Programme code GECO 22

Programme name   M.Sc.(Ag.) Agricultural Economics

Programme Outcomes

Any post graduate from the Faculty of Agriculture will

PO1. have core knowledge leading to awareness on advancements in the field of agriculture and horticulture including crop production, soil fertility, crop protection, crop improvement, microbiology, bio technology, agricultural extension and economics.

PO2. have basic understanding and skill on experimental tools in biological sciences, analytical techniques for plant and soil samples, microbial technologies, biotechnological tools, breeding methods, statistical tools & analysis, research data computation, etc, required for higher learning, research and development.

PO3. be mastering the modern agronomic techniques of crop production, water, soil & nutrient management, plant protection with respect to insect pest and plant diseases , crop improvement and ecosystem restoration.

PO4. will be able to design and execute individual research project, write concise & persuasive research articles and communicate effectively with their scientific colleagues, farmers and the general public.

PO5. be able to communicate research and educational materials properly and competently and

PO6. be able to address complex problems taking into account related ethical, social, legal, economic, and environmental issues.

Programme Specific Outcomes

PSO1: The M.Sc.,(Ag.) Agricultural Economics programme is designed in such a way to meet the growing demand in banking, insurance, Agricultural input and output marketing sectors.

PSO2: This programme will enhance the employability of students in niche emerging areas like data analysis, data management etc.,.

PSO3: The curriculum of the programme will facilitate the students to take up competitive civil service exams such as IAS, IFS, IES etc.

PSO4: This programme will bolster the graduate's confidence and skill to take up independent research and prepare and evaluate projects which will facilitate their employability by NGOs to carry out survey, data analysis, interpretation and policy formulation.

PSO5: This programme will kindle the student's aptitude for novel and futuristic research thus they will imbibe the passion for pursuing Ph.D. whereby their prospects for recruitment as teaching and research faculties (Assistant Professors and Agricultural Research Scientist) will become bright.

Department of Agricultural Economics
M.Sc. (Ag.) Agricultural Economics Degree Programme
Distribution of Courses

Major - 20 Credits

S. No.	Course No.	Title	Credit Hours T+P
1.	AEC 611	Micro Economic Analysis	2+1
2.	AEC 612	Macro Economics Analysis	2+0
3.	AEC 613	Agricultural Marketing and International Trade	2+1
4.	AEC 614	Research Methodology for Social Sciences	1+1
5.	AEC 621	Agricultural Production Economics	1+1
6.	AEC 622	Agricultural Finance and Project Management	2+1
7.	AEC 623	Basic Econometrics	2+1
8.	AEC 624	Agricultural Development Policy Analysis	2+0
		Total	**14+6=20**

Minor - 9 Credits

1.	OPC AEC 621	Natural Resource and Environmental Economics (Compulsory)	2+1
2.	OPC AEC 711	Agri Business Analysis	2+1
3.	OPC AEC 712	Agricultural Insurance and Risk Management	2+1
		Total	**6+3=9**

Supporting Courses - 5 Credits

1.	STA 612	Statistics for Social Sciences	2+1
2.	COM 611	Computer Applications for Agricultural Research	1+1
		Total	**3+2=5**

Seminar + Research - 21 Credits

1.	AEC 032	Seminar	0+1
2.	AEC 011; 021; 031; 041	Research 011-0+1; 021-0+2; 031-0+8; 041-0+9	0+20
		Total	**0+21=21**
		Grand Total	**23+32=55**

Non Credit Compulsory Courses 8 + 4 = 12

1.	PGS 611	Research Data Analysis	0+1
2.	PGS 612	Technical Writing and Communication Skills (English)	0+1
3.	PGS 623	Basic Analytical Techniques	0+1
4.	PGS 624	Library and Information Services (Library Science)	0+1
5.	PGS 715 (e-course)	Intellectual Property and its Management in Agriculture	1+0
6.	PGS 716 (e-course)	Disaster Management (Agronomy)	1+0
7.		Value Added Course	6+0
		Total	**8+4=12**

Department of Agricultural Economics
M.Sc. (Ag.) Agricultural Economics Degree Programme
Semester – Wise Distribution

S. No.	Course Code	Title	Credit Hours
First Semester			
1.	AEC 611	Micro Economic Analysis	2+1
2.	AEC 612	Macro Economics Analysis	2+0
3.	AEC 613	Agricultural Marketing and International Trade	2+1
4.	AEC 614	Research Methodology for Social Sciences	1+1
5.	STA 612	Statistics for Social Sciences	2+1
6.	COM 611	Computer Applications for Agricultural Research	1+1
7.	AEC 011	Research	0+1
8.	PGS 611 *	Research Data Analysis	0+1
9.	PGS 612 *	Technical Writing and Communication Skills **(English)**	0+1
		Total	**10+6 = 16**
Second Semester			
1.	AEC 621	Agricultural Production Economics	1+1
2.	AEC 622	Agricultural Finance and Project Management	2+1
3.	AEC 623	Basic Econometrics	2+1
4.	AEC 624	Agricultural Development Policy Analysis	2+0
5.	OPC AEC 621	Natural Resource and Environmental Economics (Minor - Compulsory)	2+1
6.	AEC 021	Research	0+2
7.	PGS 623 *	Basic Analytical Techniques	0+1
8.	PGS 624 *	Library and Information Services **(Library Science)**	0+1
		Total	**9+6 = 15**
Third Semester			
1.	OPC XXX 711	Minor Course - Outside Department	2+1
2.	OPC XXX 712	Minor Course - Outside Department	2+1
3.	AEC 031	Research	0+8
4.	AEC 032	Seminar	0+1
5.	PGS 715 * (e-course)	Intellectual Property and its Management in Agriculture	1+0
6.	PGS 716 * (e-course)	Disaster Management **(Agronomy)**	1+0
7.		Value Added Course[*]	3+0
		Total	**4+11 = 15**
Fourth Semester			
1.	AEC 041	Research	0+9
2.		Value Added Course[*]	3+0
		Total	**0+9 = 9**
		Grand Total	**23+32 = 55**

* Non Credit Compulsory Courses

AEC 611 Micro Economic Analysis (2+1)

Learning Objectives
- To introduce the basic concepts of microeconomics
- To teach applications of concepts in agriculture

Theory
Unit-I : Consumer behaviour

Meaning and nature of microeconomics - economic systems - methods of economic analysis. Theory of consumer behaviour - cardinal utility theory - ordinal utility theory - income effect and substitution effect - revealed preference hypothesis. Consumer's surplus. Theory of demand - derivation of demand curve - elasticity of demand.

Unit-II : Theory of production

Theory of production - production functions - returns to scale and economies of scale - technical progress. Theory of costs - cost curves - envelope curve - profit maximization and cost minimization. Derivation of supply curve - law of supply - producers' surplus.

Unit-III : Market equilibrium

Market equilibrium - behaviour of firms in competitive markets - perfect competition - short run and long run equilibrium - monopoly - bilateral monopoly - price discrimination - monopolistic competition - duopoly (Cournot, Stackelberg's models) - oligopoly (Kinked demand model).

Unit-IV : Factor pricing

Factor pricing in perfect and imperfect competitive markets - factor pricing and income distribution.

Unit-V : Welfare economics

General equilibrium theory - interdependence in the economy - general equilibrium and allocation of resources. Welfare economics - Pareto criterion - The Kaldor-Hicks compensation criterion. Social welfare functions. **Current streams of thought**

Practical

Theory of consumer behaviour - discussion and exercises in demand analysis - derivation of elasticity of demand - estimation of various demand functions - equilibrium price analysis - production function analysis - analysis of short run and long run costs - profit function - analysis and discussions of market structure - performance under various parameters of imperfection through graphical and mathematical means - cost function - economies of size and scale - price discrimination - factor pricing analysis - income distribution analysis - discussion of economic rent - Pareto optimality concept - models on partial and general equilibrium.

Theory schedule
1. Meaning and nature of microeconomics
2. Economic systems
3. Methods of economic analysis
4. Theory of consumer behaviour
5. Cardinal utility theory
6. Ordinal utility theory - income effect and substitution effect
7. Revealed preference hypothesis
8. Consumers' surplus
9. Theory of demand - derivation of demand curve
10. Elasticity of demand
11. Theory of production
12. Production functions
13. Return to scale and economies of scale
14. Technical progress
15. Theory of costs - cost curves - envelope curve
16. Profit maximization and cost maximization
17. **Mid semester examination**
18. Derivation of supply curve - law of supply - producer's surplus
19. Market equilibrium - behaviour of firms in competitive markets
20. Perfect competition - short run and long run equilibrium
21. Monopoly - bilateral monopoly - price discrimination
22. Monopolistic competition
23. Duopoly (Cournot, Stackelberg's models)

24. Oligopoly (Kinked demand model)
25. Factor pricing in perfect competitive markets

26. Factor pricing in imperfect competitive markets
27. Factor pricing and income distribution
28. General equilibrium theory
29. Interdependence in the economy
30. General equilibrium and allocation of resources
31. Welfare economics
32. Pareto criterion
33. The Kaldor-Hicks compensation criterion
34. Social welfare functions

Practical schedule
1) Theory of consumer behaviour
2) Demand analysis - elasticity of demand
3) Estimation of demand functions
4) Equilibrium price analysis
5) Production function analysis
6) Analysis of short run costs
7) Analysis of long run costs
8) Price determination under perfect market situation
9) Price determination under imperfect market situation
10) Cost function
11) Economies of size and scale
12) Exercises on monopolistic competition
13) Price discrimination
14) Factor pricing analysis
15) Income distribution analysis
16) Partial and general equilibrium theory
17) Pareto optimality criteria

Course Outcomes

At the end of the course students will be able to

1. Understand the basic concepts related to consumer behaviour.
2. Identify the way to maximize profit through cost minimisation.
3. Know the different market structures and to identify long run and short run equilibrium.
4. Analyse factor pricing methods under perfect and imperfect market situation.
5. Apply micro economic principles for the welfare of farming community.

Reference books

1. Barthwal, R.R., 2005. *Microeconomic Analysis*, Wiley Eastern, New Delhi.
2. Hal R. Varian, 1999. *Microeconomic Analysis*, W.W. Norton and Company, New York.
3. Henderson, J.M. and R.E. Quandt, 2000. *Microeconomic Theory: A Mathematical Approach*, Tata McGraw Hill, New Delhi.
4. Koutsoyiannis, A., 2003. *Modern Microeconomics*, The Mac Millan Publication, London.
5. Dewitt K.K., 2002. *Modern Economic Theory*, Sultan Chand and Co., New Delhi.
6. http://ocw.mit.edu/courses/economics/
7. http://jgc-econ.intrasun.tcnj.edu/Micro%20Links.htm
8. http://www.oswego.edu/~kane/eco101.htm
9. http://catalog.flatworldknowledge.com/bookhub/13

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1			X			X					
CO2		X					X				
CO3				X					X		
CO4					X				X		
CO5					X						X

AEC 612 Macro Economic Analysis (2+0)

Learning Objectives
- To explain the basic concepts of macro economics
- To explain theories and various macroeconomics indicators
- To understand the implications of the macroeconomic policy measures

Theory

Unit-I : Macroeconomics - basic concepts

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.

Unit-II : Consumption, saving and investment

Consumption function - investment and savings - concept of multiplier and accelerator - Keynesian theory of income, output and employment. Rate of interest - Classical, Neo classical and Keynesian version - classical theory Vs Keynesian theory. Unemployment and full employment.

Unit-III : Money and prices

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.

Unit-IV : Public finance

IS and LM frame work. General equilibrium of product and money markets. Monetary policy - fiscal policy- effectiveness of monetary and fiscal policy - Central banking.

Unit-V : Macroeconomic policy

Business cycles. Trade policies - balance of payments - balance of payments adjustment policy with fixed exchange rates and flexible exchange rates - international macroeconomic policies - economic growth and public policy. **Current streams of thought**

Theory schedule
1. Nature and scope of macro economics
2. Methodology and Keynesian concepts
3. National income - concepts and measurement
4. Classical theory of employment
5. Say's Law
6. Modern theory of employment and effective demand
7. Consumption function
8. Investment and savings
9. Concept of multiplier and accelerator
10. Keynesian theory of income and output and employment
11. Rate of interest - Classical, Neo classical and Keynesian version
12. Classical theory Vs Keynesian theory
13. Unemployment and full employment
14. Money and classical theories of money and price
15. Keynesian theory of money
16. Friedman restatement theory of money
17. **Mid semester examination**
18. Supply of money
19. Demand for money
20. Inflation: nature, effects and control
21. IS and LM frame work
22. General equilibrium of product market
23. General equilibrium of money market
24. Monetary policy
25. Fiscal policy
26. Effectiveness of monetary and fiscal policy
27. Central banking
28. Business cycles
29. Trade policies
30. Balance of payments
31. Balance of payments adjustment policy with fixed exchange rates

32. Balance of payments adjustment policy with flexible exchange rates
33. International macroeconomic policies
34. Economic growth and public policy

Course Outcomes

At the end of the course students will be able to

1. Understand the concepts of national income and methods for measurement of national income.
2. Analyse the relationship between consumption, saving and investment.
3. Understand the nature of inflation and ways to control it.
4. Analyze monetary and fiscal policies.
5. Identify barriers in international trade.

Reference books

1. Ahuja, H.L., 2007. *Macro Economics - Theory and Policy,* S. Chand and Co. Ltd., New Delhi.
2. Branson, H. William, 1986. *Macroeconomic Theory and Policy*, Harper Collins, New Delhi.
3. Dornbusch, 2006. *Macroeconomics*, McGraw Hill Publication, New Delhi.
4. Eugene A Diulio, 2006. *Macroeconomics*, 4th Ed. Schaums' Outlines, New Delhi.
5. Shapiro, Edward, 1989. *Macroeconomic Analysis*, Galgotta Publications, New Delhi.
6. http://ocw.mit.edu/courses/economics/14-02-principles-of-macroeconomics-fall-2009/
7. www.uh.edu/~bsorense/Macro_Lecture_Notes.pdf
8. http://www.cals.ncsu.edu/course/are012/notes.html
9. http://getyourecon.com
10. http://welkerswikinomics.com/blog/
11. http://www.econclassroom.com
12. http://econphd.econwiki.com/notes.htm
13. https://www.coursera.org/course/macroeconomics

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1			X			X					
CO2					X						X
CO3			X			X					
CO4			X					X			
CO5	X							X			

AEC 613 Agricultural Marketing and International Trade (2+1)

Learning Objectives
- To teach the students about the various principles
- To understand dynamic changes of agricultural marketing
- To identify application of principles at both micro and macro levels

Theory
Unit-I : Agricultural marketing
Agricultural marketing and economic development - characteristics of agricultural products. Producer's surplus - marketed and marketable surplus. Marketing efficiency - marketing costs, margins and price spread - technical and pricing efficiency.

Unit-II : Market structure
Market structure, conduct and performance. Market integration - vertical and horizontal integration - vertical co-ordination. Marketing system and sub-sector analysis. Determination of inputs and output prices under different market situations. Market research and information - sources of agricultural marketing information - role of ICT in agricultural marketing - NAM - e NAM - market linkages - public-private partnership - contract farming

Unit-III : Agricultural price analysis and policy
Price indices and parity concepts - price support programmes - subsidies - MSP - SAP - CACP. Spatial and temporal price relationships - price forecasting - price policies and economic development. Marketing institutions - cooperatives - regulated markets - state trading and government interventions - Agmark.

Unit-IV : Demand - supply relationship and prices
Role of agricultural prices - supply and demand relationships - demand and supply models - incorporation of risk. Future markets - speculation - hedging - commodity exchange. Marketing of derivatives - integration of spot and future markets - role of FMC in agricultural marketing.

Unit-V : International trade
International trade - introduction and scope - basic concepts. Foreign exchange market. Terms of trade - WTO and their role in promotion of trade - export and import policies of India - agricultural export zones - export promotion agencies in India - APEDA - MPEDA. Role of World Bank, IMF and ADB in international trade. Role of EXIM bank and commercial banks in foreign trade - IPR - international organization of standards - HACCP - organic certification. **Current streams of thought**

Practical
Producer's surplus - price spread analysis - estimation of marketing efficiency - technical and allocation efficiency - estimation of index numbers - price index - WPI - time series analysis and forecasting - demand and supply estimation in single and multimarket situation - value chain analysis for major agricultural commodities - price instability - Markov chain model - market equilibrium analysis - visit to cooperative marketing institution - visit to regulated market - visit to agro processing units - export organizations - EXIM bank - visit to patent office, Chennai - case studies on rice, wheat and other major food grains - case studies on horticultural crops.

Theory schedule
1. Agricultural marketing and economic development
2. Characteristics of agricultural products and production
3. Producer's surplus, marketed and marketable surplus
4. Marketing efficiency, marketing costs, margins and price spread - technical and pricing efficiency
5. Market structure, conduct and performance (SCP paradigm)
6. Market integration, vertical and horizontal integration - conglomaration
7. Vertical co-ordination
8. Marketing system and sub sector analysis
9. Determination of input and output prices under different market situations
10. Market research and information and sources of market information
11. Role of ICT in agricultural marketing - NAM - e - NAM
12. Market linkages - public - private partnership - contract farming
13. Price indices and parity concepts
14. Price support programmes and subsidies - MSP - SAP - CACP
15. Spatial and temporal price relationships
16. Price forecasting - price policies and economic development
17. **Mid semester examinations**

18. Marketing institutions - co-operative markets - regulated market
19. State trading and government intervention - Agmark
20. Role of agricultural price - supply and demand relationship
21. Demand and supply model incorporation of risk
22. Future market speculation - hedging
23. Commodity exchange - Marketing of derivatives - Integration of spot and future markets
24. Role of FMC in agricultural marketing
25. International trade - introduction and scope - basic concepts
26. Foreign exchange market
27. Terms of trade
28. WTO and the role in promotion of trade
29. Export and import policies of India
30. Agricultural export zones
31. Export promotion agencies in India - APEDA - MPEDA
32. Role of world bank, IMF and ADB in international trade
33. Role of EXIM bank and commercial banks in foreign trade - IPR
34. International organization of standards - HACCP - organic certification

Practical schedule

1. Estimation procedure for producers surplus of different agricultural commodities
2. Price spread analysis
3. Marketing efficiency - technical and allocation efficiency
4. Estimation of index number - price index - WPI
5. Time series analysis and forecasting
6. Estimation of demand and supply estimation of - single and multi market situations
7. Value chain analysis for major agricultural commodities
8. Price instability analysis for agricultural commodities
9. Markov - chain analysis
10. Market equilibrium analysis
11. Visit to co-operative market institution
12. Visit to regulated market
13. Visit to agro processing unit
14. Export organizations - EXIM bank
15. Visit to patent office - Chennai
16. Case study on rice, wheat and other major food grains
17. Case study on horticultural crops

Course Outcomes

At the end of the course students will be able to

1. Estimate the marketing efficiency.
2. Know the role of ICT in agricultural marketing.
3. Forecast the price, demand and supply.
4. Discuss the ways to minimize market risk.
5. Identifying the role of different organizations in international trade and the share of agriculture in total export.

Reference books
1. Acharya, S.S. and N.L. Agarwal, 2004. *Agricultural Prices - Analysis and Policy*, Oxford and IBH, New Delhi.
2. Acharya, S.S. and N.L. Agarwal, 2008. *Agricultural Marketing in India,* Oxford and IBH, New Delhi.
3. Dhal, C. Dale and Hammond W. Jerome, 1997. *Market and Price Analysis - The Agricultural Industries*, McGraw Hill Book Company, New York.
4. Francis Cherunilam, 2006. *International Trade and Export management*, Himalaya Publishing House, Mumbai.
5. Gulati, Ashok, 1996. *Agricultural Price Policy in India - An Econometric Approach,* Concept Publishing Company, New Delhi.
6. https://lss.at.ufl.edu/.
7. http://www.oerafrica.org.

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1	X				X		X				
CO2	X		X				X				
CO3		X		X					X		
CO4			X	X					X		
CO5	X		X		X						X

AEC 614 Research Methodology for Social Sciences (1+1)

Learning Objectives
- To expose the students to research methodology used in social sciences
- To provide knowledge related to research process, data collection and data analysis

Theory
Unit-I : Research process
Importance and scope of research in agricultural economics. Types of research - fundamental Vs. applied. Concept of researchable problem - research prioritization - selection of research problem - steps in formulation research problem. Approaches to research - research process. Hypothesis - meaning - characteristics - types of hypothesis - setting of research objectives and hypotheses - review of literature.
Unit-II : Research design
Research design and techniques - types of research design. Sampling theory and sampling design - sampling error - methods of sampling - probability and non-probability sampling methods - sampling under different situations - criteria to choose.
Unit-III : Data collection
Data collection - assessment of data needs - sources of data collection - Methods of collecting primary and secondary data - case study - criteria for selection of appropriate method of data collection. Mailed questionnaire and interview schedule - structured, unstructured, open ended and closed-ended questions. Preparation of schedule - selection of variables - scaling techniques and measurement - problems in measurement of variables in agriculture. Interviewing techniques and field problems - methods of conducting survey - reconnaissance survey and pre testing.
Unit-IV : Data analysis
Data processing - coding - editing - tabulation - validation of data. Tools of analysis - statistics in research - descriptive and inferential statistics - Parametric and non-parametric tests - correlation analysis - association of attributes - regression analysis - testing of hypothesis - statistical test based on normal population - small and large sample test. Use of econometric software in data analysis.
Unit-V : Report writing
Interpretation of results - techniques of interpretation - significance of report writing - layout of report writing - illustration of tables - preparing research report / thesis - universal procedures for preparation of bibliography, reference, foot notes - writing of research articles.
Practical
Exercises in problem identification. Project proposals - contents and scope. Formulation of objectives 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, finalizing and coding. Methods of conducting survey. Data preparation process - exercise on coding, editing, tabulation and validation of data. Preparing for data entry into computer - statistics in research descriptive and inferential statistics. Use of econometric software in data analysis. Hypothesis testing - Parametric and non-parametric tests. Exercises on format for thesis / report writing. Presentation of the results.
Theory schedule
1. Importance and scope of research in agricultural economics - types of research - fundamental Vs. applied
2. Concept of researchable problem - research prioritization - selection of research problem - steps in formulation research problem
3. Approaches to research - research process. Hypothesis - meaning - characteristics - types of hypothesis - setting of research objectives and hypotheses - review of literature
4. Research design and techniques - types of research design
5. Sampling theory and sampling design - sampling error - methods of sampling - probability and non-probability sampling methods - sampling under different situations - criteria to choose

6. Data collection - assessment of data needs - sources of data collection - methods of collecting primary and secondary data - case study - criteria for selection of appropriate method of data collection

7. Mailed questionnaire and interview schedule - structured, unstructured, open ended and closed-ended questions
8. Preparation of schedule - selection of variables - scaling techniques and measurement - problems in measurement of variables in agriculture
9. **Mid semester examination**
10. Interviewing techniques and field problems - methods of conducting survey - reconnaissance survey and pre testing.
11. Data processing - coding - editing - tabulation - validation of data
12. Tools of analysis - statistics in research - descriptive and inferential statistics
13. Parametric tests - Non-parametric tests - correlation analysis - association of attributes - regression analysis
14. Testing of hypothesis - statistical test based on normal population - small and large sample test
15. Use of econometric software in data analysis
16. Interpretation of results - techniques of interpretation - significance of report writing - layout of report writing - illustration of tables - preparing research report / thesis
17. Universal procedures for preparation of bibliography, reference, foot notes - writing of research articles

Practical schedule
1. Exercises in problem identification
2. Project proposals - contents and scope
3. Formulation of objectives and hypotheses
4. Assessment of data needs - sources of data - methods of collection of data
5. Methods of sampling - criteria to choose
6. Discussion on sampling under different situations
7. Scaling techniques - measurement of scales
8. Preparation of interview schedule - field testing, finalizing and coding
9. Methods of conducting survey
10. Exercise on coding, editing, tabulation and validation of data
11. Statistics in research descriptive and inferential statistics
12. Use of econometric software in data analysis
13. Preparing for data entry into computer
14. Hypothesis testing - parametric tests
15. Non-parametric tests
16. Exercises on format for thesis / report writing
17. Presentation of the results

Course Outcomes

At the end of the course students will be able to

1. Understand the role and importance of research in the social science.
2. Identify the appropriate research design for different research problem.
3. Know the different methods to collect data and selection of variables.
4. Use econometric software in data analysis.
5. Interpret the results and write research report & research articles.

Reference books
1. Creswell, J.W., 1999. *Research Design - Qualitative and Quantitative Approaches,* SAGE Publication, New Delhi.
2. Kothari, C.R., Gaurav Gang, 2014. *Research Methodology - Methods and Techniques*, New Age International Publication, New Delhi.
3. Raj, G.L., Saga Mondal, 2004. *Research Methods in Social Science and Extension Education*, Kalyani Publication, New Delhi.
4. Rao, K.V., 1993. *Research Methodology in Commerce and Management*, Sterling Publication, New Delhi.
5. Singh, A.K., 1993. *Tests, Measurements and Research Methods in Behavioural Sciences*, Tata McGraw-Hill, New Delhi.
6. http://ase.tufts.edu/gdae/?gclid=CPGY7pfyjL4CFU0pjgodul8AWA

7. https://www.iser.essex.ac.uk/study
8. http://www.sagepub.com/isw4/weblinks.htm
9. http://econpapers.repec.org/article/agsaerrae/

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1	X			X		X					
CO2		X		X	X		X				
CO3	X	X		X					X		
CO4		X		X	X				X		
CO5		X		X	X						X

AEC 621 Agricultural Production Economics (1+1)

Learning Objectives
- To provide applied and practical understanding of production economics
- To understand farm management techniques with emphasis on its economic analysis

Theory

Unit-I : Scope of agricultural production economics

Nature, scope and significance of agricultural production economics - agricultural production process - relationship between farm management and production economics. Neoclassical production function - three stages - physical and economic optimum - elasticity of production

Unit-II : Production and cost functions

Production functions - forms and types - production with two input case - production of more than one product. Cost concepts and cost functions - linkages between cost and production functions - duality of cost and production. Economies and diseconomies of scale - returns to scale.

Unit-III : Economic efficiency

Technology in agricultural production - nature, effect and measurement - measuring efficiency in agricultural production - technical, allocative and economic efficiencies. Yield gap analysis - concepts - types and measurement.

Unit-IV : Linear programming

Linear programming and marginal analysis - simplex method, maximization and minimization - duality - simulation and programming techniques in agricultural production.

Unit-V : Risk and uncertainty

Elements of risk and uncertainty in agriculture - measurement of risk and adjustment to risk - incorporation of weather uncertainty in decision making - risk constrained linear programming model - MOTAD model - game theory models. **Current streams of thought**

Practical

Principle of diminishing marginal returns - estimation of different forms of production functions using farm level data - estimation of elasticity - estimation of isoquant and least cost combinations of factors - product - product relationship - cost function analysis - factor share analysis - decomposition analysis - technical efficiency estimation and frontier production functions - linear programming - maximization and minimization - MOTAD - Goal programming.

Theory schedule

1. Nature, scope, significance of agricultural production economics
2. Agricultural production process - relationship between farm management and production economics
3. Neoclassical production function - three stages - physical and economic optimum
4. Elasticity of production. Production functions - forms and types of production functions
5. Production with two input case - production of more than one product
6. Cost concepts and cost functions - linkages between cost and production functions - duality of cost and production
7. Economies and diseconomies of scale
8. Returns to scale - technology in agricultural production - nature, effect and measurement
9. **Mid semester examination**
10. Measuring efficiency in agricultural production – technical, allocative and economic
11. Yield gap analysis – concepts - types and measurement of yield gap
12. Linear programming and marginal analysis. Simplex method – maximization - duality
13. Simulation and programming techniques in agricultural production
14. Elements of risk and uncertainty in agriculture - measurement of risk and adjustment to risk
15. Incorporation of weather uncertainty in decision making
16. Risk constrained linear programming model - MOTAD model
17. Game theory models

Practical schedule
1. Principle of diminishing marginal returns

2. Estimation of different forms of production functions using farm level data
3. Estimation of different forms of production functions using farm level data (cont.)
4. Estimation of elasticity of production
5. Estimation of isoquant and least cost combinations of factors
6. Product - product relationship
7. Cost function analysis
8. Factor share analysis
9. Decomposition analysis
10. Technical efficiency estimation and frontier production functions
11. Technical efficiency estimation and frontier production functions (cont.)
12. Linear programming - maximization
13. Linear programming - minimization
14. Dual problems
15. Dual problems (cont.)
16. MOTAD
17. Goal programming

Course Outcomes

At the end of the course students will be able to

1. Know the physical and economic optimum point of output.
2. Suggest efficient way of usage of agricultural resources.
3. Make decision on individual farm production effectively.
4. Analyse agricultural production function using programming techniques.
5. Identify the policy measures to enhance profit through risk management.

Reference books
1. David, L., Debertin, 2012. *Agricultural Production Economics*, (Second edition), Macmillan Publishing Company, New York.
2. Doll, John P. and Frank Orazem, 1978. *Production Economics - Theory and Applications*, John Wiley and Sons, New York.
3. Palanisami, K., P. Paramasivan and C.R. Ranganathan, 2002. *Agricultural Production Economics - Analytical Methods and Applications*, Associate Publishing Company, New Delhi.
4. Peter, B.R., Hazell and Roger D. Nortan, 1986. *Mathematical Programming for Economic Analysis in Agriculture*, Macmillan Publishing Company, New York.
5. Sankhayan, P.L., 1998. *Introduction to the Economics of Agricultural Production*, Prentice Hall of India, New Delhi.
6. http://ocw.mit.edu/courses/economics
7. https://www.msu.edu/course/ECO/855
8. http://www.uky.edu/~deberti/prod/agprod5.pdf
9. http://www.csuchico.edu/ag/_assets/documents/syllabi/ABUS/ABUS%20301%20AG%20Production%20Econ%20Analysis.pdf

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1						X					
CO2				X	X		X				
CO3		X					X				
CO4					X						X
CO5				X							X

AEC 622 Agricultural Finance and Project Management (2+1)

Learning Objectives
- To impart knowledge on issues related to lending to priority sector
- To understand various appraisal techniques in agricultural project management

Theory
Unit-I : Agricultural finance

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 - principles of co-operation - co-operative movement in India - present trend of co-operative institutions in India - NABARD, commercial banks and RRBs - District credit plans and lending to agriculture/priority sector. Micro financing - role of MFI's, NGOs and SHGs. Non-banking financial institutions in India.

Unit-II : Agricultural credit system

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 - appraisal of credit proposals. Understanding lenders and developing better working relationship and supervisory credit system. Credit inclusions - credit widening and credit deepening.

Unit-III : Financial statements and 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 - financial literacy and lending to small and marginal farmers.

Unit-IV : Agricultural project management

Project approach in financing agriculture. Financial, economic and environmental appraisal of investment projects. Project cycle - identification, formulation, appraisal, financing, implementation and evaluation of projects. Project appraisal techniques - undiscounted measures - time value of money - use of discounted measures - BCR, NPV and IRR. Sensitivity analysis, Agreements, supervision, monitoring and evaluation phases in appraising agricultural investment projects. Net work techniques - PERT, CPM and Grash programme methods.

Unit-V : Risk management in agriculture

Risks in financing agriculture. Risk management strategies and coping mechanisms. Crop Insurance programmes - review of different crop insurance schemes - yield loss and weather based insurance and their applications. Agriclinics and agribusiness centers. **Current streams of thought**

Practical

Demand and supply of institutional agricultural credit. District credit plan. Preparation of scale of finance for selected crops. Preparation of financial statements using farm/firm level data. Farm credit appraisal techniques and farm financial analysis through financial statements. Financial instruments and methods - E-banking, kisan cards and core banking. Time value of money. Identification and formulation of investment projects. Project appraisal techniques - undiscounted measures and their limitations. Discounted measures. Sensitivity analysis. Network techniques - PERT and CPM for project management. SWOC analysis - Decision tree analysis - social cost and benefit analysis - Environmental Impact Assessment (EIA).

Theory schedule
1. Role and importance of agricultural finance
2. Financial Institutions and credit flow to rural/priority sector
3. Agricultural lending - direct and indirect financing
4. Financing through co-operatives
5. Principles of co-operation and co-operative movement in India
6. Present trend of co-operative institutions in India
7. Role of NABARD, Commercial Banks and RRBs in agricultural lending
8. District Credit Plan and lending to agriculture/priority sector.
9. Micro-financing and role of MFI's, NGOs, and SHGs - Non-banking financial institutions (NBFIs) in India
10. Lending to farmers - The concept of 3 C's, 7 P's and 3 R's of credit
11. Estimation of technical feasibility, economic viability and repaying capacity of borrowers and appraisal of credit proposals
12. Understanding lenders and developing better working relationship and supervisory credit system

13. Credit inclusions - credit widening and credit deepening
14. Financial decisions - investment, financing, liquidity and solvency
15. Preparation of financial statements
16. Balance sheet, cash flow statement
17. **Mid semester examination**
18. Profit and loss account and ratio analysis
19. Assessing the performance of farm/firm
20. Financial literacy and lending to small and marginal farmers
21. Project approach in financing agriculture
22. Financial, economic and environmental appraisal of investment projects
23. Project cycle identification, preparation, appraisal, financing and implementation of projects
24. Project appraisal techniques - undiscounted measures - time value of money
25. Use of discounted measures - BCR, NPV and IRR
26. Agreements, supervision, monitoring and evaluation phases in appraising agricultural investment projects
27. Net work techniques - PERT and CPM
28. Risks in financing agriculture
29. Risk management strategies and coping mechanisms
30. Crop insurance programmes
31. Review of different crop insurance schemes
32. Assessment of yield loss
33. Weather based insurance and their applications
34. Agriclinics and agribusiness centres

Practical schedule
1. Demand and supply of institutional agricultural credit
2. District credit plan
3. Preparation of scale of finance for selected crops
4. Preparation of financial statements using farm/firm level data
5. Farm credit appraisal techniques
6. Farm financial analysis through financial statements
7. Financial instruments and methods - E banking, kisan cards and core banking
8. Time value of money
9. Identification and formulation of investment projects
10. Project appraisal techniques - undiscounted measures and their limitations
11. Discounted measures
12. Sensitivity analysis
13. Network techniques - PERT and CPM for project management
14. SWOC analysis
15. Decision tree analysis
16. Social cost and benefit analysis
17. Environmental Impact Assessment (EIA)

Course Outcomes

At the end of the course students will be able to

1. Understand nature and scope of financial management in agribusiness.
2. Identify the tools for credit, repayment and down payments.
3. Assess the performance of farm using financial ratios.
4. Do the appraisal of projects by measurement of costs benefits and sensitivity analysis.
5. Assess yield loss and to identify risk management strategies.

Reference books
1. Dhubashi, P.R., 1986. *Policy and Performance - Agricultural and Rural Development in Post Independent India.* Sage Publ. New Delhi.
2. Gittinger, J.P., 1982. *Economic Analysis of Agricultural Projects.* The Johns Hopkins Univ. Press. London.
3. Gupta, S.C., 1987. *Development Banking for Rural Development.* Deep and Deep Publ. New Delhi.

4. Little IMD and Mirlees JA., 1974. *Project Appraisal and Planning for Developing Countries.* Oxford and IBH Publ. New Delhi.
5. Muniraj, R., 1987. *Farm Finance for Development.* Oxford and IBH Publ. New Delhi.
6. Subba Reddy, S. and P. Raghu ram, 2014, *Agricultural Finance and Management,* Oxford and IBH Publ. Co. Pvt. Ltd., New Delhi.

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1	X				X	X					
CO2	X	X					X				
CO3		X	X						X		
CO4	X			X					X		
CO5	X			X							X

AEC 623 Basic Econometrics (2+1)

Learning Objectives
- To impart knowledge on econometric tools
- To analyze the economic problems by applying appropriate quantitative techniques

Theory

Unit-I : Basic concepts

Econometrics - definition - methodology and types of econometrics. Nature and sources of data for econometric analysis. Basic ideas of regression analysis - PRF and SRF - linearity of regression model - significance of stochastic error term. Estimation of two variable regression model - method of Ordinary Least Square.

Unit-II : Classical linear regression model

Classical linear regression model - assumptions underlying the method of least square - Normality assumption of error term - properties of least square estimators. Gauss-Markov theorem. Goodness of fit - coefficient of determination. Method of Maximum Likelihood Estimate (MLE). Interval estimation and hypothesis testing. Extensions of two variable regression models - regression through origin. Nature of dummy variables - dummy variable regression models - test for structural stability of regression model.

Unit-III : Hypothesis testing

Estimation in multiple regression analysis - OLS estimators - multiple coefficient of determination - R^2 and adjusted R^2 - inference in multiple regression analysis. Hypothesis testing - individual regression coefficient - overall significance of the model - F-test and t-test

Unit-IV : Problems in estimation

Relaxing the assumptions of CLRM: Multicollinearity - definition, consequences, detection, remedial measures. Heteroscadasticity - definition, detection, consequences. Autocorrelation - definition, consequences, detection - remedial measures Durbin-Watson test. Model specification diagnostic tests - tests of specification errors.

Unit-V: Econometric models

Dummy variable regression models - intercept and slope dummy - estimation and interpretation. Dummy dependent variable models. Linear probability models - logit and probit models - estimation and interpretation. Simultaneous equation models - structural equations - reduced form equations - identification and approaches to estimation. **Current streams of thought**

Practical

Single equation two variable model - specification and estimation - hypothesis testing - restrictions on parameters - 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 explanatory variables - intercept and slope dummy variable models. Estimation of regression with limited dependent variable - logit and probit models. Identification of equations in simultaneous equation models.

Theory schedule
1. Econometrics - definition, methodology and types of econometrics
2. Nature and sources of data for econometric analysis
3. Basic ideas of regression analysis: PRF and SRF
4. Linearity of regression model - significance of stochastic error term
5. Estimation of two variable regression model - method of Ordinary Least Square.
6. Classical linear regression model: assumptions underlying the method of least square
7. Normality assumption of error term in CNLRM
8. Properties of least square estimators - Gauss-Markov theorem
9. Goodness of fit - coefficient of determination
10. Method of Maximum Likelihood Estimate (MLE)
11. Interval estimation and hypothesis testing
12. Extensions of two variable regression models: regression through origin
13. Nature of dummy variables - dummy variable regression models
14. Test for structural stability of regression model
15. Estimation in multiple regression analysis: OLS estimators
16. Multiple coefficient of determination R^2 and adjusted R^2
17. **Mid semester examination**

18. Inference in multiple regression analysis: Hypothesis testing
19. Individual regression coefficient
20. Overall significance of the model - F-test and t-test
21. Relaxing the assumptions CLRM: Multicollinearity - definition, consequences, multicollinearity, detection - remedial measures
22. Heteroscadasticity - definition, consequences, detection
23. Autocorrelation - definition, consequences, detection - remedial measures
24. Durbin-Watson test
25. Model specification diagnostic tests
26. Tests of specification errors
27. Dummy variable regression models - intercept and slope dummy
28. Estimation and interpretation
29. Dummy dependent variable models
30. Linear probability models - logit and probit models
31. Estimation and interpretation
32. Simultaneous equation models
33. Structural equations - reduced form equations
34. Identification and approaches to estimation

Practical schedule
1. Single equation two variable model - specification and estimation
2. Hypothesis testing
3. Restrictions on parameters
4. Transformations of functional forms - OLS application
5. Estimation of multiple regression model
6. Hypothesis testing
7. Testing and correcting specification errors
8. Testing and managing multicollinearity
9. Testing and managing heteroscedasticity
10. Testing and managing autocorrelation
11. Estimation of regressions with dummy explanatory variables
12. Intercept dummy variable model
13. Slope dummy variable model
14. Estimation of regression with limited dependent variable
15. Logit model
16. Probit model
17. Identification of equations in simultaneous equation models

Course Outcomes

At the end of the course students will be able to

1. Identify the variables for regression.
2. Formulate and estimate non linear models.
3. Test the hypothesis and interpret the results.
4. Deduct the problems in relaxing the assumptions of classical regression model.
5. Run the dummy variable regression models independently.

References books
1. Damodar, N. Gujarati, Dawn C. Porter and Sangeetha Gunasekar, 2016, (Fifth Edition), *Basic Econometrics*, Mc-Graw Hill Education (India) Private Limited, Chennai.
2. Harry, H. Kelejan, and Walace E. Oates, 1974. *Introduction to Econometrics Principles and Applications*, Harper and Row Publication, New York.
3. Koutsoyianis, A., 1977. *Theory of Econometrics*, Barner and Noble, New York.
4. Maddala, G.S., 1992. *Introduction to Econometrics*, MacMillan, New York.
5. Robert, S. Pindyck and Daniel L. Rubinfeld, 1991. *Econometric Models and Economic Forecasts*, Mc-Graw-Hill Inc., New Delhi.
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7. http://econ.la.psu.edu/~hbierens/lecnotes.htm
8. http://www.varsitynotes.com/economics/econometrics.html
9. http://www.stata.com/features/
10. http://www.oswego.edu/~economic/econsoftware.htm
11. http://ocw.mit.edu/courses/political-science/17-874-quantitative-research-methods-multivariate-spring-2004/

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1		X			X	X					
CO2				X	X		X				
CO3		X		X					X		
CO4	X				X				X		
CO5		X		X					X		

AEC 624 Agricultural Development Policy Analysis (2+0)

Learning Objectives
- To make the students understand the background of development economics
- To explain existing policies, their performance
- To guide the students in framing meaningful and relevant policy models

Theory

Unit-I : Economic development and economic growth
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.

Unit-II : Theories 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 - The Von Newmann growth 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.

Unit-III : Agricultural policies
Role of agriculture in economic / rural development - theories of agricultural development - population and food supply - need for sound agricultural policies - population policies resource policies - credit policies - input and product marketing policies - price policies - monetary and fiscal policies.

Unit-IV : Role of agriculture in economic development
Development issues - poverty - inequality - unemployment and environmental degradation - models of agricultural development - induced innovation model - policy options for sustainable agricultural development.

Unit-V : Agricultural development and free trade
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. **Current streams of thought**

Theory schedule
1. Development economics - scope and importance
2. Economic development and economic growth - divergence in concept and approach
3. Indicators and measurement of economic development
4. GNP as a measure of economic growth
5. New measures of welfare - NEW and MEW
6. PQLI, HDI, Green GNP
7. Criteria for under development - obstacles to economic development
8. Economic and non-economic factors of economic growth
9. Economic development - meaning, stages of economic development, determinants of economic growth
10. Theories of economic growth - Ricardian growth model. The Harrod Domar Model
11. The Neo classical Model of Growth - The Kaldor Model
12. The Von Newmann growth model - Optimal Economic Growth
13. Recent experiences of developing country - economies in transition
14. Role of state in economic development - government measures to promote economic development
15. Introduction to development planning
16. Role of agriculture in economic / rural development
17. **Mid semester examination**
18. Theories of agricultural development - population and food supply
19. Need for sound agricultural policies - population policies
20. Resource policies - credit policies - input and product marketing policies
21. Price policies - monetary and fiscal policies

22. Development issues - poverty – inequality

23. Unemployment and environmental degradation
24. Models of agricultural development
25. Induced innovation model
26. Policy options for sustainable agricultural development
27. Globalization and the relevance of development policy analysis
28. The dilemma of free trade
29. Free trade versus protectionism - arguments for and against protection
30. Role of protection in developing countries
31. WTO - Agreement on Agriculture
32. Contradictions of free trade
33. Proponents and opponents policies in vulnerable sectors like agriculture
34. Lessons for developing countries

Course Outcomes

At the end of the course students will be able to

1. Understand economic growth and development.
2. Analyze indicators of economic development.
3. Know the role of agriculture in economic development.
4. Discuss various development issues and identify the policy options for sustainable agricultural development.
5. Identify the impact of globalization on economic development.

Reference books
1. Ellis Frank, 1992, *Agricultural Policies in Developing Countries*, Cambridge University Press, New York.
2. Ghatak S and Ingersent K., 1984. *Agriculture and Economic Development*, Select Book Service Syndicate, New Delhi.
3. Jhingan, M.L., 1998, *The Economics of Development and Planning*, Vrinda Publication, New Delhi.
4. Naqvi Syed Nawab Haider, 2002, *Developemnt Economics - Nature and Significance*, Sage Publication, New Delhi.
5. Vyas, V.S., 1998, *Policies for Agricultural Development*, Tamil Nadu Book House, Chennai.
6. www.econlib.org
7. www.worldbank.org
8. www.world-economics-journal.com

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1			X		X	X					
CO2			X		X		X				
CO3			X		X		X				
CO4	X			X					X		
CO5			X		X						X

OPC AEC 621 Natural Resource and Environmental Economics (2+1)

Learning Objectives

- To introduce economic 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 environmental problems
- To explore the concept of pollution control and pollution prevention decisions
- To understand the environmental policy issues and alternative instruments of environmental policies

Theory
Unit-I : Basic concepts
    Concepts, classification, problems of natural resource economics. Economy - environment interaction - the material balance principle, entropy law. Resource scarcity - limits to growth - measuring and mitigating natural resource scarcity - Malthusian and Ricardian scarcity - scarcity indices - resource scarcity and technical change.
Unit-II : Optimal use
    Theory of optimal extraction of renewable resources - economic models of forestry, fisheries - logistic growth curve - maximum sustainable yield and economic yield - theory of optimal depletion of exhaustible resources - efficiency - time path of prices and extraction. Economic models of oil extraction - Hotelling's rule - Solow Harwick's rule.
Unit-III : Markets and natural resources
    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.
Unit-IV : Economic instruments
    Environmental regulation - economic instruments - pollution charges - Pigouvian tax - Carbon trading - tradable permits - indirect instruments - environmental legislations in India.
Unit-V : Sustainability
    Concept of sustainable development - economic perspective - indicators of sustainability - relationship between development and environmental stress, poverty and environment - Environment Kuznet's Curve (EKC) - environmental accounting - resource accounting methods. International environmental issues - climate change - likely impacts - adaptation and mitigation efforts - international treaties. **Current streams of thought**
Practical
    Land use planning - energy use pattern - solid waste management - biodiversity, biopiracy, biosafety issues. 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 pricing method - travel cost method - contingent valuation method. Discount rate in natural resource management. Environment impact assessment. Visit to Pollution Control Board. Social cost benefit analysis.
Theory schedule
1. Concepts, classification, problems of natural resource economics
2. Economy - environment interaction
3. The material balance principle, entropy law
4. Resources scarcity - limits to growth
5. Measuring and mitigating natural resource scarcity
6. Malthusian and Ricardian scarcity - scarcity indices
7. Resource scarcity and technical change

8. Theory of optimal extraction renewable resources
9. Economic models of forestry
10. Economic models of fisheries
11. Logistic growth curve - maximum sustainable yield and economic yield
12. Theory of optimal extraction of exhaustible resources
13. Efficiency - time path of prices and extraction
14. Economic models of oil extraction
15. Hotelling's rule, Solow - Harwick's Rule
16. Efficiency and markets - market failures
17. **Mid semester examination**
18. Externalities - types
19. Property rights - transaction costs
20. Coase's theorem and its critique
21. Public goods - common property and open access resource management
22. Collective action - environmental regulation
23. Economic instruments
24. Pollution charges - Pigouvian tax
25. Carbon trading
26. Tradable permits
27. Indirect instruments
28. Environmental legislations in India
29. Concept of sustainable development
30. Economic perspective - indicators of sustainability
31. Relationship between development and environmental stress, poverty and environment, Environment Kuznet's curve
32. Environmental accounting - resource accounting methods
33. International environmental issues - climate change - likely impacts
34. Adaptation and mitigation efforts - international treaties

Practical schedule
1. Land use planning
2. Energy use pattern
3. Solid waste management
4. Biodiversity, biopiracy, biosafety issues - case studies
5. Renewable resource management
6. Optimum harvest of forestry/fishery
7. Discount rate in natural resource management
8. Exercise on pollution abatement - I
9. Exercise on pollution abatement - II
10. Concepts in valuing the environment
11. Taxonomy of valuation techniques
12. Productivity change method - substitute cost method
13. Hedonic pricing method - travel cost method
14. Contingent valuation method - discount rate in natural resource management
15. Environment impact assessment
16. Visit to Pollution Control Board
17. Social cost, benefit analysis

Course Outcomes

At the end of the course students will be able to

1. Gain knowledge on basic concepts of environmental economics.
2. Identify the optimal extraction level of renewable resources using economic models.
3. Assess the ways to manage common property resources.
4. Understand environmental legislations in India.
5. Analyse economic problems related to natural resource use including climate change problems.

Reference books
1. Conard, J.M. and W. Collin, 1987. *Natural Resource Economics*, Notes and Problems, Cambridge University Press, London.

2. Kerr, J.M., Marothia D.K., Katar Singh, Ramasamy C. and Bentley W.R., 1997. *Natural Resource Economics: Theory and Applications in India*, Oxford and IBH, New Delhi.
3. Pearce, D.W. and Turner K., 1990. *Economics of Natural Resources and the Environment*, John Hopkins Univ. Press., London.
4. Sengupta, R., 2000. *Ecology and Economy, an Indian Perspective*, Oxford Univ. Press, New Delhi.
5. Tietenberg, T., 2003. *Environmental and Natural Resource Economics*, 6th Ed., Addition Wesley.
6. http://www.iisd.org/publications
7. http://www.valuing-nature.net/
8. www.teebweb.org
9. http://ocw.mit.edu/courses/environment-courses/
10. http://www.colorado.edu/Economics/morey/4545/4545lnts.html
11. http://pubs.iied.org/
12. http://www.unep.org/publications/
13. http://www.env-econ.net/
14. http://environment.yale.edu/TEEB

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1	X				X	X					
CO2		X	X				X				
CO3			X		X						X
CO4			X		X						X
CO5		X		X							X

OPC AEC 711 Agri Business Analysis (2+1)

Learning Objectives
- To teach the students the basic concepts and principles
- To understand various tools of agri/farm business management

Theory

Unit-I : Agribusiness

Definition - basic concepts - structure of agribusiness - agribusiness sectors - special features of agribusiness - importance of agribusiness in Indian economy - role of farm business management - farm management decisions - farm management problems.

Unit-II : Principles of management

Management - definitions and importance - management functions - nature, roles, skills, levels and functional areas of management. Forms of business organization - sole proprietorship - partnership - private and public limited - cooperatives.

Unit-III : Elements of management

Planning - definition - types of plans - steps in planning - advantages of planning. Organizing - structure, departmentation - line and staff functions - centralization and decentralization - formal and informal organizations. Staffing - human resource planning - process. Directing - concept, principles, techniques, supervision - motivation - communication - leadership. Controlling - concept, steps, types, process.

Unit-IV : Approaches in agribusiness management

Approaches to management - Management By Objectives (MBO) - Quality Circle (QC) - profit center approach - Strength, Weakness, Opportunity and Threat (SWOT) - Management Information System (MIS) - agribusiness management - future prospects.

Unit-V : Tools of farm management

Principle of variable proportion - cost principle - factor substitution, opportunity cost principle. Farm business analysis - valuation of farm assets and depreciation - net worth statement - income statement - cash flow statement. Farm planning and budgeting - completer budget, partial budget, enterprise budget. Farm records and accounts - types of farm record. Management of farm resources - land, labour, farm machinery, farm building etc., - break even analysis. **Current streams of thought**

Practical

Agribusiness opportunities - business project preparation - business project scheduling - inventory management - production management - working capital management - repayment schedule of loans - feasibility control network analysis - project evaluation - visit to agro processing units and agribusiness units - consumer survey - market potential assessment. Farm survey - methods of data collection - estimation of cost of cultivation for annual and perennial crops - estimation of cost of production of milk, egg, broiler, fish - valuation of farm assets - depreciation of farm assets - farm financial statements - balance sheet - income statement - cash flow statement - budgeting - complete budgeting and partial budgeting - break even analysis.

Theory schedule
1. Definition - basic concepts - structure of agribusiness
2. Agribusiness sectors - special features of agribusiness
3. Importance of agribusiness in Indian economy
4. Role of farm business management
5. Farm management decision
6. Farm management problems
7. Management - definitions and importance
8. Management functions - nature, roles, skills, levels
9. Functional areas of management
10. Forms of business organization
11. Sole proprietorship, partnership
12. Private and public limited, cooperatives
13. Planning - definition - types of plans
14. Steps in planning - advantages of planning

15. Organizing - structure, departmentation - line and staff functions
16. Centralization and decentralization
17. **Mid semester examination**
18. Formal and informal organizations
19. Staffing - human resource planning process
20. Directing - concept, principles, techniques, supervision
21. Motivation - communication - leadership
22. Controlling - concept, steps, types, process
23. Approaches to management - Management By Objectives (MBO)
24. Quality Circle (QC) - profit center approach
25. Strength, Weakness, Opportunity and Threat (SWOT)
26. Management Information System (MIS) - agribusiness management - future prospects
27. Principle and variable proportion - cost principle
28. Factor substitution, opportunity cost principle
29. Farm business analysis - valuation of farm assets and depreciation
30. Net worth statement - income statement - cash flow statement
31. Farm planning and budgeting - completer budget, partial budget, enterprise budget
32. Farm records and accounts - types of farm records
33. Management of farm resources, land, labour, farm machinery, farm building
34. Break even analysis

Practical schedule
1. Agribusiness opportunities
2. Business project preparation
3. Business project scheduling
4. Inventory management
5. Production management
6. Working capital management
7. Repayment schedule of loans
8. Feasibility control network analysis - project evaluation
9. Visit to agro processing units and agribusiness units
10. Consumer survey - market potential assessment
11. Farm survey - methods of data collection
12. Estimation of cost of cultivation for annual and perennial crops
13. Estimation of cost of production of milk, egg, broiler, fish
14. Valuation of farm assets - depreciation of farm assets - budgeting
15. Farm financial statements - balance sheet - income statement - cash flow statement
16. Complete budgeting and partial budgeting
17. Break even analysis

Course Outcomes

At the end of the course students will be able to

1. Understand special features of agribusiness and its importance in Indian economy.
2. Understand the principles of agribusiness management.
3. Know the ways to communicate information effectively and economically.
4. Analyse the future prospects of agribusiness using different approaches of management.
5. Estimate economic and financial feasibility of agri-business industries.

Reference books
1. Acharya, S.S. and N.L. Agarwal, 2004. *Agricultural Prices - Analysis and Policy*, Oxford and IBH, New Delhi.
2. Acharya, S.S., and N.L. Agarwal, 2008. *Agricultural Marketing in India,* Oxford and IBH, New Delhi.

3. Francis Cherunilam, 2006. *International Trade and Export management*, Himalaya Publishing House, Mumbai.
4. Singh, S.K., 2006. *Agricultural Management (Vol. I)*, Mittal Publications, New Delhi.
5. Stephen P Robbins, 2007. *Organizational Behaviour*, Prentice Hall, New Delhi.
6. http://ocw.mit.edu/courses/economics
7. https://www.msu.edu/course/ECO/855
8. http://www.uky.edu/~deberti/prod/agprod5.pdf
9. http://www.csuchico.edu/ag/_assets/documents/syllabi/ABUS/ABUS%20301%20AG%20Production%20Econ%20Analysis.pdf

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1	X		X		X	X					
CO2	X				X		X				
CO3		X								X	
CO4		X	X	X					X		
CO5	X	X		X							X

OPC AEC 712 Agricultural Insurance and Risk Management (2+1)

Learning Objectives
- To provide the students a thorough knowledge on the principles of insurance
- To understand various practices of risk management
- To explain various insurance policies and schemes available for agri business

Unit-I : Agricultural finance

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, Commercial Banks and RRBs. District Credit Plan- and lending to agriculture/priority sector. The concept of 5 C's, 7 P's and 3 R's of credit.

Unit-II : Classification of risks

The concept of risk - kinds and classification of risks - assessment - the concept of insurance - types of general insurance - agriculture, fire, marine, engineering - insurance of property. Insurance professionals and intermediaries.

Unit-III : Principles of insurance

Basic principle of insurance - utmost good faith - insurable interest - material facts - economic principles - sharing - subrogation - contribution - legal principles - the Indian Contract, 1872 - insurable interest - nomination and assignment - financial principles - premium funds - investments.

Unit-IV : Agricultural risks

Agricultural risks - sources of risk - production and technical risk, output and input price risk, financial risk, political risk, legal risk, personal risk. Risk management tools. Low risk investments. Enterprise diversification - excess - debt capacity, liquid financial reserves. Off - farm Income, shared ownership or leasing risk transfer insurance products. Contracts - hedging and options market.

Unit-V : Agricultural insurance

Agricultural insurance - importance of agricultural insurance - scope - genesis - crop insurance development in India - Comprehensive Crop Insurance Scheme (CCIS) - advantages - livestock insurance - agencies of agricultural insurance - General Insurance Corporation - New India Assurance - Agricultural Insurance Corporation - National Agricultural Insurance Scheme - business loss estimation - appraisal - claiming and repayment. Types of insurance products - stakeholders. **Current streams of thought**

Practical

Estimation of cost of cultivation for major crops. Procedure on scale of finance for major crops. Estimation of technical feasibility, economic viability of farmers - Repaying capacity of borrowers and appraisal of credit proposals. Analysis of trend in farm lending and over dues - assessment of farm credit needs. Collection of farm level data on yield and crop losses. Visit to commercial bank, insurance agency - processes and procedure for agricultural insurance - crop loss assessment - estimation of indemnity - actuarial method of premium calculation - pure risk rate liability - case study on insurance development - case study on problem and prospect of insurance in India - role of government in farm insurance.

Theory schedule
1. Agricultural finance
2. Role and importance of agricultural finance
3. Financial institutions and credit flow to rural/priority sector
4. Agricultural lending - direct and indirect financing
5. Financing through co-operatives
6. Role of NABARD, Commercial Banks and RRBs
7. District credit plan and lending to agriculture/priority sector
8. The concept of 5 C's, 7 P's and 3 R's of credit
9. The concept of risk - kinds and classification of risks - assessment
10. The concept of insurance - types of general insurance - agriculture, fire, marine, engineering
11. Insurance of property - insurance professionals and intermediaries
12. Basic principle of insurance - utmost good faith - insurable interest - material facts
13. Economic principles - sharing - subrogation - contribution
14. Legal principles - the Indian contract, 1872

15. Insurable interest - nomination and assignment
16. Financial principles - premium funds – investments
17. **Mid semester examination**
18. Agricultural risks - sources of risk - production and technical risk
19. Output and input price risk
20. Financial risk - political risk - legal risk - personal risk
21. Risk management tools
22. Low risk investments - enterprise diversification
23. Excess - debt capacity - liquid financial reserves off - farm income - shared ownership or leasing
24. Risk transfer insurance products - contracts - hedging and options market
25. Agricultural insurance importance of agricultural insurance - scope
26. Genesis - crop insurance development in India
27. Comprehensive Crop Insurance Scheme (CCIS) - advantages
28. Livestock insurance - agencies of agricultural insurance
29. General Insurance Corporation. New India Assurance
30. Agricultural insurance corporation
31. National agricultural insurance scheme
32. Business loss estimation - appraisal
33. Claiming and repayment
34. Types of insurance products - stakeholders

Practical schedule
1. Estimation of cost of cultivation for major crops
2. Procedure on scale of finance for major crops
3. Estimation of technical feasibility, economic viability of farmers
4. Repaying capacity of borrowers and appraisal of credit proposals
5. Analysis of trend in farm lending and over dues
6. Assessment of farm credit needs
7. Collection of farm level data on yield and crop losses
8. Visit to commercial bank
9. Visit to insurance agency
10. Processes and procedure for agricultural insurance
11. Crop loss assessment
12. Estimation of indemnity
13. Actuarial method of premium calculation
14. Pure risk rate liability
15. Case study on insurance development
16. Case study on problem and prospect of insurance in India
17. Role of government in farm insurance

Course Outcomes

At the end of the course students will be able to

1. Understand the role of financial institutions in agricultural development.
2. Understand kinds of risk in agriculture and allied sectors.
3. Know the principles of insurance and assess the credit need.
4. Analyse different risk management techniques.
5. Discuss the role of agencies involved in agricultural insurance and types of insurance products.

Reference books
1. *Crop Insurance*, 1998. Publication of Insurance Institution of India, Mumbai.
2. David, C. and Debertin, 1986. *Agricultural Production Economics*, Mac Millan Publishing Company, New York.
3. *General Insurance*, 2004. Publication of United India Insurance Co, Ltd., Chennai.
4. Watis and Associate, IIRM, 2014. *Introduction to Agricultural Insurance and Risk Management*, World Bank Corporation, International Finance Corporation, Washington.
5. Sankhayan, P.L., 1988. *Introduction to the Economics of Agricultural Production*, Prentice Hall of India, New Delhi.

6. http://pages.stern.nyu.edu/~adamodar/
7. http://educ.jmu.edu//~drakepp/
8. www.microfinancegateway.org
9. http://www.ruralfinance.org
10. www.nabard.org
11. www.rbi.org

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1	X		X	X		X					
CO2			X		X		X				
CO3	X			X			X				
CO4	X				X				X		
CO5			X		X						X

STA 612 Statistics for Social Sciences (2+1)

Learning Objectives
- To expose the students to the concept of statistical methods
- To understand the importance of statistics
- To understand the concepts involved in computation, analysis and interpretation of research data

Theory

Unit - I: Theory of sampling

Basic concepts - unit and frame, population and sample - sampling and complete enumeration - probability and non-probability sampling - sampling and non-sampling errors - measurement and control of non-sampling errors. Simple Random Rampling (SRS) - with and without replacement - methods of selection of SRS - lottery method and random number table method. Systematic sampling. Stratified random sampling - stratification - types of allocation - equal, proportional allocation. Cluster sampling. Determination of sample size in SRS, stratified random sampling, systematic and cluster sampling, probability proportional to size (PPS) sampling.

Unit - II : Descriptive statistics and distributions

Measures of central value - measures of dispersion and its relative measures - applications of binomial, poission and normal distributions.

Unit - III: Correlation and regression analysis

Simple correlation - meaning - assumptions - positive and negative correlation - scatter diagram - computation of correlation coefficient - properties, testing and interpretation of correlation coefficient - coefficient of determination. Regression theory - simple linear regression - meaning assumptions - fitting of simple linear regression - properties of regression coefficients - interpretation of regression coefficients and intercept. Multiple linear regression - assumptions - standardized and partial regression coefficients - fitting of multiple linear regression equation - interpretation of regression coefficients - multiple correlation - coefficient of multiple determination (R^2) - interpretation.

Unit - IV: Test of significance

Test of significance - basic ideas - Type I error, Type II error - test of significance based on small sample -'t' test - testing the significance of single mean - testing the significance of two means for independent samples and paired samples. Large sample tests - testing the significance of single mean, two means. Test for regression coefficient - Chi-square - test for homogeneity of variance. Goodness of fit tests - 'F' test - one way ANOVA and two way ANOVA.

Unit - V: Time series analysis and non parametric test

Time series analysis - components of time series - trend, seasonal, cyclical and irregular movements - elimination of trend - moving average method - least square method - seasonal movement - simple average and ratio to trend method - link relative method. Non parametric tests (Distribution free tests) - advantages - disadvantages - run test - test for randomness - median test - sign test - Mann - Whitney U test for two samples - Kolmogrov - Smirnov one sample and two sample test, Kruskal - Walli's test.

Practical

Simple random sample - selection - estimation - determination of sample size in simple random sampling. Systematic sampling - stratified random sampling - cluster sampling - selection - estimation. Multistage sampling - selection - estimation of parameters in two stage sampling - determination of sample size in two stage sampling. Tests of significance based on small and large sample tests. Simple correlation - computation of correlation coefficient and it's testing - coefficient of determination. Rank correlation coefficient Simple linear regression - fitting of simple linear regression equations - testing and interpretation of regression coefficient and intercept. Multiple linear regression equation - interpretation of regression coefficients. Forecasting using regression techniques.

Theory schedule
1. Basic concepts - unit and frame, population and sample
2. Sampling and complete enumeration - probability and non-probability sampling
3. Sampling and non-sampling errors - measurement and control of non-sampling errors
4. Simple random sampling (SRS) - with and without replacement - methods of selection of SRS - lottery method and random number table method
5. Systematic sampling. Stratified random sampling - stratification - types of allocation - equal, proportional allocation
6. Cluster sampling

7. Determination of sample size in SRS, stratified random sampling, systematic and cluster sampling - probability proportional to size (PPS) sampling
8. Measures of central value - measures of dispersion and its relative measures - applications of binomial, poission and normal distributions
9. Simple correlation - meaning - assumptions - positive and negative correlation - scatter diagram
10. Computation of correlation coefficient - properties
11. Testing and interpretation of correlation coefficient - coefficient of determination
12. Regression theory - simple linear regression - meaning assumptions
13. Fitting of simple linear regression - properties of regression coefficients - interpretation of regression coefficients and intercept
14. Multiple linear regression - assumptions - standardized and partial regression coefficients
15. Fitting of multiple linear regression equation - interpretation of regression coefficients
16. Multiple correlation - coefficient of multiple determination (R^2) - interpretation
17. **Mid semester examination**
18. Test of significance - basic ideas - Type I error, Type II error
19. Test of significance based on small sample - 't' test
20. Testing the significance of single mean
21. Testing the significance of two means for independent samples and paired samples
22. Large sample tests - testing the significance of single mean, two means
23. Test for regression coefficient - Chi-square - test for homogeneity of variance
24. Goodness of fit tests
25. 'F' - test, one way ANOVA and two way ANOVA
26. Time series analysis - components of time series - trend, seasonal, cyclical and irregular movements
27. Elimination of trend - moving average method - least square method
28. Seasonal movement - simple average and ratio to trend method - link relative method
29. Non parametric tests (Distribution free tests) - advantages - disadvantages
30. Run test - test for randomness
31. Median test - sign test
32. Mann-Whitney U test for two samples
33. Kolmogrov - Smirnov one sample and two sample test
34. Kruskal - Walli's test

Practical schedule
1. Simple random sample - selection - estimation
2. Determination of sample size in simple random sampling
3. Systematic sampling - selection, estimation
4. Stratified random sampling - selection, estimation
5. Cluster sampling - selection - estimation
6. Multistage sampling - selection - estimation of parameters in two stage sampling
7. Determination of sample size in two stage sampling
8. Tests of significance based on small sample tests
9. Tests of significance based on large sample tests
10. Simple correlation - computation of correlation coefficient and it's testing
11. Co-efficient of determination
12. Rank correlation coefficient
13. Simple linear regression - fitting of simple linear regression
14. Testing and interpretation of regression coefficient and intercept
15. Multiple linear regression equation
16. Interpretation of regression coefficients
17. Forecasting using regression techniques

Course Outcomes

At the end of the course students will be able to

1. Understand the different sampling methods and its importance.
2. Fitting the regression and correlation analyses and test the significance
3. Know the time series analysis and other non-parametric tests

Reference books
1. Agarwal, B.M., 1995. *Basic Statistics*, New Age International Ltd, New Delhi.
2. Gupta, S.P., 2005. *Statistical Methods*, Sultan Chand and Sons, New Delhi.
3. Kapoor, V.K., and S.C. Gupta, 2006. *Fundamentals of Applied Statistics*, Sultan Chand and Sons, New Delhi.
4. Rangasamy, R., 2009. *A Textbook of Agricultural Statistics*, Wiley Eastern Ltd., New Delhi.
5. Senthamarai Kannan, K. and D. Venkatesan, 2005. *Introduction to Statistical Methods*, Scitech Publications (India) Private Ltd., Chennai.

PGS 611 Research Data Analysis (0+1)

Learning Objectives
- To explain the usage of various statistical packages
- To understand the analysis of agricultural research data
- To provide the students hands on experience in the analysis of research data

Practical

Statistical data analysis using MS Excel – creation and uuuuusage of excel spread sheet. Descriptive statistics - cross tabulation - one way, two way and multi-way tables - chi square test for socio economic conditions - comparison of means - student's t test - comparing a single mean - comparison of two means - paired and independent t tests - one way ANOVA. F test for testing the equality of variances - correlation coefficient - simple linear regression analysis - multiple linear regression analysis. Mann Whitney U-test - Wilcoxon matched pairs signed rank test - Kruskal Wallis one - way analysis - Friedman two-way analysis – Spearman's rank correlation - Kendall's rank correlation - time series analysis - moving average - exponential smoothing.

Course Outcomes

At the end of the course students will be able to

1. Use various statistical packages.
2. Identify the variables and models.
3. Interpret the results.

Reference books
1. Darren George and Paul Mallery, 2007. *SPSS for Windows Step by Step - A simple guide and reference*, Pearson Education, New Delhi.
2. Leland Wilkinson, Grant Blank and Christian Gruber, 1996. *Desktop Data Analysis with Systat,* Prentice Hall, New Jersey.
3. Ramesh Babu and Samyuktha, 2003. *Computer Practice - I,* V.R.B. Publications, New Delhi.
4. Saxena, 2003. *A first course in Computers,* Vikas Publishing House (P) Ltd., New Delhi.
5. Sharma, K.V.S., 2010. *Statistics Made Simple: Do it yourself on PC,* Prentice Hall of India, New Delhi.

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1		X		X	X		X				
CO2		X			X				X		
CO3				X							X

Learning Objective
- To provide the use of the statistical package
- To analyse agricultural research data
- To write interpretation

Practical

Use of SPSS / equivalent for frequency distribution, summarization and tabulation of data, F test, correlation, pearson correlation, spaearman correlation, ANOVA, ANCOVA. For regression: simple, multiple linear regression, estimation of regression by OLS and MLE method, logit, probit, stepwise regression, coefficient of determination. For Kolmogorov - Smirnov test, Wilcoxon signed rank test, Mann-Whitney U, Kruskal-Wallis, McNemar's test. For discriminant analysis - fitting of discriminant functions, identification of important variables, factor analysis, principal component analysis - obtaining principal component. For analysis of time series data - AR, MA, ARIMA models.

Practical schedule
1. Use of SPSS / equivalent for frequency distribution
2. Summarization and tabulation of data
3. F test
4. Correlation, pearson correlation, spearman correlation
5. ANOVA, ANCOVA
6. Regression - simple, multiple linear regression, estimation of regression by OLS and MLE method
7. Logit, probit, stepwise regression
8. Coefficient of determination
9. Kolmogorov - Smirnov test
10. Wilcoxon signed rank test, Mann - Whitney U test
11. Kruskal - Wallis, McNemar's test
12. Discriminant analysis
13. Fitting of discriminant functions
14. Identification of important variables
15. Factor analysis. Principal component analysis
16. Obtaining principal component
17. Time series data AR, MA, ARIMA models

Course Outcomes

At the end of the course students will be able to

1. Identify the methods to collect data.
2. Do different econometric analysis.
3. Forecast economic variables using AR,MA, and ARIMA models.

Reference books
1. SPSS User's guide and User's manual.
2. Wetherill, G.B., 1982. Elementary Statistical Methods. Chapman & Hall.
3. Wetherill, G.B., 1986. Regression Analysis with Applications. Chapman & Hall.
4. Learning statistics: http://freestatistics.altervista.org/en/learning.php.
5. Free statistical software's: http://freestatistics.altervista.org/en/stat.php.
6. Statistics glossary http://www.cas.lancs.ac.uk/glossary_v1.1/main.html

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1	X			X		X					
CO2		X			X		X				
CO3				X	X						X

PGS 715 Intellectual Property and its Management in Agriculture (1+0) (e-course)

Learning Objectives
- To create awareness about intellectual property rights in agriculture
- To explain management of patents, trademark, geographical indications, copy rights, designs, plant variety protection and biodiversity protection
- To understand marketing and commercialization of intellectual properties

Theory
Unit - I: World trade organization - introduction
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.

Unit - II: Patent document
Discovery *versus* invention - patentability of biological inventions - 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).

Unit - III: Plant genetic resources
Plant genetic resources - importance and conservation - sui generic system - plant varieties protection and farmers' rights act - registration of extinct varieties - registration and protection of new varieties / hybrids / essentially derived varieties - dispute prevention and settlement - farmers' rights.

Unit - IV: Trademark
Trademark - geographical indications of goods and commodities - copy rights-designs - biodiversity protection.

Unit - V: Benefit sharing
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. **Current streams of thought**

Theory schedule
1. World Trade Organization - Agreement on Agriculture (AoA) and Intellectual Property Rights (IPR)
2. Importance of intellectual property management - IPR and economic growth - IPR and bio diversity
3. Major areas of concern in Intellectual property management - technology transfer and commercialization
4. Forms of different intellectual properties generated by agricultural research
5. Discovery versus invention patentability of biological inventions
6. Procedure for patent protection
7. Preparatory work - record keeping, writing a patent document, filing the patent document
8. Types of patent application - patent application under the Patent Cooperation Treaty (PCT)
9. **Mid semester examination**
10. Plant genetic resources - importance and conservation
11. Sui generic system - plant varieties protection and farmers' rights act - registration of extant varieties
12. Registration and protection of new varieties / hybrids / essentially derived varieties - dispute prevention and settlement - farmers' rights
13. Trade mark - geographical indications of goods and commodities - copy rights - designs
14. Biodiversity protection
15. Procedures for commercialization of technology - valuation, costs and pricing of technology
16. Licensing and implementation of intellectual properties - procedures for commercialization
17. Exclusive and non exclusive marketing rights - research exemption and benefit sharing

Course Outcomes

At the end of the course students will be able to

1. Understand the concepts in international trade.
2. Understand the procedure to obtain patent rights.
3. Know the way to protect extinct varieties.
4. Create awareness about geographical indications of goods and commodities.
5. Identify the way to commercialize intellectual properties.

Reference books

1. Arun Goyal and Moor Mohamed, 2001. *WTO in the New Millennium*, Academy of Business Studies, New Delhi.
2. Bilek Debroy, 2004. *Intellectual Property Rights*, BR World of books, New Delhi.
3. Ganguli, P., 2001. *Intellectual Property Rights - Unleashing the KnowledgeEconomy*, Tata McGraw Hill, New Delhi.
4. Narayanan, R., 2006. *Patent Law,* Eastern Law House, New Delhi.
5. Ramappa, T., 2000. *Intellectual Property Rights under WTO - Tasks before India*, Wheeler Publishing, New Delhi.

	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5	PO6
CO1			X		X	X					
CO2	X			X		X					
CO3				X			X				
CO4	X				X						X
CO5		X									X