महात्मा ज्योतिबा फुले रूहेलखण्ड विश्वविद्यालय, बरेली
MAHATMA JYOTIBA PHULE ROHILKHAND UNIVERSITY, BAREILLY

पत्रांक: रू0वि0 / शैक्षणिक / 2020 / 1071-77 दिनांक: 03.12.2020

सेवा में,

प्राचार्य / प्राचार्या
समस्त सम्बद्ध कृषि महाविद्यालय
एम0जे0पी0रूहेलखण्ड विश्वविद्यालय
बरेली।

विषय– शैक्षणिक सत्र 2020–21 से स्नातक / परास्नातक (कृषि) का नवीन पाठ्यक्रम लागू किये जाने के सम्बन्ध में।

महोदय / महोदया,

उपरोक्त विषयक के संबंध में विद्या परिषद की बैठक 16.12.2019 एवं कार्यपरिषद की बैठक दिनांक 18.12.2019 में लिये निर्णयानुसार सत्र 2020–21 से स्नातक / परास्नातक (कृषि) का पाठ्यक्रम ICAR , Vth डीन कमेटी के अनुसार लागू किये जाने के आदेश कुलपति महोदय द्वारा प्रदान कर दिये गये है। उक्त पाठ्यक्रम विश्वविद्यालय की वेबसाइट www.mjpru.ac.in पर अपलोड कर दिया गया है।

कृपया उपरोक्तानुसार पठन–पाठन संबंधी आवश्यक कार्यवाही किया जाना सुनिश्चित करें।

भवदीय

Pandey

कुलसचिव

प्रतिलिपि– निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

1. परीक्षा नियंत्रक
2. सहायक कुलसचिव (शैक्षणिक / परीक्षा)
3. डा0 अमित सिंह, मीडिया प्रभारी,
4. निजी सचिव, कुलपति को कुलपति महोदय के सूचनार्थ।
5. प्रशासनिक अधिकारी (परीक्षा / गोपनीय)
6. प्रभारी, अतिगोपनीय / केन्द्रीय कम्प्यूटर / विश्वविद्यालय वेबसाइट

कुलसचिव

Faculty of Agriculture

M.Sc.-Agriculture

SYLLABUS

(Under Semester Mode) Enforced from Session 2020

Departments

1. **Department of Agronomy**
2. **Department of Agricultural Economics and Statistics**
3. **Department of Horticulture**

Department of Agronomy

M.J.P. Rohilkhand University, Bareilly

Semester wise course for Master Degree Programme in Agronomy

First Semester						
Code	**Course Title**	**Credit hrs**	**Mid Term**	**Practical**	**End Term**	**Total**
AGR-501	Modern concept in crop production	3(3+0)	50	-	50	100
AGR-502	Principles and practices of weed management	3(2+1)	20	30	50	100
AGR-503	Agronomy of major cereals and pulses	3(2+1)	20	30	50	100
AS-501	Agricultural Statistics	3(2+1)	20	30	50	100
PGS-501*	Library and Information Services (Non Gradial)	1(0+1)			100	100
PGS-503*	Intellectual property and its management in agriculture (e-course, Non-Gradial)	1(1+0)	50		50	100
		12+2*				
Second Semester						
AGR-504	Principles and practices of water management	3(2+1)	20	30	50	100
AGR-505	Agronomy of oil seed, fibre and sugar crops	3(2+1)	20	30	50	100
AGR-06	Crop Production and problems soils	3(2+1)	20	30	50	100
CA-501	Computer application in Agriculture	2(1+1)	20	30	50	100

PGS-502*	Technical writing and communications skills (Non-Gradial)	1(0+1)			100	100
PGS-505*	Agricultural research, research ethics and rural development programmes (E-course, Non-Gradial)	1(1+0)	50		50	100
		11+2*				
Third Semester						
AGR-507	Principles and practices of soil fertility and nutrient management	3(2+1)	20	30	50	100
AGR-508	Dryland farming and watershed management	3(2+1)	20	30	50	100
AGR-509	Advances in Crop growth and productivity	3(2+1)	20	30	50	100
AGR-510	Agronomy of Fodder and forage crops	3(2+1)	20	30	50	100
PGS-504*	Basic concepts in laboratory techniques (Non-Gradial)	1(0+1)			100	100
PGS-506*	Disaster management (E-course, Non Gradial)	1(1+0)	50		50	100
		12+2*				

Fourth Semester		**Evaluation Marks**				
AGR-516	Master Seminar	1(0+1)	-	-	-	100
AGR-517	Master Research (Thesis)	20	Satisfactory/Unsatisfactory			
OR Special Paper						
AGR-511	Agro-meterology and crop weather forecasting	4(3+1)	20	30	50	100
AGR-512	Agrostology and agro-forestry	4(3+1)	20	30	50	100
AGR-513	Cropping systems and sustainable agriculture	4(3+1)	20	30	50	100
AGR-514	Principles and Practices of organic farming	4(3+1)	20	30	50	100
AGR-515	Agronomy of medicinal aromatic and underutilized crops	4(3+1)	20	30	50	100
	Total Credit	**21**				
	Grand total credit hours	**62(56+6*)**				

***Non-Gradial Course**

AGRONOMY
M.Sc. (AG.)

AGR 501 MODERN CONCEPTS IN CROP PRODUCTION 3(3+0)

Theory

UNIT -1

Crop growth analysis in relation to environment, agro-ecological zones of India. Agro-climatic zones of U.P. and India.

UNIT -2

Quantitative agro-biological principles and inverse yield nitrogen law, mitscherlich yield equation, its interpretation and applicability; baule unit.

UNIT -3

Effect of lodging in cereals: physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources.

UNIT-4

Scientific principles of crop production; crop response production functions: concept of soil plant relations; yield and environmental stress.

UNIT-5

Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming determining the nutrient needs for yield potentiality of crop plant; concept of balance nutrition and integrated nutrient management.

AGR 502 PRINCEPLES AND PRACTICES OF WEED MANAGEMENT 3(2+1)

Theory

UNIT-1

Weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification.

UNIT-2

Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides.

UNIT-3

Herbicide structure-activity relationship; factors affecting the efficiency of herbicides; Herbicide formulation, herbicide mixtures; herbicide resistance and management; weed control through bio-herbicides, myco-herbicides and allelochemicals; degradation of herbicides in soil and plants.

AGR 503 AGRONOMY OF MAJOR CEREALS AND PULSES 3(2+1)

Theory

Origin and history, area and production, classification Improved varieties, adaptability, climate, Soil, water and culture requirements, nutrition, quality components, handling and processing of the produce for maximum production.

UNIT-I

Rabi cereals: wheat, barley, oat,

UNIT-II

Kharif cereals: Paddy, maize, sorghum, bajra

UNIT-III

Rabi pulses: chickpea, field pea, lentil, rajmash

UNIT-IV

Kharif pulses: Arhar, Urd, Moong, cowpea, soybean

Practical

- Phenological studies at different growth stages of crop
- Estimation of crop yield on basis of yield attributes
- Formulation of cropping schemes for various farm size and calculation of cropping and rotational intensities
- Planning and layout of field experiments
- Judging of physiological maturity in different crop
- Intercultural operations In different crops
- Determination of cost of cultivation of different crop
- Work out harvest index of various crops.
- Study of seed production techniques in various crop

Visit of field experiments on cultural, fertilizer, weed control and water management aspects

AGR 5O4 PRINCIPLES AND PRACTICES OF WATER MANAGEMENT 3(2+1)

Theory

UNIT-1

Water and its role in plants; water resources of India, major irrigation projects, extent of area and crops irrigated in India and different states.

UNIT-2

Soil water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress.

UNIT-3

Soil, plant and meteorological factors determining water needs of crop; scheduling, depth and methods of irrigation; micro-irrigation system; fertigation; management of water in controlled environments and polyhouses.

UNIT-4

Water management of the crop and cropping systems; quality of irrigation water and management of saline water for irrigation; water use efficiency.

UNIT-5

Excess of soil water and plant growth; water management in problem soils; drainage requirement of crop and methods of field drainage.

Practical

- Measurement of soil water potential by using tensiometer, pressure plate and membrane apparatus
- Soil-moisture characteristics curves
- Water flow measurements using different devices
- Determination of irrigation requirements
- Calculation of irrigation efficiency

AGR 505 AGRONOMY OF OIL SEED, FIBRE AND SUGAR CROPS 3 (2+1)

Theory

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and culture requirement nutrient management, handling and processing of the produce for maximum production of:

UNIT- I

Rabi oilseeds - Rapeseed and mustard, linseed.

UNIT-II

Kharif -oilseed – Groundnut, Til, castor, sunflower, soybean.

UNIT-III

Fiber crops- cotton, Jute, sun hemp.

UNIT- IV

Sugar crop- sugar-beet and sugarcane.

Practical

- Planning and layout of field experiments
- Cutting of sugarcane setts. It's treatment and methods of sowing, tying and propping of sugarcane
- Determination of cane maturity and calculation on purity percentage, recovery percentage and sucrose content in cane juice. Phenological studies at different growth stage of crop
- Intercultural operations In different crops
- Cotton seed treatment
- Working out growth indices (LER, CGR, RGR, NAR, LAD) aggressively, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems.
- Judging of physiological maturity in different crops and workout harvest index
- Work out cost of cultivation of different crops
- Estimation of crop yield on the basis of yield attributes
- Study of seeds production techniques In various crops
- Visit of field experiments on cultural fertilizer, weed control and water management aspects

AGR 506 CROPS PRODUCTION IN PROBLEM SOILS 3(2+1)

Objective: To impart knowledge of problem soils and their management, attention will be on crop production in problem soils and their reclamation.

Theory

Unit-I

Problem soils and their distribution in India; acid, saline and waterlogged soils: origin of problematic soils and factors responsible.

Unt-II

Response of crop to acidity, salinity, sodicity, excess water and nutrient imbalances.

Unit-III

Reclamation of problem soils, role of amendments and drainage. Lime requirement for acid soils and gypsum requirement for sodic soils.

Unit-IV

Crop production techniques in problem soils-crops, varieties, cropping system and agronomic practices.

Unit V

Effects of water table fluctuation on crop growth. Degraded lands and their rehabilitation.

PRACTICAL

- Characterization of acid, salt affected and calcareous soils.
- Lime requirement of acid soils.
- Gypsum requirement of Sodic Soils.
- Determination of cations (Na+, K+,, Ca+,+,, and Mg+,+,) in soil samples
- Determination of anions (Cl, So4, Co3) in soil samples.
- Reclamation of problem soils by agronomic practices

AGR 5O7 PRINCIPLES AND PRACTICES SOIL FERTILITY AND NUTRIENT MANAGEMENT 3(2+1)

Theory

UNIT -1

Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth.

UNIT-2

Criteria of essentiality of nutrients; essential plant nutrients - their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

UNIT-3

Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management.

UNIT-4

Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades; agronomic, chemical and physiological methods of increasing fertilizer use efficiency; nutrient interaction.

UNIT-5

Time and method of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermicompost and residue wastes in crops.

Practical

- Determination of soil pH, ECe, organic C, total N available N P K and S in soil
- Determination of total N, P. K. and S in plants.
- Numerical problem on fertilizers Requirement and fertilizer mixture.

UNIT-4

Weed management in major crops and cropping systems; parasitic weed; weed shifts in cropping systems; aquatic and perennial weed control.

UNIT-5

Integrated weed management; cost: benefit analysis of weed management.

Practical

- Identification of important weeds of different crop
- Preparation of a weed herbarium
- Weed survey in crop and cropping systems
- Crop-weed competition studies
- Preparation of spray solution of herbicides for high and low - volume sprayers
- Economics of weed control
- Herbicides resistance analysis in plant and soil
- Calculation of herbicidal requirement

AGR-508 DRYLAND FARMING AND WATERSHED MANAGEMENT 3(2+1)

THEORY

UNIT-I

Definition, concepts and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian Agriculture.

UNIT-II

Soil and climatic parameters with special emphasis on rainfall characteristics ; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions.

UNIT-III

Stress physiology and resistance to drought, adaptation of crop plant to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions

UNIT-IV

Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; technique and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); anti-transparent; soil and crop management techniques; soil and crop management techniques, seeding and efficient fertilizer use.

UNIT-V

Concept of watershed resource management, problems, approach and components.

PRACTICAL

- Seed treatment, seed germination and crop establishment in relation to soil moisture contents.
- Moisture stress effects and recovery behavior of important crops.
- Estimation of moisture index and aridity index.
- Splay of anti-transpirants and their effect on crops.
- Collection and interpretation of data for water balance equations.
- Water use efficiency.
- Preparation of crop plans for different drought conditions.
- Study of field experiments relevant to dryland farming.
- Visit to dryland research stations and watershed projects

AGR-509 ADVANCES IN CROP GROWTH AND PRODUCTIVITY 3(2+1)

Objective: To import knowledge regarding crop growth analysis and different yield prediction models.

THEORY

UNIT-I

Crop growth analysis, key growth parameters. Analysis of factors limiting crop growth and productivity-the concept of rate limitation.

UNIT-II

Phenology-Groth stages, internal and external factors influencing flowering. Photoperiodic and thermo-periodic responses and the concept of degree days and crop growth duration.

UNIT-IV

Source-sink relationships. Translocation of photosynthesis and factors influencing transport of sucrose. Physiological and molecular control of sink, activity-partitioning efficiency and harvest index.

UNIT-V

Plant growth analysis techniques, yield structure analysis, theoretical and actual yields. Plant ideotypes, simple physiological yield model- Duncan's, Monteith's and Passioura's, crop growth models-empirical models testing and yield prediction.

PRACTICAL

- Plant sampling for leaf area and biomass estimation, analysis of growth and yield parameters- LAD, NAR, CGR, LAI, LAR, SLA portioning efficiency HI.
- Measurement of light interception, light extinction coefficient, energy utilization efficiency based energy intercepted and realized.
- Computer application in plant physiology, crop productivity and modeling.

AGR 510 AGRONOMY OF FODDER AND FORAGE CROPS 3 (2+1)

UNIT-1

Area and distribution, varietal improvement, agro-technique and quality aspects including anti-quality factors of important fodder crop like maize, teosinte (mukchari), sorghum, bajra, guar, cowpea, oats, barley, berseem , lucerne.

UNIT-2

Area and distribution, varietal improvement, agro-technique and quality aspects including anti-quality factors of important forage crop/grasses, Napier grass, Nandi grass.

UNIT-3

Year -round fodder production and management, preservation and utilization of forage and pasture crop.

UNIT-4

Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage; use of physical and chemical

enrichments and biological methods for improving nutrition; value addition in poor quality fodder.

UNIT-5

Economics of forage cultivation uses and seed production techniques.

Practical

- Important of farm operation in raising fodder crops;
- Canopy measurement, yield and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc. of various fodder and forage crop.
- Anti-quality components like HCN in sorghum and such factors in other crops.
- Hay and silage making and economics of their preparation.

AGR-511 AGRO METEOROLOGY AND CROP WEATHER FORECASTING

4(3+1)

Objective: To impart knowledge about agro meteorology and crop weather forecasting to meet the challenges of aberrant weather conditions.

THEORY

UNIT-I

Agro-meteorology- aim, scope and development in relation to crop environment; composition of atmosphere, distribution of atmospheric pressure and wind.

UNIT-II

Characteristic of solar radiation, energy balance of atmosphere system, radiation distribution in plant canopies, radiation utilization by field crops, photosynthesis and efficiency of radiation utilization by field crops energy budget of plant canopies, environmental temperature; soil, air and canopy temperature.

UNIT- III

Temperature profile in air, soil, crop canopy; soil and air temperature effects on plant processes; environmental moisture and evaporation; measures of atmospheric temperature and relative humidity vapor pressure and their relationship; evapo-transpiration and meteorological factors determining evapo-transpiration.

UNIT-IV

Modification of plant environment; artificial rain marketing, heat transfer, controlling heat load, heat trapping and shading; protection from cold, sensible and latent heat flux, controlling soil moisture; monsoon and their origin, characteristics of monsoon ; onset, progress and withdrawal of monsoon; weather hazards, drought monitoring and planning for mitigation.

UNIT-V

Weather forecasting in India-short medium and long range; aerospace science and weather forecasting; benefits of weather services to agriculture, remote sensing; application in agriculture and its present status in India; atmospheric pollution and its effect on climate and crop production; climate change and its impact on agriculture.

PRACTICAL

- Visit to agro-meteorological observatory and to record sun-shine hours, wind velocity, wind direction, relative humidity, soil and air temperature, evaporation, precipitation and atmospheric pressure.
- Measurement of solar radiation outside and within plant canopy.
- Measurement/estimation of evapotranspiration by various methods.
- Measurement/estimation of soil water balance.
- Rainfall variability analysis.

AGR-512 AGROSTOLOGY AND AGRO-FORESTRY 4(3+1)

Objective : To teach crop husbandry of different fodder and agro-forestry crops/trees along with their processing.

Theory

Unit - 1

Agrostology: Definition and importance, principles of grassland ecology, grassland ecology-community, climax, dominant species, succession biotype, ecological status of grasslands in India, grass cover of India, problems and management of grasslans.

Unit- II

Importance, classification (various criteria), scope, status and research needs of pastures, pasture establishment, their improvement and renovation-natural pastures, cultivated pastures; common pasture grasses.

Unit- III

Agrofirestry: definition and importance, agroforestry systems, agrisilviculture, silvipasture, agrisilvipasture, agrihorticulture, alley cropping and energy plantation.

Unit - IV

Crop production technology in agrofirestry and agroforestry system, silvipastoral system, meaning and importance for wasteland development, selection of spacies, planting methods and problems of seed germination in agro-forestry system.

Unit -V

Irrigation and manuring in agroforestry system, associative influence in relation to above ground and underground interferences; lopping and coppicing in agro-forestry system; social acceptability and economic viability, nutritive value of trees, tender operation, desirable tree characteristics.

PRACTICAL

- Preparation of charts and maps of India showing different types of pastures and agro-forestry systems.
- Identification of seeds and plants of common grasses, legumes and trees of economic importance with reference to agro-forestry.
- Seed treatment for better germination of farm vegetation
- Methods of propagation/planting of grasses and trees in silvi-pastoral system.
- Fertilizer application in strip and silvipastoral s-ys-tem
- After-care of plantation
- Estimation of protein content in looping of important fodder trees.

- Estimation of calories value of wood important fuel trees.
- Estimation of total biomass and fuel wood
- Economics of agro-forestry
- Visit to important agro-forestry research stations.

AGR-513 CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE 4(3+1)

Objective: To acquaint the students about prevailing cropping systems in the country and practices to improve their productivity.

THEORY

Unit- I

Cropping systems; Definition, indices and its importance physical resources, soil and water management in cropping system; assessment of land use.

Unit - II

Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping multiple cropping, alley cropping, sequential cropping and intercropping, mechanism of yield advantage in intercropping systems.

Unit- III

Above and below ground interactions and allelopathic effects, competition relations; multistoried cropping and yield stability of intercropping, role of non-monetary inputs and low cost technologies, research need on sustainable agriculture.

Unit - IV

Crop diversification for sustainability; role of organic-matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system.

Unit - V

Plant ideotypes for dry lands; plant growth regulators and their role in sustainability.

PRACTICAL

- Tools for determining productions and efficiencies in cropping and farming systems
- Indicators of sustainability of cropping and farming systems.
- Site specific development of IFS models for different agro-climatic zones
- Visit of IFS models in different agro climatic zones of nearby state Universities/Institutes and farmer fields.

AGR 514 PRINCIPLES AND PRACTICES OF ORGANIC FARMING 4(3+1)

Objectives: To study the principles and practices of organic farming for sustainable crop production.

Unit - 1

Organic farming-concept and definition, its relevance to India and global agriculture and future prospects; and water management- land use, minimum tillage; shelter zones, hedges, pasture management, agro forestry.

Unit - II

Organic farming and water use efficiency, soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworks and vermi-compost, green manures and bio-fertilizers.

Unit- III

Farming systems, crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.

Unit- IV

Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides.

Practical :

- Aerobic and anaerobic methods of making compost.
- Making of vermicompost
- Identification and nursery raising of important agro-forestry trees and tress for shelter belts.
- Efficient use of bio-fertilizers, techniques of treating legume seeds with Rhizobium cultures, use of Azotobacter, Azospirillum and PSB cultures in field
- Quality standards, inspection, certification and labelling and accreditation procedures for farm produce from organic farms.

AGR- 515 AGRONOMY OF MEDICINAL, AROMATIC AND UNDER-UTILIZED CROPS (4(3+1)

Objectives: To acquaint students about different medicinal, aromatic and underutilized field crops, their package of practices and processing.

Theory:

Unit - 1

Importance of medicinal and aromatic plants in human health, national economy and related industries, classification of medicinal and aromatic plants according to botanical characteristics and uses.

Unit - II

Climate and soil requirements; cultural practices; yield and important constituents of medicinal plants (isabgol, Rauwolfia, Poppy, Aloe vera, Satavar, Stevia, Safed musli, Kalmegh, Asaphoetida, Nux vomic, Rosadle etc.)

Unit - III

Climate and soil requirements; cultural practices; yield and important constituents of aromatic plats (citronella, palmarosa, mentha, basil, lemon grass, rose, patchouli, Geranium etc.)

Unit - IV

Climate and soil requirements cultural practices, yield of under-utilized crops (Rice bean, Lathyrus, Sesbanic, cluster bean, French bean, Fenugreek, gain Amarnath, Coffee, Tea and Tobacco.

PRACTICAL

- Identification of crops based on morphological and seed characteristics
- Raising of herbarium of medicinal, aromatic and under utilized plants.
- Quality characters in medicinal and aromatic plants.
- Methods of analysis of essential oil and other chemicals of importance in medicinal and aromatic plants.

AGR 517 Thesis / Research Project

Aim of introducing thesis in M.Sc. (Ag.) Agronomy is to give the students preliminary exposure for conducting the research and presenting its findings systematically and scientifically in a manuscript shape. To fulfill this goal, a specific topic for thesis research shall be assigned to eligible student by the teacher(s) /supervisor(s) of the department. Student will submit a written report to the department before commencement of the examination of the final semester. Thesis/report will be evaluated by the external examiners. The external examiners will also conduct the viva-voce based on project report.

Common Course for M.Sc. (Ag.)

CA 501 COMPUTER APPLICATION IN AGRICULTURE 2(1+1)

Theory

Introduction to Computers, Operating Systems, definition and types, Applications of MS-Office 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, Smart phone Apps in Agriculture for farm advises, market price, post harvest 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. Int6duction 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-EXCEI. - 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/CmpSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial Technology for generating valu2ble information for Agriculture.Hands on Decision Support System.Preparation of contingent crop planning.

Common course for M.Sc. (Ag.)

AS 501 Agricultural Statistics 3(2+1)

Theory

Unit-I

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

Unit II :

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

Unit III :

Introduction to theory of estimation and confidence-intervals. Correlation and regression, Simple and multiple linear regression model, estimation of parameters. predicted values and residuals, correlation coefficient partial correlation coefficient, multiple correlation coefficient, rank correlation coefficient. Test of significance of correlation coefficient and regression coefficients, coefficient of determination.

Unit IV

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

Unit V

Uniformity trails, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing plot techniques, split plot design.

Unit VI

Sampling techniques - Planning of survey, method of data collection, questionnaire v/s schedule. Problems of sampling frame, choice of sample of design, probability sampling, sample space, sampling design, simple random sampling, Estimation of proportion, confidence interval, determination of sample size, stratified sampling, cluster sampling, multi-state sampling, systematic sampling, ratio and regression method of estimation. Non sampling error source and classification,

Practical

On the topic listed on the theory syllabus.

COMPULSORY NON-GRADIAL COURSES

(Compulsory for Master's programme in all disciplines; Optional for Ph.D. scholars)

CODE	COURSE TITLE	CREDITS
PGS 501	Library and information services	1(0+1)
PGS 502	Technical writing and Communications skills	1(0+1)
PGS 503 (e-Course)	Intellectual Property and its Management in Agriculture	1(1+0)
PGS 504	Basic concepts in Laboratory Techniques	1(0+1)
PGS 505 (e-Course)	Agricultural Research, Research ethics and Rural Development Programmes	1(1+0)
PGS 506 (e-Course)	Disaster Management	1(1+0)

COURSE CONTENTS

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

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer: Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index. Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey: Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

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

Objective

To equip the students/scholars with skills to Milt dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

Technical Writing - Various forms of scientific writings- theses, technical papers. reviews, manuals. etc.; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction. review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries. precis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of

tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

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

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPs Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout. tradesecrets and traditional knowledge, trademarks. protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters. protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

PGS 504; BASIC CONCEPTS IN LABORATORY TECHNIQUES 1(0+1)

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strength an their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralization of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy.

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

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Theory

UNIT 1

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (COIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT II

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT III

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group -Area Specific Programme, Integrated Rural Development Programme(IRDF) Panchayati Raj Institutions, Co-operatives, Voluntary Ageneles/Non-GovernmentalOrganizations. Critical evaluation of rural development policies and programmes.Constraints in implementation of rural policies and programmes.

PGS 506: DISASTER MANAGEMENT 1(1+0)

(e-Course)

Objectives

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

Department of Horticulture

M.Sc. (Ag.) Horticulture

M.J.P. Rohilkhand University, Bareilly

Semester wise course for Master Degree Programme in Horticulture

1st Semester			Evaluation Marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term (Internal)**	**Practical (External)**	**End term/Final (External)**	**Total**
Hort 501	Propagation and Nursery management for Horticultural crops	3(2+1)	20	30	50	100
Hort 502	Landscaping and ornamental Gardening	3(2+1)	20	30	50	100
Hort 503	Tropical and Dry Land Fruit Production	3(2+1)	20	30	50	100
AS 501	Agricultural Statistics	3(2+1)	20	30	50	100
PGS-501	Library and Information Services (Non Gradial)	1(0+1)			100	100
PGS-503	Intellectual property and its management in agriculture (e-course, Non-Gradial)	1(1+0)	50		50	100
	Total Credit	**12+2***				
2nd Semester			**Evaluation Marks**			
Hort 504	Production technology of cool season vegetables	3(2+1)	20	30	50	100
Hort 505	Subtropical and temperate fruit production	3(2+1)	20	30	50	100
Hort 506	Production Technology of cut and loose flowers	3(2+1)	20	30	50	100
CA 501	Computer Application in Agriculture	2(1+1)	20	30	50	100
PGS-502	Technical writing and communications skills (Non-Gradial)	1(0+1)			100	100

PGS-505	Agricultural research, research ethics and rural development programmes (E-course, Non-Gradial)	1(1+0)	50		50	100
	Total Credit	**11+2***				
3rd Semester			**Evaluation Marks**			
Hort 507	Production technology of warm season vegetables	3(2+1)	20	30	50	100
Hort 508	Protected Cultivation of Horticultural Crops	3(2+1)	20	30	50	100
Hort509	Breeding of Horticultural Crops	3(2+1)	20	30	50	100
Hort 510	Post Harvest Technology for Horticultural Crops	3(2+1)	20	30	50	100
PGS-504	Basic concepts in laboratory techniques (Non-Gradial)	1(0+1)			100	100
PGS-506	Disaster management (E-course, Non Gradial)	1(1+0)	50		50	100
	Total Credit	**12+2***				
4th Semester			**Evaluation Marks**			
Hort 516	Master Seminar	1(0+1)	-	-	-	100
Hort 517	Master Research (Thesis)	20	Satisfactory/Unsatisfactory			
OR Special Paper						
Hort 511	Fruit Technology (Special Paper)	4(3+1)	20	30	50	100
Hort 512	Production Technologies of Medicinal and Aromatic Crops	4(3+1)	20	30	50	100
Hort 513	Production Technologies of plantation and spice crops	4(3+1)	20	30	50	100
Hort 514	Hi Tech/Advance Horticulture	4(3+1)	20	30	50	100
Hort 515	Production Technology of under	4(3+1)	20	30	50	100

	utilize Sub-Tropical crops					
	Total Credit	**21**				
	Grand total credit hours	**62(56+6*)**				

*Non Gradial

COURSE CONTENT - DETAILED SYLLABUS

HORT501 PROPAGATION AND NURSERY MANAGEMENT FOR HORTICULTURAL CROPS **3(2+1)**

Theory

UNIT-I

Introduction, life cycles in plants, cellular basis for propagation, sexual propagation, apomixes, polyembryony, chimeras. Principles factors influencing seed germination of horticultural crops, dormancy, hormonal regulation of germination and seedling growth.

UNIT-II

Seed quality, treatment, packing, storage, certification, testing. Asexual propagation-rooting of soft and hard wood cutting under mist by growth regulators. Rooting of cuttings in hotbeds. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering — principle and methods.

UNIT-III

Budding and grafting — selection of elite mother plants, methods. Establishment of bud wood bank, stock, scion and inter stock relationship-incompatibility. Rejuvenation through top working — Progeny orchard and scion bank.

UNIT-IV

Micro-propagation-principles and concepts, commercial exploitation in horticultural crops.Techniques-in vitro clonal propagation, direct organogenestis, embryogenesis, micrografling, meristem culture. Hardening, packing and transport of micro-propagules.

UNIT-V

Nursery-types, structures, components, planning and layout. Nursery management practices for healthy propagule production.

Practical

Anatomical studies in rooting of cutting and graft union, construction of propagation structures, study of media and PGR. Hardening –case studies, micro propagation, explant preparation, media preparation, culturing - in vitro clonal propagation, meristem culture, shoot tip culture, axillary bud culture, direct organogcnesis, direct and indirect ambryogenesis, micro grafting, hardening. Visit to TC labs and nurseries.

HORT 502 LANDSCAPING AND ORNAMENTAL GARDENING 3(2+1)

Theory

UNIT-I

Landscape designs types of gardens, English, Mughal, Japnese, Persian, Spanish, Italian, Vanams, Buddha garden; Styles of garden, formal, informal and free style gardens.

UNIT II

Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporates.

UNIT-III

Garden plant components, arboretum, shrubbery, fernery, palmatum, arches and pergolas, edges and hedges, climbers and creepers, cacti and succulents, herbs, annuals, flower borders and beds, ground covers, carpet beds, bamboo groves; Production technology for selected ornamental plants.

UNIT-IV

Lawns, Establishment and maintenance, special types of gardens, vertical garden, roof garden, bog garden, sunken garden, rock garden, clock garden, colour wheels, temple garden, sacred groves.

UNIT-V

Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.

Practical

Selection of ornamental plants, practices in preparing designs for home gardens, industrial gardens, institutional gardens, corporates, avenue planting, practices in planning and planting of special types of gardens, burlapping, lawn making, planting herbaceous and shrubbery borders, project preparation on landscaping for different situations, visit to parks and botanical gardens, case study on commercial landscape gardens.

HORT 503 Tropical and Dry Land Fruit Production 3(2+1)

Theory

Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zoon and canopy management, nutrient management, water management, fertigation, role of bioregulators, abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, pest and diseases management physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, industrial and export potential, Agri. Export Zones (AEZ) and industrial supports.

UNIT-I :- Mango and Banana

UNIT-II :- Citrus and Papaya

UNIT-III :- Guava, Sapota and Jackfruit

UNIT-IV :- Pineapple, Annonas, Avocado and Bael

UNIT-V :-Aomla, Phalsa and Ber, minor fruits of tropics

UNIT-VI:- Plantation crops- Coconut, Cashewnut, Tea and Coffee

Practical

Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical and arid zone orchards, Project preparation for establishing commercial orchards.

HORT 504 PRODUCTION TECHNOLOGY OF WINTER SEASON VEGETABLE CROPS 3(2+1)

Theory

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed production of :-

Unit-I :- Potato

Unit-II :- Cole crops: cabbage, cauliflower, knoll kohl, sprouting broccoli, Brussels sprout.

Unit-III :- Root crops: carrot, radish, turnip and beetroot Unit IV- Bulb crops: onion and garlic.

Unit-V :- Peas and broad bean, green leafy cool season vegetables.

Practical

Cultural operations (fertilizer application, sowing, mulching. irrigation, weed control) of winter vegetable crops and their economic; Experiments to demonstrate the role of mineral elements, plant growth substances and herbicides; study of physiological disorders; preparation of cropping scheme for commercial farms; visit to commercial greenhouse/polyhouse.

HORT 505 SUBTROPICAL AND TEMPERAT FRUIT PRODUCTION 3(2+1)

Theory

Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems. cropping systems, root zone and canopy management, nutrient management, water management, fertigation, bioregulation, abiotic factors limiting fruit production, physiology of flowering, fruit set and development *biotic factors limiting production. Physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, industrial and export potential, Agri. Export Zone (AEZ) and industrial support.

Crops

Unit-I :- Apple, pear, quince, grapes

Unit-II :- Plums, peach, apricot, cherries, hazelnut

Unit-III :- Litchi, loquat, persimmon, kiwifruit, strawberry

Unit-IV:- Nuts-walunt, almond, pistachio, pecan

Unit-V:- Minor fruits-mangosteen, carambola, heel, wood apple, fig,jamun, rambudan pomegranate.

Practical

Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical, subtropical, humid tropical and temperate orchards, Project preparation for establishing commercial orchards.

HORT 506 PRODUCTION TECHNOLOGY OF CUT AND LOOSE FLOWERS **3(2+1)**

Theory UNIT-I

Scope of cut and loose flowers in global trade, Global Scenario of cut and loose flower production. Varietal wealth and diversity, area under cut and loose flowers and production problems in India-Patent rights, nursery management media for nursery, special nursery practices.

UNIT-II

Growing environment, on cultivation of cut and loose flower, soil it requirements, field preparation, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and CO_2 on growth and flowering.

UNIT-III

Flower production – water and nutrient management, fertigation, weed management rationing, training and printing, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes.

UNIT-IV

Flower forcing and year round flowering through physiological interventions, chemical regulation, environmental manipulation.

UNIT-V

Cut flower standards and grades, harvest indices, harvesting techniques. Post-harvest handling. Methods of delaying flower opening, prolonging self life, Pre-cooling, pulsing, packing, Storage & transportation, marketing, export potential, institutional support. Agri. Export Zones. Crops: Rose, chrysanthemum, carnation, gerbera, gladioli. tuberose, orchids, anthurium, aster. 'Mums, as cut flower nyctanthes, jaismine, marigold, crosandra, celosia, gomphrena as loose flower.

Practical

Botanical description of varieties, progagation techniques, mist chamber operation, training and puruning techniques, practices in manuring, dirp and fertigation, foliar nutrition, growth regulator application, pinching, disbudding. staking, harvesting techniques, post-harvest handling, cold chain, project preparation for regionally important cut and loose flowers, visit to commercial flower units and case study.

HOR 507 PRODUCTION TECHNOLOGY OF WARM SEASON VEGETABLE AND SPICES **3(2+1)**

Theory

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids. sowing/planting times and methods, seed rare and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management plant protection measures, economics of crop production and seed production of :

Unit-I :-Tomato, eggplant, hot and sweet pepers

Unit-II:- Okra, beans, cowpea and clusterbean

Unit-III :- Cucurbitaceous crops

Unit-IV:- Tapioca and sweet potato

Unit-V:- Green Leafy Warm season vegetables.

Unit-VI:- Production technology of spices crop like Zinger, Turmeric, Cumin, Coriander, Black pepper.

Practical

Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of summer vegetable, spices crops and their economics; study of physiological disorders and deficiency of mineral elements. preparation of cropping schemes for commercial farms; experiments to demonstrate the role of mineral elements, physiological disorders; plant growth substances and herbicide; seed extraction techniques; identification of important pests and diseases and their control; maturity standards; economics of warm season vegetable crops.

HORT 508 PROTECTED CULTIVATION OF HORTICULTURAL CROPS

3(2+1)

Theory

Unit-I

Importance and scope of protected cultivation, world scenario Indian situation present and future scope. Principles used in protected cultivation, energy management, low cost structures;

Unit-II

Regulatory structures used in protected structure types of greenhouse/ployhouse/nethouse, hot beds, cold fumes, effect of environmental factors viz. temperature, light. CO_2 and humidity on growth of different vegetables, flowers and fruits. Manipulation of CO_2 light and humidity and temperature for production of horticultural crops installation of micro irrigation and fertilization.

Unit-III

Nursery raising in protected structures like poly-tunnels, types of benches and containers, different media for growing nursery under cover.

Unit IV

Regulation of flowering and fruiting in horticultural crops technology for raising tomato, sweet pepper, cucumber, herbera, rose, chrysanthemum and straw berry in protected structures training and staking in protected crops, varieties and hybrids suitable for growing in protected structures.

Unit-V

Problem of growing horticultural crops in protected structures and their remedies, insect and disease management in protected structures;

Practical

Study of various types of structures, methods to control temperature, CO_2 and light, media, training and pruning, fertigation and nutrient management, control of insect-pests and disease

in greenhouse; economics of protected cultivation, visit to established green/poly house/net house/shade house in the region.

HORT 509 BREEDING OP HORTICULTURAL CROPS 3(2+1)

Theory

Origin, botany, taxonomy, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, 'nation), varieties and varietal characterization, resistance breeding for biotic and biotic stress, quality improvement, issue of patenting, PPVFR act achievement and future trust in following selected crops,.

Unit-I

Mango, Papaya, banana, grape and citrus fruits.

Unit- II

Potato, tomato, brinjal, hot pepper and sweet pepper.

Unit-III

Okra, Pea and beans.

Unit-IV

Gourds, melons, pumpkins and squashes

Unit-V

Cabbage, cauliflower, carrot beetroot, radish

Practical

Selection of desirable plants from breeding population, observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations; induction of flowering, falanological studies, selling and crossing techniques in horticulture crops; hybrid seed production of vegetable crops in bulk, screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops, demonstration of sib-mating and mixed population; Visit to breeding blocks.

HORT510 POST HARVEST TECHNOLOGY OF HORTICULTURAL CROPS 3(2+1)

Theory

Unit-I

Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration.

Unit-II

Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management, factors leading to post-harvest losses horticultural crops, pre-cooling. Spolilage, microbial and biochemical physical injuries and disorders.

Unit-III

Treatments prior to transportation, viz. grading, precooling chlorination, waxing, chemicals, bio-control agents and natural plant products. Methods of storage-ventilated, refrigerated, MAS, CA storage zero energy cool chamber, hypobaric storage.

Unit-IV

Packing methods and transport, principles and methods of preservation, food processing, canning preparation of fruit juices.

Unit-V

Dried and dehydrated products, nutritionally enriched products, fermented beverages, packaging technology management of processing waste, food safety standards.

Unit-VI

Jam ,Jelly,Marmalades,Pickles and Potato chips

Practical

Analyzing maturity stages of commercially important horticultural crops, improved packing and storage of important horticultural commodities, physiological loss in weight of fruits and vegetables, estimation of transpiration, respiration rate, ethylene release and study of vase life extension in cut flower using chemicals. estimation of quality characteristics in stored fruits and vegetables, cold chain management visit to cold storage and CA storage units, visit to fruit and vegetable processing units, project preparation, evaluation of processed horticultural products.

HORT 511 FRUIT TECHNOLOGY (Special Paper) 4(3+1)

Unit-I :

History, present position and future scope of fruit and vegetables preservation industries in India General principles of fruit and vegetables preservation

Unit-II :

Canning and bottling of fruit and vegetables, brief history of scientific canning equipment for home canning and commercial production, important consideration for laying out of canny Canning of important fruits, vegetables, spoilage in canned fruits and vegetables

Unit-III:

Fruits and vegetables juices, unfermented beverages [sweetened and unsweetened], principles of preservation, home and commercial scale equipment for juices, preparation and preservation of juices, squashes and Cardials from Citrus fruits, Mango, Phalsa, Jamun, Grape, Pomegranate, Tomato etc. Fruit juice concentrates and their general method of preparation

Unit-IV :

Jams, Jellies and Marmalades, role of pectin-sugar and acid in jelly formation, general method of preparation of jams, jellies and marmalades, use of jelly meter etc.Equipment for home and commercial production.

Unit-V :

Pickles, sauces, chutney and Vinegar, Potato chips general principles equipment and method of preparation, preserve candy and canes fruits, general principles and method of preparation

of byproduct from fruit and vegetables waste in home and commercial production and sun drying and dehydration of fruit and vegetables, equipment and methods.

Practical

(1) List of important equipments for fruit and vegetable preservation .
(2) Preparation of Jam, Jelly, Marmalade and Pickles (Mango, Lime and Mix Veg.)
(3) Preparation of Beverages (RTS, Squash, Nectar, Syrup and Barley Water)
(4) Preparation of preserve and candy (Aonla, Bael and Karaunda).
(5) Preparation of Tomato products (Sauce , Ketchup and chutney)
(6) Preparation of Potato Chips and canning of Pea

HORT 512 Production Technologies of Medicinal and Aromatic Crops. (Special Paper)

4(3+1)

Unit- I :

Importance and scope of medicinal and aromatic crops in India and future prospects, classification of medicinal and aromatic crops

Unit- II :

Cultivation of medicinal crops like Rauvolfia, Dioscoria, Alovera, Safed Musii, Stevia, lsabgol, Ashwagandha and Asparegus

Unit- III :

Cultivation of Aromatic crops like Mentha, Javacitronella, Khus, Ocimum, Chamomile, Lemon grass, Geranium, Palmarosa and Rose.

Unit-IV :

Special problems of Medicinal and Aromatic crops and their control.

Unit-V :

Different method of distillation of medicinal and aromatic crops, problems of distillation and there solution.Marketing of medicinal and aromatic crops.

Practical :

1. Identification of medicinal and aromatic crops.
2. Study of propagation techniques of medicinal and aromatic crops.
3. Study of cost of production of Rauvolfia, Alovera, Safed Musli, Mentha, Turmeric and Ginger
4. Study of different method of distillation of medicinal and aromatic crops.
5. Visit of distillation plant and institute related to medicinal and aromatic crops

HORT 513Production Technology of Plantation Medicinal, Aromatic and Species Crops

Unit- I :

Importance and scope of aromatic, medicinal, aromatic and Species crops in India and its area and distribution. Future prospects, classification of plantation, medicinal, aromatic, Species crops.

Unit-II :

Production technology of plantation crops like, Coconut, Areca nut, Cashew nut, Tea, Coffee and Coco.

Unit- III :

Cultivation of medicinal crops like Rauvolfia, Dioscona, Aloe vera, Safed Musli, Stevia, lsabgol, Ashwagandha and Asparegus

Unit- IV :

Cultivation of Aromatic crops like Mentha, Javacitronella, Khus, Ocimum, Chamomile, Lemon grass, Geranium, Palmarosa and Rose.

Unit-V :

Production technology of Spices crops like Turmeric, Zinger, Cumin, Coriander, Fennel, Black Pepper, Cardamon (Large and small).

Unit-VI :

Different method of distillation of medicinal and aromatic crops, problems of distillation and there solution.Marketing of plantation, medicinal, aromatic and species crops.

Practical :

1. Identification of plantation, medicinal, aromatic and species, crops.
2. Study of propagation techniques of plantation, medicinal, aromatic and species, crops.
3. Study of cost of production of Rauvolfia, Alovera, Safed Musli, Mentha, Turmeric, Ginger, Coriander, Coconut, Cashew, Tea, Coffee.
4. Study of different method of distillation of medicinal and aromatic crops.
5. Visit of distillation plant and institute related to plantation, medicinal, aromatic and species, crops.

HORT 514Production Technology of Plantation and spice crops (Special Paper)

Unit I :

Importance and scope of Plantation and Spice crop in India, its area and distribution.

Unit II:

Production technology of Plantation crops like, Coconut, Areca nut, Cashew nut, Tea, Coco and Coffee.

Unit III :

Production technology of Spice crops like Turmeric, Zinger, Cumin, Coriander, Fennel, Black Paper, Cardamom (Large and small).

Unit IV :

Propagation techniques of Plantation and spice crops

Unit V :

Problems of Plantation and spice crop and their remedies. Marketing, Post harvest management and storage of plantation and spice crops

Practical

1. Identification of Plantation and spice crops.

2. Propagation methods of plantation crops.
3. Preparation of nursery for Plantation crops.
4. Calculation of cost of production per hectare of spice crops- Turmeric, Zinger, Coriander and Cumin.

HORT 515 Hi Tech/Advance Horticulture (Special Paper) 4(3+1)

Unit-I :

Introduction and importance, mechanization of Nursery.Micro Propagation of Horticulture Crops Advantages and limitations Types of culture (Seed, embryo, organ, callus en cell).

Unit II :

Advances made in root stocks Development of root stocks for biotic and abiotic stress

Unit III :

Advances in irrigation system Advantage and disadvantage of drip irrigation, sprinkler and rain gun.

Unit IV :

Canopy management of Tropical and Subtropical fruit crops like Mango, Guava, Grapes, Ber and Beal.

Unit V:

Special problem of fruit crops and there control (Mango, Guava, Papaya, Grapes, Pine apple and Apple). High density or herding in fruits crops

Practical :

1. Identification and use of equipments in tissue culture laboratory.
2. Sterilization technique of media.
3. Identification and application of tools and equipment related to micro irrigation system and canopy management.
4. Identification of special problems of fruit crops.

HORT 516 Production Technology of under utilize Sub-tropical Fruits (Special Paper)

4(3+1)

Unit I :

Importance and scope of under utilize fruits in India. Distribution and description of under utilize fruits.

Unit II :

Production technique of under utilize sub-tropical fruits like Beal, Carambola, Custard apple, Wood Apple, Tamarind, Lasora, Barbadas cherry, Chirounji, Jamun, Falsa, Fig, Mulberry, Karounda, Barhal and Amra.

Unit III :

Propagation technique of under utilize fruits sexual and asexual including micro propagation.

Unit IV :

Problem of under utilize fruits and their remedies.

Unit V:

Marketing, Post harvest management and storage of under utilize fruits.

Practical :

1. Identification of under utilize fruits.
2. Propagation of under utilize fruits.
3. Filling and Lifting of poly bags
4. Packaging of sampling.
5. Visit of Research centers working on under utilize fruits.

HORT 517 Thesis / Research Project

Aim of introducing thesis in M.Sc. (Ag.) Horticulture is to give the students preliminary exposure for conducting the research and presenting its findings systematically and scientifically in a manuscript shape. To fulfill this goal, a specific topic for thesis research shall be assigned to eligible student by the teacher(s) /supervisor(s) of the department. Student will submit a written report to the department before commencement of the examination of the final semester. Thesis/report will be evaluated by the external examiners. The external examiners will also conduct the viva-voce based on project report.

Common Course for M.Sc. (Ag.)

CA 501 COMPUTER APPLICATION IN AGRICULTURE 2(1+1)

Theory

Introduction to Computers, Operating Systems, definition and types, Applications of MS-Office 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, Smart phone Apps in Agriculture for farm advises, market price, post harvest 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. Int6duction 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-EXCEI. - 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/CmpSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial Technology for generating valu2ble information for Agriculture.Hands on Decision Support System.Preparation of contingent crop planning.

Common course for M.Sc. (Ag.)

AS 501 Agricultural Statistics 3(2+1)

Theory

Unit-I

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

Unit II :

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

Unit III :

Introduction to theory of estimation and confidence-intervals. Correlation and regression, Simple and multiple linear regression model, estimation of parameters. predicted values and residuals, correlation coefficient partial correlation coefficient, multiple correlation coefficient, rank correlation coefficient. Test of significance of correlation coefficient and regression coefficients, coefficient of determination.

Unit IV

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

Unit V

Uniformity trails, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing plot techniques, split plot design.

Unit VI

Sampling techniques - Planning of survey, method of data collection, questionnaire v/s schedule. Problems of sampling frame, choice of sample of design, probability sampling, sample space, sampling design, simple random sampling, Estimation of proportion, confidence interval, determination of sample size, stratified sampling, cluster sampling, multi-state sampling, systematic sampling, ratio and regression method of estimation. Non sampling error source and classification,

Practical

On the topic listed on the theory syllabus.

COMPULSORY NON-GRADIAL COURSES

(Compulsory for Master's programme in all disciplines; Optional for Ph.D. scholars)

CODE	COURSE TITLE	CREDITS
PGS 501	Library and information services	1(0+1)
PGS 502	Technical writing and Communications skills	1(0+1)
PGS 503 (e-Course)	Intellectual Property and its Management in Agriculture	1(1+0)
PGS 504	Basic concepts in Laboratory Techniques	1(0+1)
PGS 505 (e-Course)	Agricultural Research, Research ethics and Rural Development Programmes	1(1+0)
PGS 506 (e-Course)	Disaster Management	1(1+0)

COURSE CONTENTS

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

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer: Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index. Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey: Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

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

Objective

To equip the students/scholars with skills to Milt dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

Technical Writing - Various forms of scientific writings- theses, technical papers. reviews, manuals. etc.; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction. review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries. precis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of

tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

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

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPs Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout. tradesecrets and traditional knowledge, trademarks. protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters. protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

PGS 504; BASIC CONCEPTS IN LABORATORY TECHNIQUES 1(0+1)

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strength an their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralization of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy.

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

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Theory

UNIT 1

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (COIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT II

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT III

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group -Area Specific Programme, Integrated Rural Development Programme(IRDF) Panchayati Raj Institutions, Co-operatives, Voluntary Ageneles/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes.Constraints in implementation of rural policies and programmes.

PGS 506: DISASTER MANAGEMENT 1(1+0)

(e-Course)

Objectives

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

Department of AGRICULTURAL ECONOMICS & STATISTIC

M.Sc. (Ag.) AGRICULTURAL ECONOMICS

M.J.P. Rohilkhand University, Bareilly

Semester wise course for Master Degree Programme in Agricultural Economics

First Semester		**Evaluation Marks**				
Code	**Course Title**	**Credit hrs**	**Mid Term**	**Practical**	**Theory**	**Total**
AGECON-501	Micro Economic theory and Applications	3(3+0)	50		50	100
AGECON-504	Agricultural Production Economics	3(2+1)	20	30	50	100
AGECON-505	Agricultural Marketing and Price Analysis	3(2+1)	20	30	50	100
AS-501	Agricultural Statistics	3(2+1)	20	30	50	100
PGS-501*	Library and Information Services (Non Gradial)	1(0+1)			100	100
PGS-503*	Intellectual property and its management in agriculture (e-course, Non-Gradial)	1(1+0)	50		50	100
	Total Credit Hours	12+2*				
Second Semester		**Evaluation Marks**				
Code	**Course Title**	**Credit hrs**	**Mid Term**	**Practical**	**Theory**	**Total**
AGECON-502	Macro Economics theory and Policy	3(3+0)	50		50	100
AGECON-506	Research Methodology for Social Science	3(2+1)	20	30	50	100
AGECON-508	Linear Programming	3(2+1)	20	30	50	100
AGECON-510	Rural Marketing	3(2+1)	20	30	50	100
PGS-502*	Technical writing and communications skills (Non-Gradial)	1(0+1)			100	100
PGS-505*	Agricultural research, research ethics and rural development programmes (E-course, Non-Gradial)	1(1+0)	50		50	100
	Total Credit Hours	**12+2***				
Third Semester		**Evaluation Marks**				
Code	**Course Title**	**Credit hrs**	**Mid Term**	**Practical**	**Theory**	**Total**
AGECON-503	Evaluation of Economic Thought	3(3+0)	50		50	100
AGECON-507	Econometrics	3(2+1)	20	30	50	100

AGECON-509	Agricultural Finance and Project Management	3(2+1)	20	30	50	100
CA-501	Computer Application in Agriculture	2(1+1)	20	30	50	100
PGS-504*	Basic concepts in laboratory techniques (Non-Gradial)	1(0+1)			100	100
PGS-506*	Disaster management (E-course, Non Gradial)	1(1+0)	50		50	100
	Total Credit Hours	11+2*				
Fourth Semester		**Evaluation Marks**				
Code	**Course Title**	**Credit hrs**	**Mid Term**	**Practical**	**Theory**	**Total**
AGECON-516	Master's Seminar	1(1+0)				100
AGECON-517	Master's Thesis	20	Satisfactory/ Unsatisfactory			
	Total Credit hours	21				
	OR Special Paper					
AGECON-511	International Economics	4(3+1)	20	30	50	100
AGECON-512	Agricultural Development and Policy	4(4+0)	50		50	100
AGECON-513	Institutional Economics	4(4+0)	50		50	100
AGECON-514	Natural Resources and Environment Economics	4(3+1)	20	30	50	100
AGECON-515	Commodity Future Trading	4(4+0)	50		50	100
	Total Credit Hours	**21**				
	GRAND TOTAL	**62(56+6)**				

COURSE CONTENT - DETAILED SYLLABUS

AGECON 501 MICRO ECONOMIC THEORY AND APPLICATIONS 3(3+0)

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

GeneralEquilibrium Theory - Welfare Economics - Pareto Optimality - Social welfare criteria - Social Welfare functions.

AGECON 502 MACRO ECONOMICS THEORY AND POLICY 3(3+0)

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

AGECON 503 EVOLUTION OF ECONOMIC THOUGHT 3 (3+0)

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

Theory
UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

AGECON 504 AGRICULTURAL PRODUCTION ECONOMICS 3(2+1)

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

Theory

UNIT I

Nature, scope and significance of agricultural production economics - Agricultural Production processes, character and dimensions-spatial, temporal - Centrality of production functions, assumptions of production functions, commonly used forms - Properties.limitations, specification, estimation and interpretation of commonly used production functions.

UNIT II

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

UNIT III

Cost functions and cost curves, components, and cost minimization -Duality theory - cost and production functions and its applications - Derivation of firm's input demand and output supply functions -Economics and diseconomies of scale.

UNIT IV

Technology in agricultural production, nature and effects and measurement - Measuring efficiency in agricultural production; technical, allocative and economic efficiencies - Yield gap analysis-concepts-types and measurement - Nature and sources of risk, modeling and coping strategies.

Practical

Different forms of production functions – specification, estimation and interpretation of production functions - returns to scale, factor shares, elasticity of production - physical optima-

economic optima-least cost combination- optimal product choice- cost function estimation, interpretation-estimation of yield gap - incorporation of technology in production functions-measuring returns to scalerisk analysis through linear programming.

AGECON 505 AGRICULTURAL MARKETING AND PRICE ANALYSIS 3(2+1)

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

Theory

UNIT I

Review of Concepts in Agricultural Marketing - Characteristic of Agricultural product and Production Problems in Agricultural Marketing from Demand and Supply and Institutions sides. Market intermediaries and their role - Need for regulation in the present context -Marketable & Marketed surplus estimation. Marketing Efficiency - Structure Conduct and Performance analysis - Vertical and Horizontal integration - Integration over space, time and form-Vertical coordination.

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Theory of storage - Introduction to Commodities markets and future trading - Basics of commodity futures - Operation Mechanism of Commodity markets - Price discovery - Hedging and Basis - Fundamental analysis - Technical Analysis - Role of Government in promoting commodity trading and regulatory measures.

Practical:

Supply and demand elasticities in relation to problems in agricultural marketing. Price spread and marketing efficiency analysis. Marketing structure analysis through concentration ratios. Performance analysis of Regulated market and marketing societies. Analysis on contract farming and supply chain management of different agricultural commodities, milk and poultry products. Chain Analysis quantitative estimation of supply chain efficiency - Market Intelligence - Characters. Accessibility, and Availability Price forecasting. Online searches for market information sources and interpretation of market intelligence reports -commodity outlook - Technical Analysis for

important agricultural commodities - Fundamental Analysis for important agricultural commodities - Presentation of the survey results and wrap-up discussion.

AGECON 506 RESEARCH METHODOLOGY FOR SOCIAL SCIENCES 3(2+1)

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

Theory

UNIT I

Importance and scope of research in agricultural economics.Types of research - Fundamental vs. Applied.Concept of researchable problem - research prioritization - selection of research problem.Approach to research - research process.

UNIT II

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

UNIT III

Sampling theory and sampling design - sampling error - methods of sampling - probability and non-probability sampling methods - criteria to choose.Project proposals - contents and scope- different types of projects to meet different needs - trade-off between scope and cast of the study. Research design and techniques - types of research design.

UNIT IV

Data collection - assessment of data needs - sources of data collection - discussion of different situations. Mailed questionnaire and interview schedule – structured, unstructured, open ended and closed-ended questions. Scaling Techniques.Preparation of schedule - problems in measurement of variables in agriculture.Interviewing techniques and field problems- methods of conducting survey - Reconnaissance survey and Pre testing.

UNIT V

Coding editing - tabulation - validation of data.Tools of analysis - data processing.Interpretation of results - Preparing research report / thesis - Universal procedures for preparation of bibliography - writing of research articles.

Practical:

Exercises in problem identification.Project proposals - contents and scope.Formulation of Objective and hypotheses. Assessment of data needs - sources of data -methods of collection of data. Methods of sampling - criteria to choose - discussion on sampling under different situations. Scaling Techniques - measurement of scales. Preparation of interview schedule - Field testing.Method of conducting survey. Exercise on coding. editing. tabulation and validation of data. Preparing for data entry into computer.Hypothesis testing - Parametric and Non-Parametric Tests.Exercises on format for Thesis / Report writing.Presentation of the results.

AGECON 507 ECONOMETRICS 3 (2+1)

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical:

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

AGECON 508 LINEAR PROGRAMMING 3(2+1)

Objective: To provide knowledge of linear programming technique to solve the various problem of given objective.

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

Practical: Graphical and algebraic formulation of linear programming models. Solving of maximization and minimization problems by simplex method.Formulation of the simplex matrices for typical farm situations.

AGECON 509 AGRICULTURAL FINANCE AND PROJECT MANAGEMENT

3(2+1)

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

Theory

UNIT I

Role and Importance of Agricultural Finance.Financial Institutions and credit flow to rural/priority sector. Agricultural lending - Direct and Indirect Financing - Financing through Co-operatives, NABARD and Commercial Banks and RRBs. District Credit Plan and lending to agriculture/priority sector. Micro-Financing and Role of MFI's - NGO's, and SEIG's.

UNIT II

Lending to farmer - The concept of 3 C's. 7 Ps and 3R's of credit. Estimation of Technical feasibility, Economic viability and repaying capacity of borrowers and appraisal of credit proposals. Understanding lenders and developing better working relationship and supervisory credit system. Credit inclusions • credit widening and credit deepening.

UNIT Ill

Financial Decisions - Investment, Financing, Liquidity and Solvency. Preparation of financial statements - Balance Sheet, Cash Flow Statement and Profit and Loss Account. Ratio Analysis and Assessing the performance of farm/firm.

UNIT IV

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

UNIT V

Risks in financing agriculture. Risk management strategies and coping mechanism. Crop Insurance programmes - review of different crop insurance schemes - yield loss and weather based insurance and their applications.

Practical: Development of Rural Institutional Lending • Branch expansion, demand and supply of institutional agricultural credit and over dues and loan waiving- : An overview, Rural Lending Programmes of Commercial Banks, Lead Bank Scheme- Preparation of District Credit Plan. Rural

Lending Programmes of Co-operative Lending Institutions. Preparation of financial statements using farm/firm level data, Farm credit appraisal techniques and farm financial analysis through financial statements. Performance of Micro Financing Institutions - NGO's and Self-I help Groups. Identification and formulation of investment projects, Project appraisal techniques Undiscounted Measures and their limitations. Project appraisal techniques Discounted Measures, Network techniques - PERT and CPM for project management, Case Study Analysis of an Agricultural project. Financial Risk and risk management strategies - crop insurance schemes. Financial instruments and methods E- banking. Kisan Cards and core banking.

AGECON 510 RURAL MARKETING 3(2+1)

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

Theory
UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical: Survey of rural market both primary and secondary, case study of marketing of a minor and major commodity with respect to rural marketing channels, casts, margin and market price spread, market performance and rural market efficiency. On line searches for rural market information sources and interpretation of market intelligence report, submission of a report on above all aspects.

AGECON 511 INTERNATIONAL ECONOMIC 4(3+1)

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

Theory
UNIT I

Scope and Significance of International Economics - The role of trade- General Equilibrium in a Closed Economy (Autarky Equilibrium) - Equilibrium in a Simple Open Economy -Possibility of World trade - trade gains and Trade Equilibrium.

UNIT II

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

UNIT III

Export Supply Elasticity and Import Demand Elasticity - Comparative Advantage and Absolute Advantage.

UNIT IV

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

UNIT V

IMF, World Bank, IDA, IFC, ADB - International Trade agreements - Uruguay Round – GATT-WTO.

Practical

Producer's Surplus, Consumer's Surplus, National Welfare under Autarky and tree Trade Equilibrium with small and large country assumption- Estimation of Trade Gains-Estimation of competitive and comparative measures like NPC. EPC, ERP and DRC-Estimation of Offer Curve Elasticity- Estimation of Effect of Tariff, Export Subsidy.Producer Subsidy, Import Quota and Export Voluntary Restraints on National Welfare.

AGECON 512 AGRICULTURAL DEVELOPMENT AND POLICIES 4(4+0)

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

Theory

UNIT I

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

UNIT II

Economic development - meaning, stages of economic development, determinants of economic growth. Role of state in economic development - Government measures to promote economic development. Introduction to development planning.

UNIT III

Role of agriculture in economic / rural development - theories of agricultural development - Population and food supply - need for sound agricultural policies - resource policies - credit policies - input and product marketing policies - price policies.

UNIT IV

Development issues, poverty, inequality, unemployment and environmental degradation - Models of Agricultural Development - Induced Innovation Model -policy options for sustainable agricultural development.

UNIT V

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

ACECON 513 INSTITUTIONAL ECONOMICS 4(4+0)

Objective: The course exposes the students to the institutional problems and remedies. Theory

UNIT I

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

UNIT II

Institutional change and economic performance - national and international economic institutions. Transaction cost economics - Transaction costs and the allocation of resources.

Transaction costs and efficiency. Asymmetric information - Moral hazard and Principal-Agent problem.

UNIT III

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

UNIT IV

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

UNIT V

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

AGECON 514 NATURAL RESOURCE AND ENVIRONMENTAL ECONOMICS 4(3+1)

Objectives • To introduce economics principles related to natural resource and environmental economics • To explore the concept of efficiency and the efficient allocation of natural resources • To understand the economics of why environmental problems occur.

• To explore the concept of efficiency and the efficient allocation of pollution control and pollution prevention decisions. • To understand the environmental policy issues and alternative instruments of environmental policies.

Theory
UNIT I

Concepts, Classification and Problems of Natural Resource Economics - Economy - Environment interaction –The Material Balance principle, Entropy law- Resources Scarcity - Limits to Growth -Measuring and mitigating natural resource scarcity Malthusian and Recardian scarcity - scarcity indices - Resource Scarcity and Technical Change.

UNIT II

Theory of optimal extraction renewable resources -economic models of oil extraction- efficiency - time path of prices *and* extraction • Hotelling's rule.Solow-Harwick's Rule.Theory of optimal extraction exhaustible resources - economic models of forestry and fishery.

UNIT III

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

UNIT IV

Environmental perspectives– biocentrism, Sustainability, anthropocentrisrn- Environmental problems and quality of environment - Sources and types of pollution -air, water, solid waste, land degradation - environmental and economic impacts - Economics of pollution control - efficient reduction in environmental pollution.

UNIT V

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

UNIT VI

Concept of sustainable development - Economic Perspective - Indicators of sustainability Relation between development and environment stress- Environmental Ktznet,s curve Environmental Accounting - resource accounting methods - International Environmental Issues - climate change -likely impacts - mitigation efforts and international treaties.

Practical:

Exhaustible resource management -optimum rate of oil extraction.Renewable resource management -optimum harvest of Forestry/fishery. Exercise on pollution abatement **-I.** Exercise on pollution abatement -II. Concepts in valuing the environment.Taxonomy of valuation techniques. Productivity change method - substitute cost method - Hedonic price method - Travel cost method-Contingent valuation methods. Discount rate in natural resource management. Environment impact assessment Visit to Pollution Control Board.

AGECON 515 COMMODITY FUTURES TRADING 4 (4+0)

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

AGECON 517 Thesis / Research Project

Aim of introducing thesis in M.Sc. (Ag.) Agricultural Economics is to give the students preliminary exposure for conducting the research and presenting its findings systematically and scientifically in a manuscript shape. To fulfill this goal, a specific topic for thesis research shall be assigned to eligible student by the teacher(s) /supervisor(s) of the department. Student will submit a written report to the department before commencement of the examination of the final semester. Thesis/report will be evaluated by the external examiners. The external examiners will also conduct the viva-voce based on project report.

Common Course for M.Sc. (Ag.)

CA 501 COMPUTER APPLICATION IN AGRICULTURE 2(1+1)

Theory

Introduction to Computers, Operating Systems, definition and types, Applications of MS-Office 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, Smart phone Apps in Agriculture for farm advises, market price, post harvest 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. Int6duction 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-EXCEI. - 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/CmpSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial Technology for generating valu2ble information for Agriculture.Hands on Decision Support System.Preparation of contingent crop planning.

Common Course for M.Sc. (Ag.)

AS 501 Agricultural Statistics 3(2+1)

Theory

Unit-I

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

Unit II :

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

Unit III :

Introduction to theory of estimation and confidence-intervals. Correlation and regression, Simple and multiple linear regression model, estimation of parameters. predicted values and residuals, correlation coefficient partial correlation coefficient, multiple correlation coefficient, rank correlation coefficient. Test of significance of correlation coefficient and regression coefficients, coefficient of determination.

Unit IV

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

Unit V

Uniformity trails, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing plot techniques, split plot design.

Unit VI

Sampling techniques - Planning of survey, method of data collection, questionnaire v/s schedule. Problems of sampling frame, choice of sample of design, probability sampling, sample space, sampling design, simple random sampling, Estimation of proportion, confidence interval, determination of sample size, stratified sampling, cluster sampling, multi-state sampling, systematic sampling, ratio and regression method of estimation. Non sampling error source and classification,

Practical

On the topic listed on the theory syllabus.

COMPULSORY NON-GRADIAL COURSES

(Compulsory for Master's programme in all disciplines; Optional for Ph.D. scholars)

CODE	COURSE TITLE	CREDITS
PGS 501	Library and information services	1(0+1)
PGS 502	Technical writing and Communications skills	1(0+1)
PGS 503 (e-Course)	Intellectual Property and its Management in Agriculture	1(1+0)
PGS 504	Basic concepts in Laboratory Techniques	1(0+1)
PGS 505 (e-Course)	Agricultural Research, Research ethics and Rural Development Programmes	1(1+0)
PGS 506 (e-Course)	Disaster Management	1(1+0)

COURSE CONTENTS

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

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer: Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index. Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey: Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

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

Objective

To equip the students/scholars with skills to Milt dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

Technical Writing - Various forms of scientific writings- theses, technical papers. reviews, manuals. etc.; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction. review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries. precis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of

tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

PGS 503: INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE 1(1+0)

(e-Course)

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPs Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout. tradesecrets and traditional knowledge, trademarks. protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters. protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

PGS 504; BASIC CONCEPTS IN LABORATORY TECHNIQUES 1(0+1)

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strength an their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralization of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy.

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

(e-Course)

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Theory

UNIT 1

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (COIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT II

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT III

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group -Area Specific Programme, Integrated Rural Development Programme(IRDF) Panchayati Raj Institutions, Co-operatives, Voluntary Ageneles/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes.Constraints in implementation of rural policies and programmes.

PGS 506: DISASTER MANAGEMENT 1(1+0)

(e-Course)

Objectives

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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