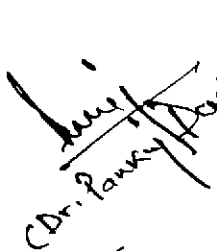



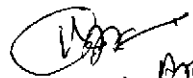
**NEW AND RESTRUCTURED
UNDER GRADUATE CURRICULA & SYLLABUS**

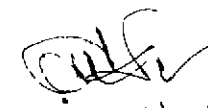
**B.Sc. (Agriculture)
w.e.f. 2019-20**

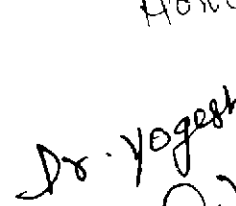
**Semester System as per ICAR
Vth Deans Committee Report**

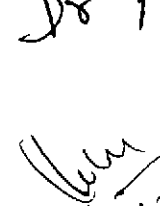

CDR. PANKAJ PRASAD
(Dr. P.K.R. Dut)


(Dr. Manoj Kumar Prajapati)


Dr. Anil Kumar
Smt. Seema Devi
(Dr. M.P. SINHA)


Dr. Sangeet Kumar
Horticulture


Dr. Yogesh Kumar


Dr. Dharmendra Kumar

Submitted by:

**Board of Studies in Agriculture
C.S.J.M. University, Kanpur**


(DR. RAJEEV KUMAR)

Ist Semester

Fundamentals of Agronomy	3	AG-101	
Fundamentals of Genetics	3	AG-102	
Fundamentals of Soil Science	3	AG-103	
Fundamentals of Horticulture	2	AG-104	
Rural Sociology & Educational Psychology	2	AG-105	
Introduction to Forestry	2	AG-106	
Introductory Animal Husbandry	3	AG-107	
Comprehension & Communication Skills in English	2	AG-108	
Agricultural Heritage	1	AG-109	
Introductory Biology/Basic Agriculture-I	2	AG-110A/ AG-110B	
Elementary Mathematics/ Basic Agriculture-II	2	AG-111A/ AG-111B	
NSS/NCC/Physical Education & Yoga Practices	2	AG-112A/ AG-112B/ AG-112C	27

IInd Semester

Fundamentals of Crop Physiology	3	AG-201	
Fundamentals of plant biochemistry	3	AG-202	
Fundamentals of Entomology-I	3	AG-203	
Fundamentals of Agricultural Economics	2	AG-204	
Principles of Organic Farming	2	AG-205	
Fundamentals of Plant Pathology	4	AG-206	
Production Technology for Vegetables and Spices	2	AG-207	
Fundamentals of Agricultural Extension Education	3	AG-208	
Food Processing and Safety Issues	3	AG-209	
Human Values & Ethics	1	AG-210	26

IIIrd Semester

Crop Production Technology -I (<i>Kharif</i> /crops)	2	AG-301	
Practical Crop Production -I (<i>Kharif</i> crops)	2	AG-302	
Fundamentals of Plant Breeding	3	AG-303	
Agricultural Microbiology	2	AG-304	
Agricultural Finance and Co-Operation	3	AG-305	
Farm Machinery and Power	2	AG-306	
Principles of Integrated Disease Management	3	AG-307	
Environmental Studies & Disaster Management	3	AG-308	
Statistical Methods	2	AG-309	
Soil and Water Conservation Engineering	2	AG-310	
Dairy Science	3	AG-311	
Fundamentals of Entomology-II	2	AG-312	29

IVth Semester

Crop Production Technology - II (<i>Rabi</i> crops)	2	AG-401	
Practical Crop Production - II (<i>Rabi</i> crops)	2	AG-402	
Principles of Seed Technology	3	AG-403	
Problematic soils and their Management	2	AG-404	
Renewable Energy and Green Technology	2	AG-406	
Production Technology for Ornamental Crops, MAP and Landscaping	2	AG-407	
Entrepreneurship Development and Business Communication	2	AG-408	
Introductory Agro-meteorology & Climate Change	2	AG-409	
Agri- Informatics	2	AG-410	
Poultry Production & Management	3	AG-411	22

Vth Semester			
Rainfed and dryland Agriculture	2	AG-501	
Crop Improvement-I (<i>Kharif</i> crops)	2	AG-502	
Pests of Crops and Stored Grain and their Management	3	AG-503	
Agricultural Marketing Trade & Prices	3	AG-504	
Protected Cultivation and Secondary Agriculture	2	AG-505	
Diseases of Field and Horticultural Crops and their Management-I	3	AG-506	
Production Technology for Fruit and Plantation Crops	2	AG-507	
Communication Skills and Personality Development	2	AG-508	
Intellectual Property Rights	1	AG-509	
Principles of Food Science & Nutrition	3	AG-510	
Geo-informatics and Nanotechnology	2	AG-511	
Elective-1(AGE-51/ AGE-52/ AGE-53/ AGE-54/ AGE-55/ AGE-56)	3	AGE	28
VIth Semester			
Farming System, Precision Farming & Sustainable Agriculture	2	AG-601	
Crop Improvement-II (<i>Rabi</i> crops)	2	AG-602	
Manures, Fertilizers and Soil Fertility Management	3	AG-603	
Farm Management, Production & Resource Economics	2	AG-604	
Diseases of Field and Horticultural Crops and their Management-II	3	AG-605	
Post-harvest Management and Value Addition of Fruits and Vegetables	2	AG-606	
Watershed and Wasteland Management	2	AG-607	
Beneficial insects and Pest of Horticultural Crops and their Management	3	AG-608	
Elective-2(AGE-61/ AGE-62/ AGE-63/ AGE-64/ AGE-65/ AGE-66)	3	AGE	
Educational Tour	2	AGT-99	24

VIIth Semester

VIIth Semester			
SN.	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)		
	Activities	No. of weeks	Credit Hours
1	General orientation & On campus training by different faculties	1	14
2	Village attachment	8	
	Unit attachment in Univ./ College. KVK/ Research Station Attachment	5	
3	Plant clinic	2	02
	Agro-Industrial Attachment	3	04
4	Project Report Preparation, Presentation and Evaluation	1	
Total weeks for RAWE & AIA		20	20

RAWE Component -II

Agro Industrial Attachment

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for 03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing- value addition, Agri-finance institutions, etc.

Activities and Tasks during Agro-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry
- Study of various processing units and hands-on trainings under supervision of industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students

VIIIth semester

Modules for Skill Development and Entrepreneurship: A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in **the viii sem.**

Sr.	Title of the module	Credits
1.	Production Technology for Bioagents and Biofertilizer	0+10
2.	Seed Production and Technology	0+10
3.	Mushroom Cultivation Technology	0+10
4.	Soil, Plant, Water and Seed Testing	0+10
5.	Commercial Beekeeping	0+10
6.	Poultry Production Technology	0+10
7.	Commercial Horticulture	0+10
8.	Floriculture and Landscaping	0+10
9.	Food Processing	0+10
10.	Agriculture Waste Management	0+10
11.	Organic Production Technology	0+10
12.	Commercial Sericulture	0+10

Evaluation of Experiential Learning Programme/ HOT

Sl.No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	100

Discipline-wise summary of credit hours

S.N.	Group	Credits
1.	Agronomy	17'
2.	Genetics & Plant Breeding	20
3.	Soil Science & Agricultural Chemistry	15
4.	Entomology	11
5.	Agricultural Economics	10
6.	Agricultural Engineering	8
7.	Plant Pathology	13
8.	Horticulture	10
9.	Agricultural Extension	9
10.	Soil conservation	9
11.	Statistics, Computer Application and I.P.R.	4
12.	Animal Husbandry and Dairying	15
13.	English	2
14.	Remedial Courses*	05 (Bio/Math); 05 (Agriculture)
15.	NSS/NCC/Physical Education & Yoga Practices**	2
16.	Human Values and Ethics**	1
17.	Educational Tour**	2
	Total	143 + 5* + 5** + 6 credits elective =159
	RAWE	20+20
	ELP	
	Grand Total	159+20+20=199

* Remedial courses

** Non-gradual courses

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

S.N.	Courses	Credit Hours	
1.	Agribusiness Management	3(2+1)	AGE-51
2.	Agrochemicals	3(2+1)	AGE-52
3.	Commercial Plant Breeding	3(1+2)	AGE-53
4.	Landscaping	3(2+1)	AGE-54
5.	Food Safety and Standards	3(2+1)	AGE-55
6.	Biopesticides & Biofertilizers	3(2+1)	AGE-56
7.	Protected Cultivation	3(2+1)	AGE-61
8.	Hi-tech. Horticulture	3(2+1)	AGE-62
9.	Weed Management (Deptt. of Agronomy)	3(2+1)	AGE-63
10.	System Simulation and Agro-advisory (Soil Conservation)	3(2+1)	AGE-64
11.	Agricultural Journalism	3(2+1)	AGE-65
12.	Composition cum Duck/ (and) Quail/ (and) Rabbit culture.	3(2+1)	AGE-66

AGRONOMY

1. Fundamentals of Agronomy

3(2+1) AG-101

Theory

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water.

Weeds- importance, classification, crop weed competition, concepts of weed management- principles and methods, herbicides- classification, selectivity and resistance, allelopathy. Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, harvesting and threshing of crops.

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements. Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation. Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Study of soil moisture measuring devices, Measurement of irrigation water.

2. Crop Production Technology-I (Kharif Crops)

2(1+1) AG-301

Theory

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

Practical

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

3. Crop Production Technology-II (Rabi crops)

2(1+1) AG-401

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals -wheat, barley and oat, pulses-chickpea, lentil, peas, oilseeds-rapeseed, mustard, linseed and sunflower; sugar crops-sugarcane; other crop-Potato. Forage crops-berseem, lucerne and oat.

Practical

Sowing methods of wheat and sugarcane, identification of weeds in *rabi* season crops. Numerical problems on seed requirement of rabi crop. Study of yield contributing characters of *rabi* season crops, study of important agronomic experiments of *rabi* crops at experimental farms. Study of *rabi* forage experiments, visit to research stations of related crops.

4. Farming System, Precision Fanning and Sustainable Agriculture

2(1+1) AG-601

Theory

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming. Farming system components and their maintenance, Cropping system and pattern, multiple cropping system. Efficient cropping system and their evaluation, Sustainable agriculture-problems and its impact on agriculture, conservation agriculture strategies, HEIA, LELA and LEISA and its techniques for sustainability, Integrated farming system components of IFS and its advantages, farming system and environment.

Practical

- Tools for determining productions & efficiencies in cropping and farming systems.
- Indicators of sustainability of cropping & Fanning 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.

5. Practical Crop Production-I (*Kharif Crops*)

2(0+2) AG-302

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

6. Practical Crop Production-II (*Rabi Crops*)

2(0+2) AG-402

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

7. Principles of Organic Farming

2(1+1) AG-205

Theory

Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture. Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Certification process and standards Of organic farming.

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Quality aspect, grading, packaging and handling.

8. Rain fed and Dryland Agriculture:

2(1+1) AG-501

Theory

Rainfed and dryland agriculture - Introduction, types and history. Problems & prospects of rainfed agriculture in India. Soil and climatic conditions prevalent in rainfed areas. Drought: types, effect of water deficit on physio - morphological characteristics of the plants. Mechanism of crop adoption under moisture deficit conditions. Efficient utilization of water through soil and crop management practices, management of crops in rainfed areas. Contingent crop planning for aberrant weather conditions. Precision agriculture; concepts and techniques; their issues and concerns for Indian agriculture.

Practical

Studies on climatic classifications, studies on rainfall pattern in rainfed areas of the country. Studies on cropping pattern of different dryland areas in the country and demarcation of dryland area on map of India. Interpretation of metrological data and scheduling of supplemental irrigations on the basis of evapo-transpiration demand of crops effective rainfall and its calculations. Visit to rainfed research stations/watersheds.

DEPARTMENT OF GENETICS AND PLANT BREEDING

Course Code	Course Title	Credit Hours
AG-102	Fundamentals of Genetics	3(2+1)
AG-303	Fundamentals of Plant Breeding	3(2+1)
AG-502	Crop Improvement - I (<i>Kharif</i> Crops)	2(1+1)
AG-509	Intellectual Property Right	1(1+0)
AG-602	Crop Improvement - II (<i>Rabi</i> Crops)	2(1+1)
AG-403	Principles of Seed Technology	3(2+1)
AG-201	Fundamentals of Crop Physiology	3(2+1)
AG-308	Environmental Studies and Disaster Management	3(2+1)

Course wise Syllabus

Fundamentals of Genetics

3(2+1) AG-102

Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosome; special types of chromosomes. Chromosomal theory of inheritance; cell cycle and cell division - mitosis and meiosis. Chi-square test; Dominance relationships, Epistatic interactions; Multiple alleles, pleiotropism and pseudoalleles. Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural and numerical variations in chromosome and their implications, use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CLB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis. Cytoplasmic inheritance. Genetic disorders. Nature, structure & replication of genetic material (DNA). Protein synthesis, Transcription and translational mechanism of genetic material. Gene concept: Gene structure, function and regulation.

Practical

Study of microscope. Study of cell structure. Mitosis and Meiosis cell division. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test. Determination of linkage and cross-over analysis (through two point test cross and three point test cross data). Study on sex linked inheritance in *Drosophila*. Study of models on DNA and RNA structures.

Fundamentals of Plant Breeding

3(2+1) AG-303

Theory

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

Practical

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

Theory

Centers of origin, distribution of species, wild relatives in different cereals (Rice, Maize, Sorghum and Pearl millet); pulses (Pigeonpea, Urdbean and Mungbean); oilseeds (Groundnut); fibre (Cotton). Important concepts of breeding self-pollinated and cross pollinated. Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress and quality (physical, chemical, nutritional); Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea.

Practical

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl millet, Pigeonpea, Urdbean, Mungbean, Groundnut, Cotton crops. Maintenance breeding of different *kharif* crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Kharif* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

Crop Improvement - II (*Rabi*)**Theory**

Centers of origin, distribution of species, wild relatives in different crops: cereal (Wheat); pulses (Chickpea, Pea); oilseeds (Rapeseed and Mustard, Sunflower); cash crop (Sugarcane); vegetable crop (Potato, Tomato); Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology of *rabi* crops.

Practical

Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Chickpea, pea, Rapeseed Mustard, Sunflower, Tomato; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Rabi* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

Principles of Seed Technology**Theory**

Seed and seed production technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production. Seed quality; Definition and Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983. Varietal Identification through Grow Out Test. History and development of Seed Industry in India. Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage. Seed marketing, Private and public sectors and their production and marketing strategies.

Practical

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

Theory

Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms; Photosynthesis: Light and Dark reactions, C₃, C₄ and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

Practical

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO₂ assimilation by Infra Red Gas Analyser (IRGA).

Environmental Studies and Disaster Management**3(2+1) AG-308****Theory**

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

Disaster Management

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, ozone depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution. Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community - based organizations and media. Central, state, district and local administration.

Practical

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

Intellectual Property Rights**1(1+0) AG-509****Theory**

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection; Types of Intellectual Property and legislations covering IPR in India: - Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing. Patent Cooperation Treaty, Patent search and patent database. Origin and history including a brief introduction to UPOV for protection of plant varieties. Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeder's rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. International treaty on plant genetic resources for food and agriculture (ITPGRFA).

SOIL SCIENCE & AGRICULTURAL CHEMISTRY

1. Fundamentals of Soil Science

3(2+1) AG-103

Theory

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy, classification of soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth, Soil reaction-pH, EC, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties. Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel method. Determination of soil pH and electrical conductivity. Study of soil map. Estimation of organic matter content of soil. Estimation of CO_3 and HCO_3 in soil water

2. Agricultural Microbiology

2(1+1) AG-304

Theory

Introduction of Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon. Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation- symbiotic, associative and a symbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: biofertilizers, biopesticides, biofuel production and biodegradation. Microbial degradation of organic matter in soil. Cellulose decomposing micros for composed preparation & vermin composed. Soil organisms: macro and micro organisms, their beneficial and harmful effects.

Practical

Introduction to microbiology laboratory and its equipments; principles of microscopy. Methods of sterilization. Nutritional media and their preparations. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. Methods of isolation and purification of microbial cultures. Isolation of *Rhizobium* from legume root nodule. Isolation of *Azotobacter* from soil. Isolation of *Azospirillum* from roots. Isolation of BGA. Staining and microscopic examination of microbes.

3. Fundamentals of Plant Biochemistry

3(2+1) AG-202

Theory

Biochemistry- introduction, scope and Importance in agriculture. Carbohydrate: Importance and classification of Monosaccharides, Disaccharides and Polysaccharides. Lipid: Importance and classification; Structures and properties of fatty acids; lipids. Proteins: Importance of proteins and classification; Structures. Amino acid- definition, classification and important function. Structural organization of proteins. Enzymes: General properties; Classification; Mechanism of action; classification of vitamin structure role and its deficiency symptoms. Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides. Metabolism of carbohydrates: Glycolysis.

Practical

Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Paper chromatography Monosaccharides. Estimation of Ca, CaO and CaCO₃ in Hcl extract. Estimation of reducing and non reducing in cane sugar and jaggary.

4. Manures, Fertilizers and Soil Fertility Management

3(2+1) AG-603

Theory

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. History of soil fertility and plant nutrition, criteria of essentiality, role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation. Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical

Estimation of soil organic carbon, Estimation of available N available P, available K; available S available Ca and Mg and available Zn in soils. Estimation of N, P & K in plants, manures and fertilizers. Elementary idea of determination micro nutrients.

5. Problematic Soils and their Management (New)

2(1+1) AG-404

Theory

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils. Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, & Polluted soils. Irrigation water - quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species,

bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.

Practical

Determination of pH & Ec in soil and water. Lime and gypsum requirement in soil, ESP and SAR in Soils.

Application of remote sensing and GIS in delineating problematic soil in UP. Visit problematic soil in U.P.

6. Geo-informatics, Nano-technology

2(1+1) AG-511

Theory

Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors. Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

Practical

Introduction to GIS software, Introduction to image processing software. Visual interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation., Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

ENTOMOLOGY

	Course code	semester	Name of papers	Credit hrs.
1	AG-203	II	Fundamentals of Entomology-I (Insect Morphology and Taxonomy)	3 (2+1)
2	AG-312	III	Fundamentals of Entomology-II (Insect Ecology and concept of IPM)	2 (1+1)
3	AG-503	V	Pests of Field crops & Stored Grain and their Management	3 (2+1)
4	AG-608	VI	Beneficial insects and Pest of Horticultural Crops and their Management	3 (2+1)

1. FUNDAMENTALS OF ENTOMOLOGY-I (INSECT MORPHOLOGY & TAXONOMY)

3(2+1) AG-203

Theory

Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and moulting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, wing venation, modifications and wing coupling apparatus. Structure of male and female genital organs. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive systems in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes and chemoreceptors. **Systematics:** Taxonomy -importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like **Orthoptera:** Acrididae, **Dictyoptera:** Mantidae, **Odonata;** **Isoptera:** Termitidae; **Thysanoptera:** Thripidae; **Hemiptera:** Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; **Lepidoptera:** Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; **Coleoptera:** Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; **Hymenoptera:** Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; **Diptera:** Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper);

Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

2. FUNDAMENTALS OF ENTOMOLOGY-II (INSECT ECOLOGY & CONCEPTS OF IPM)

2(1+1) AG-312

Theory

Insect Ecology:

Introduction, Environment and its components. Effect of abiotic factors- temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors - food competition, natural and environmental resistance.

IPM:

Categories of pests. Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control- importance, hazards and limitations. Recent methods of pest control, repellents, anti feed ants, hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes. Survey, surveillance and forecasting of insect pests. Safety issues of pesticides uses.

Practical

Sampling techniques for estimation of insect population and damage. Insecticides and their formulations. Pesticide appliances and their maintenance.

3. PESTS OF FIELD CROPS, STORED GRAINS AND THEIR MANAGEMENT 3(2+1) AG-503

Theory

General account on nature and type of damage by following insect pests arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests(mites) of various field crops. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

Paddy: *Leptocorisa varicornis*, *Hieroglyphus Spp.*, *Nilaparvata lugens*, *Nephotetix, spp.*, *Mythimna separata*.

Jowar Maize: *Chilo partellus*, *Atherigona varisocata*, *Scirpophaga excerptalis*, *Chilo infuscatelles*

Sugarcane: *Top borer*, *Pyrilla*, *Early Shoot borer and white fly*

Cotton: *Pectinophora gossypiella*, *Earias Spp*, *Sylepta derogata*, *Dysdercus Spp*, *Bemisia tabaci*, *Amrasca bigutulla*.

Oilseeds: *Lipaphis erysimi*, *Athalia proxima* *Bagrada Cruciferarun*, *Dasyneura lini*.

Pulses: *Helicoverpa armigera* *Agrotis Spp.*, *Etiella zinckenella*

Pests of Stored Grains: *Sitophilus oryzae*, *Trogoderma granarium*, *Sitotroga cerealella*, *Callosobruchus chinensis*.

Polyphagous pests: *Odontotermes obesus*, *Holotrichia consanguinea*, *Spilosoma obliqua*, *Spodoptera litura*, *Amsacta Spp*

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking field crops and their produce. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

4. BENEFICIAL INSECTS and PESTS OF HORTICULTURAL CROPS AND THEIR MANAGEMENT

3 (2+1) AG-608

Theory

General account on nature and type of damage by different arthropod pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific names. order, family, host range, distribution, nature of damage and control practices for other important arthropod pests of various vegetable crops, fruit crops, plantation crops, ornamental crops and major pests of narcotics, spices and condiments. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties, methods of harvesting and preservation of leaves. Rearing of mulberry silkworm, rearing appliances, mounting and harvesting of cocoons. Pests and diseases of silkworm, management, and methods of disinfection.

Importance of beneficial insects, bee keeping, pollinating plants and their cycle, bee biology, commercial methods of rearing, equipment used and seasonal management. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee.

Species of lac insect, morphology, biology, host plant and lac production - Processing of lac - seed lac, button lac, shellac and lac- products.

Identification of major parasitoids and predators commonly used in biological control.

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking horticultural crops - vegetable crops, fruit crops, plantation gardens, narcotics, spices & condiments. Visit to orchards and gardens.

Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Types of silkworm, voltinism and biology and rearing of silkworm and equipment. Honey bee species and castes of bees. Beekeeping appliances and seasonal management. Bee enemies and diseases. Bee pasturage, bee foraging and communication. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to sericulture, beekeeping, lac culture and natural enemies.

AGRICULTURAL ECONOMICS

1. Fundamentals of Agricultural Economics

2 (2+0) AG-204

Theory

Economics Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. *Demand*: meaning, law of demand, demand schedule and demand curve, determinants, utility theory: law of diminishing marginal utility, equimarginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Concepts of rent, wage, interest and profit. *National income*: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation, public revenue and public expenditure. *Tax*: meaning, direct and indirect taxes, agricultural taxation, VAT. *Economic systems*: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

2. Agricultural Marketing, Trade and Prices

3(2+1) AG-504

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus - meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; cost based and competition based pricing; market promotion - advertising, personal selling, sales promotion and publicity - their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions - buying and selling; physical functions - storage, transport and processing; facilitating functions - packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt, in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI - their objectives and functions; cooperative

marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR GST.

Practical

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

3. Farm Management, Production and Resource Economics

2(1+1) AG-604

Theory

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance - weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the

estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

4. Agricultural Finance and Co-Operation

3(2+1) AG-305

Theory

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks. Micro financing including K.C.C. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions - RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements - Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms - SWOT analysis. Agricultural Cooperation - Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED.

Practical

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

AGRICULTURAL ENGINEERING

1. Soil and Water Conservation Engineering

2(1+1) AG-310

Theory

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

Practical

General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion.

2. Farm Machinery and Power

2(1+1) AG-306

Theory

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

Practicals

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

3. Renewable Energy and Green Technology

2(I+I) AG-406

Theory

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

Practical

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

4. Protected Cultivation and Secondary Agriculture

2(I+I) AG-505

Theory

Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying.

Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation. Drying and dehydration; moisture measurement, EMC, drying theory. various drying method. commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical

Study of different type of green houses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of green house equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying & infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials). Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant.

PLANT PATHOLOGY

1. Fundamentals of Plant Pathology

4(3+1) AG-206

Theory

Introduction: Importance of plant diseases, scope and objective of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concept in Plant Pathology, Pathogenesis, diseases triangle and tetrahedron and classification of plant diseases, Important Plant pathogenic organism fungi, bacteria, fastidious vesicular bacteria, Phytoplasmas, Spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasite and nematodes with example of diseases caused by them. Diseases due to abiotic causes.

Fungi: general character, definition of fungus, somatic structures, type of fungus thalli, fungal tissues, modifications of thallus, reproduction (Asexual and Sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi, key to divisions, sub-divisions, orders and classes.

Bacteria and mollicutes: general morphological characters, basic methods reproduction.

Viruses: nature of properties, structure and transmission.

Study of phanerogamic plant parasites.

Epidemiology: Factors affecting disease development.

Practical

Acquaintance with various laboratory equipments and microscopy. Collection and preservation of disease specimen.

Preparation of media, isolation and Koch's postulates. General study of different structure of fungi, study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria.

Study of phanerogamic plant parasites. Identification of plant parasitic nematodes.

2. Diseases of Field and Horticultural Crops & their Management-I

3(2+1) AG-506

Theory

Symptoms, etiology, disease cycle and management of major diseases of following crops:

Field Crops: Rice: Blast, Brown spot, Bacterial Blight, Sheath blight, false smut, Khaira and tungro; Maize: stalk rots, downy mildew; Sorghum: smuts; Bajra: downy mildew and ergot; Groundnut: early and leaf spots; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Green gram: Cercospora leaf spot, web blight and yellow mosaic; Tobacco: Mosaic.

Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, sigatoka and bunchy top; Papaya: foot rot and leaf curl.

Cruciferous vegetable: Alternaria leaf spot and black rot; Brinjal: phomopsis blight, sclerotinia and little leaf; Tomato: early and late blight, leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: Anthracnose and bacterial blight; ginger: soft rot; Colocasia: Phytophthora blight.

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory.

Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium

Note: Students should submit 10 pressed and well-mounted specimens.

3. Diseases of Field and Horticultural Crops & their Management –II

3(2+1) AG-605

Theory

Symptoms, etiology, disease cycle and management of major diseases of following crops:

Field Crops:

Wheat: Rusts, loose smut, karnal bunt, powdery mildew, Alternaria blight and ear cockle;

Sugarcane: red rot, smut, wilt and grassy shoot

Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew; Gram: wilt and Ascochyta blight; Lentil: Rust and wilt; Cotton: Vascular wilt and black arm; Pea: Downy mildew, powdery mildew and rust.

Horticultural Crops:

Mango: Anthracnose, malformation, powdery mildew; Citrus: canker and gummosis; Grape vine: Downy mildew powdery mildew; Apple: scab and Fire blight; Peach: leaf curl;

Cucurbits: downy mildew, powdery mildew and wilt; Onion and garlic: purple blotch and stemphylium blight; Chilli: anthracnose and leaf curl; Turmeric: leaf spot; Coriander; stem gall; Marigold: Botrytis blight; Rose: dieback, powdery mildew; Potato: Early and late blight, Common scab, powdery scab, black scurf and potato mosaic.

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium

Note: Students should submit 10 pressed and well- mounted specimens.

4. Principles of Integrated Disease Management

3(2+1) AG-307

Theory

Categories of diseases, IDM: Introduction, history, importance, concepts, principles and tools of IDM. Economic importance of, diseases and Methods of detection and diagnosis of and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Survey surveillance and forecasting of diseases. Safety issues in fungicide uses. Political, social and legal implication of IDM.

Practical

Methods of diagnosis and detection of plant diseases, Methods of plant disease measurement, Assessment of crop yield losses, calculations based on economics of IDM, Identification of biocontrol agents, different predators and natural enemies. Identification and nature of damage of important diseases and their management. Plan & assess preventive strategies (IDM module) and decision making, crop monitoring attacked by diseases . Farmers fields visit.

HORTICULTURE

1. Fundamentals of Horticulture (NEW)

2(1+1) AG-104

Theory

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; use of plant bioregulators in horticulture, irrigation and fertilizers applications - method and quality.

Practical

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation Layout and planting of orchard plants. Training and pruning of fruit trees transplanting and care of vegetable seedlings making of herbaceous and shrubby borders. Preparation of potting mixture potting and repotting. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

2. Production Technology for Fruit and Plantation Crops

2(1+1) AG-507

Theory

Importance and scope of fruit and plantation crop industry in India; High density planting; Use of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, Litchi, papaya, apple, pear, peach and; minor fruits-pineapple, pomegranate, jackfruit, strawberry. nut crops; plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Practical

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

3. Production Technology for Vegetable and Spices

2(1+1) AG-207

Theory

Importance of vegetables & spices in human nutrition and national economy, types of vegetable gardening brief about origin, area, production improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting storage, physiological disorders, disease and seed production of important vegetable (potato, tomato, cauliflower, onion, okra, bottle guard and bitter guard) and spices i.e. condiments, Ginger, turmeric, coriander, cumin, funnel, black peper, ilaichi.

Practical

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