

Resolution

We the undersigned convenors of the following P.G. Subjects have re-structured the respective courses as per ICAR latest guidelines on the meeting held on 05/09/2017 alongwith Dr. Jyoti Shanker, Principal, K.A.P.G. College, Allahabad.

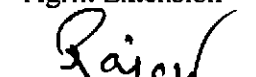
- 1- Agricultural Economics
- 2- Agricultural Extension
- 3- Genetics & Plant Breeding
- 4- Horticulture
- 5- Soil Science & Agricultural Chemistry

The nomenclature of earlier Ag. Botany & Ag. Chemistry be changed as Genetics & Plant Breeding, Soil Science & Agricultural Chemistry respectively in view of existing subjects names in other Universities.

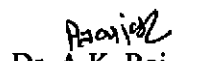
The restructured syllabus of the above courses are submitted for your kind approval w.e.f 2017-18



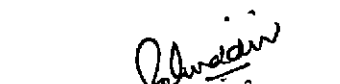
Dr. Ravi Prasad
Convenor
Agril. Extension




Dr. Rajendra Prasad
Convenor
Horticulture




Dr. A.K. Rai
Convenor
Agril. Economics



Dr. Salimuddin
Convenor
Genetics & Plant Breeding



Dr. R.L. Pal
Convenor
Soil Science & Agril. Chemistry



Dr. Jyoti Shanker
Principal

**NEW AND RESTRUCTURED
POST-GRADUATE CURRICULA & SYLLABUS**

Agricultural Economics
Agricultural Extension
Genetics & Plant Breeding
Horticulture
Soil Science & Agricultural Chemistry
w.e.f. 2017-18
Semester System
As per ICAR



Submitted by :

Conveners Board of Studies in Agriculture

Kulbhaskar Ashram P.G. College, Allahabad - 211001

Affiliated Allahabad State University

Allahabad - 211001

M.Sc. (Ag.) AGRICULTURAL ECONOMICS

I st Semester			Evaluation Marks			
Code No.	Course Title	Credit Hours	Mid Term	Practical	Theory	Total
AGECON 501	Micro Economic Theory and Applications	3(3+0)	20	-	80	100
AGECON504	Agricultural Production Economics	3(2+1)	20	30	50	100
AGECON506	Research Methodology for Social Sciences	3(2+1)	20	30	50	100
	Computer Application in Agriculture	2 (1+1)	20	30	50	100
	Total Credit	11				
II nd Semester			Evaluation Marks			
Code No.	Course Title	Credit Hours	Mid Term	Practical	Theory	Total
AGECON 502	Macro Economics and Policy	3(3+0)	20	-	80	100
AGECON505	Agricultural Marketing & Price Analysis	3(2+1)	20	30	50	100
AGECON509	Agricultural Finance and Project Management	3(2+1)	20	30	50	100
	Agricultural Statistics	3(2+1)	20	30	50	100
	Total Credit	12				
III rd Semester			Evaluation Marks			
Code No.	Course Title	Credit Hours	Mid Term	Practical	Theory	Total
AGECON 507	Econometric	3(2+1)	20	30	50	100
AGECON 515	Rural Marketing	3(3+1)	20	30	50	100
AGECON508	Linear Programming	2(1+1)	20	30	50	100
AGECON503	Evaluation of Thought	3(3+0)	20	-	80	100
	Total Credit	11				
IV th Semester			Evaluation Marks			
Code No.	Course Title	Credit Hours	Mid Term	Practical	Theory	Total
AGECON 591	Masters Seminar	1	-	-	-	100
AGECON 599	Masters Research	20	-	-	-	100
	Total Credit	21				
	Total Credit Hours	55				

Asst. Prof.

Agricultural Economics

Course Contents

AGECON 501 MICRO ECONOMIC THEORY AND APPLICATIONS 3(3+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

UNIT I: 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.

UNIT II: 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.

UNIT III: 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.

UNIT IV: 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.

AGECON 502 MACRO ECONOMICS AND POLICY 3(3+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

UNIT I: 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 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.

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

UNIT V: 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

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.

TheoryUNIT I

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.

UNIT II

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.

UNIT III

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

UNIT IV

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.

UNIT V

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.

AGECON 504 AGRICULTURAL PRODUCTION ECONOMICS 3(2+1)

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

Theory

UNIT I: 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.

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

UNIT III: 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.

UNIT IV: 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. 1. *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.

AGECON 505 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

UNIT I: 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.

UNIT II: 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.

UNIT III: 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.

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

UNIT V: 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.

AGECON 506 RESEARCH METHODOLOGY FOR SOCIAL SCIENCES 3(2+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 etc.

Theory

UNIT I: 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.

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

UNIT III: 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.

UNIT IV: Data collection – assessment of data needs – sources of data collection – discussion of different situations. Mailed questionnaire and interview schedule – structured, unstructured, open ended and closed-ended

questions. Scaling Techniques. Preparation of schedule – problems in measurement of variables in agriculture. Interviewing techniques and field problems - methods of conducting survey – Reconnaissance survey and Pre testing.

UNIT V: 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.

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.

TheoryUNIT I

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

UNIT II

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.

UNIT III

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

UNIT IV

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

UNIT V

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.

AES 508

LINEAR PROGRAMMING

2(1+1)

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

Theory

UNIT I: 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.

UNIT II: Simplex Method: Concept of simplex Method, solving profit maximization and cost minimizations problems. Formulation of farms and non farm problems as linear programming models and solutions.

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

UNIT IV: Game Theory- Concepts of game theory, two person constant sum, zero sum game, saddle point, 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

AGECON 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

UNIT I :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.

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

UNIT III: 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.

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

UNIT V: 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.

AGECON 515

RURAL MARKETING

3(2+1)

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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.

UNIT V

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

Practical – Survey of Rural market both Primary and Secondary case study of marketing of a minor and major commodity with respect to rural marketing channels.

Casts, margin and market price spread, market performance and Rural market efficiency. On line searches for Rural market information sources and interpretation of market intelligence report, submission of a report on above all aspects.

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.

M.Sc. (Ag.) AGRICULTURAL EXTENSION

Ist Semester			Evaluation Marks			
Code No.	Course Title	Credit Hours	Mid Term	Practical	Theory	Total
EXT 511M	Development Perspective of Extension Education	3(2+1)	20	30	50	100
EXT 512 M	Development Communication and Information Management	3(2+1)	20	30	50	100
EXT 513 M	Diffusion and Adoption of Innovations	3(2+1)	20	30	50	100
	Computer Application in Agriculture	2(1+1)	20	30	50	100
	Total Credit	11				
IInd Semester			Evaluation Marks			
Code No.	Course Title	Credit Hours	Mid Term	Practical	Theory	Total
EXT 522 M	Entrepreneurship Development and Management in Extension	3(2+1)	20	30	50	100
EXT 523M	Human Resource Development	3(2+1)	20	30	50	100
EXT 524	Participatory methods for technology Development and transfer	3(2+1)	20	30	50	100
	Agricultural Statistics	3(2+1)	20	30	50	100
	Total Credit	12				
IIIrd Semester			Evaluation Marks			
Code No.	Course Title	Credit Hours	Mid Term	Practical	Theory	Total
EXT 521M	E-Extension	3(2+1)	20	30	50	100
EXT 531	Research methods in behavioral sciences	3(2+1)	20	30	50	100
EXT 532	Visual Communication	3(2+1)	20	30	50	100
EXT 611	Advances in Agricultural Extension	2(1+1)	20	30	50	100
	Total Credit	11				
IVth Semester			Evaluation Marks			
Code No.	Course Title	Credit Hours	Mid Term	Practical	Theory	Total
EXT 591	Masters Seminar	1	-	-	-	100
EXT 599	Masters Research	20	-	-	-	100
	Total Credit	21				
	Total Credit Hours	55				

M.Sc. (Ag) Programme

EXT 511 Development Perspectives of Extension Education 3(2+1)

Objective

The course is intended to orient the students with the concept of extension education and its importance in Agriculture development and also to expose the students with various rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis. Besides, the students will be learning about the new innovations being brought into the Agricultural Extension in India.

Theory

Extension Education — Meaning, objectives, concepts, principles and philosophy, critical analysis of definitions — Extension Education as a Profession — Adult Education and Distance Education. Pioneering Extension efforts and their implications in Indian Agricultural Extension — Analysis of Extension systems of ICAR and SAU — State Departments Extension system and NGOs — Role of Extension in Agricultural University. Poverty Alleviation programmes - SGSY, SGRY, PMGSY, DPAP, DDP, CAPART — Employment Generation Programmes — NREGP, women Development Programmes — ICDS, MSY, RMK, Problems in Rural Development. Current Approaches in extension: Decentralized Decision Making, Bottom up Planning, Farming System Approach, Farming Situation Based Extension, Market — Led — Extension, Farm Field School, ATIC, Kisan Call Centres, NAIP.

Practical

Visit to Gram Panchayat to study on-going Rural Development Programmes, Visit to KVK, NGO and Extension centers of State Agricultural University and State Departments. Bottom up planning, Report preparation and presentation

Suggested Readings

- Chandrakandan KM, Senthil Kumar & Swatilaxmi. PS. 2005. Extension Education What? And What Not ? RBSA publ.
- Gallagher K. 1999. Farmers Field School (FES) — A Group Extension Process based on Non-Formal Education methods. Global EPM Facility, FAO.
- Gancsan R, Iqbal IM & Anandaraja N. 2003. Reaching the Unreached: Basics of Extension Education. Associated Publishing com.
- Jalihal KA & Veerabhadraiah V. 2007. Fundamentals of Extension Education and Management in Extension. Concept Publ.

Khan PM 2002. Textbook of Extension Education. Himalaya Publ.
Ray GL 2006 Extension Communication and Management. Kalyani Publ.
Van Den Ban AW & Hawkins HS. 1998 Agricultural Extension .2nd Ed. CBS.
Viswanathan M. 1994. Women in Agriculture and Rural Development. Printwell Publ.

EXT 512 Development Communication And Information Management 3(2+1)

Objective

In this course, students will learn about the concept, meaning and process of communication and various methods and modern media of communication. Besides, the students will also learn the information management and journalistic writing of various information materials and also study their readability.

Theory

Communication process — concept, elements and their characteristics — Models and theories of communication — Communication skills— fidelity of communication, communication competence and empathy, communication effectiveness and credibility, feedback in communication, social networks and Development communication — barriers in communication, Message — Meaning, dimensions of a message, characteristics of a good message, message treatment and effectiveness, distortion of message. Methods of communication — Meaning and functions, classification. Forms of communication Oral and written communication, Non-verbal communication, interpersonal communication, organizational communication. Key communicators — Meaning, characteristics and their role in development. Media in communication — Role of mass media in dissemination of farm technology, Effect of media mix for Rural People. Modern communication media — Electronic video, Tele Text, Tele conference, Computer Assisted Instruction, Computer technology and its implications. Agricultural Journalism as a means of mass communication. Its form and role in rural development, Basics of writing — News stories, feature articles, magazine articles farm bulletins and folders. Techniques of collection of materials for news stories and feature articles; Rewriting Art of clear writing, Readability and comprehension testing procedures; photo journalism, communicating with pictures. Radio and TV Journalism, Techniques of writing scripts for Radio and TV.

Practical

Writing News for Farm News paper/Magazines. Reporting of Various Extension activities like-Field day, Training, result Demonstration and farmer' fair etc. Preparing and delivering effective speech. Handling of communication and recording equipments (like-Computer,

P.A.System & Camera). Script writing for Radio, T.V. Conducting students' visit to Radio & T.V. station

Suggested Readings

Dahama OP & Bhatnagar OP. 2005. Education and Communication for Development. Oxford & IBH.

Grover I. Kaushik S, Yadav L & Varna SK. 2002. Communication and Instructional Technology. Agrotech Publ. Academy.

Jana B1 & Mishra K P. 2005. Farm Journalism. Agrotech Publ. Academy.

Ray GL 2006. Extension Communication and Management. Kalyani Publ.

Rayudu CS.2002. Communication. Himalaya Publ. House.

Reddy AA. 1987. Extension Education. Sree Lakshmi Press, Bapatla.

Sandhu A S. 2004. 1 extbook on Agricultural Communication Process and Methods. Oxford & IBH.

EXT 513

Diffusion and Adoption of Innovations

3(2+1)

Objective

The students will learn how the agricultural innovations spread among the farmers in the society by getting into the insights of diffusion concept and adoption process, stages of adoption and innovation decision process, adopter categories and their characteristics, opinion leaders and their characteristics, attributes of innovations, and factors influencing adoption. In addition, the students would be learning various concepts related to diffusion and adoption of innovations.

Theory

Diffusion — concept and meaning, elements; traditions of research on diffusion; the generation of innovations; innovation-development process; tracing the innovation-development process, converting research into practice. The adoption process- concept and stages, dynamic nature of stages, covert and overt processes at stages, the innovation-decision process — a critical appraisal of the new formulation. Adopter categories — Innovativeness and adopter categories, adopter categories as ideal types, characteristics of adopter categories; Perceived attributes of Innovation and their rate of adoption, factors influencing rate of adoption. Diffusion effect and concept of over adoption, opinion leadership- measurement and characteristics of opinion leaders, monomorphic and polymorphic opinion leadership, multi -step flow of innovation; concepts of homophily and heterophily and their influence on flow of innovations; Types of innovation-decisions — Optional, Collective and Authority and contingent innovation decisions; Consequences of

Innovation-Decisions — Desirable or Undesirable, direct or indirect, anticipated or unanticipated consequences; Decision making — meaning, theories, process, steps, factors influencing decision — making.

Practical

Case studies in individual and community adoption process, content analysis of adoption studies, Identification of adopter categories on a selected technology, study of attributes of current farm technologies, Identification of opinion leaders-. Sources of information at different stages of adoption on a selected technology, study of factors increasing or retarding the rate of adoption, presentation of reports on adoption and diffusion of innovations.

Suggested Readings

- Dasgupta 1989. Diffusion of Agricultural Innovations in Village India. Wiley Eastern.
Jalihal KA & Veerabliadraiah V. 2007. Fundamentals of Extension Education and Management in Extension. Concept Publ. Co.
Ray G L. 2005. Extension Communication and Management. Kalyani Publ.
Reddy AA. 1987. Extension Education. Sree Lakshmi Press, Bapatla.
Rogers EM. 2003. Diffusion of Innovations. 5th Ed. The Free Press, New York.

EXT 521

e- Extension

3(2+1)

Objective

Students will gain knowledge and skills in understanding the concepts of Information and communication technologies and how these ICT tools can be used for Agricultural Extension. Besides, he studies various ICT projects which are successful in delivering the services to the clientele fulfilling the objective of Transfer of technology i.e. Reaching the unreached.

Theory

ICTs- Concept, definition, tools and application in extension education. Reorganizing the extension efforts using ICTs. advantages, limitations and opportunities. ICTs projects, case studies in India and developing world. Different approaches (models) to ICTs. ICT use in field of extension- Expert systems on selected crops and enterprises; Self learning CDs on package of practices, diseases and pest management, Agricultural web sites and portals related crop production and marketing etc. Community Radio, Web, Tele, and Video conferencing. Computer Aided Extension. knowledge management, Information kiosks, Multimedia. Online, Offline Extension. Tools-Mobile technologies, e-learning concepts. ICT

Extension approaches-pre-requisites, information and science needs of farming community. Need integration. Human resource information. Intermediaries. Basic e-extension training issues. ICT enabled extension pluralism. Emerging issues in ICT.

Practical

Agri content analysis of ICT Projects. Handling of ICT tools. Designing extension content. Online extension service. Project work on ICT enabled extension. Creation of extension blogs. Visit to ICT extension projects.

Suggested Readings

Batnagar S & Schware R. 2000. Information and Communication Technology in Development- Cases from India. Sage Publ.

Meera SN. 2008. ICTs in Agricultural Extension: Tactical to Practical. Ganga-Kaveri Publ. House. JangamWadiMath, Varanasi.

Willem Zip. 1994. Improving the Transfer and Use of Agricultural Information - A Guide to Information Technology. The World Bank, Washington.

EXT 522 Entrepreneurship Development and Management in Extension 3(2+1)

Objective

The first part of the course is intended to provide overall picture of planning and development of enterprises for extending sustainable livelihoods for rural people. The second part of the course is structured to help the students to gain (knowledge and skills in different concepts and techniques of management in extension organizations.

Theory

Entrepreneurship — Concept, characteristics, Approaches, Theories, Need for enterprises development. Agri —entrepreneurship — Concept, characteristics, Nature and importance for sustainable Livelihoods. Traits of entrepreneurs - Risk taking, Leadership, Decision making, Planning, Organising, Coordinating and Marketing, Types of Intrepreneurs. Stages of establishing enterprise — Identification of sound enterprise, steps to be considered in setting up an enterprise, feasibility report, product selection, risk and market analysis, legal requirements. Project \ management and Appraisal — Market, Technical, Financial, Social Appraisal of Projects. Management — Meaning, concept. nature and importance, Approaches to management, Levels of management, Qualities and skills of a manager. Extension Management — Meaning, Concept, Importance, Principles of management, Classification of Functions of Management. Planning — Concept, Nature, Importance, Types, Making planning effective. Change Management — factors, process and procedures.

Decision making — Concept, Types of decisions, Styles and techniques of decision making, Steps in DM Process, Guidelines for making effective decisions. Organizing — meaning of Organization, Concept, Principles, Organizational Structure, Span of Management, Departmentalization, authority and responsibility, Delegation and decentralization, line and staff relations. Coordination — Concept, Need, type techniques of Coordination. Interpersonal relations in the organization. Staffing — Need and importance, \Nonpo\\CF planning, Recruitment, Selection, Placement and Orientation, Training and Development — Performance appraisal meaning, Concept, Methods. Direction — Concept, Principles, Requirements of effective direction, Giving orders, Techniques of direction. Leadership — Concept, Characteristics, Functions, Approaches to leadership, Leadership styles. Organizational Communication — Concept, Process, Types, Net Works, Barriers to Communication. Managing work motivation — Concept, Motivation and Performance, Approaches to motivation.

Supervision Meaning, Responsibilities, Qualities and functions of supervision, Essentials of effective supervision. Managerial Control - Nature, Process, Types, Techniques of Control, Budgeting, Observation, PERT and CPM, MIS.

Practical

Field visit to Successful enterprises-Study of Characteristics of Successful entrepreneurs
Development of Project Proposal -Case Studies of Success / Failure enterprises-Exercise on Market Survey-Field visit to Financial institution-Simulated exercise to understand management process-Field visit to extension organizations to understand the functions of management -Group exercise on development of short term and long term plan-Simulated exercise on techniques of decision making-Designing organizational structure -Group activity on leadership development skills.

Suggested Readings

- Gupta CB. 2001. Management Theory and Practice. Sultan Chand & Sons.
Indu Grover. 2008. Handbook on Empowerment and Entrepreneurship. Agrotech Public Academy.
Khanka SS. 1999. Entrepreneurial Development. S. Chand & Co.
Singh D. 1995. Effective Managerial Leadership. Deep & Deep Publ.
Tripathi PC & Reddy PN. 1991. Principles of Management. Tata McGraw Hill.
Vasanta Desai 1997. Small Scale Industries and Entrepreneurship. Himalaya Publ. House.

Objective

To orient the students about key concepts importance, scope & conceptual frame work, growth & development of Human Resource Development, Subsystems of Human Resource Development for extension organization and process of HRD.

Theory

Human Resource Development — Definition, Meaning, Importance, Scope and Need for HRD; Conceptual frame work, inter disciplinary approach, function systems and case studies in HRD; HRD Interventions — Different experiences, Selection, Development & Growth-Selection, Recruitment, Induction Staff Training and Development, career planning; Social and Organizational Culture: Indian environment perspective on cultural process and social structure society in transition; Organizational and Managerial values and ethics, organizational commitment; innovation productivity -job description — analysis and evaluation; Performance Appraisal. Human Resource management: Collective bargaining, Negotiation skills; Human Resource Accounting (HRA): What is HRA? Why HRA? Information Management for HRA and Measurement in HRA; Intra personal processes: Collective behaviour, learning, and perception ; Stress and coping mechanisms; Inter-Personal Process, Helping Process — communication and Feedback and interpersonal styles; Group & Inter group process: group information and group processes; Organizational communication, Team building Process and functioning, Conflict management, Collaboration and Competition: HRD & Supervisors: Task Analysis; Capacity Building — Counseling and Mentoring; Role of a Professional Manager: Task of Professional Manager — Responsibility of Professional Manager; Managerial skills and Skills required for Extension workers; Decision Making: Decision Making models, Management by Objectives; Behavioural Dynamics : Leadership styles — Group dynamics. Training — Meaning, determining training need and development strategies — Training types, models, methods and evaluation; Facilities for training — Trainers training, — techniques for trainees participation; Research studies in training extension personnel; Main issues in HRD: HRD culture and climate — organizing for HRD — emerging trends and Prospective.

Practical

Visit to different training organizations to review ongoing activities & facilities; Analysis of Training methods followed by training institutions for farmers and extension workers Studies on evaluation of training programmes; study of HRD in organization in terms of

performance, organizational development, employees welfare and improving quality of work life and human resource information, Presentation of reports.

Suggested Readings

- Ageohiya D. 2002. Every trainers Handbook. Sage Publ.
- David Gross 1997 Human Resource management - The Basics. TR Publ.
- Davis Keth & Newston W John 1989. Human Behaviour at Work. 8th Ed. McGraw-Hill.
- Hersey Paul & Balanchard H Kenneth. 1992. Management of Organizational Behaviour Utilizing Human Resource. 5th edition Prentice-Hall of India.
- Knoont / Harold Wehrich Heinz 1990. Essentials of Management. 5th Ed. McGraw-Hill.
- Lynton RP Pareek U. 1993. Training for Development. DB. Taraporewale Sons & Co.
- Punna Rao P & Sudarshan Reddy M. 2001. Human Resource Development Mechanisms for Extension Organization. kalyani Publ.
- Rao TV. 2003. Readings in Human Resource Development. Oxford Publ. Co.
- Silberman Mel. 1995. Active Training. Press Johnston Publ. Co., New Delhi.
- Singh RP. 2000. management of Training Programmes. Anmol Publ.
- Subba Rao P. 2005. Management & Organizational Behavior. Himalaya Publ. House.
- Sundaram R M. Gupta V, George SS. 2006. Case Studies in Human Resource Management. ICFAI, Hyderabad.
- Tripathi & Reddy. 2004. Principles of Management. Tata McGraw-Hill.
- Wayne MR Robert MN. 2005. Human Resource Management. International Ed. Pearson Prentice Hall.

EXT 524 Participatory Methods for Technology Development and Transfer 3(2+1)

Objective

This course is intended to orient the students with the key concepts, principles process of different participatory approaches for technology development and transfer and also to expose the students with various participatory tools and techniques like space related, time related, relation oriented methods. Besides the students will be learning the preparation of action plans participatory monitoring and evaluation.

Theory

Participatory extension — importance, key features, principles and process of participatory approaches: Different participatory approaches (RRA, PRA, PLA, AEA, PALM, PAR, PAME, ESRE, FPR) and successful models. Participatory tools and techniques. Space Related Methods : village map (social & resource), mobility services and opportunities Map and transect; Time related methods : time line, trend analysis, seasonal diagram. Daily activity schedule dream map; Relation oriented methods : cause and effect diagram (problem

tree), impact — diagram, well being ranking method, Venn diagram, matrix ranking, livelihood analysis. Preparation of action plans, concept and action plan preparation; Participatory technology development and dissemination; Participatory planning and management, phases and steps in planning and implementation aspects; Process monitoring, participatory evaluation.

Practical

Simulated exercises on space related methods, time related method and relation oriented methods; Documentation of PTD and dissemination; Preparation of action plan; Participatory monitoring and evaluation of developmental programmes

Suggested Readings

Adhikary 2006. Participatory Planning and Project Management in Extension Science. Agrotech Publ. Academy.

Mukharjee N. 2002. Participatory Learning and Action. Concept Publ. Co.

Singh BK. 2008. PRA/PLA and Participatory Training. Adhyayan Publ. & Distr.

Somesh Kumar. 2002. Methods for community Participation. Vistaar Publ.

EXT 531

Research Methods In Behavioural Science

3(2+1)

Objective

This course is designed with a view to provide knowledge and skills in methods of behavioural sciences research and student will learn the appropriate statistics for data analysis.

Theory

Research - meaning, importance, characteristics. Behavioural sciences research — Meaning, concept and problems in behavioural sciences research. Types and methods of Research — Fundamental, Applied and Action research, exploratory, Descriptive, Diagnostic, Evaluation, Experimental, Analytical, Historical, Survey and Case Study. Review of literature — Need, Search Procedure, Sources of literature, Planning the review work. Research problem — Selection and Formulation of research problem and guiding principles in the choice of research problem, Factors and criteria in selection of research problem, statement of research problem and development of theoretical orientation of the research problem. Objectives Meaning, types and criteria for judging the objectives. Concept and Construct — Meaning role of concepts in research and Conceptual frame work development in research. Variable — Meaning, type and their role in research. Definition — Meaning, characteristics of workable definitions, types and their role in research. Hypothesis —

Meaning, importance and functions of hypothesis in research, Types of hypothesis, linkages, sources, problems in formulation and criteria for judging a workable hypothesis. Measurement — Meaning, postulates and levels of measurement, Use of appropriate statistics at different levels of measurement, criteria for judging the measuring instrument and importance of measurement in research. Validity — Meaning and methods of testing. Reliability- Meaning and methods of testing. Sampling — Universe, Sample and Sampling- Meaning, basis for sampling advantages and limitations, size and factors affecting the size of the sample and sampling errors — Methods of elimination and minimizing, Maximincon Principle, Sampling — Types of sampling and sampling procedures. Research Designs — Meaning, purpose and criteria for research design, Types, advantages and limitations of each design. Experimental design — Advantages and limitations. Data Collection devices - Interview — Meaning, purpose, types, techniques of interviewing and advantages and limitations. Enquiry forms and Schedules — Meaning, types of questions used, steps in construction and advantages and limitations in its use. Questionnaires — Meaning, difference between schedule and questionnaire, types of questions to be used, pre — testing of the questionnaires or schedules and advantages and limitations. Check lists — Meaning, steps in construction, advantages and limitations in its use. Rating. scales — Meaning, types, limits in construction. advantages and limitations in its use. Observation — Meaning, types, tips in observation, advantages and limitations in its use. Case studies — Meaning, types, steps in conducting, advantages and limitations in its use. Social survey — Meaning, objectives, types and steps in conducting, advantages and limitations. Data processing — Meaning, coding, preparation of master code sheet, analysis and tabulation of data, choosing appropriate statistics for data analysis based on the level of measurement of variables. Report writing Meaning guidelines to be followed in scientific report writing, References in reporting.

Practical

Selection and humiliation of research problem - Formulation of objectives and hypothesis- Selection of variables based on objectives-Developing the conceptual framework of research. Operationally defining the selected variables-Development of data collection devices.-Testing the validity and reliability of the data collection instruments.- Pretesting of the data collection instrument-Techniques of interviewing and collection of data using the data collection instruments-Data processing, coding. tabulation and analysis. Formulation of secondary tables based on objectives of research. Writing report, Writing of thesis and research articles-Presentation of reports.

Suggested Readings

Chandrakandan K, Venkatapirabu J, Sekar V & Anand Kumar V. 2000. Tests and Measurements in Social Research. APH Publ.

Kerlinger FN. 1973. Foundations of Behavioural Research. Holt Rhinehart.

Kothari CR.1984. Research Methodology, Methods and Techniques. Chaitanya Publ. House.

Krislinaswanii OR & Ranganatham M. 2005. Methodology of Research in Social Sciences. Himalaya Publ. House.

Mlulay S & Sabaratnam VE.1983. Research Methods in Extension Education. Manasavan.

Ranjit Kumar. 1999. Research Methodology - A Step by Step Guide for Beginners. Sage Publ.

Ray GL & Sagar Mondal. 1999. Research methods in Social Sciences and Extension Education. Naya Prokash.

Wilkinson TS & Bhandarkar PC.1 993. Alethodolgy and Techniques of Social Research. Himalaya Publ. Home.

EXT 532

Visual Communication

3(2+1)

Objective

This course is intended to give a clear perspective about the importance of visuals and graphics in communication. The course starts with the delineating about the characteristics of visuals and graphics followed by its main functions, theories of visual perception and its classification and selection. Further, the course deals with the designing the message, graphic formats and devices and presentation of data. It makes the students to understand, prepare and present the scientific data effectively by using low cost visuals. The course also exposes the students to various Video material in multimedia and also enable to design visuals for print, TV and know-how about scanning of visual.

Theory

Role of visuals & graphics in Communication Characteristics of visuals & graphics. Functions of visuals and Graphic theories of visual, perception classification and selection of visuals. Designing message for visuals, graphic formats and devices. Presentation of scientific data. Principles and production of low cost visuals. Photographs - reprographic visuals. PC based visual. Digitized video material in multimedia production Designing graphic for print and TV and video. Pre-testing and evaluation of visuals.

Practical

Preparation of low cost projected and Non-projected visuals. Designing and layout of charts, posters, flash cards etc. Power point presentations. Generating computer aided presentation graphics. Scanning and evaluation of visuals.

EXT 611

Advances in Agricultural Extension

2(1+1)

Theory

Approaches of Agricultural Extension: A critical analysis of different approaches of agricultural extension. Importance and relevance of indigenous knowledge system, identification and documentation of ITK, Integration-of ITK system in research formulation, Concept of Agricultural Knowledge and Information System, Training of stakeholders of AKIS. Cyber Extension - Concept of cyber extension, national and international cases of extension Projects using ICT and their impact of agricultural extension, alternative methods of financing agricultural extension Scope. Limitations and experience and cases. Research - Extension -Farmer - Market linkage: Importance, Scope, implications etc., Market — Led Extension, Farmer - Led Extension, Concept of Farm Field School, Farm School, Public - Private Partnership: Meaning, Models, Identification of various areas for partnership. Stakeholders analysis in Extension. Main streaming gender in Extension - Issues and Prospects. Implications of WTO - AOA for extension Services. Re-orientation of extension services for Agri-business and marketing activities, GOI-NGO collaboration to improve efficiency of extension. Extension and contemporary issues: Extension and issues-related to rural poverty. Privation of Extension. Intellectual Property Rights (IPRs). Extension reforms in India - Decentralized decision making. Bottom up planning, Farming System and Situation based Extension Delivery system Extension delivery through Commodity Interest Groups. Organization innovations in Extension - ATIC, IVLP, Kisan Call Centers.

Practical

Analysis of ITK systems, cases on integration of ITK and formal research system, Analysis of cases on cyber extension and privatization of extension. Analyses of ATMA and SREP. Practicing bottom up planning. Visit to –public private Farmer partnership. Learning from Food and Nutritional Security and bio-diversity Projects and programmes.

M.Sc(Ag): Genetics & Plant Breeding

Code No.	Course Title	Credit	Marks			Total
			Theory	Practical	Mid Term	
GPB-501	Principles of Genetics	2+1	50	30	20	100
GPB-502	Principles of Cytogenetics	2+1	50	30	20	100
GPB-503	Principles of Plant Breeding	2+1	50	30	20	100
GPB-504	Principles of Quantitative Genetics	2+1	50	30	20	100
GPB-505	Mutagenesis and Mutation Breeding	2+1	50	30	20	100
GPB-506	Population Genetics	2+1	50	30	20	100
GPB-507	Heterosis Breeding	2+1	50	30	20	100
GPB-508	Cell Biology and Molecular Genetics	2+1	50	30	20	100
GPB-509	Biotechnology for Crop Improvement	2+1	50	30	20	100
GPB-515	Maintenance Breeding, Concepts of Variety Release and Seed Production	1+1	50	30	20	100
	Computer Application in Agriculture	1+1	50	30	20	100
	Agricultural Statistics	2+1	50	30	20	100
	Total	34				
Semester wise Course Distribution:						
Ist Semester						
GPB -501	Principles of Genetics	2+1	50	30	20	100
GPB-502	Principles of Cytogenetics	2+1	50	30	20	100
GPB-506	Population Genetics	2+1	50	30	20	100
	Computer Application in Agriculture	1+1	50	30	20	100
	Total	11				
IInd Semester						
GPB-503	Principles of Plant Breeding	2+1	50	30	20	100
GPB-504	Principles of Quantitative Genetics	2+1	50	30	20	100
GPB-505	Mutagenesis and Mutation Breeding	2+1	50	30	20	100
	Agricultural Statistics	0+1	50	30	20	100
	Total	12				
IIIrd Semester						
GPB-508	Cell Biology and Molecular Genetics	2+1	50	30	20	100
GPB-509	Biotechnology for Crop Improvement	2+1	50	30	20	100
GPB-515	Maintenance Breeding, Concepts of Variety Release and Seed Production	1+1	50	30	20	100
GPB-507	Heterosis Breeding	2+1	50	30	20	100
	Total	12				
IVth Semester						
GPB-591	Master Seminar	1	-	-	-	100
GPF-899	Masters Research	20	-	-	-	100
	Total	20				
	G.Total	55				

elements; Molecular chaperones and gene expression; Gene regulation in eukaryotes; RNA editing.

UNIT VII

Gene isolation, synthesis and cloning; Genomic and cDNA libraries; PCR-based cloning, positional cloning; Nucleic acid hybridization and immuno-chemical detection; DNA sequencing; DNA restriction and modification; Anti-sense RNA and ribozymes; Micro-RNAs (miRNAs).

UNIT VIII

Genomics and proteomics; Functional and pharmacogenomics; Metagenomics.

UNIT IX

Methods of studying polymorphism at biochemical and DNA level; Transgenic bacteria and bioethics; Gene silencing; Genetics of mitochondria and chloroplasts.

UNIT X

Concepts of Eugenics; Epigenetics; Genetic disorders and Behavioural genetics.

Practical

Laboratory exercises in probability and chi-square; Demonstration of genetic principles using laboratory organisms; Chromosome mapping using three point test cross; Tetrad analysis; Induction and detection of mutations through genetic tests; DNA extraction and PCR amplification-Electrophoresis-basic principles and running of amplified DNA-Extraction of proteins and isozymes-use of *Agrobacterium* mediated method and Biolistic gun; practical demonstrations- Detection of transgenes in the exposed plant material; visit to transgenic glasshouse and learning the practical considerations.

Suggested Readings

- Gardner EJ & Snustad DP. 1991. *Principles of Genetics*. John Wiley & Sons.
Klug WS & Cummings MR. 2003. *Concepts of Genetics*. Peterson Edu. Lewin B. 2008. *Genes IX*. Jones & Bartlett Publ.
Russell PJ. 1998. *Genetics*. The Benzamin/Cummings Publ. Co.
Snustad DP & Simmons MJ. 2006. *Genetics*. 4th Ed. John Wiley & Sons. Strickberger MW. 2005. *Genetics (III Ed)*. Prentice Hall, New Delhi, India Tamarin RH. 1999. *Principles of Genetics*. Wm. C. Brown Publs.

Uppal S, Yadav R, Subhadra & Saharan RP. 2005. *Practical Manual on Basic and Applied Genetics*. Dept. of Genetics, CCS HAU Hisar.

GPB 502

PRINCIPLES OF CYTOGENETICS

3(2+1)

Objectives

To provide insight into structure and functions of chromosomes, chromosomes mapping, polyploidy and cytogenetic aspects of crop evolution.

Theory

UNIT I

Architecture of chromosome in prokaryotes and eukaryotes; Chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; Artificial chromosome construction and its uses; Special types of chromosomes.

UNIT II

Chromosomal theory of inheritance — Cell Cycle and cell division — mitosis and meiosis; Differences, significance and deviations — Synapsis, structure and function of synaptonemal complex and spindle apparatus, anaphase movement of chromosomes and crossing over-mechanisms and theories of crossing over- recombination models, cytological basis, - Variation in chromosome structure: Evolutionary significance - Introduction to techniques for karyotyping; Chromosome banding and painting - *in situ* hybridization and various applications.

UNIT III

Structural and Numerical variations of chromosomes and their implications - Symbols and terminologies for chromosome numbers - euploidy - haploids, diploids and polyploids ; Utilization of aneuploids in gene location - Variation in chromosome behaviour - somatic segregation and chimeras — endomitosis and somatic reduction ; Evolutionary significance of chromosomal aberrations - balanced lethals and chromosome complexes.

UNIT IV

Inter-varietal chromosome substitutions; Polyploidy and role of polyploids in crop breeding; Evolutionary advantages of autopolyploids vs allopolyploids-Role of aneuploids in basic and applied aspects of crop breeding, their maintenance and

utilization in gene mapping and gene blocks transfer-Alien addition and substitution lines-creation and utilization; Apomixis-Evolutionary and genetic problems in crops with apomixes.

UNIT V

Reversion of autopolyploids to diploids; Genome mapping in polyploids-Interspecific hybridization and allopolyploids; Synthesis of new crops (wheat, *triticale* and *brassica*)-Hybrids between species with same chromosome number, alien translocations-Hybrids between species with different chromosome number; Gene transfer using amphidiploids-Bridge species.

UNIT VI

Fertilization barriers in crop plants at pre-and post-fertilization levels- *in vitro* techniques to overcome the fertilization barriers in crops; Chromosome manipulations in wide hybridization; case studies- Production and use of haploids, dihaploids and doubled haploids in genetics and breeding.

Practical

Learning the cytogenetics laboratory, various chemicals to be used for fixation, dehydration, embedding, staining, cleaning etc.-Microscopy: various types of microscopes, -Observing sections of specimen using electron microscope; Preparing specimen for observation-Fixative preparation and fixing specimen for light microscopy studies in cereals- Studies on the course of mitosis in wheat, pearl millet- Studies on the course of mitosis in onion and *Aloe vera*- Studies on the course of meiosis in cereals, millets and pulses- Studies on the course of meiosis in oilseeds and forage crops- Using micrometers and studying the pollen grain size in various crops-Variou methods of staining and preparation of temporary and permanent slides- Pollen germination *in vivo* and *in vitro*; Microtomy and steps in microtomy; Agents employed for the induction of various ploidy levels; Solution preparation and application at seed, seedling level-Identification of polyploids in different crops- Induction and identification of haploids; Anther culture and ovule culture- Morphological observations on synthesized autopolyploids-Observations on C-mitosis, learning on the dynamics of spindle fibre assembly-Morphological observations on allopolyploids- Morphological observations on aneuploids – Cytogenetic analysis of interspecific and intergeneric crosses- Maintenance of cytogenetic stocks and their importance in crop breeding- Various ploidy levels due

to somaclonal variation; Polyploidy in ornamental crops,-Fluorescent *in situ* hybridization (FISH)- Genome *in situ* hybridization (GISH)

Suggested Readings

- Becker K & Hardin. 2004. *The World of Cell*. 5th Ed. Pearson Edu.
- Carroll M. 1989. *Organelles*. The Guilford Press.
- Charles B. 1993. *Discussions in Cytogenetics*. Prentice Hall.
- Darlington CD & La Cour LF. 1969. *The Handling of Chromosomes*.
Georger Allen & Unwin Ltd.
- Elgin SCR. 1995. *Chromatin Structure and Gene Expression*. IRL Press.
- Gray P. 1954. *The Microtome's Formulatory Guide*. The Blakiston Co.
- Gupta PK & Tsuchiya T. 1991. *Chromosome Engineering in Plants: Genetics, Breeding and Evolution*. Part A. Elsevier.
- Gupta PK. 2000. *Cytogenetics*. Rastogi Publ.
- Johatmson DA. 1975. *Plant Microtechnique*. McGraw Hill.
- Karp G. 1996. *Cell and Molecular Biology: Concepts and Experiments*. John Wiley & Sons.
- Khush GS. 1973. *Cytogenttics of Aneuploids*. Academic Press.
- Sharma AK & Sharma A. 1988. *Chromosome Techniques: Theory and Practice*. Butterworth.
- Sumner AT. 1982. *Chromosome Banding*. Unwin Hyman Publ.
- Swanson CP. 1960. *Cytology and Cytogenetics*. Macmillan & Co.

Objectives

To impart theoretical knowledge and practical skills about plant breeding objectives, modes of reproduction and genetic consequences, breeding methods for crop improvement.

TheoryUNIT I

History of plant breeding (Pre-and post-Mendelian era); Objectives of plant breeding; characteristics improved by plant breeding; Patterns of evolution in crop plants-Centres of origin-biodiversity and its significance.

UNIT II

Genetic basis of breeding self-and cross-pollinated crops including mating systems and response to selection-nature of variability, components of variation; Heritability and genetic advance, genotype-environment interaction; General and specific combining ability; Types of gene actions and implications in plant breeding; Plant introduction and role of plant genetic resources in plant breeding.

UNIT III

Self-incompatibility and male sterility in crop plants and their commercial exploitation.

UNIT III

Pure line theory, pure line selection and mass selection methods; Line breeding, pedigree, bulk, backcross, single seed descent and multiline method; Population breeding in self-pollinated crops (diallel selective mating approach).

UNIT IV

Breeding methods in cross pollinated crops; Population breeding-mass selection and ear-to-row methods; S_1 and S_2 progeny testing, progeny selection schemes, recurrent selection schemes for intra-and inter-population improvement and development of synthetics and composites; Hybrid breeding-genetical and physiological basis of heterosis and inbreeding, production of inbreds, breeding approaches for improvement of inbreds, predicting hybrid performance; seed production of hybrid and their parent varieties/inbreds.

UNIT V

Breeding methods in asexually/clonally propagated crops, clonal selection, apomixes.

UNIT VI

Self-incompatibility and male sterility in crop plants and their commercial exploitation; Concept of plant ideotype and its role in crop improvement; Transgressive breeding.

UNIT VII

Special breeding techniques-Mutation breeding; Breeding for abiotic and biotic stresses.

UNIT VIII

Cultivar development-testing, release and notification, maintenance breeding, Participatory plant breeding, Plant breeders' right and regulations for plant variety protection and farmers rights.

Practical

Floral biology in self and cross pollinated species, selfing and crossing techniques; Selection methods in segregating populations and evaluation of breeding material; Analysis of variance (ANOVA); Estimation of heritability and genetic advance; Maintenance of experimental records; Learning techniques in hybrid seed production using male-sterility in field crops.

Suggested Readings

- Allard RW. 1981. *Principles of Plant Breeding*. John Wiley & Sons.
- Chopra VL. 2001. *Breeding Field Crops*. Oxford & IBH.
- Chopra VL. 2004. *Plant Breeding*. Oxford & IBH.
- Gupta SK. 2005. *Practical Plant Breeding*. Agribios.
- Pohlman JM & Bothakur DN. 1972. *Breeding Asian Field Crops*. Oxford & IBH.
- Roy D. 2003. *Plant Breeding, Analysis and Exploitation of Variation*. Narosa Publ. House.
- Sharma JR. 2001. *Principles and Practice of Plant Breeding*. Tata McGraw-Hill.
- Simmonds NW. 1990. *Principles of Crop Improvement*. English Language Book

Society.

Singh BD. 2006. *Plant Breeding*. Kalyani.

Singh P. 2002: *Objective Genetics and Plant Breeding*. Kalyani.

Singh P. 2006. *Essentials of Plant Breeding*. Kalyani.

Singh S & Pawar IS. 2006. *Genetic Bases and Methods of Plant Breeding*. CBS.

GPB 504 PRINCIPLES OF QUANTITATIVE GENETICS 3(2+1)

Objectives

To impart theoretical knowledge and computation skills regarding component of variation and variances, scales, mating designs and gene effects.

Theory

UNIT I

Mendelian traits vs polygenic traits-nature of quantitative traits and its inheritance- Multiple factor hypothesis-analysis of continuous variation; Variations associated with polygenic traits-phenotypic, genotypic and environmental-non-allelic interactions; Nature of gene action-additive, dominance, epistatic and linkage effects.

UNIT II

Principles of Analysis of Variance (ANOVA)-Expected variance components, random and fixed models; MANOVA, biplot analysis; Comparison of means and variances for significance.

UNIT III

Designs for plant breeding experiments-principles and applications; Genetic diversity analysis-metroglyph, cluster and D^2 analyses-Association analysis-phenotypic and genotypic correlations; Path analysis and parent-progeny regression analysis; Discriminant function and principal component analyses; Selection indices-selection of parents; Simultaneous selection models-concepts of selection-heritability and genetic advance.

UNIT IV

Generation mean analysis; Mating designs-Diallel, partial diallel, line x tester analysis, NCDs and TTC; Concepts of combining ability and gene action; Analysis