POST GRADUATE DIPLOMA (PGD)

IN

AGRICULTURAL & RURAL MANAGEMENT WITH STATISTICAL METHODS AND ANALYTICS (ARSMA)

ABOUT THE COURSE

PG Diploma in ***"Agricultural and Rural Management with Statistical Methods and Analytics"*** is an integrated multidisciplinary course for career aspiring young graduates and post graduates. It will educate those inspired to work with organisations serving the rural sector and engaging directly with the rural communities. The thrust of the proposed PG diploma course is not only to offer diploma but also to develop next generation professionals with advanced level of competency to work in government or non-government sectors for promotion of agriculture and rural management. The uniqueness of the proposed syllabus is its emphasis on statistics and data analytics modules along with agricultural science and social science modules. Modules are designed with adequate focus on both theory and practical work while keeping an eye on employability.

The new PG Diploma is also designed with the idea to develop motivated professionals who can be assets for any organization associated with the revival of rural economy through agriculture and allied sectors, banking and finance and rural entrepreneurship for sustained growth and inclusive development.

DURATION

The total duration of the PG Diploma programme is one year which includes two regular semesters and a six week summer internship during June-July (at the end of the second semester). The first semester has five compulsory courses. The second semester has four compulsory courses and one optional course. Therefore each student will have five courses in each semester. Each course carries 100 marks. There is a study break of one week before the final examination in each semester. The first semester will commence in July and the second semester will commence in January of the following year.

EXAMINATION AND SCORES

The pattern will be the same as other One Year PG Diploma Courses of ISI (Mid-Semester, Semester, Practical/Assignment and Project report)

ELIGIBILITY

In order to be eligible for this programme, a candidate must have Graduate degree in any discipline with Mathematics/Statistics as a subject studied at least at the intermediate (10+2) level. Women and reserved category candidates are encouraged to apply.

INTERNSHIP

An internship will be a must for a student admitted to the course. It will be undertaken in June-July after the completion of the second semester. Students will be either associated in the projects undertaken by the faculty members of ISI or they may be attached with industry/agencies beyond ISI. Each student has to submit a project report after completion of the internship which will cover a maximum period of one and a half months. On successful completion of the project, students may obtain experience certificate from the respective supervisor /organization.

PLACEMENT OPPORTUNITIES

The institute will provide placement assistance to the students after successful completion of the course.

Hostel Facilities: Limited hostel seats with mess facilities are available for the students at ISI Giridih main campus. If necessary, the Institute may facilitate alternative arrangements outside the Giridih campus of the Institute on payment basis.

Financial Assistance: There is a provision for need based financial assistance for deserving candidates. These will be considered on a case-by-case basis.

Other Facilities: Desktop/laptop to each student joining the course with internet facilities in the campus for students of the PG Diploma course.

METHOD OF SELECTION

An all India Admission Test will be carried out for which notification will be published along with other admission notifications of ISI on the ISI webpage. Admission test will be on Mathematics (up to 12th standard), Logical Reasoning, and English Grammar and Comprehension. Question paper will consist of multiple choice questions only. There will be altogether 30 multiple choice questions and each question will carry 4 marks. Thus, the total marks will be 120. However, the test will be as per the tests in other courses of ISI (test will be OMR based and for 2 HRs in the Forenoon session). Actual test Structure/Syllabus will be decided by a Selection Test Committee.

Selection will be based on the performance in written test and interview.

GENERAL RULES, METHOD OF EXAMINATIONS AND AWARD OF DEGREE

Each course, except the summer internship, has two examinations, namely mid-semester and semester (final) examinations. The composite score in a course is a weighted average of the scores in the mid-semester and semester examinations, home-assignments, practical record-book, etc. (announced at the beginning of the semester). The general rules to enable the students to appear for the examinations as well as the rules for pass / fail, award of degrees and repeating years in case a student fails to pass examinations during a semester will be as per the existing rules of the Institute.

CLASS TEACHER

One of the faculty, who has been allotted a class in a semester is designated as the class-teacher. All students are required to meet their respective class-teacher periodically to get their academic performance reviewed and to discuss academic problems, if any.

COURSE STRUCTURE

The courses for study and examinations in each semester are as follows.

SUBJECTS (COURSES) FOR INSTRUCTION AND GRADES

SEMESTER-I (500 Marks)

[Duration: 16 weeks (14 weeks of class): July to December]

Five Compulsory Subjects
Agricultural Farm Management (C)
Climate Change: Agriculture and Food Security(C)
Basic Probability and Statistical Methods (C)
Rural Sociology (C)
Computer Operation & Programming (C)

SEMESTER II (500 Marks)

[Duration: 16 weeks (14 weeks of class): January to May]*

Four Compulsory (C) Subjects	Three Optional (O) Subjects#
Data Analytics and Experimental Design (C)	Agricultural Production & Operations Management (O)
Agricultural Economics and Ag. Marketing (C)	Rural Entrepreneurship (O)
Natural Resource Management (C)	Rural Developmental Strategies & Approaches (O)
Database Management & Business Analytics (C)	# A student has to opt for only one optional subject out of three choices.

* A eight-weeks (Jun-July) Summer Internship starts immediately after Semester II examination. The summer internship will be evaluated on qualitative scale in order to assess the satisfactory completion.

SYLLABI OF SUBJECTS - SEMESTER I

AGRICULTURAL FARM MANAGEMENT (Course#1)

(1st Semester; 100 marks)
(14 weeks)

Cropping systems: Definition, Principles, Concepts, Classification, mono cropping, intensive cropping, cropping systems of India, Interaction between different cropping systems, cropping system management, resource management, land, nutrient, water and weed, Indices for evaluation of cropping systems, Land use, yield advantages, Economic evaluation **(12 Classes)**

Farming systems: Definition, Principles, Concepts, Enterprises selection and management, interaction between different enterprises with cropping, scope and advantages of Integrated Farming system, evaluation indicators of integrated farming system, Integrated farming system models for different agro eco-systems, LEIA & HEIA- concepts and principles **(12 Classes)**

Dryland farming and rainfed farming: Significance of dry farming in India- History of dry land agriculture- Distribution of Arid and semiarid regions in India, Major crops of Dryland in India, Characteristics, constraints **(8 Classes)**

Drought and its management: Definition, Types and effects of Drought on crop production, Drought management, Contingent crop planning, Mid-season correction, Mulching, anti-tranpirants, Soil moisture conservation techniques and approaches, Water harvesting, storage and recycling, Integrated dry land technologies, Mechanization, Watershed management **(8 Classes)**

Resource management in dry lands: Cost reduction strategies in crop production, Non-monetary inputs and low cost technologies, Labour management, Resource recycling, Residue management, crop and livestock, Conservation agriculture, principles, concept and scope **(8 Classes)**

Practical: Preparation of cropping scheme, working out input requirements for crops, cropping systems, preparation of calendar of operations, study of tools and implements and machineries for tillage, sowing and after cultivation**(8 Classes)**

Readings

Principles and practice of Dryland Agriculture by Govindan K. and V. Thirumurugan. 2003. Kalyani Publishers, Chennai.

Farming System : Principles and Practices by C Jayanthi; P Devasenapathy and C Vennila, ISBN 10: 8189304496 / ISBN 13: 9788189304492, Published by Satish Serial, 2008.

CLIMATE CHANGE: AGRICULTURE AND FOOD SECURITY (Course #2)

(1st Semester; 100 marks)
(14 weeks)

Climate change – historical perspectives; Carbon Cycle, Non-CO_2 Greenhouse Gases and Aerosols; Greenhouse Effect: Temp, Radiation, & Energy, Linking Human Dimension to Climate Change; Green House Gas Emissions Scenarios; Sequestrations of Atmospheric CO_2; Impacts of Climate Change; Climate change & policy options; Description of the climate system, natural greenhouse effect and the effect of trace gases and aerosols, climate change in the past, ice ages, abrupt climate change, impacts and mitigation of climate change **(10 Classes)**

Accelerated mineral carbonation, clean coal technology, coalbed methane produced water **(4 Classes)**

Environmental Pressures on Agriculture; Response of Agriculture to Rising CO_2 and Climate Change; Sensitivity of Tropical Agriculture to Climate change; Social Vulnerability and Food Security; Economic Policy, Effect of global change in Agricultural Pests; Possible Impacts and Dynamics at Population, Species, Interactions and Community Level Food Webs **(8 Classes)**

Soil and climate change: effects of global warming on soils and its management. Relative importance of soil and vegetation management in global warming. Greenhouse gases production, emission, mitigation, carbon sequestration, soil quality, Crop production in Dry-land Region; Soil Organic Matters; Sequestering Soil Carbon; Food Security in Dry-land Areas; Soil and climatic requirements, varieties, cultural practices, systems of cultivation, harvesting and processing of major cereals and millets, pulses, tubercrops **(8 Classes)**

Conservation and Management of Water resources: Groundwater Pollution and its control measures, Rainwater Harvesting and Artificial recharge, Impact of climate change on water resources **(6 Classes)**

Agricultural classification of crops, agronomic classification of crops, botanical classification of crops, major farming systems and cropping intensity, methods of sowing/planting - planting geometry and its effect on growth and yield **(4 Classes)**

Hunger and food security, agronomy, sustainable agriculture, subsistence agriculture, commercial agriculture, extensive and intensive agriculture, urban agriculture, agribusiness **(4 Classes)**

Soils of India, soil texture and structure, soil productivity and fertility, crop nutrition - nutrients - classification -nutrient sources, organic manures and biofertilizers, fertilizers and fertilizer use, nutrient recycling through manures and fertilizers, soil organic matter, biological nitrogen fixation, green manure crops, integrated nutrient management, soil health, soil microorganisms and their roles in soil quality, problem soils of India **(8 Classes)**

Irrigation: definition and objectives. Role of water in soil and plants- irrigated agriculture vs. Rainfed agriculture, Irrigation methods - drip and sprinkle irrigation systems. Water management of different agricultural and horticultural crops **(4 Classes)**

Readings

Climate Change synthesis report (2007), *IPCC*

Climate Change 2014: Impacts, Adaptation and Vulnerability, *IPCC*

Climate Change 2013: The Physical Science Basis, *IPCC*

IPCC (1995) Climate Change 1995: The Science of Climate Change, CambridgeUniv Press, Cambridge, UK.

Climatic risk in crop production: models and management for the semi-arid tropics and subtropics. Muchow, R.C. & Bellamy, J.A.1991.

Coalbed natural gas: Energy and environment by K.J. Reddy, Nova Publishers, Hauppauge, NY, USA.

BASIC PROBABILITY AND STATISTICAL METHODS (Course - #3)

(1st Semester; 100 marks)

(14 weeks)

All lectures to be motivated through examples, preferably from agricultural & rural domains and demonstrated using R/Python/Excel.

1. Concept of Probability (6 Classes)

Classical definition of probability and its drawbacks, Sample space and events, Concept of random experiment with examples, Axiomatic definition of probability, Properties of probability, Conditional probability, Bayes' theorem, Independence of events.

2. Introduction to Statistics (14 Classes)

Definition of Statistics. Scope, purpose and objectives. Population and Sample. Measurement scales. Types of Data.

Tabulation of univariate data. Frequency distribution and histogram. Frequency and cumulative frequency curve. Box Plot. Descriptive measures - central tendency, dispersion, coefficient of variation, skewness and kurtosis. correlation coefficient, rank correlation. contingency tables.

3. Concept of random variables and probability distributions (14 Classes)

Definition of random variable, Discrete random variables - their p.m.f. Continuous random variables - their p.d.f. and c.d.f. Expectation and Variance of random variables.

Bernoulli trials, Binomial, Poisson, Uniform, normal, Chi-square distributions and their properties. Numerical examples.

4. Statistical Inference (8 Classes)

Principles of statistical inference. Point estimation - methods of moments, maximum likelihood estimation. Hypothesis testing: Critical region, Type-I, Type-II errors, power of the test. Formulation of problems with examples. Tests of Mean and Variance of Normal population (one sample, two samples), paired-t test. Central Limit Theorem. Confidence intervals.

5. Sampling Techniques (8 Classes)

Survey methodology-Survey designing, Primary and secondary Data, monitoring and evaluation**.**
Random numbers. Sampling frame. Simple random sampling (with replacement and without replacement). estimation of sample size and sampling error.

6. Introduction to R, R-Studio **(6 Classes)**

Readings

A First Course in Probability by S.M. Ross. 9th Ed. Pearson Education Limited

Introduction to the Theory of Statistics by A.M. Mood, F.A.Graybill, D.C. Boes, McGraw Hill, New York.

Fundamentals of Statistics, Vol. I - A. M. Goon, M. K. Gupta and B. Dasgupta.

Applied Statistics and Probability for Engineers – D. C. Montgomery and G. C. Runger.

Statistical Concepts & Methods - G.K. Bhattacharya and R.A. Johnson.

Mathematical Statistics – Parimal Mukhopadhyay.

An Introduction to Probability Theory and Mathematical Statistics – V. K. Rohatgi.

Sampling Techniques – W. G. Cochran.

RURAL SOCIOLOGY (Course # 4)

(1st Semester; 100 marks)
(14 weeks)

Introduction to Rural Sociology: Meaning, scope, importance, origin, concepts, and theories **(10 Classes)**

Contributions to Rural Sociology in India: G. S. Ghurye, A. R. Desai, N.K. Bose, Radhakamal Mukerjee, D.P Mukerji, M.N. Srinivas, S.C. Dube, Oscar Lewis, F. G. Bailey, Ramkrishna Mukherjee, Andre Beteille, Dipankar Gupta, Surinder Jodhka **(12 Classes)**

Rural Society, culture, economy and Polity: Society and culture- rural society in India, Rural–urban continuum; Dominant caste; jajmani system, culture-concept, classification, meaning and characteristics **(4 Classes)**

Social stratification-Caste system, Class system, Power, Gender, Ethnicity **(4 Classes)**

Social institution and social organization-Family-joint family, nuclear family, extended family, changing nature of family, marriage-types and forms of marriage, kinship-definition, Theories, types and classification **(4 Classes)**

Political institutions- State, peasant, tribe and nation, Panchayati raj institutions, 5th and 6th Scheduled areas, PESA, etc. **(2 Classes)**

Economic organization- Rural economic organization, formal and informal/unorganized sectors, rural market **(4 Classes)**

Agrarian studies: Concept and theories- agrarian society, agrarian social structure, agrarian class, peasant theory, theory of capitalism, concept of land tenure, property rights, agrarian question, political economy

of agrarian transition; Agrarian transformation- institutional and technological transformation, green revolution and its implications, land use change, contract and corporate farming, changing role of women in agriculture, agrarian crisis, agrarian movement

Land and tenancy reforms-Land reforms in India, tenancy, national land record modernization program, forest rights act, land acquisition and rehabilitation and resettlements, land, market and neoliberal enclosure **(16 Classes)**

Readings

Society: An Introductory analysis by MacIver, Robert M. and Charles H. Page, New York: Holt, Rinehart and Winston

Modern Society by Kingsley Davis, Rinehart

Sociological theory by George Ritzer, TATA McGraw-Hill, Rawat

Modern Sociological theory: An introduction by M. Francis Abraham, Oxford University Press.

Society in India by Ram Ahuja (2003), New Delhi: Rawat Publications

Caste, class and power by Andre Beteille (1965), Oxford University Press

Studies in Agrarian Social Structure by Andre Beteille (1974), OUP

Society and Politics in India: Essays in a comparative perspective by Andre Beteille (1991), Berg

The Hindu Jajmani System: A case of economic particularism by Harold A Gould (1986). Journal of Anthropological Research, Vol. 42 (3).

Caste in Modern India and other essays by M.N. Srinivas (1962), APH

India: Social structure by M.N. Srinivas (1980), HPC

The Theory of Peasant Economy by A.V. Chayanov (1986), Madison.: University of Wisconsin Press

Peasants and Peasant Societies by Teodor Shanin (1987), Blackwell Publishers

Peasants and globalization: Political economy, rural transformation and the Agrarian question, Akram-Lodhi, A.H. and C. Kay (eds.) , Routledge, London

Indian Capitalism in Development, Harriss-White, Barbara, and J. Heyyer (eds.), Routledge, New York

Agrarian structures and their transformations' by Surinder S. Jodhka, 2004 in Veena Das (ed.) Oxford Companion to Sociology and Social Anthropology, Delhi: Oxford University Press

Agrarian prospect in India by Thorner, Daniel, Delhi University Press, 1956

Critical perspectives on agrarian transition, Mohanty, B.B. (edited), Routledge, New Delhi

COMPUTER OPERATION AND PROGRAMMING (Course - #5)

(1st Semester; 100 marks)

(14 weeks)

All lectures to be motivated through examples, preferably from agricultural & rural domains and demonstrated using R/Python/Excel.

Introduction to Computers, Operating Systems – Windows and Linux. Office Suite and Spreadsheets. **(10 Classes)**

Elementary concepts of data structures: arrays, stack, queue, linked list. Sorting and Searching **(10 Classes)**

Programing with C/C++/Java: Implementation of the above data structures, static and dynamic memory allocation, file handling.**(20 Classes)**

Introduction to R/Python. Introduction to Data Exploration and Visualization using R/Python. **(16 Classes)**

Readings

Programming in ANSI C by E Balagurusami, Mc Graw Hill Education.

Programming with C by Byron Gottfried, Mc Graw Hill Education.

SYLLABI OF SUBJECTS -- SEMESTER II

DATA ANALYTICS AND EXPERIMENTAL DESIGN (Course - #6)

(2nd Semester; 100 marks)
(14 weeks)

All lectures to be motivated through examples, preferably from agricultural & rural domains and demonstrated using R/Python/Excel.

1. Data Analytics - Descriptive/Exploratory (8 Classes)
Introduction to analytics. Data labelling and indexing. Data pre-processing - missing data, outliers. Data transformation - Standardisation/Normalization, Data Visualization (with R/Python)

2. Data Analytics - Predictive (30 Classes)
Simple linear regression. Multiple linear regression. Multiple and partial correlation. Definition of linear model. ANOVA - One way and two way models. Concept of multicollinearity. Dummy variable regression, Logistic regression. Clustering techniques: Distance Measures, Hierarchical and partitioning methods. Classification techniques: Bayes' rule, Linear Discriminant Analysis, K-nearest neighbour method.

3. Introduction to Design of Experiments (10 Classes)
Basic concepts of experimental design. Basic concepts of experimental unit, experimental error, factor, levels, treatments, confounding. Basic concepts of fixed and random factors. Basic principles of experimentation. Basic concepts of Completely Randomized Design, Randomized Block Design, Latin Square Design, Balanced Incomplete Block Design, Factorial Design (2-factor 2-level only). Illustration using ANOVA.

4. Use of R / Python (8 Classes)

Readings

Design and Analysis of experiments - D.C. Montgomery.

Statistics for Experimenters : An Introduction to design, data analysis and model building - G. E. P. Box, W. G. Hunter, J. S. Hunter.

Applied Statistics and Probability for Engineers – D. C. Montgomery and G. C. Runger

Statistical Methods - G.W. Snedecor and W.G. Cochran.

Statistical Concepts & Methods - G.K. Bhattacharya and R.A. Johnson.

Introduction to Linear Regression Analysis - D.C. Montgomery and E. Peck.

Regression Analysis by Example – S. Chatterjee and A. S. Hadi.

An Introduction to Applied Multivariate Analysis with R, Brian Everitt, Torsten Hothorn,

Applied Multivariate Statistical Analysis, Richard A. Johnson and Dean W. Wichern,

Logistic Regression: A Self Learning Text- D. G. Kleinbaum and M. Klein.

Cluster analysis for Applications, M.R. Anderberg,

Cluster Analysis, B. Everitt, Halsted, N.Y.

NATURAL RESOURCE MANAGEMENT (Course # 7)

(2nd Semester; 100 marks)
(14 weeks)

Components of environment: Lithosphere, hydrosphere, atmosphere and biosphere; physical and biological environments **(4 Classes)**

Environmental Chemistry: Atoms, elements, compounds, chemical bonds and chemical reactions; Stoichiometry **(4 Classes)**

Principles of analytical methods: Design of sampling techniques (air, soil, biological matters), Chromatography, gas chromatography, HPLC, Atomic absorption spectroscopy, Flame photometry; some microbial methods **(6 Classes)**

Water pollution: Sources, types and consequences; inorganic and organic pollutants; concept of eutrophication, DO, BOD, COD; sewage and groundwater pollution; status of water pollution in different water bodies with reference to Indian context; thermal pollution **(6 Classes)**

Soil pollution: Sources, effect of soil pollution on biota, fate and behavior of soil pollutants; trace element pollution, impact of different pesticides on soil; different kinds of synthetic fertilizer (NP&K) and their interactions with different components of soil; management of soil pollution in India **(4+2 Classes)**

Air Pollution: Natural and anthropogenic sources of pollution; inorganic pollutants, ozone, SPM, photochemical smog, acid rain; organic pollutants, bio-pollutants; effects of air pollutants on human, plants, materials and climate; status of air pollution in Indian cities; different control measures and air quality standard **(4 Classes)**

Industrial pollution: Impacts of industrial effluents: General impacts of some effluents discharged from paper and pulp industry, sugar, distillery, tannery, mining, sponge-iron on ecosystem with special reference

to occurrence, Fly ash and flue gas, environmental sources, biochemical effects, and remedial measures **(4 Classes)**

Biochemical aspects of heavy metals: Sources, distribution, mechanism of action, effects and remedial measures of some trace element like arsenic, cadmium, lead, mercury, aluminum, chromium, fluorine **(4 Classes)**

Waste Management: Municipal solid waste, sewage sludge, composting, vermicomposting etc **(4 +2 Classes)**

Environmental disaster: draught, flood, mining disaster, disaster management, disaster resilience **(4 Classes)**

Common Property Resource management: Overview-definition, concept, classification/category, CPR management in international and national context, CPR and rural livelihoods; Common property resource vs. common pool resource, managing common property resources such as irrigation, village commons, social regime around resources

CPR degradation and challenges: Nature of CPR degradation, causes and effect of CPR degradation, CPR challenges in mining areas **(4 Classes)**

Forest policy and governance: Forest policy-forest policy evolution, concept and classification, forest rights and tribal land rights, forest rights act, forest and livelihood of indigenous communities, natural resources, identity and law.

Governance: community forest management, joint forest management in India, JFM in West Bengal, participatory forest management- Andhra Pradesh experience-implementation, outcomes and livelihood impacts, democratising forest governance in India **(4 Classes)**

Readings

Understanding environmental pollution --- Marquita K. Hill, Cambridge University Press, 1997

Environmental Science --- S. C. Santra, New Central Book Agency.

Environmental Science: A comprehensive Treatise on Ecology and Environment --- Sovan Roy, Publishing Syndicate, Calcutta.

Common property resources: ecology and community based sustainable development, Ed. by Berkes, F. 1986, Belhaven Press, London

Common property resources in crisis. Life on Edge: Sustaining agriculture and community resources in fragile environments by Jodha, N.S. edited (2001), New Delhi, Oxford University Press

Common property resource management: Reflections on theory and the India experience by Kakekodi, G.K. (1992), New Delhi: Oxford University Press

Managing common pool resources: principles and case studies, Katar Singh, Oxford University Press, New Delhi, 1994

Institutionalising common pool resources edited by Dinesh Marothia

Village commons, livelihoods and governance: An assessment of Karnataka's experience by Lele, S., S. Purushothaman, and S. Kashyap, 2013, in S. Purushothaman and R. Abraham (Eds.), *Livelihood*

strategies in Southern India: Conservation and Poverty reduction in forest fringes, Vol., Springer India, new Delhi

Managing common property: Irrigation in India and the Philippines by Sengupta, N., 1991, Sage Publications, New Delhi.

Democratizing Forest Governance in India by Lele, S. and A. Menon, Ed.s, 2014, Oxford University Press, New Delhi.

"Joint Forest Management in West Bengal" by Banerjee, A., 2007, in O. Springate-Baginski and P. Blaikie (Eds.), Forests, People & Power: *The Political Ecology of Reform in South Asia*, vol., Earthscan, London, pp.221-260.

"Participatory forest management in Andhra Pradesh: Implementation, outcomes and livelihood impacts" by Reddy, V.R., et al., 2007, in O. Springate-Baginski and P. Blaikie (Eds.), *Forests, People & Power: The Political Ecology of Reform in South Asia*, Earthscan, London, pp.302-334.

Deeper Roots of Historical Injustice: Trends and Challenges in the Forests of India, Rights and Resources Initiative, Washington, D.C.

"Forest Law, Ideology, and Practice" by Vasan, S., 2005, in N. Sundar (Ed.) Legal Grounds: Natural *Resources, Identity and the Law in Jharkhand*, Oxford University Press, New Delhi, pp.112-130.

"Forests and Tribals of Jharkhand" by Das, V., 1991, *Economic and Political Weekly*, 26(6): 275-277.

"From forest struggles to forest citizens? Joint Forest Management in the unquiet woods of India's Jharkhand" by Corbridge, S. and S. Jewitt, 1997, *Environment and Planning* A, 29(12): 2145-2164.

AGRICULTURAL ECONOMICS AND AGRICULTURAL MARKETING (Course #8)

(2nd Semester; 100 marks)
(14 weeks)

Fundamentals of agricultural economics: Meaning, scope, nature, principles of agricultural economics, production economics, principles of supply and demand, etc. **(8 Classes)**

Principle of management and organizational behaviour: Role of management, decision making and controlling, market organization, structure and contract theory, organizational behaviour, group dynamics and motivation, leadership, change management **(10 Classes)**

Agribusiness policy and Environment: Emerging trend in production, processing, marketing, and exporting; pricing policy, credit policy, macroeconomic policy (fiscal, monetary, trade), labour laws and regulation, consumer laws, policy controls and regulations; contract farming, agri-business policies-concept, formulation, agri-business start-up policy and principles **(12 Classes)**

Marketing system: Concept and definition of agricultural marketing, marketing methods and principles and exchange system, regulation of agricultural marketing- procurement system, wholesale and retail pricing, etc, food safety regulation, market reforms, cooperative marketing, e marketing-e NAM, other ICT application in agricultural marketing**(8 Classes)**

Financial management in agriculture: Concepts and tools of finance, planning, analysing, and controlling business performance in agriculture and related financial markets, agricultural credit and financing, financial risk management, etc. **(12 Classes)**

Business laws and ethics (6 Classes)

Readings

Principles of Agricultural Economics by Colman, D. and Young T. , Cambridge University Press

Agricultural Policies in Developing Countries by Ellis Frank, Cambridge University Press

Principles of Management, Tata McGraw Hill

Financial management in agriculture, Seventh edition, Pearson

Agricultural Marketing by Acharya, S.S. and Agarawal, A.N. 2005. Oxford and IBH, New Delhi.

Agricultural Price Analysis by Acharya, S.S. and Agarawal, A.N. 2000. Oxford and IBH, New Delhi.

The Agricultural Marketing System by Rhodes, V. James, Duave, J.L. and Parcell, J. 2006. Halcomb Hathaway.

DATABASE MANAGEMENT AND BUSINESS ANALYTICS (Course - #9)

(2nd Semester; 100 marks)
(14 weeks)

All lectures to be motivated through examples, preferably from agricultural & rural domains and demonstrated using R/Python/Excel.

1. **Introduction (20 Classes)**
   Introduction to Database Management Systems: Concepts and types, architecture. Database design - conceptual, logical and physical levels. Relational model - definitions and properties, keys and constraints, normal forms. Relational algebra. Query language. Use of RDBMS package.

2. **Business Analytics (4+16 Classes)**
   Diagnostic Analytics **(4 Classes)** - Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test. Kruskal–Wallis test, Anderson-Darling test for normality.
   Predictive Analytics with Machine learning **(16 Classes)** -
   Decision trees. Principal Component Analysis. Association Rule Mining.
   Basic Concepts of Artificial Neural Network (ANN), General characteristics. Architecture of Multilayer perceptron (MLP) and basic concepts. Backpropagation learning. Applications in agricultural and sociological domains.

3. **E-Agriculture (6 Classes)**
   Concepts and applications. Use of ICT in Agriculture and Social Sciences. Role of DBMS in agricultural and social applications (Simple applications)

4. Use of R/R-Studio/Python (10 Classes)

Readings

Database System Concepts – Silberschatz Abraham, Korth Henry F, Sudarshan S

Database Systems, The Complete Book - H.G.Molina, J.D.Ullman and J.Widom, Pearson Education

Database Management Systems – Raghu Ramakrishnan and Johannes Gehrke

SQL,PL/SQL the programming language of Oracle by Ivan Bayross, BPB Publication.

An introduction to statistical learning – Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani

Data Analytics by Anil Maheshwari, Mc Graw Hill Education

Handbook of Statistical Analysis and Data Mining – Robert Nisbert, John Elder, Gary Miner

Data Mining and Business Analytics with R – Johannes Ledolter

IoT and Analytics for agriculture by P.K. Pattnaik, R. Kumar, S.Pal& S. N. Panda, Springer.

Neural Networks, 1994: By Haykin Simon, Macmilan, U.K

OPTIONAL SUBJECTS

AGRICULTURAL PRODUCTION & OPERATIONS MANAGEMENT (Course # 10)
(2nd Semester; 100 marks)
(14 weeks)

Crops grown in India, Soil and climatic requirements, varieties, cultural practices of cereals and millets, pulses and oilseeds, tubercrops, value addition to crops, etc **(10 Classes)**

Manures and Fertilizers: Sources of nutrients, types of manures and fertilizers, nutrient use efficiency of manures and fertilizers **(10 Classes)**

Irrigation and drainage: definition. Role of water in soil and plants- irrigated agriculture vs. Rainfed agriculture, Irrigation methods –advantages and disadvantages. Water management of different agricultural and horticultural crops. Drainage methods **(10 Classes)**

Maximization of crop production: factors affecting the maximization of crop production **(8 Classes)**

Intercropping system; methods and cultural practices involved in different methods of intercropping, Indices for assessing advantages and disadvantages of intercropping systems **(10 Classes)**

Practical **(8 Classes)**

RURAL ENTREPRENEURSHIP(Course # 11)
(2nd Semester; 100 marks)
(14 weeks)

Concept and characteristics of rural entrepreneurship, triple option, types of rural entrepreneurship, individual entrepreneurship (proprietorship) and group entrepreneurship, qualities of entrepreneurs, institutional mechanism of rural entrepreneurship, factors influencing rural entrepreneurship, agri-entrepreneurship, etc., advantages and disadvantages of entrepreneurship **(20 Classes)**

Entrepreneurship support system: Financing rural entrepreneurship, SIDBI, NABARD and its schemes, role of CAPART, etc., MUDRA Yojana, Start-up initiatives **(14 Classes)**

Micro-financing, Self Help Group, Joint liability groups, micro-enterprises, SHG-Bank linkage programme, forward and backward linkage, women entrepreneurship; entrepreneurship, skill development and rural livelihoods **(14 Classes)**

Entrepreneurship and technology intervention: IT application, DBT, UPI, etc. **(8 Classes)**

Readings

Handbook of New Entrepreneurs by P.C. Jain, Oxford University Press

Microfinance and Rural Entrepreneurship Development in India: An Analysis of Empirical Evidence, by Tiyas Biswas, Scholars Press

Community-based Entrepreneurship and Rural Development by Matthias Fink, S. Loidl and Richard Land, Routledge

Entrepreneurship, Skill development and Rural livelihoods Edited by Sunil Bhardwaj and Rohit Bhagat, Bharti Publications

RURAL DEVELOPMENT STRATEGIES AND APPROACHES (Course#12)

(2nd Semester; 100 marks)
(14 weeks)

Rural development strategies and approaches-community development programme (multi-purpose approach), growth oriented strategy (Intensive Agriculture District Programme (IADP), the Intensive Cattle Development Programme (ICDP), the High Yielding Varieties Programme (HYVP), Area development strategy (DPAP, Tribal Area Development programme, Command area development programme, Hill area development programme, etc), top-down and bottom-up approach; concept of sustainable rural development; watershed development programmes **(20 Classes)**

Contemporary rural development schemes and programmes-Mahatma Gandhi National Rural employment Guarantee programme (MGNREGP), National horticulture mission (NHM), National rural livelihood mission (NRLM)/State Rural livelihood Mission, etc **(14 Classes)**

Tribal development in India: policy and practice-Tribal culture and development, tribal development approaches in India, National policy on tribals, Provisions under 5th and 6th Schedules of the Indian Constitution, Tribal Sub Plan (TSP), ITDP, Forest Right Act and tribal, etc **(10 Classes)**

Participatory Rural Appraisal and Resource Mapping-Participatory rural appraisal concept, principles, methods and applications, Robert Chamber's contribution, PRA application in rural planning, agriculture and rural development research and training

Tools of PRA-Mapping tools-Transect walk, Resource mapping, social mapping, mobility map, Ranking and scoring technique (RST)-Matrix and scoring technique, preference ranking, pairwise ranking, etc; PRA experiences in village studies **(6 Classes)**

Practical/Field study **(6 Classes)**

Readings

Rural development: principles, policies and management (3rd edition) by Katar Singh, Sage Publications

Rural development: Putting last the first by Robert Chambers, Longman

Tribal development: policy and practice by P.V. Rao, Sarup and sons

Rural appraisal; rapid, relaxed and participatory by Robert Chambers,1992. Sussex, United Kingdom, Institute of Development Studies. (Discussion paper 311).

Empowering panchayat: Handbook for master trainers using participatory approach by D. Bandyopadhyay, Amitava Mukherjee, and Mitali Sen, Concept Publishing Company, New Delhi

Participatory rural appraisal: Principles, methods and application, N. Narayanasamy, Sage, 2009

Participatory rural appraisal: Methods and applications in rural planning by Amitava Mukherjee, Concept Publishing Company

Rural development-Principles, Policies and Management by Katar Singh and Anil Shishodia, Sage