Theory

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.

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

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.

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

IMF, World Bank, IDA, IFC, ADB - International Trade agreements - Uruguay Round - 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 and DRC- Estimation of Offer Curve Elasticity - Estimation of Effect of Tariff, Export Subsidy, Producer Subsidy, Import Quota and 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 - Trade Creation and Diversion.

Suggested Readings

Apple Yard DR & Field AJ Jr. 1995. *International Economics - Trade, Theory and Policy*. Irwin, Chicago.
Cherunilam F. 1998. *International Economics*. Tata McGraw Hill.
Krugman PR & Obstfeld M. 2000. *International Economics - Theory and Policy*. Addison-Wesley.

AEC - 511 INSTITUTIONAL ECONOMICS 1 (1 + 0)

Objective

The course exposes the students to the institutional problems and remedies.

Theory

Old and New Institutional Economics - Institutional Economics Vs Neo- classical Economics. Definition of institutions - Distinction between institutions and organizations - Institutional evolution.

Institutional change and economic performance - national and international economic institutions. Transaction cost economics - Transaction costs and the allocation of resources. Transaction costs and efficiency. Asymmetric information - Moral hazard and Principal - Agent problem.

Free rider problem - path dependency - Interlinked transactions. Collective action and the elimination of free-rider problem - The logic of collective action and its role in reducing free rider problem - theory of Groups. Rent seeking - interest groups and policy formulation.

Economic analysis of property rights - property rights regimes - private property - State Property - Common property Resources (CPRs) - public goods and club goods.

Special features of institutional arrangements in agriculture - Transaction costs in agriculture - Case Studies - Theories of agrarian institutions - tenancy institutions.

Suggested Readings

Barzel, Y. 1990. *Economic Analysis of Property Rights*. Cambridge Univ. Press.
Bhardhan P. (Ed.). 1989. *The Economic Theory of Agrarian Institutions*. Clarendon Press, Oxford.
Bromley DW. 1989. *Economic Interests and Institutions: The Conceptual Foundations of Public Policy*. Basil Blackwell, Cambridge.
Eggertsson T. 1990. *Economic Behaviour and Institutions*. Cambridge Univ. Press.
Greif A. 2006. *Institutions and the Path to the Modern Economy: Lessons from Medieval Trade (Political Economy of Institutions & Decisions)* Cambridge Univ. Press.
Neelakandan S. 1992. *New Institutional Economics and Agrarian Change - A Primer*. Indian Economic Association Trust for Research and Development, New Delhi.
North DC. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge Univ. Press.
Ostrom E. 1990. *Governing the Commons: The Evolutions of Institutions forCollective Actions.* Cambridge Univ. Press.

AEC - 512 AGRICULTURAL DEVELOPMENT AND POLICIES 2 (2 + 0)

Objectives

• to provide orientation to the students regarding the concepts and measures of economic development
• to provide orientation on theories of economic growth and relevance of theories in developing countries.
• to make them to understand the agricultural policies and its effect on sustainable agricultural development
• to make them to understand the globalization and its impact on agricultural development.

Theory

Development Economics - Scope and Importance - Economic development and economic growth - divergence in concept and approach - Indicators and Measurement of Economic Development - GNP as a measure of economic growth - New Measures of Welfare - NEW and MEW - PQLI - HDI - Green GNP - Criteria for under development - Obstacles to economic development - Economic and Non-Economic factors of economic growth.

Economic development - meaning, stages of economic development, determinants of economic growth. Theories of economic growth - Ricardian growth model - The Harrod - Domar Model - The Neo classical Model of Growth - The Kaldor Model - Optimal Economic Growth - Recent Experiences of developing country economies in transition - Role of state in economic development - Government measures to promote economic development. Introduction to development planning.

Role of agriculture in economic / rural development - theories of agricultural development - Population and food supply - need for sound agricultural policies - resource policies - credit policies - input and product marketing policies - price policies.
Development issues, poverty, inequality, unemployment and environmental degradation - Models of Agricultural Development - Induced Innovation Model - policy options for sustainable agricultural development.

Globalization and the relevance of development policy analysis - The dilemma of free trade? Free trade versus Protectionism- Arguments for protection. Arguments against protection. Role of protection in Developing Countries. WTO - Agreement on Agriculture - Contradictions of free trade - proponents and opponents policies in vulnerable sectors like agriculture - Lessons for developing countries.

Suggested Readings

Chakaravathi RM. 1986. *Under Development and Choices in Agriculture*. Heritage Publ. New Delhi.
Diwett KK. 2002. *Modern Economic Theory***.** S. Chand & Co.
Eicher KC & Staatz JM. 1998. *International Agricultural Development*. Johns Hopkins Univ. Press.
Frank E. 1992. *Agricultural Polices in Developing Countries*. Cambridge Univ. Press.
Ghatak S & Ingersent K. 1984. *Agriculture and Economic Development*. Select Book Service Syndicate, New Delhi.
Jhingan ML. 1998. *The Economics of Development and Planning*. Vrinda Publ.
Jules PN. 1995. *Regenerating Agriculture – Polices and Practice for Sustainability and Self Reliance*. Vikas Publ. House.
Naqvi SNH. 2002. *Development Economics – Nature and Significance*. Sage Publ.

AEC - 513 INSTITUTIONAL ECONOMICS 1 (1 + 0)

Objective

The course exposes the students to the institutional problems and remedies.

Theory

Old and New Institutional Economics - Institutional Economics Vs Neo - classical Economics. Definition of institutions - Distinction between institutions and organizations - Institutional evolution.

Institutional change and economic performance - national and international economic institutions. Transaction cost economics - Transaction costs and the allocation of resources. Transaction costs and efficiency. Asymmetric information - Moral hazard and Principal - Agent problem.

Free rider problem - path dependency - Interlinked transactions. Collective action and the elimination of free - rider problem - The logic of collective action and its role in reducing free rider problem - theory of Groups. Rent seeking - interest groups and policy formulation.

Economic analysis of property rights - property rights regimes - private property - State Property - Common property Resources (CPRs) - public goods and club goods.

Special features of institutional arrangements in agriculture - Transaction costs in agriculture - Case Studies - Theories of agrarian institutions - tenancy institutions.

Suggested Readings

Barzel, Y. 1990. *Economic Analysis of Property Rights*. Cambridge Univ. Press.
Bhardhan P. (Ed.). 1989. *The Economic Theory of Agrarian Institutions*. Clarendon Press, Oxford.
Bromley DW. 1989. *Economic Interests and Institutions: The Conceptual Foundations of Public Policy*. Basil Blackwell, Cambridge.
Eggertsson T. 1990. *Economic Behaviour and Institutions*. Cambridge Univ. Press.
Greif A. 2006. *Institutions and the Path to the Modern Economy: Lessons from Medieval Trade (Political Economy of Institutions & Decisions).* Cambridge Univ. Press.
Neelakandan S. 1992. *New Institutional Economics and Agrarian Change - A Primer*. Indian Economic Association Trust for Research and Development, New Delhi.
North DC. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge Univ. Press.
Ostrom E. 1990. *Governing the Commons: The Evolutions of Institutions for Collective Actions.* Cambridge Univ. Press.

AEC - 514 NATURAL RESOURCE AND ENVIRONMENTAL ECONOMICS 2 (1 + 1)

Objectives

• To introduce economics principles related to natural resource and environmental economics
• To explore the concept of efficiency and the efficient allocation of natural resources
• To understand the economics of why environmental problems occur.
• To explore the concept of efficiency and the efficient allocation of pollution control and pollution prevention decisions.
• To understand the environmental policy issues and alternative instruments of environmental policies.

Theory

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.

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 optimal extraction exhaustible resources - economic models of forestry and fishery.

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

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.

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

Concept of sustainable development - Economic Perspective - Indicators of sustainability Relation between development and environment stress - Environmental Kuznet's curve Environmental Accounting - resource accounting methods - International 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 Readings

Ahmad Y, El Serafy S & Lutz E. (Eds.). 1989.Environmental Accounting for Sustainable Development. World Bank.

Freeman AM. 1993. *The Measurement of Environmental and Resource Values*. Resources for the Future Press, Baltimore.
Hackett SC. 2001. *Environmental and Natural Resource Economics: Theory, Policy, and the Sustainable Society*. M. E. Sharpe, Armonk, NY.
Hartwick JM & Olewiler ND. 1998. *The Economics of Natural Resource Use*. 2nd Ed. Addison-Wesley Educational Publ.
Kerr JM, Marothia DK, Katar Singh, Ramasamy C & Bentley WR. 1997. *Natural Resource Economics: Theory and Applications in India.* Oxford & IBH.
Kolstad CD. 2000. Environmental Economics. Oxford Univ. Press.
Pearce DW & Turner K. 1990. *Economics of Natural Resources and the Environment*. John Hopkins Univ. Press.
Prato T. 1998. *Natural Resource and Environmental Economics*. Iowa State Univ. Press.
Sankar U. 2001. Environmental Economics. Oxford Univ. Press.
Sengupta R. 2000. *Ecology and Economy, an Indian Perspective*. Oxford Univ. Press.
Tietenberg T. 2003. *Environmental and Natural Resource Economics*. 6th Ed. Addison Wesley.

AEC - 515 INTELLECTUAL PROPERTY MANAGEMENT 1 (1 + 0)

Objective

The Course Objective of the course is to create awareness about intellectual property rights in agriculture. The course deals with management of patents, trademark, geographical indications, copy rights, designs, plant variety protection and biodiversity protection. The students will be taught on the Marketing and Commercialization of Intellectual Properties.

Theory

World Trade Organization- Agreement on Agriculture (AoA) and Intellectual Property Rights (IPR) - Importance of Intellectual Property Management - IPR and Economic growth - IPR and Bio diversity - Major areas of concern in Intellectual Property Management -Technology Transfer and Commercialization - Forms of different Intellectual Properties generated by agricultural research.

Discovery *versus* Invention - Patentability of Biological Inventions - Method of Agriculture and Horticulture - procedure for patent protection: Preparatory work. Record keeping, writing a patent document, filing the patent document - Types of patent application-patent application under the Patent cooperation treaty (PCT).

Plant genetic resources - Importance and conservation - Sui Generic System - Plant Varieties Protection and Farmers Rights Act - Registration of Extant varieties - Registration and protection of New Varieties / Hybrids / Essentially Derived Varieties - Dispute prevention and settlement - Farmers' Rights.

Trademark- Geographical Indications of Goods and Commodities - Copy rights - Designs - Biodiversity Protection.

Procedures for commercialization of technology - Valuation, Costs and Pricing of Technology - Licensing and implementation of Intellectual Properties - Procedures for commercialization - Exclusive and non exclusive marketing rights - Research Exemption and benefit sharing .

Suggested Readings

Ganguli P. 2001. *Intellectual Property Rights - Unleashing the Knowledge Economy*. Tata McGraw Hill.
Gupta AK. 2003. *Rewarding Conservation of Biological and Genetic Resources and Associated Traditional Knowledge and Contemporary Grass RootsCreativity*. Indian Institute of Management, Ahmedabad.
Khan SA & Mashelkar R. 2004. *Intellectual Property and Competitive Strategies in the 21st Century*. Kluwer Law International, The Hague.

AEC - 516 RURAL MARKETING 2 (2 + 0)

Objective

To provide understanding regarding issues in rural markets like marketing environment, consumer behaviour, distribution channels, marketing strategies, etc.

Theory

Concept and scope of rural marketing, nature and characteristics of rural markets, potential of rural markets in India.

Environmental factors - socio-cultural, economic and other environmental factors affecting rural marketing.

Rural consumer's behaviour - behavior of rural consumers and farmers; buyer characteristics and buying behaviour; Rural v/s urban markets.

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

Product promotion - Media planning, planning of distribution channels and organizing personal selling in rural market in India.

Suggested Readings

Krishnamacharyulu CSG & Ramakrishan L. 2002. *Rural Marketing.* Pearson Edu.
Ramaswamy VS & Nanakumari S. 2006. *Marketing Management.* 3rd Ed. MacMillan.
Singh AK & Pandey S. 2005. *Rural Marketing*. New Age.
Singh Sukhpal. 2004. *Rural Marketing*. Vikas Publ. House.

AEC - 517 COMMODITY FUTURES TRADING 2 (2 + 0)

Objective

This course is aimed at providing the basic understanding and the mechanics and value of futures markets for speculators and hedgers who in turn will serve as price risk management activities of agribusiness firms.

Theory

History and Evolution of commodity markets - Terms and concepts: spot, forward and futures Markets - factors influencing spot and future markets. Speculatory mechanism in commodity futures.

Transaction and settlement - delivery mechanism - role of different agents - trading strategies - potential impact of interest rate, Foreign Exchange, FDI in Commodity Markets.

Risk in commodity trading, importance and need for risk management measures - managing market price risk: hedging, speculation, arbitrage, swaps - pricing and their features.

Important global and Indian commodity exchanges - contracts traded - special features -Regulation of Indian commodity exchanges - FMC and its role.

Fundamental Vs Technical analysis - construction and interpretation of charts and chart patterns for analyzing the market trend - Market indicators - back testing. Introduction to technical analysis software - analyzing trading pattern of different commodity groups.

Suggested Readings

Kaufman PJ. 1986. *The Concise Handbook of Futures Markets*. John Wiley & Sons.
Leuthold RM, Junkus JC & Cordier JE. 1989. *The Theory and Practice of Futures Markets***.** Lexington Books.
Lofton T. 1993. *Getting Started in Futures*. 3rd Ed. John Wiley & Sons, 1993.
Purcell WD. 1991. *Agricultural Futures and Options: Principles and Strategies*. Macmillan Publ.
Wasendorf RR & McCafferty 1993. *All about Commodities from the Inside Out*. McGraw-Hill.

AEC - 518 MATHEMATICS METHODS FOR SCIENCES 2 (2 + 0)

Objective

This course is meant for students who do not have sufficient background of Mathematics. The students would be exposed to elementary mathematics that would prepare them to study their main courses that involve knowledge of Mathematics. The students would get an exposure to differentiation, integration and differential equation.

Theory

Variables and functions; limit and continuity. Specific functions. Differentiation: theorems of differentiation, differentiation of logarithmic, trigonometric, exponential and inverse functions, function of a function, derivative of higher order, partial derivatives. Application of derivatives in agricultural research; determination of points of inflexion, maxima and minima in optimization, etc.

Integration as a reverse process of differentiation, methods of integration, reduction formulae, definite integral; Applications of integration in agricultural research with special reference to economics and genetics, engineering, etc.

Vectors and vector spaces, Matrices, notations and operations, laws of matrix algebra; transpose and inverse of matrix; Eigen values and eigen vectors. Determinants - evaluation and properties of determinants, application of determinants and matrices in solution of equation for economic analysis.

Set theory-set operations, finite and infinite sets, operations of set, function defined in terms of sets.

Suggested Readings

Harville DA. 1997. *Matrix Algebra from a Statistician's Perspective*. Springer.
Hohn FE. 1973. *Elementary Matrix Algebra*. Macmillan.
Searle SR. 1982. *Matrix Algebra Useful for Statistics*. John Wiley.
Stewart J. 2007. *Calculus*. Thompson.
Thomas GB. Jr. & Finney RL. 1996. *Calculus.* 9th Ed. Pearson Edu.

AEC - 519 STATISTICAL METHODS FOR SCIENCES 3 (2 + 1)

Objective

This course is meant for students who do not have sufficient background of Statistical Methods. The students would be exposed to concepts of statistical methods and statistical inference that would help them in understanding the importance of statistics. It would also help them in understanding the concepts involved in data presentation, analysis and
interpretation. The students would get an exposure to presentation of data, probability distributions, parameter estimation, tests of significance, regression and multivariate analytical techniques.

Theory

Classification, tabulation and graphical representation of data. Box-plot, Descriptive statistics. Exploratory data analysis; Theory of probability. Random variable and mathematical expectation.

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

Correlation and regression. Simple and multiple linear regression model, estimation of parameters, predicted values and residuals, correlation, partial correlation coefficient, multiple correlation coefficient, rank correlation, test of significance of correlation coefficient and regression coefficients.

Basic concept of non-parametric tests - sign, Wilcoxon, Mann-Whitney U-test, Wald Wolfowitz run test, Run test for the randomness of a sequence. Median test.

Practical

Exploratory data analysis, Box-Cox plots; Fitting of distributions ~ Binomial, Poisson, Normal; Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F; Correlation and regression analysis, Nonparametric tests.

Suggested Readings

Anderson TW. 1958. *An Introduction to Multivariate Statistical Analysis*. John Wiley.
Dillon WR & Goldstein M. 1984. *Multivariate Analysis - Methods and Applications*. John Wiley.
Goon AM, Gupta MK & Dasgupta B. 1977. *An Outline of Statistical Theory*. Vol. I. The World Press.
Goon AM, Gupta MK & Dasgupta B. 1983. *Fundamentals of Statistics*. Vol. I. The World Press.
Hoel PG. 1971. *Introduction to Mathematical Statistics*. John Wiley. Hogg RV & Craig TT. 1978. *Introduction to Mathematical Statistics*. Macmillan.
Morrison DF. 1976. *Multivariate Statistical Methods*. McGraw Hill.
Siegel S, Johan N & Casellan Jr. 1956. *Non-parametric Tests for BehaviorSciences*. John Wiley.
Learning Statistics: http://freestatistics.altervista.org/en/learning.php. Electronic Statistics Text Book:
http://www.statsoft.com/textbook/stathome.html.

AEC - 520 APPLIED REGRESSION ANALYSIS 3 (2 + 1)

Objective

This course is meant for students of all disciplines including agricultural and animal sciences. The students would be exposed to the concepts of correlation and regression. Emphasis will be laid on diagnostic measures such as autocorrelation, multicollinearity and heteroscedasticity. This course would prepare students to handle their data for analysis and interpretation.

Theory

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

Auto correlation; Durbin Watson Statistics; Analysis of collinear data; Detection and correction of multicollinearity; Regression analysis; Method of least squares for curve fitting; Testing of regression coefficients; Multiple and partial regressions.

Examining the multiple regression equation; Concept of weighted least squares; regression equation on grouped data; regression approach applied to analysis of variance in one way classification.

Heteroscedastic models, Concept of nonlinear regression and fitting of quadratic, exponential and power curves.

Practical

Correlation coefficient, various types of correlation coefficients, partial and multiple, testing of hypotheses; Multiple linear regression analysis, partial regression coefficients, testing of hypotheses, multicollinearity; Fitting of quadratic, exponential and power curves,
fitting of orthogonal polynomials.

Suggested Readings

Draper NR & Smith H. 1998. *Applied Regression Analysis*. 3rd Ed. John Wiley.
Ezekiel M. 1963. *Methods of Correlation and Regression Analysis*. John Wiley.
Kleinbaum DG, Kupper LL, Muller KE & Nizam A. 1998. *Applied Regression Analysis and Multivariable Methods*. Duxbury Press.
Koutsoyiannis A. 1978. *Theory of Econometrics*. MacMillan.
Kutner MH, Nachtsheim CJ & Neter J. 2004. *Applied Linear Regression Models*. 4th Ed. With Student CD. McGraw Hill.

AEC - 521 EXPERIMENTAL DESIGNS 3 (2 + 1)

Objective

This course is meant for students of agricultural and animal sciences other than Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

Theory

Need for designing of experiments, characteristics of a good design. Basic principles of designs-randomization, replication and local control.

Uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design.

Factorial experiments, (symmetrical as well as asymmetrical). Factorial experiments with control treatment.

Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations.

Practical

Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law; Analysis of data obtained from CRD, RBD, LSD; Analysis of factorial experiments without and with confounding; Analysis with missing data; Split plot and strip plot designs; Transformation of data.

Suggested Readings

Cochran WG & Cox GM. 1957. *Experimental Designs*. 2nd Ed. John Wiley.

Dean AM & Voss D. 1999. *Design and Analysis of Experiments*. Springer.
Federer WT. 1985. *Experimental Designs*. MacMillan.
Fisher RA. 1953. *Design and Analysis of Experiments*. Oliver & Boyd.
Nigam AK & Gupta VK. 1979. *Handbook on Analysis of Agricultural Experiments*. IASRI Publ.
Pearce SC. 1983. *The Agricultural Field Experiment: A Statistical Examination of Theory and Practice*. John Wiley.
Design Resources Server: www.iasri.res.in/design.

AEC - 522 SAMPLING TECHNIQUES 3 (2 + 1)

Objective

This course is meant for students of agricultural and animal sciences other than Statistics. The students would be exposed to elementary sampling techniques. It would help them in understanding the concepts involved in planning and designing their surveys, presentation of survey data analysis of survey data and presentation of results. This course would be especially important to the students of social sciences.

Theory

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

Simple random sampling, sampling for proportion, determination of sample size; Stratified sampling.

Cluster sampling, PPS sampling, Multi-stage sampling, double sampling, systematic sampling; Use of auxiliary information at estimation as well as selection stages.

Practical

Random sampling ~ use of random number tables, concepts of unbiasedness, variance, etc.; simple random sampling, determination of sample size; Exercises on stratified sampling, cluster sampling and systematic sampling; Estimation using multistage design, double sampling and PPS sampling.

Suggested Readings

Cochran WG. 1977. *Sampling Techniques*. John Wiley.
Murthy MN. 1977. *Sampling Theory and Methods*. 2nd Ed. Statistical Publ. Soc., Calcutta.
Singh D, Singh P & Kumar P. 1982. *Handbook on Sampling Methods*. IASRI Publ.
Sukhatme PV, Sukhatme BV, Sukhatme S & Asok C. 1984. *Sampling Theory of Surveys with Applications*. Iowa State University Press and Indian Society of Agricultural Statistics, New Delhi.

AEC - 523 DATA ANALYSIS USING STATISTICAL PACKAGES 3 (2 + 1)

Objective

This course is meant for exposing the students in the usage of various statistical packages for analysis of data. It would provide the students an hands on experience in the analysis of their research data. This course is useful to all disciplines.

Theory

Use of Software packages for: Summarization and tabulation of data; Descriptive statistics; Graphical representation of data, Exploratory data analysis.

Fitting and testing the goodness of fit of discrete and continuous probability distributions; Testing of hypothesis based on large sample test statistics; Testing of hypothesis using chi-square, *t* and *F* statistics.

Concept of analysis of variance and covariance of data for single factor, multi-factor, one-way and multi-classified experiments.

Correlation and regression including multiple regression.

Fitting of non-linear models.

Practical

Use of software packages for summarization and tabulation of data, obtaining descriptive statistics, graphical representation of data. Testing linearity and normality assumption. Cross tabulation of data including its statistics, cell display and table format and means for different sub-classifications; Fitting and testing the goodness of fit of probability distributions; Testing the hypothesis for one sample *t*-test, two sample *t*-test, paired *t*-test, test for large samples - Chi-squares test, F test, One way analysis of variance, pairwise comparisons; Multiway classified analysis of variance - cross-classification, nested classification, factorial set up, fixed effect models, random effect models, mixed effect models, estimation of variance components; Generalized linear models - analysis of unbalanced data sets, testing and significance of contrasts, Estimation of variance components in unbalanced data sets - maximum likelihood.

Suggested Readings

Anderson CW & Loynes RM. 1987. *The Teaching of Practical Statistics*. John Wiley.
Atkinson AC. 1985. *Plots Transformations and Regression*. Oxford University Press.
Chambers JM, Cleveland WS, Kleiner B & Tukey PA. 1983. *Graphical Methods for Data Analysis*. Wadsworth, Belmount, California.
Chatfield C & Collins AJ. 1980. *Introduction to Multivariate Analysis*. Chapman & Hall.
Chatfield C. 1983. *Statistics for Technology*. 3rd Ed. Chapman & Hall.
Chatfield C. 1995. *Problem Solving: A Statistician's Guide*. Chapman & Hall.
Cleveland WS. 1985. *The Elements of Graphing Data*. Wadsworth, Belmont, California.
Ehrenberg ASC. 1982. *A Primer in Data Reduction*. John Wiley.
Erickson BH & Nosanchuk TA. 1992. *Understanding Data*. 2nd Ed. Open University Press, Milton Keynes.
Snell EJ & Simpson HR. 1991. *Applied Statistics: A Handbook of GENSTAT Analyses*. Chapman & Hall.
Sprent P. 1993. *Applied Non-parametric Statistical Methods*. 2nd Ed. Chapman & Hall.
Tufte ER. 1983. *The Visual Display of Quantitative Information*. Graphics Press, Cheshire, Conn.
Velleman PF & Hoaglin DC. 1981. *Application, Basics and Computing ofExploratory Data Analysis*. Duxbury Press.
Weisberg S. 1985. *Applied Linear Regression*. John Wiley.
Wetherill GB. 1982. *Elementary Statistical Methods*. Chapman & Hall.
Wetherill GB.1986. *Regression Analysis with Applications*. Chapman & Hall.

Course on Experimental design: http://www.stat.sc.edu/~grego/courses/stat706/.
Design Resources Server: www.iasri.res.in/design.
Analysis of Data: Design Resources Server.
http://www.iasri.res.in/design/Analysis%20of%20data/Analysis%20of%2 Data.html.

AEC - 524 COMPUTER APPLICATIONS FOR AGRICULTURAL ECONOMICS 3 (2 +1)

Objective

This course builds an understanding of the structure of computers and how they execute programs, data representation and computer arithmetic. The course is also aimed to develop problem-solving strategies, techniques and skills to help students develop the logic, ability to solve the problems efficiently using C programming.

Theory

Computer Fundamentals - Number systems: decimal, octal, binary and hexadecimal; Representation of integers, fixed and floating point numbers, character representation; ASCII, EBCDIC.

Functional units of computer, I/O devices, primary and secondary memories. The importance of Networking, Types of Networking, Network Topology, Transmission Media, Data communication: Concepts of data, signal, channel, bandwidth, bit-rate and baud-rate; Maximum data-rate of channel; Analog and digital communications,

Practical

Number Systems: decimal, octal, binary and hexadecimal. Conversion of different number types; Creation of flow chart, conversion of Algorithm / flowchart to program; Mathematical operators, operator precedence; Sequence, control and iteration; Arrays and string processing; Pointers and File processing.

Suggested Readings

Balaguruswamy E. 1998. *Programming with ANSI C*. Tata McGraw Hill.
Gottfried B. 1999. *Programming with C, Schaum Outline Series*. Tata McGraw Hill.
Kanetkar Y. 1999. *Let Us C*. BPB Publ.
Malvino AP & Brown JA. 1999. *Digital Computer Electronics*. Tata McGraw Hill.
Mano MM. 1999. *Digital Logic and Computer Design*. Prentice Hall of India.

COMPULSORY NON-CREDIT COURSES
(Compulsory for Master's programme in all disciplines; Optional for Ph.D. scholars)

CODE COURSE TITLE CREDITS (6 Credits to be offered):

PGS - 501: **LIBRARY AND INFORMATION SERVICES 1 (0 + 1)**

PGS - 502: **TECHNICAL WRITING AND COMMUNICATIONS SKILLS 1 (0+1)**

PGS - 503: **INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE (e-Course) 1 (1 + 0)**

PGS - 504: **BASIC CONCEPTS IN LABORATORY TECHNIQUES 1 (0 + 1)**

PGS - 505: AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES (e-Course) 1 (1 + 0)

PGS - 506: DISASTER MANAGEMENT(e-Course) 1 (1 + 0)

COMPULSORY NON-CREDIT COURSES

PGS - 501: **LIBRARY AND INFORMATION SERVICES 1 (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.

PGS - 502: **TECHNICAL WRITING AND COMMUNICATIONS SKILLS 1 (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, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

Suggested Readings:

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

PGS - 503: **INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE 1 (e-Course) (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 bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic

Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings:

Erbisch FH & Maredia K.1998. *Intellectual Property Rights in Agricultural Biotechnology*. CABI.
Ganguli P. 2001. *Intellectual Property Rights: Unleashing Knowledge Economy*. McGraw-Hill.
Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC & Aesthetic Technologies.
Ministry of Agriculture, Government of India. 2004. *State of Indian Farmer*. Vol.
V. *Technology Generation and IPR Issues*. Academic Foundation.
Rothschild M & Scott N. (Ed.). 2003. *Intellectual Property Rights in Anima Breeding and Genetics*. CABI.
Saha R. (Ed.). 2006. *Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies*. Daya Publ. House.
The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000;
Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design
Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003

PGS - 504: **BASIC CONCEPTS IN LABORATORY TECHNIQUES 1 (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, sandbath, waterbath, oilbath; 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:

Furr AK. 2000. *CRC Hand Book of Laboratory Safety*. CRC Press.
Gabb MH & Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co.

PGS - 505: **AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES 1 (e-Course) (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:

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.

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics. Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group - Area Specific Programme, Integrated Rural Development Programme (IRDP) 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:

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

PGS - 506: **DISASTER MANAGEMENT (e-Course) 1 (1 + 0)**

Objectives:
To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

Theory:

Natural Disasters - Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion.

Man Made Disasters - Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

Disaster Management - Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

Suggested Readings:

Gupta HK. 2003. *Disaster Management*. Indian National Science Academy. Orient Blackswan.
Hodgkinson PE & Stewart M. 1991. *Coping with Catastrophe: A Handbook of Disaster Management*. Routledge.
Sharma VK. 2001. *Disaster Management*. National Centre for Disaster Management, India.

DEPARTMENT OF AGRICULTURAL ECONOMICS

List of Journals

- Agricultural Economics Research Review
- Agricultural Finance Review
- Agricultural Marketing
- Agriculture and Agro-industries Journal
- Agriculture Statistics at a Glance
- APEDA Trade yearbook
- Asian Economic and Social Review (Old Series)
- Bulletin of Agricultural Prices
- Economic and Political Weekly
- Economic Survey of Asia and Far East
- FAO Commodity Review and Outlook
- FAO Production Year book
- FAO Trade year book
- Indian Cooperative Review
- Indian Economic Journal
- Indian Journal of Agricultural Economics
- Indian Journal of Agricultural Marketing
- Indian Journal of Economics
- International Food Policy Research Institute Research Report
- Journal of Agricultural Development and Policy
- Journal of Agricultural Economics
- Journal of Agricultural Economics and Development
- Journal of Farm Economics
- Land Economics
- Productivity
- Reserve Bank of India Bulletin
- Rural Economics and Management
- World Agricultural Economics and Rural Sociology Abstracts

• World Agricultural Production and Trade: Statistical Report
• Yojana
• Agricultural Situation in India

e-Resources

• www.pearsoned.com (Pearson Education Publication)
• www.mcgraw-hill.com (McGraw-Hill Publishing Company)
• www.oup.com (Oxford University Press)
• www.emeraldinsight.com (Emerald Group Publishing)
• www.sagepub.com (Sage publications)
• www.isaeindia.org (Indian Society of Agricultural Economics)
• www.macmillanindia.com (Macmillan Publishing)
• www.icar.org.in (Indian Council of Agricultural Research)
• www.khoj.com (Directory for Agricultural Economics)
• www.ncap.res.in (National Centre for Agricultural Economics and Policy Research)
• www.ncdex.com (National Commodity & Derivatives Exchange Limited)
• www.phdcci.in (PHD Chamber of Commerce and Industry)
• www.ficci.com (Federation of Indian Chambers of Commerce and Industry)
• www.assocham.org (Associated Chambers of Commerce and Industry of India)
• www.apeda.com (Agricultural and Processed Food Products Export Development Authority)
• www.mpeda.com (Marine Products Export Development Authority)

Suggested Broad Topics for Master's and Doctoral Research

• Economics of Irrigation water in different agro-climatic conditions
• Potential of exports of agri-products
• Potential domestic as well as international markets for value added agri-products
• Demand & supply gap of different agri-products and agri-inputs
• Economic analysis of new agri-technologies
• Input use efficiency in different agro-climatic conditions
• Income and expenditure pattern in rural areas
• Saving and investment pattern in rural areas
• Return from investment in agriculture research
• Marketing of agri-products in WTO regime
• Impact of WTO on agricultural economy
• Impact of Agricultural credit on socio-economic condition of the farmers
• Optimization of production process to reduce the cost of production
• Economic analysis of diversification, processing and value addition in agriculture sector
• Emerging international marketing scenario of agri-products
• Extent of farmers' indebtedness in different agro-climatic conditions