



Evaluation Scheme & Syllabus

Of

Bachelor of (Hons.) Agriculture
(II Year)

(w.e.f. Academic Session 2018-19)

Department of Agriculture

INVERTIS UNIVERSITY - INVERTIS VILLAGE Bareilly-
Lucknow NH-24, Bareilly

Examination Scheme (Third Semester)

III Semester (Credit hours distribution)			
S.No	Course Code	Course Title	Credit Hours
1.	BAG301	Crop Production Technology – I (<i>Kharif</i> Crops)	2 (1+1)
2.	BAG302	Fundamentals of Plant Breeding	3(2+1)
3.	BAG303	Agricultural Finance and Cooperation	3 (2+1)
4.	BAG304	Agri- Informatics	2 (1+1)
5.	BAG305	Farm Machinery and Power	2 (1+1)
6.	BAG306	Production Technology for Vegetables and Spices	2(1+1)
7.	BAG307	Environmental Studies and Disaster Management	3(2+1)
8.	BAG308	Statistical Methods	2(1+1)
9.	BAG309	Livestock and Poultry Management	4(3+1)
TOTAL			23 (14+9)

3(2+1): 3 lectures per week, (2+1): indicate 2 Lecture and one practical

Evaluation Scheme									
Course code	Course title	C	L	P	PM	UT	ESM	T	FM
BAG301	Crop Production Technology – I (Kharif Crops)	2	1	1	20	30	50	100	200
BAG302	Fundamentals of Plant Breeding	3	2	1	20	30	50	100	300
BAG303	Agricultural Finance and Cooperation	3	2	1	20	30	50	100	300
BAG304	Agri- Informatics	2	1	1	20	30	50	100	200
BAG305	Farm Machinery and Power	2	1	1	20	30	50	100	200
BAG306	Production Technology for Vegetables and Spices	2	1	1	20	30	50	100	200
BAG307	Environmental Studies and Disaster Management	3	2	1	20	30	50	100	300
BAG308	Statistical Methods	2	1	1	20	30	50	100	200
BAG309	Livestock and Poultry Management	4	3	1	20	30	50	100	400
Total									2300
C-Credit, L-Lecture, P-Practical, , UT-Unit test, ESM: End semester marks, FM-Final marks (TXC)									

BAG301: CROP PRODUCTION TECHNOLOGY – I (KHARIF CROPS)	
Teaching Scheme Lectures and Practical: 2 hr./week (1+1) Tutorials: Nil Credits: 2	Examination Schemes Unit Test: 30 Marks Practical marks :20 Marks End Semester Exam:50 Marks

Course Objectives:

- 1.To know the origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops.
- 2.To identify weeds in *kharif* season crops.
- 3.To understand the yield attributing characters of *kharif* crops and Estimate yield of *Kharif* crops.
- 4.Basic knowledge of production technology of *Kharif* crops

Syllabus

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops. Cereals-rice, maize, sorghum, pearl millet and finger millet, pulses-pigeonpea, mungbean and urdbean; oilseeds- groundnut, and soybean; fibre crops-cotton & jute; forage crops-sorghum, cowpea, cluster bean and napier.

Practical

Rice nursery preparation, transplanting of rice, sowing of soybean, pigeonpea and mungbean, Maize, groundnut and cotton, effect of seed size on germination and seedling vigour of *kharif* season crops, Effect of sowing depth on germination of *kharif* crops, identification of weeds in *kharif* season crops, top dressing and foliar feeding of nutrients, Study of yield contributing characters and yield calculation of *kharif* season crops, study of crop varieties and important agronomic experiments at experimental farm, Study of forage experiments, morphological description of *kharif* season crops, visit to research centers of related crops.

References:

1. Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Singh, S.S.and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
4. Singh, S.S.and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.
5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.
6. Prasad, Rajendra. 2002. Text Book of Field Crops Production, ICAR, New Delhi.

Course Outcomes:

After completing the course, students will be able to:
1.Student will able to plan and manage cultivation of <i>Kharif</i> crops
2.Identify seasonal weeds and their management.
3.Detailed knowledge on geographical adaption of crops and their cultivation practices
4.Qualtiy and other important constituents, storage management and important varieties of different crops

BAG302- FUNDAMENTALS OF PLANT BREEDING	
Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits: 3	Examination Schemes Unit Test: 30 Marks Practical marks :20 Marks End Semester Exam:50 Marks

Course Objectives:

- 1.To study the principle, objective, methods and use of plant breeding
2. Acquaintance with concept, nature and role of plant breeding, major achievements and future prospects.
3. Genetics in relation to plant breeding, modes of reproduction and apomixes, self – incompatibility and male sterility- genetic consequences, cultivar options.
4. Plant Breeder's kit, Study of germplasm of various crops.
5. Study of floral structure of self-pollinated and cross-pollinated crops.
6. Emasculation and hybridization techniques in self- & cross-pollinated crops.

Syllabus

Theory

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization and Introduction; Centres of origin/ diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes- Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and prebreeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights

Practical

Plant Breeder's kit, Study of germplasm of various crops, Study of floral structure of self-pollinated and cross pollinated crops, Emasculation and hybridization techniques in self & cross pollinated crops, Consequences of inbreeding on genetic structure of resulting populations, Study of male sterility system, Handling of segregation populations, Methods of calculating mean, range, variance, standard deviation, heritability, Designs used in plant breeding experiments, analysis of Randomized Block Design, To work out the mode of pollination in a given crop and extent of natural out-crossing, Prediction of performance of double cross hybrids.

Text and Reference books:

1. Essentials of Plant Breeding, Phundhan Singh, Kalyani Publishers 2018
2. Plant Breeding, Principles and methods, Kalyani Publishers 2017
3. Alard, R.W. 2000. Principles of Plant Breeding. John Willey & Sons, New York.
4. Chahel, G.S. and S.S. Ghosal. 2002. Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi.
5. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.
6. Singh, P. 2001. Essentials of Plant Breeding-Principles and Methods. Kalyani Publishing House, New Delhi.
7. Jain, H.K. and M.C. Kharkwal. 2004. Plant Breeding- Mendelian to Molecular Approach. Narosa Publishing House, New Delhi.
8. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
9. Shekhawat, S. S. (ed) (2016). Advances and Current Issues in Agriculture, Vol. III. Shiksha Prakashan, S. M. S. Highway, Jaipur.

Course Outcomes:

After completing the course, students will be able to:
1. Acquaintance with concept, nature and role of plant breeding, major achievements and future prospects
2. Genetics in relation to plant breeding, modes of reproduction and apomixes, self – incompatibility and male sterility- genetic consequences, cultivar options.
3. Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross-pollinated crops.
4. Emasculation and hybridization techniques in self- & cross-pollinated crops.
5. Student will be able to understand different scientific methods to provide improved crop varieties to the farmers /mass.
6. Student will be able to understand advanced technology of plant breeding

BAG303-AGRICULTURAL FINANCE AND COOPERATION**Teaching Scheme**

Lectures and Practical: 3 hr./week (2+1)

Tutorials: Nil

Credits: 3

Examination Schemes

Unit Test: 30 Marks

Practical marks :20 Marks

End Semester Exam:50 Marks

Course Objectives:

1. To study about agriculture finance and its role in Indian agriculture
2. To study about agriculture credit system.
3. To study the role of NABARD, RBI, World bank in Indian agriculture
4. To study the balance sheet and SWOT analysis

Syllabus**Theory**

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

Agriculture Cooperation-Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED.

Practical

Determination of most profitable level of capital use, Optimum allocation of limited amount of capital among different enterprise, Analysis of progress and performance of cooperatives using published data, Analysis of progress and performance of commercial banks and RRBs using published data, Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures, Estimation of credit requirement of farm business – A case study, Preparation and analysis of balance sheet – A case study, Preparation and analysis of income statement – A case study, Appraisal of a loan proposal– A case study, Techno-economic parameters for preparation of projects, Preparation of Bankable projects for various agricultural products and its value added products, Seminar on selected topics.

References:

1. Johil, S.S. and C.V. More. 1970. Essentials of Farm Financial Management. Today and Tomorrow Printers and Publishers, New Delhi
2. John, J. Hamptson. 1983. Financial decision making: Concepts, Problems and Cases of India. New Delhi

3. Mamoria, C.B. and R.D. Saksena. 1973. Co-Operatives in India. Kitab Mahal, Allahabad.
4. Mukhi, H.R. 1983. Cooperation in India and Abroad. New Heights Publishers, New Delhi.
5. S. Subba Reddy, P. Raghu Ram, 1996, Agricultural finance and management, Oxford & IBH Pub. Co, New Delhi.
6. Kamat, G.S., 1978, New Dimensions of Cooperative Management, Himalyan Publishing House, Mumbai.
7. Nelson and Murray, 1988. Agricultural Finance. Kalyani Publishers, New Delhi.
8. Pandey, U.K. 1990. An Introduction to Agricultural Finance, Kalyani Publishers, New Delhi.

Course Outcomes:

After completing the course, students will be able to:
1. Detailed knowledge on Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture.
2. Agriculture credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits.
3. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.
4. Student will be able to understand scope and significance of Agriculture Finance.
5. Student will be able to understand significance of cooperatives in Indian agriculture.

BAG304-AGRI- INFORMATICS	
Teaching Scheme Lectures and Practical: 2 hr./week (1+1) Tutorials: Nil Credits: 2	Examination Schemes Unit Test: 30 Marks Practical marks :20 Marks End Semester Exam:50 Marks

Course Objectives:

1. Student will be aware with fundamental of computer and its different application
2. Will be able to understand the role of computer in agriculture
3. Use of ICT in agriculture
4. Will be able to operate different apps of smart phone related to agriculture like market price etc

Syllabus

Theory

Introduction to Computers, Operating Systems, definition and types, Applications of MSOffice for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components. Introduction to computer programming languages, concepts and standard input/output operations.

e-Agriculture, concepts and applications, Use of ICT in Agriculture. Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions. Preparation of contingent crop-planning using IT tools.

Practical

Study of Computer Components, accessories, practice of important DOS Commands, Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management, Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document, MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data, MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system, Introduction to World Wide Web (WWW), Introduction of programming languages, Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools, Introduction of Geospatial Technology for generating valuable information for Agriculture, Hands on Decision Support System, Preparation of contingent crop planning.

Reference:

- 1.G. Vanitha. Agriculture informatics. New India Publishing Agency
- 2.Subrat K Mahapatra, S.K.Mohanty, J. Bhuiya and JS. Pradhan: Introductory Agri- Informatics. Jain Brothers publication.

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| <p>3.Amit Deogirikar and SanchaliKshrisagar, A textbook of Agri-informatics: Shri RajlakshmiPrakashan, Aurangabad.</p> <p>4.John Walkenbach, Herb Tyson, Michael R.Groh, FaitheWempen, Microsoft Office 2010 Bible</p> <p>5.Bangia, LearningMs Office 2010</p> <p>6.Prof. Satish Jain and M.Geetha, MS-Office 2010 Training Guide</p> <p>7.Kate Shoup, Microsoft Office 2010</p> <p>8.Melanie Gass, It's All about You! Office 2010</p> <p>9.Nancy Conner and Matthew MacDonald, Office 2010: The Missing Manual</p> |
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Course Outcomes:

After completing the course, students will be able to:
1.Basic knowledge on Computers
2.Anatomy of Computers, Memory Concepts, Units of Memory, Operating System, definition and types.
3.Applications of MS-Office for creating.
4.Editing and formatting a document. Student will able to learn computer application for the development of agriculture.
5.Student will able to learn IT tools for the development of agriculture.

BAG305: FARM MACHINERY AND POWER	
Teaching Scheme Lectures and Practical: 2 hr./week (1+1) Tutorials: Nil Credits: 2	Examination Schemes Unit Test: 30 Marks Practical marks :20 Marks End Semester Exam:50 Marks

Course Objectives:

1. Basic knowledge of farm machinery and power
2. To acquaints with the IC engines and their working.
3. Will get familiarize with the different part of tractor.
4. Will learn to derive tractors.
5. Will get familiarize with different implements used in agricultural practices in field.

Syllabus

Theory

Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines , Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practical

Study of different components of I.C.engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Implements for hill agriculture, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow, Familiarization with seedcum- fertilizer drills their seed metering mechanism and calibration, planters and transplanter, Familiarization with different types of sprayers and dusters, Familiarization with different intercultural equipment, Familiarization with harvesting and threshing machinery.

References:

1. Principles of Agricultural Engineering. Vol. I. 2012. Michael, A.M. and T.P. Ojha. Jain Brothers, Jodhpur.
2. Farm Tractors, Maintenance and Repair.1989. Rai and Jain. Tata Mc Graw Hill Publ. New Delhi.
3. Elements of Farm Machinery.1989. Srivastava, A.C. Oxford IBH Publ. Company, New Delhi.
4. Elements of Agricultural Engineering, Vol. I & III. 1989. Singhal, O.P. Suraj Prakashan, Allahabad.
5. Element of Agricultural Engineering. 1990. Sahay, Jagdishwar. Agro. Book Agency, New Chitragupta Nagar, Patna.

Course Outcomes:

After completing the course, students will be able to:
1.Student will able to understand use of different farm machinery in Agriculture.
2. Student will able to understand significance of power to operate farm machinery.
3. Detailed knowledge on Status of Farm Power in India, Sources of Farm Power.
4.I.C. engines, working principles of IC engines, comparison of two stroke and four stroke cycle engines, fuel supply and hydraulic control system of a tractor.
5.Tractor types, Cost analysis of tractor power and attached implement.

BAG306-PRODUCTION TECHNOLOGY FOR VEGETABLES AND SPICES	
Teaching Scheme Lectures and Practical: 2 hr./week (1+1) Tutorials: Nil Credits: 2	Examination Schemes Unit Test: 30 Marks Practical marks :20 Marks End Semester Exam:50 Marks

Course Objectives:

1. Basic knowledge of production technology of Vegetable and spices
2. To study the climate and soil required by different vegetable and spice crops.
3. To study methods and technology of production.

Syllabus

Theory

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Raddish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables)

Practical

Identification of vegetables & spice crops and their seeds, Nursery raising, Direct seed sowing and transplanting, Study of morphological characters of different vegetables & spices, Fertilizers applications, Harvesting & preparation for market, Economics of vegetables and spices cultivation.

References:

- 1.B.R.Choudhary A Text book on production technology of vegetables (2009) Kalyani Publishers
- 2.K S Yawalkar Vegetable crops in India (2008) Agri-Horticultural Pub. House. Nagpur
- 3.K.V.Kamath Vegetable Crop Production (2007). Oxford Book Company
- 4.M.S.Dhaliwal Handbook of Vegetable Crops (2008). Kalyani Publishers
- 5.P.Hazra Modern Technology in Vegetable Production (2011) New India Publishing Agency, New Delhi
- 6.Pruthi, J.S Minor Spices of India- Crop Management Postharvest Technology (2001) ICAR
- 7.S. Thamburaj Text book of vegetable, tuber crops and Spices (2014) ICAR

Course Outcomes:

After completing the course, students will be able to:

- 1.To study about origin, area, production, improved varieties and cultivation practices.
- 2.Student will able to understand importance of vegetable and spices in nutrition and economy
- 3.Student will able to learn cultivation of vegetable and spices

BAG307-ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT	
Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits: 3	Examination Schemes Unit Test: 30 Marks Practical marks :20 Marks End Semester Exam:50 Marks

Course Objectives:

- 1.To get familiar with important terms of the subject
- 2.To get knowledge of Multidisciplinary nature of environmental studies Definition, scope and importance
3. To study about natural Resources, Renewable and non-renewable resources, Natural resources and associated problems.

Syllabus

Theory

Multidisciplinary nature of environmental studies Definition, scope and importance
 Natural Resources: Renewable and non-renewable resources, Natural resources and associate problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles. Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity and its conservation: Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer

depletion, nuclear accidents and holocaust. dies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents. Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

Practical

Pollution case studies, Case Studies- Field work: Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site-Urban/Rural/Industrial/Agricultural, Study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.

References:

1. Ecology and Environment- P D Sharma, 2010, Rastogi publication, Meerut- New Delhi
2. Environmental Science: A New Approach- Pushpa Dahiya, Manisha Ahlawat, 2013, Alpha Science
3. Fundamentals of environmental Sciences, Bamanayha B. R. Verma L. N. and Verma A., 2005, Yash publishing house, Bikaner
4. Disaster Management and Risk Reduction: *Role of Environmental Knowledge*, Editor(s): Anil K. Gupta, Sreeja S. Nair, Florian Bemmerlein-Lux, Sandhya Chatterji, 2013, Alpha Science
5. Environmental Biology, Agarwal K C, 1999, Agro Botanica, Bikaner

Course Outcomes:

After completing the course, students will be able to:

1. Knowledge of Multidisciplinary nature of environmental studies Definition, scope and importance.
2. Knowledge about natural Resources, Renewable and non-renewable resources, Natural resources and associated problems

BAG308- STATISTICAL METHODS	
Teaching Scheme Lectures and Practical: 2 hr./week (1+1) Tutorials: Nil Credits: 2	Examination Schemes Unit Test: 30 Marks Practical marks :20 Marks End Semester Exam:50 Marks

Course Objectives:

- 1.To study the mathematics dealing with the collection, organization, analysis, interpretation and presentation of data.
- 2.In applying statistics to, for example, a scientific, industrial, or social problem, to begin with a statistical population or a statistical model process to be studied.
- 3.Statistics deals with all aspects of data including the planning of data collection in terms of the design of surveys and experiments.

Syllabus

Theory

Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2×2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

Practical

Graphical Representation of Data, Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles, Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles, Measures of Dispersion (Ungrouped Data), Measures of Dispersion (Grouped Data), Moments, Measures of Skewness & Kurtosis (Ungrouped Data), Moments, Measures of Skewness & Kurtosis (Grouped Data), Correlation & Regression Analysis, Application of One Sample t-test, Application of Two Sample Fisher's t-test, Chi-Square test of Goodness of Fit, Chi-Square test of Independence of Attributes for 2×2 contingency table, Analysis of Variance One Way Classification, Analysis of Variance Two Way Classification, Selection of random sample using Simple Random Sampling.

Text and Reference books:

1. Chandel, S.R.S. 1998. Handbook of Agril. Statistics. Achal Prakashan Mandir, Kanpur.
2. Gupta S.P. 2002. Statistical Methods. Sultan Chand & Sons, New Delhi.
3. Agarwal B.L. 1991. Basic Statistics Wiley Eastern, New Delhi.

Course Outcomes:

After completing the course, students will be able to

- 1.Graphical Representation of Data.
- 2.Acquaintance with Statistics and its Applications in Agriculture
- 3.Field experimentation, data analysis and interpretation of result

BAG309-LIVESTOCK AND POULTRY MANAGEMENT	
Teaching Scheme Lectures and Practical: 4 hr./week (3+1) Tutorials: Nil Credits: 4	Examination Schemes Unit Test: 30 Marks Practical marks :20 Marks End Semester Exam:50 Marks

Course Objectives:

1. To understand the importance of farm animals.
2. To study characters of indigenous and exotic breeds of cattle, goat, buffalo, swine and poultry.
3. To study the management of farm animals, its nutrient requirement and its housing

Syllabus

Theory

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry. Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical

External body parts of cattle, buffalo, sheep, goat, swine and poultry, Handling and restraining of livestock, Identification methods of farm animals and poultry, Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records, Judging of cattle, buffalo and poultry, Culling of livestock and poultry, Planning and layout of housing for different types of livestock, Computation of rations for livestock, Formulation of concentrate mixtures, Clean milk production, milking methods, Hatchery operations, incubation and hatching equipments, Management of chicks, growers and layers, Debeaking, dusting and vaccination, Economics of cattle, buffalo, sheep, goat, swine and poultry production.

References:-

1. Banerjee, G.C. 2013. A Text Book of Animal Husbandry. 8th Ed. Oxford & IBH Pub.CO.PvtLtd.N-Delhi.
2. Devendra C and Mecleroy GB, 1982. Goat and Sheep Production in Tropics.
3. Sastry N S R and Thomas, Ck 2006. Livestock Production and Management, Kalyani.
4. Thomas CK and Sastry, NSR. 1991. Dairy Bovine Production. Kalyani.
5. ICAR, Handbook of Animal Husbandry, 2011. 3rd revised Ed.
6. Dimiri, U, Sharma, M C and Tiwari R. 2013. Swine production and Health Management. New India Pub Agency.
7. Singh, R A. 1996. Poultry Production 3rd Ed. Kalyani.
8. Prasad, J. 2008. Poultry Production and management. Kalyani Pub.

Course Outcomes:

After completing the course, students will be able to:
1. Understood the importance of farm animals and its influence in rural economy
2. Gained knowledge on characteristics of indigenous and exotic breeds of cattle, goat, buffalo, swine and poultry
3. knowledge on management of farm animals, its nutrient requirement and its housing Reproduction in farm animals and poultry.
4. Housing principles.
5. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers.

Examination Scheme (Fourth Semester)

VI Semester (Credit hours distribution)			
S.No	Course Code	Course Title	Credit Hours
1.	BAG401	Crop Production Technology –II (<i>Rabi Crops</i>)	2 (1+1)
2.	BAG402	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
3.	BAG403	Renewable Energy and Green Technology	2(1+1)
4.	BAG404	Problematic Soils and their Management	2 (2+0)
5.	BAG405	Production Technology for Fruit and Plantation Crops	2 (1+1)
6.	BAG406	Principles of Seed Technology	3(1+2)
7.	BAG407	Farming System & Sustainable Agriculture	1(1+0)
8.	BAG408	Agricultural Marketing Trade & Prices	3(2+1)
9.	BAG409	Introductory Agro-meteorology & Climate Change	2(1+1)
10.		Elective Course*	3 credits
TOTAL			19(11+8)+3
19(11+8)+3: 19 lectures per week, (11+8) :indicate11 Lecture and 8 practical and 3- represent elective courses			

Evaluation Scheme									
Course code	Course title	C	L	P	PM	UT	ESM	T	FM
BAG401	Crop Production Technology –II (<i>Rabi Crops</i>)	2	1	1	20	30	50	100	200
BAG402	Production Technology for Ornamental Crops, MAP and Landscaping	2	1	1	20	30	50	100	200
BAG403	Renewable Energy and Green Technology	2	1	1	20	30	50	100	200
BAG404	Problematic Soils and their Management	2	2	0	0	50	50	100	200
BAG405	Production Technology for Fruit and Plantation Crops	2	1	1	20	30	50	100	200
BAG406	Principles of Seed Technology	3	1	2	20	30	50	100	300
BAG407	Farming System & Sustainable Agriculture	1	1	0	0	50	50	100	100
BAG408	Agricultural Marketing Trade & Prices	3	2	1	20	30	50	100	300
BAG409	Introductory Agro-meteorology & Climate Change	2	1	1	20	30	50	100	200
	Elective Course*	3			20	30	50	100	300
Total									2200
C-Credit, L-Lecture, P-Practical, , UT-Unit test, ESM: End semester marks, FM-Final marks (TxC), Elective Course*: To be select from the elective course list									

BAG401: CROP PRODUCTION TECHNOLOGY –II (RABI CROPS)	
Teaching Scheme Lectures and Practical: 2 hr./ week (1+1) Tutorials: Nil Credits: 2	Examination Scheme Unit Test: 30Marks Practical marks: 20Marks End Semester Exam:50Marks

Course Objectives:

1. To study the origin, geographical distribution and economic importance of different *Rabi* crops.
2. To study the weeds, disease and pest of different crops and their management.
3. To study the cultivation and production of different medicinal and aromatic crops.
4. To study the extraction of essential oil from different parts of medicinal and aromatic plants.
5. To study cultivation practices of different fodder crops.

Syllabus

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops; cereals –wheat and barley, pulses-chickpea, lentil, peas, oilseeds-rape seed, mustard and sunflower; sugar crops-sugarcane; medicinal and aromatic crops- mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat.

Practical

Sowing methods of wheat and sugarcane., Identification of weeds in *rabi* season crops., Study of morphological characteristics of *rabi* crops., Study of yield contributing characters of *rabi* season crops., Yield and juice quality analysis of sugarcane., Study of important agronomic experiments of *rabi* crops at experimental farms., Study of *rabi* forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

Text and Reference books:

- 1.Singh, Chhidda, Singh, Prem and Singh, Rajbir.2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
- 2.Singh, S.S.1998. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
- 3.Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
- 4.Singh, S.S.and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
- 5.Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.
- 6.Prasad, Rajendra. 2002. Textbook of Field Crops Production, ICAR, New Delhi.
- 7.ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.
- 8.Reddy, S.R. 2012. Agronomy of Field Crops. Kalyani Books, New Delhi.

Course Outcomes:

After completing the course, students will be able to:
1. Students will be able to know about the economic importance of medicinal and Aromatic crops in present sphere.
2. Will be able to identify weeds, pest and diseases along with their management.
3. It will be helpful to know about basic morphological characteristics of <i>Rabi</i> crops.
4. Input management of different crops.

BAG402: PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS, MAP AND LANDSCAPING**Teaching Scheme**

Lectures and Practical: 2 hr./ week (1+1)

Tutorials: Nil

Credits: 2

Examination Scheme

Unit Test: 30Marks

Practical marks: 20Marks

End Semester Exam:50Marks

Course Objectives:

1. To study about ornamental, medicinal and aromatic plants
2. To study about landscaping and their principles.
3. To study plant technology of different flowers and medicinal plants.
4. To understand medicinal value of different crops
5. To study training and pruning of ornamental plants

Syllabus**Theory**

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping, Principles of landscaping. Landscape uses of trees, shrubs and climbers. Production technology of important cut flowers like rose, gerbera, carnation, lily and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

Practical

Identification of Ornamental plants. Identification of Medicinal and Aromatic Plants. Nursery bed preparation and seed sowing. Training and pruning of Ornamental plants. Planning and layout of garden. Bed preparation and planting of MAP. Protected structures – care and maintenance. Intercultural operations in flowers and MAP. Harvesting and post harvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

Text and Reference books:

- 1.A.K. Tiwari and R. Kumar Fundamentals of ornamental horticulture and landscape gardening (2012) New India
- 2 Arora, J.S. Introductory Ornamental Horticulture (2006) Kalyani Publishers
- 3 Atal, E. K. and Kapur, B. Cultivation and Utilization of Medicinal and Aromatic plants (1982) CSIR, New Delhi
- 4 Azhar Ali Farooqui and Sreeramu, B.S. Cultivation of medicinal and aromatic plants (2001) United Press Limited
- 5 Bimal das Chowdhury and Balai Lal Jana Flowering Garden trees (2014) Pointer publishers, Jaipur
- 6 Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P. Floriculture and Landscaping (2004) Nayaprakash 7 Bose, T.K. and Mukherjee, D. Gardening in India (2004) Oxford & IBH Publishers 8 Chadha, K.L. and

Chaudhary, B. Ornamental Horticulture in India (1986) ICAR 9
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Course Outcomes:

After completing the course, students will be able to:

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| 1. To evaluate natural herbal products from an economic perspective. |
| 2. To use medicinal and aromatic herbs sustainably. |
| 3. To set up business related to medicinal, aromatic and landscaping. |
| 4. To develop effective ideas related to collecting, processing and marketing herbal natural sources. |
| 5. Understand medicinal value of different plants |

BAG 403: RENEWABLE ENERGY AND GREEN TECHNOLOGY	
Teaching Scheme Lectures and Practical: 2 hr./ week (1+1) Tutorials: Nil Credits: 2	Examination Scheme Unit Test: 30Marks Practical marks: 20Marks End Semester Exam:50Marks

Course Objectives:

1. To study about energy sources and their contribution in agriculture.
2. To study biomass and its utilization in the production of biofuel.
3. To study about production of biodiesel, bio oil, bio alcohol etc.
4. To give an overview on unfruitfulness, pollination, fertilization and parthenocarpy
5. To study the utilization of solar energy in various aspects.
6. To study cultivation of different aromatic and medicinal plants along with their uses

Syllabus

Theory

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bio alcohol, biodiesel and biooil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.

Practical

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier. To study the production process of biodiesel, To study briquetting machine. To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker. To study solar drying system. To study solar distillation and solar pond.

Text and Reference books:

- 1.G.D. Rai. Non-Conventional Energy Sources, Kh Publishers, New Delhi.
2. N. S. Rathore. A.K. Kurchania, N.L. Panwar. (2007). Non-Conventional Energy Sources, Himanshu Publications.
3. N.S. Rathore. A. K. Kurchania, N.L. Panwar. (2007). Renewable Energy, Theory and Practice, Himanshu Publications.
4. K.C. Khandelwal. & S.S. Mandi. (1990). Biogas Technology.

Course Outcomes:

After completing the course, students will be able to:

1. Understand the role of renewable sources in agriculture sector
2. Understand the bio fuel production and their applications in today's world.

BAG 404: PROBLEMATIC SOILS AND THEIR MANAGEMENT	
Teaching Scheme Lectures and Practical: 2 hr./ week (2+0) Tutorials: Nil Credits: 2	Examination Scheme Unit test :50 Marks End Semester Exam:50Marks

Course Objectives:

1. To study about the quality and fertility of soil.
2. To study about the problematic soils of India along with their management.
3. To study about the wasteland present in India.
4. To give an overviews on land capability classification.

Syllabus

Theory

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils.

Irrigation water–quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystem.

Text and Reference books:

1. Bear FE. 1964. Chemistry of the Soil. Oxford & IBH.
2. Jurinak JJ. 1978. Salt-affected Soils. Department of Soil Science & Biometeorology. Utah State Univ.
3. USDA Handbook No. 60. 1954. Diagnosis and improvement of Saline and Alkali Soils. Oxford & IBH.
4. Abrol, I.P. and Dhurvanarayana, V.V. (1998) Technologies for wasteland development, ICAR, New Delhi-110012
5. Cirsan Paul, J.(1985) Principles of remote sensing. Longman, New York.
6. Richards, L.A. (1954). Diagnosis and improvement of saline and alkali soils. USDA Hand book No. 60, Washington, DC USA.
7. Somani, L.L. and Totawat, K.L. (1993). Management of salt affected soils and waters. Agrotech publishing Academy, Udaipur.

Course Outcomes:

After completing the course, students will be able to:

1. Knowledge of different reclamation and management practices for the development of the soils.
2. Understand the different factors responsible for saline ,sodic and acidic soils and their properties
3. Capable of identifying problematic soils in India and their management

BAG 405: PRODUCTION TECHNOLOGY FOR FRUIT AND PLANTATION CROPS	
Teaching Scheme Lectures and Practical: 2 hr./ week (1+1) Tutorials: Nil Credits: 2	Examination Scheme Unit Test: 30 Marks Practical Marks: 20 Marks End Semester Exam: 50 Marks

Course Objectives:

1. To study production technology of major and minor fruits.
2. To study the cultivation of plantation crops.
3. To study the importance of fruit and plantation crops.

Syllabus

Theory

Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond and; minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Practical

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Preparation of plant bio regulators and uses, Important pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchards.

Text and Reference books:

- 1 Bal, J.S. Fruit Growing (2010) Kalyani Publishers
- 2 Banday F.A. and Sharma M.K. Advances in Temperate Fruit Production (2010) Kalyani Publishers
- 3 Bose, T.K., Mitra, S.K. and Sanyal, D. Tropical and Sub-Tropical-Vol-I (2002) Nayaprakash, Kolkata
- 4 Chadha, T.R Text Book of Temperate Fruits (2001) ICAR Publication
- 5 Chattopadhyay T.K. A text book on Pomology-IV Devoted to Temperate fruits (2009) Kalyani Publishers
- 6 Das B.C and Das S.N . Cultivation of Minor Fruits Kalyani Publishers
- 7 K.L.Chadda Advanced in Horticulture (2009) Malhotra Publishing House, New Delhi
- 8 Kumar, N.J.B. M. Md. Abdul Khaddar, Ranga Swamy, P. and Irrulappan, I. Introduction to spices, Plantation crops and Aromatic plants (1997) Oxford & IBH, New Delhi
- 9 Radha T and Mathew L. Fruit crops (2007) New India Publishing Agency
- 10 S.P. Singh Commercial fruits (2004) Kalyani Publishers

Course Outcomes:

After completing the course, students will be able to:

1. Students will understand package of practices for the major crops like mango, banana, guava, lemon, pineapple, coffee, coconut and rub

BAG 406: PRINCIPLES OF SEED TECHNOLOGY	
Teaching Scheme Lectures and Practical: 3 hr./ week (1+2) Tutorials: Nil Credits: 3	Examination Scheme Unit Test: 30 Marks Practical Marks: 20 Marks End Semester Exam: 50 Marks

Course Objectives:

1. To study about seeds and its importance in agriculture.
2. To study different classes of seeds
3. To study the seed production of some importance crops, pulses etc
4. To give an overview seed certification.
5. To study seed acts.

Syllabus

Theory

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important **cereals, pulses, oilseeds, fodder and vegetables**. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage. Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

Practical

Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea. Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard. Seed production in important vegetable crops. Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

Text and Reference books:

1. Agarwal, R.L. 1991. Seed Technology. Oxford & IBH Publishing Co. Delhi
2. Agarwal, P.K. 1999. Seed Technology. ICAR, New Delhi.
3. Subir Sen and Nabinanda Ghosh. 1999. Seed Science and Technology. Kalyani Publishers.

New Delhi.

4. DhirenraKhare and Mohan S. Bhale.2000. Seed Technology. Scientific Publishers (India), Jodhpur.
5. Maloo,S.R., Intodia, S.K. and Pratap Singh.2008. Beej Pradyogiki. Agrotech Publishing Academy.
6. A.K. Joshi and B.D. Singh.2005.Seed Technology. Kalyani Publishers, New Delhi.
7. Arya, P.S. 2001. Vegetable Breeding and Seed Production. Kalyani Pub., Ludhiana
8. Saxena,R.P.1984. BeezSansadhan. GBPA&T, Pantnagar.
9. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.
10. Shekhawat, S. S. and S. Gangopadhyay (eds.) (2013). Quality Fodder Seed Production. Centre for Forage Management, ARS, SKRAU, Bikaner.

Course Outcomes:

After completing the course, students will be able to:
1. To supply the disease free seed in the market to get the environment friendly cultivation of crops.
2. To increase the farm income by producing high yielding disease free quality seed and decrease the cost of cultivation also.
3. Production of hybrid seed of different crops to increase the farm income.
4. Store the pure variety seed to avoid the availability crises of pure variety seed due to adverse environmental conditions.

BAG 407: FARMING SYSTEM & SUSTAINABLE AGRICULTURE	
Teaching Scheme Lectures and Practical: 1 hr./ week (1+0) Tutorials: Nil Credits: 1	Examination Scheme Unit test :50 Marks End Semester Exam:50 Marks

Course Objectives:

1. To study different components of farming systems.
2. To study mechanism and interaction of different components
3. To study the processes for waste recycling
4. To study different techniques and approaches of sustainable agriculture.

Syllabus

Theory

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

Text and Reference books:

1. Panda, S.C.2004. Cropping Systems and Farming Systems, Agrobios (India), Jodhpur.
2. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Sharma, Arun K. 2002. A Handbook of Organic Farming, Agrobios (India) Ltd., Jodhpur
4. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
5. Shukla, Rajeev K. 2004. Sustainable Agriculture, Surbhee Publications, Jaipur
6. Palaniappan, S.P.1985. Cropping Systems in the Tropics: Principles and Management, Wiley Easter Ltd. and TNAU, Coimbatore.
7. Reddy S. R. 2016. Principles of Agronomy (5th edition), Kalyani Publishers, Ludhiana.

Course Outcomes:

After completing the course, students will be able to:
1. The student will be able to design and develop farming system models.
2. The will learn efficient management of different farming system components

BAG 408: AGRICULTURAL MARKETING TRADE & PRICES	
Teaching Scheme Lectures and Practical: 3 hr./ week (2+1) Tutorials: Nil Credits: 3	Examination Scheme Unit Test: 30Marks Practical marks: 20Marks End Semester Exam:50Marks

Course Objectives:

1. To study market and their different types.
2. To study producer surplus of agriculture commodities.
3. To study product life cycle.
4. To study different types marketing channels.
5. TO study E commerce and E marketing.

Syllabus

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical

Plotting and study of demand and supply curves and calculation of elasticities. Study of relationship between market arrivals and prices of some selected commodities. Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, Identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. To study their organization and functioning; Application of principles of comparative advantage of international trade.

Text and Reference Books:

1. Acharya, S.S. and Agarwal, N.L., 1994, Agricultural Price Analysis and Price Policy, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Acharya, S.S. and Agarwal, N.L., 2004, Agricultural Marketing in India, Oxford and IBH Publishing Co. New Delhi.
3. G. L. Meena, S. S. Burark, D. C. Pant and Rajesh Sharma, 2017. Fundamentals of Agribusiness Management, Agrotech Publishing Academy, Udaipur, ISBN: 978-818321-418-6. First edition.
4. Kahlon, A.S. and George, M.V., 1985, Agricultural Marketing and Price Policy, Allied Publication Pvt. Ltd., New Delhi.
5. Kohls, Richard L. and Uhl, Joseph N., 1980, Marketing of Agricultural Products, Macmillan Publishing Co., Inc. New York
6. Mamoria, C.B and Joshi, R.L., 1971, Principles and Practice of Marketing in India, Kitabmahal, Allahabad.

Course Outcomes:**After completing the course, students will be able to:**

1. Increase in Farm Income: An efficient marketing system ensures higher levels of income for the farmers by reducing the number of middlemen or by restricting the commission on marketing services and the malpractices adopted by them in the marketing of farm products.
2. Growth of Agro-based Industries: An improved and efficient system of agricultural marketing helps in the growth of agro-based industries and stimulates the overall development process of the economy. Many industries depend on agriculture for the supply of raw materials.
3. Adoption and Spread of New Technology: The marketing system helps the farmers in the adoption of new scientific and technical knowledge. New technology requires higher investment and farmers would invest only if they are assured of market clearance.
4. Addition to National Income: Marketing activities add value to the product thereby increasing the nation's gross national product and net national product.
5. Will learn different production factors and their rationalization

BAG 409: INTRODUCTORY AGRO-METEOROLOGY & CLIMATE CHANGE	
Teaching Scheme Lectures and Practical: 2 hr./ week (1+1) Tutorials: Nil Credits: 2	Examination Scheme Unit Test: 30Marks Practical marks: 20Marks End Semester Exam:50Marks

Course Objectives:

1. To study earth atmosphere and their different layers.
2. To study about weather and climate.
3. To study different climatic parameters.
4. To crop weather parameters relationship.
5. To study climate change and mitigation strategies.
6. To study climate and its impact on agriculture.

Syllabus

Theory

Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon-mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

Practical

Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction, preparation of wind rose. Measurement, tabulation and analysis of rain. Measurement of open

pan evaporation and evapotranspiration. Computation of PET and AET.

Test and Reference books:

- | |
|---|
| <ol style="list-style-type: none">1. Sacheti, A.K. 1985. Agricultural Meteorological Instructional Cum Practical Manual (Ed.) NCERT Publication, New Delhi.2. Lal, D.S. 2005 Climatology, Sharda Pustak Bhawan, Allahabad..3. Varshneya, M.C. and Balakrishna, Pillai, 2003. Text book of Agricultural Meteorology. ICAR, New-Delhi.4. Sahu, D.D., 2007. Agrometeorology and Remote sensing: Principles and Practices ,Agrobios (India) , Jodhpur.5. Murithy, K, and Radha, V. 1995. Practical Manual on Agricultural Meteorology , Kalyani Publishers, New-Delhi6. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur7. Balasubramaniyan, P. and Palaniappan, S.P. 2016. Principles and Practices of Agronomy, Agrobios (India), Jodhpur |
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Course Outcomes:

After completing the course, students will be able to:

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| 1. Become familiar with atmospheric composition. |
| 2. They will learn about agromet observatory and recording of weather parameters. |
| 3. Will learn strategies to mitigate climate change impacts. |
| 4. Will learn weather forecast and its long term impact on crop production. |

ELECTIVE COURSES

Elective Courses: A student can select three elective courses out of the following and offer during 4th, 5th and 6th semesters.

Examination Scheme (Semester wise)

Credit hours distribution			
S.No	Course Code	Course Title	Credit Hours
1.	BAG001	Agribusiness Management	3(2+1)
2.	BAG002	Agrochemicals	3(2+1)
3.	BAG003	Commercial plant Breeding	3(1+2)
4.	BAG004	Landscaping	3(2+1)
5.	BAG005	Food safety and Standards	3(2+1)
6.	BAG006	Biopesticides & Biofertilizers	3(2+1)
7.	BAG007	Protected Cultivation	3(2+1)
8.	BAG008	Micro Propagation technologies	3(1+2)
9.	BAG009	Hi-Tech Horticulture	3(2+1)
10.	BAG010	Weed Management	3(2+1)
11.	BAG011	System Simulation and Agro-advisory	3(2+1)
12.	BAG012	Agriculture Journalism	3(2+1)
TOTAL			36 (21+15)

Evaluation Scheme									
Course code	Course title	C	L	P	PM	UT	ESM	T	FM
BAG001	Agribusiness Management	3	2	1	20	30	50	100	300
BAG002	Agrochemicals	3	2	1	20	30	50	100	300
BAG003	Commercial plant Breeding	3	1	2	20	30	50	100	300
BAG004	Landscaping	3	2	1	20	30	50	100	300
BAG005	Food safety and Standards	3	2	1	20	30	50	100	300
BAG006	Biopesticides & Biofertilizers	3	2	1	20	30	50	100	300
BAG007	Protected Cultivation	3	2	1	20	30	50	100	300
BAG008	Micro Propagation technologies	3	1	2	20	30	50	100	300
BAG009	Hi-Tech Horticulture	3	2	1	20	30	50	100	300
BAG010	Weed Management	3	2	1	20	30	50	100	300
BAG011	System Simulation and Agro-advisory	3	2	1	20	30	50	100	300
BAG012	Agriculture Journalism	3	2	1	20	30	50	100	300
C-Credit, L-Lecture, P-Practical, UT-Unit test, ESM: End semester marks, FM-Final marks (TxC)									

BAG001- AGRIBUSINESS MANAGEMENT	
Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits: 3	Examination Schemes Unit Test: 30Marks Practical marks: 20Marks End Semester Exam:50Marks

Course Objectives:

1. To examine the complexity of managing in a global world.
2. To use agribusiness management thought to develop a better understanding of agriculture.
3. To develop an ability to work with moral and ethical dilemmas and make decisions using critical thinking.
4. To expose students to several models of agribusiness management.

Syllabus

Theory

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

Study of agri-input markets: Seed, fertilizers, pesticides, Study of output markets: grains, fruits, vegetables, flowers, Study of product markets, retails trade commodity trading, and value added products, Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD, Preparations of projects and Feasibility reports for agribusiness entrepreneur, Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques, Case study of agro-based industries, Trend and growth rate of prices of agricultural commodities, Net present worth technique for selection of viable project, Internal rate of return.

Text and Reference books:

1. G. L. Meena, S. S. Burark, D. C. Pant and Rajesh Sharma, 2017. Fundamentals of Agribusiness Management, Agrotech Publishing Academy, Udaipur, ISBN: 978-81-8321-418-6. First edition.
2. Gittinger, J.P, 1984, Economic Analysis of Agricultural Projects, John Hopkins University Press.
3. Kotler, Philip, 1999, Marketing Management, Prentice Hall of India, New Delhi,
4. L.L. Somani and G. L. Meena, 2017. Agribusiness & Farm Management at a Glance, Vol-2, Basic & Applied Fundamentals, Agrotech Publishing Academy, Udaipur, ISBN: 978-81-8321-429-2. Second edition.
5. Mamoria, C. B., Joshi, R. L. and Mulla, N. I. 2005, Principles and Practices of Marketing in India, Kitab Mahal, Allahabad.
6. Sudha, G.S, 2000, Business Management, RBSA Publishers, Jaipur.
7. Tripathi, P. C. and Reddy, P. N, Principles of Management, Tata McGraw Hill Education Private Limited, New Delhi, 2008.

Course Outcomes:**After completing the course, students will be able to:**

1. Students will be able to effectively evaluate the impact of trade policy, common markets, trading blocks, market instability, commodity problems, trade agreements and environmental regulations on imports and exports in international trade to be able to improve production decision making.

BAG002- AGROCHEMICALS	
Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits: 3	Examination Schemes Unit Test: 30Marks Practical marks: 20Marks End Semester Exam:50Marks

Course Objectives:

1. To know the chemicals present in different agrochemical products
2. To study the different formulation methods
3. Learn about chemicals composition and formulations.

Syllabus

Theory

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. Herbicides-Major classes, properties and important herbicides. Fate of herbicides. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride. Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and use of Zineb and maneb. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical

Sampling of fertilizers and pesticides, Pesticides application technology to study about various pesticides appliances, Quick tests for identification of common fertilizers, Identification of anion and cation in fertilizer, Calculation of doses of insecticides to be used, To study and identify various formulations of insecticide available in market, Estimation of nitrogen in Urea, Estimation of water soluble P_2O_5 and citrate soluble P_2O_5 in single super phosphate, Estimation of potassium in Muriate of Potash/ Sulphate of Potash by flame photometer, Determination of copper content in copper oxychloride, Determination of sulphur content in sulphur fungicide, Determination of thiram, Determination of ziram content.

Text and Reference books:

1. Jaganathan, R. and R. Jayakumar. 2003. Weed Science Principles, Kalyani Publishers, New Delhi.
2. Gupta, O. P. 1998. Modern Weed Management. Agro Botanica Bikaner, India.
3. Rao, V.S. 2000. Principles of Weed science. Oxford & IBH Publishing Co. New Delhi.

Course Outcomes:**After completing the course, students will be able to:**

- 1.Students will be familiarized about the agrochemical and their classification.
- 2.Different weed control methods and management through these agrochemicals will be studied.
- 3.Different chemicals and its formulations for weed management will be understood.

BAG003- COMMERCIAL PLANT BREEDING	
Teaching Scheme Lectures and Practical: 3 hr./week (1+2) Tutorials: Nil Credits: 3	Examination Schemes Unit test: 30 Marks Practical marks : 20 Marks End Semester Exam:50

Course Objectives:

1. To impart knowledge on genetic diversity, inheritance and variation in crops
2. To make the student understand different breeding methods in asexually propagated, self and cross pollinated crops
3. To learn IPR, patenting, Plant Breeders and Farmers Rights

Syllabus

Theory

Types of crops and modes of plant reproduction. Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production. Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc. Quality seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools. IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.

Practical

Floral biology in self and cross pollinated species, selfing and crossing techniques, Techniques of seed production in self and cross pollinated crops using A/B/R and two line system, Learning techniques in hybrid seed production using male-sterility in field crops, Understanding the difficulties in hybrid seed production, Tools and techniques for optimizing hybrid seed production, Concept of rouging in seed production plot, Concept of line its multiplication and purification in hybrid seed production, Role of pollinators in hybrid seed production, Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops, Sampling and analytical procedures for purity testing and detection of spurious seed, Seed drying and storage structure in quality seed management, Screening techniques during seed processing viz., grading and packaging, Visit to public private seed production and processing plants

Text and Reference books:

1. Chopra, V.L. 2000. *Breeding of Field Crops* (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Mandal, A.K., P.K. Ganguli and S.P. Banerjee. 1991. *Advances in Plant Breeding*. Vol. I and II. CBS Publishers and Distributors, New Delhi.
3. Manjit S. Kang 2004. *Crop Improvement: Challenges in the Twenty-First Century* (Edt). International Book Distributing Co. Lucknow.

4. Poehlman, J.M. 1987. *Breeding of Field Crops*. AVI Publishing Co.. INC, East Port, Connecticut, USA. 51
5. Ram, H.H. and H.G. Singh. 1994. *Crop Breeding and Genetics*. Kalyani Publishers, New Delhi.
6. Sharma, A.K. 2005. *Breeding Technology of Crop Plants* (Edt.). Yash Publishing House, Bikaner.
7. Ram. H.H. 2005. *Vegetable Breeding — Principles and Practices*. Kalyani Publishers, New Delhi.
8. Agarwal, R.L.1991.*Seed Technology*. Oxford & IBH Publishing Co. Delhi.
9. Dhirenra Khare and Mohan S. Bhale.2000. *Seed Technology*. Scientific Publishers India), Jodhpur.
10. Maloo,S.R., Intodia, S.K. and Pratap Singh.2008. *Beej Pradyogiki*. Agrotech Publishing Academy.
11. A.K. Joshi and B.D. Singh.2005.*Seed Technology*. Kalyani Publishers, New Delhi.
12. Arya, P.S. 2001. *Vegetable Breeding and Seed Production*. Kalyani Pub., Ludhiana
13. Singh, B.D. 2005. *Plant Breeding*. Kalyani Publishing House, New Delhi.
14. Singh, P. 2001.*Essentials of Plant Breeding-Principles and Methods*. Kalyani Publishing House, New Delhi.
15. Shekhawat, S. S. (ed) (2016). *Advances and Current Issues in Agriculture*, VoI. III. Shiksha Prakashan, S. M. S. Highway, Jaipur.

Course Outcomes:

After completing the course, students will be able to:
1. Origin and diversity of different crops, components of inheritance and variations will be understood.
2. Students will be able to apply different breeding techniques for crop improvement
3. Gain knowledge on IPR, patenting, Plant Breeders and Farmers Rights followed.

BAG004- LANDSCAPING	
Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits : 3	Examination Schemes Unit test: 30 Marks Practical marks : 20 Marks End Semester Exam:50

Course Objectives:

1. To educate students on production technology of cut flowers, ornamental crops and turf management.
2. To study the Landscape use of trees, shrubs and climbers
3. Exposing the students to different styles of landscape gardening.
4. To know about harvesting and post-harvest handling of flower crops.

Syllabus

Theory

Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes. Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

Practical

Identification of trees, shrubs, annuals, pot plants, Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house, Use of computer software, visit to important gardens/ parks/ institutes.

Text and Reference books:

1. Bose, T. Ornamental Plants and Garden Design in Tropics and subtropics, Vol-2 sets Daya
2. Arora J. S. 2006 Introductory Ornamental Horticulture Kalyani Publishers, Ludhiana
3. Gopalaswamiengar, K.S. The Complete Gardening in India. The Hosali Press, Bangalore
4. Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P. Floriculture and Landscaping (2004) Nayaprakash
5. Bose, T.K. and Mukherjee, D. Gardening in India (2004) Oxford & IBH Publishers
6. Chadha, K.L. and Chaudhary, B. Ornamental Horticulture in India (1986) ICAR
7. H.S.Grewal and Parminder Singh Landscape designing and ornamental plants (2014)
8. K.V.Peter. Ornamental plants (2009) New India publishing agency

9. R.K. Roy Fundamentals of Garden designing (2013) New India publishing agency
10 Randhawa, G.S. Amitabha Mukhopadhyay Floriculture in India (2004) Allied Publishers Pvt. Ltd., New Delhi
11 Tiwari, A.K. Fundamentals of Ornamental Horticulture and Landscaping Gardening NIPA

Course Outcomes:

After completing the course, students will be able to:

- 1.Familiarized with the production technology of cut flowers, ornamental crops and turf management.
- 2.Landscape use of trees, shrubs and climbers were studied.
- 3.Learnt about the various styles of gardening.
- 4.Got familiarized with the harvesting and post-harvest handling of flower crops.

BAG005- FOOD SAFETY AND STANDARDS	
Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits: 3	Examination Schemes Unit test: 30 Marks Practical marks : 20 Marks End Semester Exam:50

Course Objectives:

1. To disseminate the knowledge of properties of products, unit operations and packaging involved in dairy and food engineering.
2. To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products , sanitation and effluent treatment in dairy industry
3. To expose the students to the fundamental knowledge of food, its properties and different methods of food processing

Syllabus

Theory

Food Safety- Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards- Biological, Chemical, Physical hazards. Management of hazards- Need. Control of parameters. Temperature control. Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM- concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene. Food laws and Standards- Indian Food Regulatory Regime, FSSAI. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

Practical

Water quality analysis physico-chemical and microbiological, Preparation of different types of media, Microbiological Examination of different food samples, Assessment of surface sanitation by swab/rinse method, Assessment of personal hygiene, Biochemical tests for identification of bacteria, Scheme for the detection of food borne pathogens, Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000.

Text and Reference books:

1. Pandey, R.H. 1997. Postharvest Technology of fruits and vegetables (Principles and practices). Saroj Prakashan, Allahabad.
2. Sudheer, K P. and Indira, V. 2007. Post Harvest Engineering of horticultural crops. New India Publishing House.

Course Outcomes:

After completing the course, students will be able to:
1. The students will gain knowledge about Dairy and Food process engineering
2. The students will understand the process of manufacturing of dairy products and thermal processing of food.

BAG006- BIOPESTICIDES & BIOFERTILIZERS	
Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits: 3	Examination Schemes Unit test: 30 Marks Practical marks : 20 Marks End Semester Exam:50 Marks

Course Objectives:

1. Teaching students the history of microbes and conventional fertilizer.
2. To study the classification, characteristics features of microbes.
3. Understanding the process and technique of synthesis of biofertilizer and biopeptides
4. To study the impacts on crops and environment

Syllabus

Theory

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide. Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cyanobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

Practical

Isolation and purification of important biopesticides: *Trichoderma*, *Pseudomonas*, *Bacillus*, *Metarhizium* etc and its production, Identification of important botanicals, Visit to biopesticidelaboratory in nearby area, Field visit to explore naturally infected cadavers, Identification of entomopathogenic entities in field condition, Quality control of biopesticides, Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium*, P-solubilizers and cyanobacteria, Mass multiplication and inoculums production of biofertilizers, Isolation of AM fungi -Wet sieving method and sucrose gradient method, Mass production of AM inoculants.

References:

1. Lakshman, H.C. (2014) Bio-fertilizers and Bio-pesticides. Pointer Publishers
2. Sylvia D.N. 2005; Principles and application of Soil Microbiology. Pearson Publisher.
3. Project Directorate of Biological control. 1994. Technology for mass production of natural enemies. Technical Bulletin-4.

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| <p>4. Rabindra, R.J., Kennedy, J.S., Sathaiah, N., Rajeshkharan, B. and Srinivasan, M.R. 2001. Microbial control of crop pests. TNAU.</p> <p>5. Dhaliwal, GS & Koul O. 2007. Biopesticides and pest management. Kalyani Publ., New Delhi</p> |
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Course Outcomes:

After completing the course, students will be able to:
1.Development of biofertilizers and biopesticides
2.Understanding the impacts on soil, crop and environmental health
3.Development of skill to set up biofertilizer and biopesticides units

BAG007- PROTECTED CULTIVATION**Teaching Scheme**

Lectures and Practical: 3 hr./week (2+1)

Tutorials: Nil

Credits: 3

Examination Schemes

Unit test: 30 Marks

Practical marks : 20 Marks

End Semester Exam:50 Marks

Course Objectives:

1. To enable the students to know the basics of protected cultivation.
2. To impart knowledge about the various techniques involved in protected cultivation.
3. To provide technical know-how on secondary agriculture.

Syllabus**Theory**

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, liliun, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc. Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

Practical

Raising of seedlings and saplings under protected conditions, Use of protrays in quality planting material production, Bed preparation and planting of crop for production, Inter cultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging and misting.

References:

1. Brahma Singh, Balraj Singh, NavedSabir and MurtazaHasan, 2014. Advances in Protected Cultivation. New India Publishing Agency, New Delhi.
2. Donell Hunt, 2013. Farm Power and Machinery Management. 10th edition. MedTec Publishers, New Delhi.
3. Jana, B. L., 2008. Precision Farming. AgroTech Publishing Academy Green house: Science and Technology. 2016. Kothari S, S.C. Kaushic and A.N. Mathur. Himanshu Publication, Udaipur.
4. Green House Technology- Application and Practice. Sharma A and V.M. Salokhe. 2006. Agro Tech. publication, Udaipur
5. Principles of Agricultural Engineering, Vol. I. 2012. Michael, A.M. and T. P. Ojha . Jain Brothers, New Delhi.
6. Post Harvest Technology of Cereals, Pulses and Oil Seeds. 1999. Chakravarty, A. Oxford and IBH Pub. New Delhi.
7. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willy and Sons, New York.
8. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.
9. K. RadhaManohar and C. Ignathinathane. 2015. Greenhouse Technology and Management.

2nd edition. B. S. Publications.

Course Outcomes:

After completing the course, students will be able to:

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| 1. The students will understand the basic concepts of protected cultivation. |
| 2. The students will design improved protected cultivation measures. |
| 3. The students will analyze cost economics in secondary agriculture. |

BAG008- MICRO PROPAGATION TECHNOLOGIES	
Teaching Scheme Lectures and Practical: 3 hr./week (1+2) Tutorials: Nil Credits: 3	Examination Schemes Unit test: 30 Marks Practical marks : 20 Marks End Semester Exam:50 Marks

Course Objectives:

1. To impart skill oriented knowledge on media preparation and handling of tools for propagation
2. To teach students on propagation methods
3. To familiarize with the maintenance and after care of propagated plants

Syllabus

Theory

Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell), Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture), Organogenesis (callus and direct organ formation), Somatic embryogenesis, cell suspension cultures, Production of secondary metabolites, Somaclonal variation, Cryopreservation.

Practical

Identification and use of equipments in tissue culture, Laboratory, Nutrition media composition, sterilization techniques for media, containers and small instruments, sterilization techniques for explants, Preparation of stocks and working solution, Preparation of working medium, Culturing of explants: Seeds, shoot tip and single node, Callus induction, Induction of somatic embryos/regeneration of whole plants from different explants, Hardening procedures.

References:

1. Chawala H S (2000). *Introduction to Plant Biotechnology*. Oxford & IBH, New Delhi
2. Gupta, P. K. (2008). *Elements of Biotechnology*. Rastogi Publications, Meerut
3. Ray V. Herren (2005). *Introduction to Biotechnology* (An Agricultural revolution)
4. Shekhawat, M. S. (2011) *Plant Biotechnology, In vitro Principles, Techniques and Applications*. MJP Publishers, Chennai
5. Mascarenhas, A. F. (2008). *Hand Book of Plant Tissue Culture*. ICAR, New Delhi
6. Singh BD. 2005. *Biotechnology, Expanding Horizons*. Kalyani Publishers, New Delhi.

Course Outcomes:

After completing the course, students will be able to:
1. Students benefited with hands-on training in media preparation handling of tools for propagation
2. Students learnt about mother plant selection and propagation techniques.
3. Students familiarized with the maintenance and after care of propagated plants

BAG009- HI-TECH. HORTICULTURE	
Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits: 3	Examination Schemes Unit test: 30 Marks Practical marks : 20 Marks End Semester Exam:50 Marks

Course Objectives:

1. To teach fundamentals of horticulture and horticultural practices
2. To impart knowledge on different types of plant propagation and also structures used in farms
3. To expose the students to different horticulture vegetables, fruits, species, aromatic and medicinal crops.

Syllabus

Theory

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding, Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA), application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

Practical

Types of polyhouses and shade net houses, Intercultural operations, tools and equipments identification and application, Micro propagation, Nursery-protrays, micro-irrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

References:

- 1 Hartman, HT and Kester, DE (1986). Plant propagation principles and practices. Prentice Hall of India Pvt. Ltd., Bombay
1. Gill, SS. Bal, JS and Sadhu, AS (1985). Raising Fruit Nursery, Kalyani Publishers, New Delhi.
2. Chadha, K.L. Handbook of Horticulture (2002) ICAR, New Delhi
3. Chadda K.L Advanced in Horticulture (2009) Malhotra Publishing House, New Delhi
4. Anonymous 2003. *Proc. All India Seminar on Potential and Prospects for Protective Cultivation*. Organised by Institute of Engineers, Ahmednagar. Dec.12-13, 2003.
5. Chandra, S & Som, V. 2000. *Cultivating Vegetables in Green House*. *Indian Horticulture* 45: 17- 18.
6. Prasad S & Kumar U. 2005. *Greenhouse Management for Horticultural Crops*. 2nd Ed. Agrobios.
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Course Outcomes:

After completing the course, students will be able to:
1. Fundamentals of horticulture and classification of crops learned.
2. Different types of plant propagation techniques and structures used in the farm studied.
3. Gained practical knowledge in plant propagation and pest and disease control

BAG010- WEED MANAGEMENT	
Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits: 3	Examination Schemes Unit test: 30 Marks Practical marks : 20 Marks End Semester Exam:50 Marks

Course Objectives:

1. To identify the weed species, present in different agro ecosystems
2. To study the different weed control methods
3. Learn about herbicides and its formulations and integrated weed management

Syllabus

Theory

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application. Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.

Practical

Techniques of weed preservation, Weed identification and their losses study, Biology of important weeds, Study of herbicide formulations and mixture of herbicide, Herbicide and agrochemicals study, Shift of weed flora study in long term experiments, Study of methods of herbicide application, spraying equipments, Calculations of herbicide doses and weed control efficiency and weed index.

Reference:

1. Saraswat, V.N., Bhan, V.M. and Yaduraju, N.T. 2003. Weed Management , ICAR, New-Delhi.
2. Gupta, O.P. 2015. Weed Management: Principles and Practices (2nd Ed.), Agribios (India), Jodhpur.
3. Gupta, O.P. 2016. Modern Weed Management , Agribios (India), Jodhpur
4. Das, T.K. 2008. Weed Science : Basics and Applications , Jain Brothers, New-Delhi.
5. Rao, V.S. 2000. Principals of Weed Science (2nd edition), Oxford and IBH Publishing Co., New Delhi.

Course Outcomes:

After completing the course, students will be able to:
1. Will develop capability to identify the weeds of different crops.
2. Learn different methods to control weeds
3. Understanding different modules of IWM for different crops
4. Getting knowledge on different herbicides and their formulation

BAG011- SYSTEM SIMULATION AND AGROADVISORY	
Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits: 3	Examination Schemes Unit test: 30 Marks Practical marks : 20 Marks End Semester Exam:50 Marks

Course Objectives:

1. To learn the simulation modelling using large number of variables
2. To predict yield and crop response under different environment and input management
3. To rationalize inputs and practices for higher efficiencies
4. To develop decision support systems

Syllabus

Theory

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams. Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept and modelling techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance. Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

Practical

Preparation of crop weather calendars, Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts, Working with statistical and simulation models for crop growth, Potential & achievable production; yield forecasting, insect & disease forecasting models, Simulation with limitations of water and nutrient management options, Sensitivity analysis of varying weather and crop management practices, Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast, Feedback from farmers about the agroadvisory.

Course Outcomes:

After completing the course, students will be able to:
1. Development of skills for appropriation of inputs and farm operations.
2. Understanding climatic impacts and tailoring management options.
3. Understanding strategies and practices for mitigation of climate change

BAG012- AGRICULTURAL JOURNALISM

Teaching Scheme Lectures and Practical: 3 hr./week (2+1) Tutorials: Nil Credits: 3	Examination Schemes Unit test: 30 Marks Practical marks : 20 Marks End Semester Exam:50 Marks
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Course Objectives:

1. The course is intended to orient the students with the concept of extension education and its importance in Agriculture development.
2. To expose the students with various rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis
3. To make the students learn about the new innovations being brought into the Agricultural Extension in India.
4. To learn about the new trends in agriculture extension

Syllabus

Theory

Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism. Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines. The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources. Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outting.

Practical

Practice in interviewing, Covering agricultural events, Abstracting stories from research and scientific materials and from wire services, Writing different types of agricultural stories, Selecting pictures and artwork for the agricultural story, Practice in editing, copy reading, headline and title writing, proofreading, layouting, Testing copy with a readability formula, Visit to a publishing office.

References:

1. Ray, G. L. and Mondal, S. 2005. Journalism including communication, Farm and Rural Journalism, Public Relations, Kalyani Publication, Ludhiana.
2. Bhaskaran et. Al. 2008. Farm Journalism and media management Agrotech Publishing Company.
3. Narayanaswamy V R. 1979. Strengthen your writing. Orient Longman, New Delhi.
4. Kamat, M.G., Writing for farm families.
5. Indu Grover. Mass media and Communication.
6. Arvind Kumar (1999). The Electronic Media. Anmol Publications, New Delhi.

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| <p>7. Bhatt, S.C. (1993) Broadcast Journalism. Basic Principles Har Anand Publications, Delhi</p> <p>8. Bhatnagar, R. (2001). Print Media and Broadcast Journalism. Indian Publisher Distributors, Delhi</p> <p>9. Katyal, V.P (2007). Fundamentals of Media Ethics. Cyber Tech Publishers, New Delhi.</p> <p>10. Subin Mohan et al (2010) Handbook on farm Journalism. Pulari Publishers, Karnal.</p> <p>11. A.K. Singh, 2014, Agricultural Extension and Farm Journalism. Agrobios, Jodhpur</p> |
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Course Outcomes:

After completing the course, students will be able to:
1.Students learned the concepts of agricultural extension and rural development programs.
2.New innovations in the area of agricultural extension in India understood
3. Gained practical knowledge on watershed development and self-help groups
4.New trends in agriculture extension learned