
Syllabus for
B.Sc. (Hons.) Agri.

(As per the recommendations of
Fourth Deans Committee on
Agricultural Education in India)

Agron. 2.3 Field Crops- II (Rabi)**(2+1) = 3**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi crops; Cereals: wheat, barley; Pulses: chickpea, lentil, peas, french bean; Oilseeds: rapeseed and mustard, sunflower, safflower and linseed; Sugar crops: sugarcane and sugarbeet, Medicinal and aromatic crops such as citronella, palma rosa and isabgol; Commercial crops: potato and tobacco, Forage crops: lucerne and oat.

Practical

Seed bed preparation and sowing of wheat, sugarcane and sunflower; Calculations on seed rate; Top dressing of nitrogen in wheat and study of fertilizer experiments on wheat and mustard; Identification of weeds in wheat and grain legumes, application of herbicide and study of weed control experiments; Morphological characteristics of wheat, sugarcane, chickpea and mustard; Yield contributing characters of wheat; Yield and quality analysis of sugarcane; Crop distribution in the state and the region; Important agronomic experiments of rabi crops and visit to research stations related to rabi crops.

Agron. 3.4 Practical Crop Production-I (Kharif Crops)**(0+1) = 1**

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed treatment, nursery raising, sowing, nutrient management, water management, weed management and management of insect pests and diseases of crops harvesting, threshing, drying, winnowing, storage and marketing of produce. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students.

Agron. 3.5 Weed Management**(1+1) = 2**

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy. Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological. Integrated weed management; Herbicides: advantages and limitation of herbicide usage in India, Herbicide classification, formulations, methods of application; Introduction to Adjuvants and their use in herbicides; Selectivity of herbicides; Compatibility of herbicides with other agro chemicals; Weed management in major field and horticultural crops, shift of weed flora in cropping systems, aquatic and problematic weeds and their control. Herbicide resistant crops.

Practical

Terminology used in weed management. Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of

nut sedge, bermuda grass, parthenium, tiger and jhonson grass; Economics of weed control practices; Tours and visits of problem areas.

Agron. 4.6 Practical Crop Production II (*Rabi* Crops) (0+1) = 1

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed treatment, nursery raising, sowing, nutrient management, water management, weed management and management of insect-pests and diseases of crops harvesting, threshing, drying, winnowing, storage and marketing of produce. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students.

Agron. 5.7 Water Management Including Micro Irrigation (2+1) = 3

Irrigation: definition and objectives, water resources and irrigation development in India and Gujarat; Soil plant water relationships; Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, scheduling of irrigation; Methods of irrigation: surface, sprinkler and drip irrigation; Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato); Agricultural drainage.

Practical

Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water through flumes and weirs; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability; Determination of EC, pH, carbonates, biocarbonates, Ca⁺⁺ and Mg⁺⁺ in irrigation water (quality parameters).

Agron. 6.8 Organic Farming (1+1) = 2

Introduction, concept, relevance in present context; Organic production requirements; Biological intensive nutrient management-organic manures, vermicomposting, green manuring, recycling of organic residues, biofertilizers; Soil improvement and amendments; Integrated diseases and pest management – use of biocontrol agents, biopesticides pheromones, trap crops, bird perches; Weed management; Quality considerations, certification, labeling and accreditation processors, marketing, exports.

Practical

Raising of vegetable crops organically through nutrient, diseases and pest management; vermicomposting; vegetable and ornamental nursery raising; macro quality analysis, grading, packaging, post harvest management.

Agron. 6.9 Farming Systems and Sustainable Agriculture**(1+1) = 2**

Sustainable agriculture: Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures; Land degradation and conservators of natural resources, LEIA & HEIA; Irrigation problems, waste lands and their development; Organic farming: definition, principles and components; Farming systems: definition, principles and components, IFS models for wetland, irrigated dryland and dryland situations.

Practical

Preparation of cropping scheme for irrigated situations; Preparation of cropping scheme for dryland situations; Study of existing farming systems in nearby villages; Preparation of integrated farming system model for wetlands; Preparation of integrated farming system model for drylands; Preparation of enriched Farm Yard Manure; Preparation of Vermicompost; Visit to urban waste recycling unit; Study of profitable utilization of agricultural wastes; Visit to poultry and dairy units to study resource allocation, utilization and economics; Visit to an organic farm to study various components and utilization; Study of degraded lands.

PLANT BREEDING AND GENETICS

PBG 1.1 Economic Botany

(1+1) = 2

Introduction and history of economic plants, Classification and importance of economic plants. Agriculturally important crop plants: Cereals, pulses and oilseeds, vegetables, spices and condiments, fruits and nuts; fibre yielding plants, forage crop plants. Industrially important plants: Sugar, starch and cellulose plants; fumitory and masticatory plants; beverages, dyes and tannins, gums and resins, rubber; drug plants – medicinal plants, plant insecticides, wood and timber plants. Ethnobotany, common adulterants, toxins and teratogens.

Practical

Taxonomic status of food plants, industrial plants and drug plants; Identification and extraction of Phytochemicals and valuable plant products; Propagation of Plants; Agricultural and Industrial uses of plants.

PBG 2.2 Principles of Genetics

(2+1) = 3

Mendel's laws of inheritance and exceptions to the laws; Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Quantitative traits, Qualitative traits and differences between them; Multiple factor hypothesis; Cytoplasmic inheritance, its characteristic features and difference between chromosomal and cytoplasmic inheritance; Mutation and its characteristic features; Methods of inducing mutations and C / B technique. Gene expression and differential gene activation; Lac operon and Fine structure of Gene; Ultra structure of cell and cell organelles and their functions; Study of chromosome structure, morphology, number and types, Karyotype and Idiogram; Mitosis and meiosis, their significance and differences between them; DNA and its structure, function, types, modes of replication and repair. RNA and its structure, function and types; Transcription, Translation, Genetic code and outline of protein synthesis; Crossing over and factors affecting it; Mechanism of crossing over and Cytological proof of crossing over; Linkage, Types of linkage and estimation of linkage; Numerical chromosomal aberrations (Polyploidy) and evolution of different crop species like Cotton, Wheat, Tobacco, Triticale and Brassicas; Structural chromosomal aberrations.

Practical

Microscopy (Light microscopes and electron microscopes; Preparation and use of fixatives and stains for light microscopy; Preparation of micro slides and identification of various stages of mitosis; Preparation of micro slides and identification of various stages of mitosis; Preparation of micro slides and identification of various stages of meiosis; Preparation of micro slides and identification of various stages of meiosis; Monohybrid ratio and its modifications; Dihybrid ratio and its modifications; Trihybrid ratio; Chi-square analysis and Interaction of factors; Epistatic factors, Supplementary factors and Duplicate factors; Complementary factors, Additive factors and Inhibitory factors; Linkage – Two point test cross; Linkage – Three point test cross; Induction of polyploidy using colchicines; Induction of chromosomal aberrations using chemicals.

PBG 3.3 Principles of Plant Breeding**(2+1) = 3**

Aims and objectives of Plant Breeding; Modes of reproduction, Sexual, Asexual, Apomixis and their classification; Significance in plant breeding; Modes of pollination, genetic consequences, differences between self and cross pollinated crops; Methods of breeding – introduction and acclimatization. Selection, Mass selection Johannson's pure line theory, genetic basis, pure line selection; Hybridization, Aims and objectives, types of hybridization; Methods of handling of segregating generations, pedigree method, bulk method, back cross method and various modified methods; Incompatibility and male sterility and their utilization in crop improvement; Heterosis, inbreeding depression, various theories of Heterosis, exploitation of hybrid vigour development of inbred lines, single cross and double cross hybrids; Population improvement programmes, Hardy-Weinberg Law; recurrent selection, synthetics and composites; Methods of breeding for vegetatively propagated crops; Clonal selection; Mutation breeding; Ploidy breeding; Wide hybridization, significance in crop improvement. Plant Genetic Resources, their conservation and utilization in crop improvement; ideotype concept in crop improvement; breeding resistance to biotic and abiotic stresses, variability in pathogens and pests; Mechanisms of resistance in plant pathogens and pests; Genetic basis of adaptability to unfavourable environments; definition of biometrics, assessment of variability i.e. additive, dominance and epistasis and their differentiation; genotype x environment interaction and influence on yield/ performance, IPR and its related issues.

Practical

Study of megasporogenesis and microsporogenesis; Fertilization and life cycle of an angiospermic plant; Plant Breeder's kit; Hybridization techniques and precautions to be taken; Study of male sterility and incomparibility in field plots. Handling of segregating generations, Problems on Hardy Weinberg Law; back cross methods; Field lay out of experiments; Field trials, maintenance of records and registers; Estimation of heterosis and inbreeding depression; Estimation of heritability, GCA and SCA; Estimation of variability parameters.

PBG 4.4 Breeding of Field / Horticulture Crops**(2+1) = 3**

Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Study in respect of origin, distribution of species, wild relatives and forms, Cereals, (rice, wheat, maize, millets, sorghum, bajra, ragi); Pulses (redgram, greengram, blackgram, soybean, chickpea); Oilseeds (Groundnut, sesame, sunflower, safflower, castor, mustard) etc. Fibers (Cotton, kenaf, roselle, jute) etc. Vegetables (Tomato, bhindi, chilli, cucumbers); Flowers crops (Chrysanthemum, rose, galardia, gerbera & marigold); Fruit crops (aonla, guava, sapota, mango, custard apple, banana, papaya) vegetatively propagated crops(sugarcane,potato); Major breeding procedures for development of hybrids / varieties of various crops. Classification of plants, Botanical description, Floral biology, Emasculation and Pollination techniques in cereals, millets, pulses, oilseeds, fibres, plantation crops etc.

Practical

Emasculation and Hybridization techniques; Parentage of released varieties/hybrids; Study of quality characters; Sources of donors for different characters; Visit to seed production and certification plots; Visit to AICRP trials and programmes; Visit to grow out test plots; Visit to various research stations; Visit to other institutions. Handling of segregating generations, pedigree methods; Handling of segregating generations, bulk methods. Botanical description and floral biology; Floral morphology, selfing, emasculation and crossing techniques in following crops : Rice and Sorghum; Maize and Wheat; Bajra and Ragi; Sugarcane and Coconut; Groundnut, Castor, Safflower and Sesamum; Redgram, Bengal gram and Greengram; Soybean, Gram and Blackgram; Chilies, Brinjal and Tomato; Bhindi, Onion, Bottle gourd and Ridge gourd; Cotton and mesta; Jute and Sunhemp.

PBG 5.5 Principles of Seed Technology

(2+1) = 3

Introduction to Seed Production, Importance of Seed Production, Seed policy, Seed demand forecasting and planning for certified, foundation and breeder seed production, Deterioration of crop varieties, Factors affecting deterioration and their control; Maintenance of genetic purity during seed production, Seed quality; Definition, Characters of good quality seed, Different classes of seed, Production of nucleus & breeder's seed, Maintenance and multiplication of pre-release and newly released varieties in self and cross-pollinated crops; Seed Production, Foundation and certified seed production in maize (varieties, hybrids, synthetics and composites); Foundation and certified seed production of rice (varieties & hybrids); Foundation and certified seed production of sorghum and bajra (varieties, hybrids, synthetics and composites); Foundation and certified seed production of cotton and sunflower (varieties and hybrids); Foundation and certified seed production of castor (varieties and hybrids); Foundation and certified seed production of tomato and brinjal (varieties and hybrids); Foundation and certified seed production of chillies and bhendi (varieties and hybrids); Foundation and certified seed production of onion, bottle gourd and ridge gourd (varieties and hybrids); Seed certification, phases of certification, procedure for seed certification, field inspection and field counts etc.; Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories; Duties and powers of seed inspectors, offences and penalties; Seed control order: Seed Control Order 1983, Seed Act 2000 and other issues related to seed quality regulation. Intellectual Property Rights, Patenting, WTO, Plant Breeders Rights, Varietal Identification through Grow-Out Test and Electrophoresis; Seed Drying: Forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air, Heated air drying, building requirements, types of air distribution systems for seed drying, selection of crop dryers and systems of heated air drying, recommended temperature and depth of the seeds, management of seed drying, Planning and layout of seed processing plant; Establishment of seed processing plant. Seed processing: air screen machine and its working principle, different upgrading equipments and their use, Establishing a seed testing laboratory. Seed testing procedures for quality assessment, Seed treatment, Importance of seed treatment, types of seed treatment, equipment used for seed treatment (Slurry and Mist-O-matic treater), Seed packing and seed storage, stages of seed storage, factors affecting seed

longevity during storage and conditions required for good storage, General principles of seed storage, constructional features for good seed warehouse, measures for pest and disease control, temperature control, Seed marketing, marketing structure, marketing organization, sales generation activities, promotional media, pricing policy; Factors affecting seed marketing.

Practical

Seed sampling principles and procedures; Physical Purity analysis of Field and Horticultural crops; Germination analysis of Field and Horticultural crops; Moisture tests of Field and Horticultural crops; Viability test of Field and Horticultural crops; Seed health test of Field and Horticultural crops; Vigour tests of Field and Horticultural crops; Seed dormancy and breaking methods; Grow out tests and electrophoresis for varietal identification; Visit to Seed production plots of Maize, Sunflower, Bajra, Rice, Sorghum, Cotton, Chillies and Vegetables. (Add or delete crops of the region); Visit to Seed processing plants; Visit to Seed testing laboratories; Visit to Grow out testing farms; Visit to Hybrid Seed Production farms; Varietal identification in seed production plots; Planting ratios, isolation distance, roging etc.

PBG 6.6 Principles of Plant Biotechnology (2+1) = 3

Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant Genetic Engineering; Scope and importance in Crop Improvement: Totipotency and Morphogenesis, Nutritional requirements of in-vitro cultures; Techniques of In-vitro cultures, Micro propagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above in-vitro culture; Applications and Achievements; Somaclonal variation, Types, Reasons: Somatic embryogenesis and synthetic seed production technology; Protoplast isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement. Genetic engineering; Restriction enzymes; Vectors for gene transfer – Gene cloning – Direct and indirect method of gene transfer – Transgenic plants and their applications. Blotting techniques – DNA finger printing – DNA based markers – RFLP, AFLP, RAPD, SSR and DNA Probes – Mapping QTL – Future prospects. MAS, and its application in crop improvement.

Practical

Requirements for Plant Tissue Culture Laboratory; Techniques in Plant Tissue Culture; Media components and preparations; Sterilization techniques and Inoculation of various explants; Aseptic manipulation of various explants; Callus induction and Plant Regeneration; Micro propagation of important crops; Anther, Embryo and Endosperm culture; Hardening / Acclimatization of regenerated plants; Somatic embryogenesis and synthetic seed production; Isolation of protoplast; Demonstration of Culturing of protoplast; Demonstration of Isolation of DNA; Demonstration of Gene transfer techniques, direct methods; Demonstration of Gene transfer techniques, indirect methods; Demonstration of Confirmation of Genetic transformation; Demonstration of gel-electrophoresis techniques.

SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

Ag.Chem. 1.1 Introduction to Soil Science (2+1) = 3

Soil: Pedological and edaphological concepts, Origin of the earth, Earth's crust; Composition: Rocks and minerals Weathering, Soil formation factors and processes Components of soils; Soil profile, Soil physical properties, Soil texture, Textural classes, Particle size analysis, Soil structure Classification, Soil aggregates, significance, Soil consistency, Soil crusting, Bulk density and particle density of soils & porosity, their significance and manipulation, Soil compaction, Soil Colour, Elementary knowledge of soil classification and soils of India; Soil water, Retention and potentials, Soil moisture constants, Movement of soil water, Infiltration, percolation, permeability, Drainage, Methods of determination of soil moisture Thermal properties of soils, Soil temperature, Soil air, Gaseous exchange, Influence of soil temperature and air on plant growth; Soil colloids, Properties, nature, types and significance; Layer silicate clays, their genesis and sources of charges, Adsorption of ions, Ion exchange, CEC & AEC Factors influencing ion exchange and its Significance. Soil organic matter, Composition, Decomposability, Humus, Fractionation of organic matter, Carbon cycle, C: N ratio. Soil biology, Biomass, Soil organisms and their beneficial and harmful roles.

Practical

Determination of bulk density and particle density, Aggregate analysis, Soil strength, Soil moisture determination, Soil moisture constants – Field capacity Infiltration rate, water holding capacity, soil texture and mechanical analysis – Soil temperature. Analytical chemistry – Basic concepts, techniques and calculations – Collection and processing of soil for analysis – Organic carbon, pH, EC, soluble cations and anions – Study of a soil profile – Identification of rocks and minerals.

Ag.Chem. 2.2 Soil Chemistry, Soil Fertility and Nutrient Management (2+1) = 3

Soil as a source of plant nutrients. Essential and beneficial elements, criteria of essentiality, forms of nutrients in soil, mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Measures to overcome deficiencies and toxicities. Problem soils – acid, salt affected and calcareous soils, characteristics, nutrient availabilities. Reclamation – mechanical, chemical and biological methods. Fertilizer and insecticides and their effect on soil water and air. Irrigations water – Quality of irrigation water and its appraisal. Indian standards for water quality. Use of saline water for agriculture. Soil fertility – Different approaches for soil fertility evaluation. Methods, Soil testing – Chemical methods, critical levels of different nutrients in soil. Plant analysis – DRIS methods, critical levels in plants. Rapid tissue tests. Indicator plants. Biological method of soil fertility evaluation. Soil test based fertilizer recommendations to crops. Factors influencing nutrient use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers. Source, method and scheduling of nutrients for different soils and crops grown under rainfed and irrigated conditions.

Practical

Principles of analytical Instruments and their calibration and applications, Colorimetry and flame photometry. Estimation of available N, P, K, S, and Zn in oils, pH, EC, soluble cations and anions in soil water extracts. Lime requirement and gypsum requirement of problem soils. Estimation of N, P and K in plants.

Ag.Chem. 6.3 Manures, Fertilizers and Agro-Chemicals**(2+1) = 3**

Introduction – Raw materials – Manures – Bulky and concentrated – FYM, Composts – Different methods, Mechanical compost plants, Vermicomposting, Green manures, Oil cakes, Sewage and sludge – Biogas plant slurry, Plant and animal refuges. Fertilizers – classifications, Manufacturing processes and properties of major nitrogenous (ammonium sulphate, urea, calcium ammonium nitrate, ammonium nitrate, ammonium sulphate nitrate) phosphatic (single super phosphate, enriched super phosphate, diammonium phosphate, ammonium poly phosphate), potassic and complex fertilizers their fate and reactions in the soil, Secondary and micronutrients fertilizers, Amendments. Fertilizer Control Order, Fertilizer storage; Biofertilizers and their advantage, Organic chemistry as prelude to agro chemicals, Diverse types of agrochemicals, Botanical insecticides (Neem), Pyrethrum, Synthetic pyrethroids. Synthetic organic insecticides, Major classes, Properties and uses of some important insecticides under each class. Herbicides – Major classes – Properties and uses of 2, 4-D, atrazine, glyphosate, butachlor benthiocarb; Fungicides – Major classes – Properties and uses of carbendazim, carboxin, captan, tridemorph and copper oxychloride – Insecticides Act, Plant growth regulators.

Practical

Total nitrogen and phosphorus in manures / composts – Ammoniacal and nitrate nitrogen – Water soluble P₂O₅, potassium, calcium, sulphur and zinc contents of fertilizers COD in organic wastes – Adulteration in fertilizer. Argentimetric and iodometric titrations – their use in the analysis of lindane metasystox, endosulfan, malathion, copper and sulphur fungicides – Compatibility of fertilizers with pesticides.

ENTOMOLOGY

Ag.Ento. 3.1

Insect Morphology and Systematics

(2+1) = 3

History of Entomology in India. Factors for insects abundance. 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 and legs. Wing venation, modifications and wing coupling apparatus. Structure male and female genitalia. Sensory organs. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system in insects. Types of reproduction in insects. 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. Orthoptera, Acrididae. Dictyoptera-Mantidae, Blatidae, Odonata, Isoptera, Termitidae, Thysanoptera, Thripidae, Hemiptera, Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae, Neuroptera, Chrysopidae Lepidoptera, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Coleoptera, Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Hymenoptera, Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Diptera, Cecidomyiidae, Trypetidae, Tachinidae, Agromyziidae.

Practical

1. Methods of collection and preservation of insects including immature stages.
2. External features of Grasshopper/Blister beetle.
3. Types of insect antennae, mouthparts and legs.
4. Wing venation, types of wings and wing coupling apparatus
5. Types of insect larvae and pupae.
6. Dissection of digestive system in insects
7. Dissection of male and female reproductive systems in insects
8. Study of characters of orders Orthoptera, Dictyoptera, Odonata and their families of agricultural importance
9. Study of characters of orders Isoptera, Thysanoptera and their families of agricultural importance
10. Study of characters of orders Hemiptera and their families of agricultural importance
11. Study of characters of orders Lepidoptera, Neuroptera and their families of agricultural importance.
12. Study of characters of orders Coleoptera and their families of agricultural importance.
13. Study of characters of orders Hymenoptera and their families of agricultural importance.
14. Study of characters of orders Diptera and Neuroptera and their families of agricultural importance.

**Ag.Ento. 4.2 Insect Ecology and Integrated Pest Management
Including Beneficial Insects**

(2+1) = 3

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. Concepts of Balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem. Pest surveillance and pest forecasting. Categories of pests.

IPM; Introduction, importance, concepts principles and tools of IPM-Host plant resistance, Cultural, Mechanical, Physical, Legislative, Biological (parasites, predators & transgenic plant pathogens such as bacteria, fungi and viruses) methods of control.

Chemical control – importance, hazards and limitations. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Study of important insecticides. Botanical insecticides – neem based products, Cyclodiens, Organophosphates, Carbamates, Synthetic pyrethroids, Novel insecticides, Pheromones, Nicotinyl insecticides, Chitin synthesis inhibitors, Phenyl pyrazoles, Avermectins, Macrocyclic lactones, Oxadiazimes, Thiourea derivatives, pyridine azomethines, pyrroles, etc. Nematicides, Rodenticides, Acaricides and fumigants. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation and genetic control. Practices, scope and limitations of IPM. Insecticides Act 1968 – Important provisions. Application techniques of spray fluids. Phytotoxicity of insecticides. Symptoms of poisoning, first aid and antidotes.

Beneficial insects: parasites and predators used in pest control and their mass multiplication techniques. Important groups of microorganisms, bacteria, viruses and fungi used in pest control and their mass multiplication techniques. Important species of pollinators, weed killers and scavengers, their importance.

Practical

Study of terrestrial and pond ecosystems of insects; Studies on behaviour of insects and orientation (repellency, stimulation, deterancy); Study of distribution patterns of insects, sampling techniques for the estimation of insect population and damage; Pest surveillance through light traps, pheromone traps and field incidence; Practicable IPM practices, Mechanical and physical methods; Practicable IPM practices, Cultural and biological methods; Chemical control, Insecticides and their formulations; Calculation of doses/concentrations of insecticides; Compatibility of pesticides and Phytotoxicity of insecticides; IPM case studies; Identification of beneficial insects – Pollinators, weed killers and scavengers.

**Ag.Ento. 5.3 Pests of Field Crops and Stored Grain and their
Management**

(2+1) = 3

Stored grain pests: Coleopteran and Lepidopteran pests, their biology and damage, preventive and curative methods. Distribution, biology, nature and symptoms of damage, and management strategies of insect and non insect pests of rice, sorghum, maize, ragi (Eleusine coracana), wheat, sugarcane, cotton, sunhemp, pulses, groundnut, castor, gingerly, safflower, sunflower, mustard, cumin, fennel, spinch, amaranthus and tobacco,. Common phytophagous mites, rodents and bird pests.

Practical

Identification of pests, their damage symptoms and management of rice and pearl millet; sorghum, maize and wheat; sugarcane; cotton; pulses; tobacco; cumin, fennel and spinach; groundnut, sesamum, sunflower; castor, mustard and safflower; Identification of common phytophagous mites and their morphological characters; Identification of rodents and bird pests.

Ag.Ento.6.4 Pests of Horticultural Crops and their Management (1+1) = 2

Distribution, biology, nature and symptoms of damage, and management strategies of insect and non insect pests of vegetable crops viz., brinjal, okra, tomato, potato, cruciferous and cucurbitaceous vegetables, leafy vegetables sweet potato, colacasia, morinage species crops viz., chillies, onion, turmeric garlic, ginger, coriander and curry leaf; fruit trees viz., mango, sapota, citrus, banana, cashew pomegranate, custard apple, aonla, ber, guava and plantation crops viz. coconut and date palm and ornamental plants.

Practical

Identification and nature of damage of pests of solanaceous crops; malvaceous vegetables; cruciferous crops; cucurbitaceous crops; chillies, onion and garlic ; turmeric ginger and colacasia; curry neem, leafy vegetable and coriander; mango and sapota; guava, pomegranate and custard apple; citrus, ber moringo and aonla; coconut and date palm; banana and cashew; ornamental plants

AGRICULTURAL ECONOMICS

Ag.Econ. 2.1 Principles of Agricultural Economics

(2+0) = 2

Economics: Meaning, Definition, Subject matter, Divisions of Economics, Importance of Economics; Agricultural Economics: Meaning, Definition; Basic Concepts: Goods, Service, Utility, Value, Price, Wealth, Welfare. Wants: Meaning, Characteristics, Classifications of Wants, Importance. Theory of consumption: Law of Diminishing Marginal utility, Meaning, Definition, Assumption, Limitations, Importance. Consumer's surplus: Meaning, Definition, Importance. Demand: Meaning, Definition, Kinds of Demand, Demand schedule, Demand Curve, Law of Demand, Extension and Contraction Vs Increase and Decrease in Demand. Elasticity of Demand: Types of Elasticity of Demand, Degrees of price elasticity of Demand, Methods of Measuring Elasticity, Factors influencing elasticity of Demand, Importance of Elasticity of Demand. Welfare Economics: Meaning. National Income: Concepts, Measurement. Public Resource: Meaning, Services Tax, Meaning, Classification of Taxes: Cannons of Taxation, Inflation: Meaning, Definition, Kinds of inflation.

Ag.Econ. 3.2 Agricultural Marketing, Trade and Prices

(1+1) = 2

Agricultural Marketing: Concepts and Definition, Scope and subject matter, Market and Marketing: Meaning, Definitions, Components of a market, Classification. Market structure, Conduct, performance. Marketing structure, Market functionaries or agencies, Producer's surplus: Meaning, Types of producers surplus, marketable surplus. Marketed surplus, importance, Factors affecting Marketable surplus. Marketing channels: Meaning, Definition, Channels for different products. Market integration, Meaning, Definition, Types of Market Integration. Marketing efficiency: Meaning, Definition, Marketing costs, Margins and price spread, Factors affecting the cost of marketing, Reasons for higher marketing costs of farm commodities, Ways of reducing marketing costs. Theories of International Trade: Domestic Trade, Free trade, GATT, WTO. Cooperative Marketing. State Trading. Ware Housing Corporation; Central and State, Objectives, Functions, Advantages. Food Corporation of India: Objectives and Functions. Quality Control, Agricultural Products, AGMARK. Price Characteristics of agricultural product process, Meaning, Need for Agricultural Price Policy. Risk in Marketing: Meaning and importance, Types of Risk in Marketing. Speculations and Hedging, Futures trading, Contract farming.

Practical

Identification of marketing channels; Study of Rythu Bazars, Regulated markets; Study of unregulated markets; Study of livestock markets; Price spread analysis; Visit to market institutions, NAFED; Analysis of information of daily prices; Marketed and marketable surplus of different commodities.

Ag.Econ. 4.3 Agricultural Finance and Co-Operation**(1+1) = 2**

Agricultural finance: nature and scope. Time value of money, Compounding and Discounting. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4R's 5C's and 7 P's of credit, repayment plans. History of financing agriculture in India. Commercial banks, nationalization of commercial banks. Lead bank scheme, regional rural banks, scale of finance. Higher financing agencies, RBI, NABARD, AFC, World Bank, Insurance and Credit Guarantee Corporation of India. Assessment of crop losses, determination of compensation. Crop insurance, advantages and limitations in application. Agricultural cooperation: philosophy and principles. History of Indian cooperative Movement, pre-independence and post independence periods, cooperative credit structure: PACS, FSCS. Reorganisation of single window system. Successful cooperative systems in Gujarat, Maharashtra, Punjab etc.

Practical

Factors governing use of Capital and identification of credit needs; Time value of money, Compounding and discounting; Tools of financial management, Balance sheet, Income statement and cash flow analysis; Estimations of credit needs and determining unit costs; Preparations and analysis of loan proposals; Types of repayment loans; Study of financial institutions: PACS, DCCB, Apex Banks, RRBs, CBs, NABARD.

Ag.Econ. 5.4 Fundamentals of Agribusiness Business Management**(1+1) = 2****(Including Project Development, Appraisal and Monitoring)**

Importance of Agribusiness in the Indian Economy, Agricultural Policy. Agribusiness Management, Distinctive features, Importance of Good Management, Definitions of Management. Management Functions, Planning, Meaning, Definition, Types of Plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, rules, programmes, Budget) characteristics of sound plan, Steps in planning, Organisation, Staffing, Directing, Motivation, Ordering, Leading, Supervision, Communication, control. Capital Management. Financial Management of Agribusiness: Importance of Financial Statements, Balance sheet, Profit and Loss Statement, Analysis of Financial statements. Agro-based Industries: Importance and Need, Classification of Industries, Types of Agro-based Industries, Institutional arrangement, Procedure to set up agro-based industries, Constraints in establishing agro-based industries. Marketing Management: Meaning, Definitions, Marketing Mix, 4Ps of Marketing. Mix, Market segmentation, Methods of Market, Product life cycle. Pricing policy, Meaning, pricing method. Prices at various stages of Marketing. Project, definitions, project cycle, Identification, Formulation, Appraisal, Implementation, Monitoring and evaluation, Appraisal and Evaluation techniques, NPW, BCR, IRR, N/K ratio, sensitivity analysis, characteristics of agricultural projects: preparation of project reports for various activities in agriculture and allied sectors: Dairying, poultry, fisheries, agro-industries etc.

Practical

Study of input markets: seed, fertilizers, pesticides. Study of output markets, grains, fruits, vegetables, flowers. Study of product markets, retail trade commodity trading, and value added products. Study of financing institutions cooperatives commercial banks, RRBs, Agribusiness Finance Limited, NABARD; Preparations of projects, Feasibility reports; Project appraisal techniques; Case study of agro-based industries.

Ag.Econ. 6.5 Production Economics and Farm Management**(1+1) = 2**

Production Economics: Meaning, Definition, Nature and Scope of Agricultural Production Economics. Basic concepts and terms. Concepts of Production. Production Functions: Meaning, Definition, Types. Laws of returns: Increasing, Constant and decreasing. Factor Product Relationship. Determination of optimum input and output. Factor relationship. Product relationship. Types of enterprise relationships. Returns to scale: Meaning, Definition, Importance. Farm Management. Economic principles applied to the Organizations of farm business. Types and systems of farming. Farm planning and budgeting. Risk and uncertainty. Farm budgeting.

Practical

Computation of cost concepts; Methods of computation of depreciation; Analysis of Net worth statement; Farm inventory analysis; Preparation of farm plans and budgets; Types of farm records and accounts; Preparation of profit and loss account; Break, Even analysis; Economics analysis of different crop and livestock enterprises; Application of Farm Management Principles.

AGRICULTURAL ENGINEERING

Ag.Engg. 2.1 Fundamentals of Soil, Water and Conservation Engineering (2+1) = 3

Surveying: survey equipment, chain survey, cross staff survey, plotting procedure, calculations of area of regular and irregular fields. Levelling – levelling equipment, terminology, methods of calculation of reduced levels, types of levelling, contouring. Irrigation, classification of projects, flow irrigation and lift irrigation. Water source, Water lifting devices – pumps (shallow and deep well), capacity, power calculations. Irrigation water measurement – weirs, flumes and orifices and methods of water measurement and instruments. Water conveyance systems, open channel and underground pipeline. Irrigation methods – drip and sprinkle irrigation systems. Soil and water conservation – soil erosion, types and engineering control measures.

Practical

Acquaintance with chain survey equipment; Ranging and measurement of offsets; Chain triangulation; Cross staff survey; Plotting of chain triangulation; Plotting of cross staff survey; Levelling equipment – dumpy level, levelling staff, temporary adjustments and staff reading; Differential leveling; Profile leveling; Contour survey – grid method; Plotting of contours; Study of centrifugal pumping system and irrigation water measuring devices; Study of different components of sprinkler irrigation systems; Study of different components of drip and sprinkle irrigation systems; Uniformity of water application in drip and sprinkle systems; Study of soil and water conservation measures.

Ag.Engg. 3.2 Farm Power and Machinery

(1+1) = 2

Farm power in India: sources, I.C engines, working principles, two stroke and four stroke engines, I.C. engine terminology, different systems of I.C. engine. Tractors, Types, Selection of tractor and cost of tractor power. Tillage implements: Primary and Secondary tillage implements, Implements for intercultural operations, seed drills, paddy transplanters, plant protection equipment and harvesting equipment; Equipment for land development and soil conservation.

Practical

Study of different components of I.C. Engine; Study of working of four stroke engine; Study of working of two stroke engine; Study of M.B. plough, measurement of plough size, different parts, horizontal and vertical suction, determination of line of pull etc.; Study of disc plough; Study of seed-cum-fertilizer drills-furrow opener, metering mechanism, and calibration; Study, maintenance and operation of tractor; Learning of tractor driving; Study, maintenance and operation of power tiller; Study of different parts, registration, alignment and operation of mower. Study of different inter cultivation equipment in terms of efficiency, field capacity; Repairs and adjustments and operation of sprayers; Repairs and adjustments and operation of dusters; Study of paddy transplanters.

Ag.Engg. 5.3 Protected Cultivation and Post Harvest Technology (1+1) = 2

Green house technology, Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of greenhouse for cooling and heating purposes. Green house equipment, 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. Cost estimation and economic analysis. Choice of crops for cultivation under greenhouses, problems / constraints of greenhouse cultivation and future strategies. Growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT) / hydroponics. Threshing, threshers for different crops, parts, terminology, care and maintenance. Winnowing, manual and power operated winnowers, care and maintenance. Groundnut decorticators, hand operated and power operated decorticators, principles of working, care and maintenance. Maize shellers & castor shellers. Drying, grain drying, types of drying, types of dryers. Storage, grain storage, types of storage structures. Fruits and vegetables cleaning, machinery for cleaning of fruits and vegetables, care and maintenance. Grading, methods of grading, equipment for grading of fruits and vegetables, care and maintenance. Size reduction. equipment for size reduction care and maintenance. Evaporation, Principle, types of evaporators, quality standards – FAQ, ASTA, FPO, FDA.

Practical

Study of different types of green houses based on shape, construction and cladding materials; Calculation of air rate exchange in an active summer winter cooling system; Calculation of rate of air exchange in an active winter cooling system; Estimation of drying rate of agricultural products inside green house; Testing of soil and water to study its suitability for growing crops in greenhouses; The study of fertigation requirements for greenhouses crops and estimation of E.C. in the fertigation solution; The study of various growing media used in raising of greenhouse crops and their preparation and pasteurization / sterilization; Visit to commercial green houses; Study of threshers, their components, operation and adjustments; Winnowers, their components, operation and adjustments; Study of different components of groundnut decorticator; Study of maize shellers; Study of castor shellers; Study of improved grain storage structure; Study of dryers; Study of cleaners & graders.

Ag.Engg. 6.4 Renewable Energy (1+1) = 2

Energy sources, Introduction, Classification, Energy from Biomass, Types of biogas plants, constructional details, Biogas production and its utilization, Agricultural wastes, Principles of combustion, pyrolysis and gasification, Types of gasifiers, Producer gas and its utilization. Briquettes, Types of Briquetting machines, uses of Briquettes, Shredders. Solar energy, Solar flat plate and focussing plate collectors, Solar air heaters, Solar space heating and cooling, Solar energy applications / Solar energy gadgets, Solar cookers, Solar water heating systems, solar grain dryers, Solar Refrigeration system, Solar ponds, Solar photo voltaic systems, solar lantern, Solar street lights, solar fencing, Solar

pumping systems. Wind energy, Types of wind mills, Constructional details & application of wind mills. Liquid Bio fuels, Bio diesel and Ethanol from agricultural produce, its production & uses.

Practical

Constructional details of KVIC & Janatha type biogas plants; Constructional details of Deen Bandu type biogas plants; Field visit to biogas plants; Constructional details of different types of gasifiers; Testing of gasifiers; Briquette preparation from biomass; To study and find the efficiency of solar cooker; To study and find the performance of a solar still; To study and find the performance of a solar dryers; Study and working of solar photovoltaic pumping system; Study and performance evaluation of domestic solar water heater; Study and performance evaluation of solar lantern; Study and performance evaluation of solar street light; To study the performance of different types of wind mills; Field visit to wind mills; To study the processing of Bio-diesel production from Jatropha.

AGRICULTURAL METEOROLOGY

Ag.Met. 2.1

Agricultural Meteorology

(2+1) = 3

Earth's atmosphere, Composition, division of atmosphere. Sun-earth relationship, season, weather and climate. Pressure and wind systems, cyclone and anticyclone. Condensation, precipitation, clouds, Indian monsoon. Meaning and scope of Agricultural meteorology. Importance of weather and climate in agricultural production. Microclimate, crop-weather-pest disease relationship. Climatic hazards in crop production-Droughts and frost. Heat unit concept and its application in India. Potential evapotranspiration and its estimation. Weather forecasting. Agro-climatic zones of India in general and Gujarat in particular.

Practical

Study of meteorological observatories, its site selection and layout. Study of different types of thermometers and psychrometers. Study of rainfall and evaporation measurement instruments. Study of radiation measurement instruments. Study of wind measurement instruments. Calculation of RH, VP and dew point temperature. Estimation of heat indices. Analysis of rainfall data for climatological studies. Estimation of PET by Thornthwaite and Penman methods. Estimation of net radiation using weather parameters.

PLANT PATHOLOGY

Pl.Path. 1.1 Introductory Plant Pathology (1+1) = 2

Introduction, Important plant pathogenic organisms, different groups, fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, virioids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them. Prokaryotes: classification of prokaryotes according to Bergey's Manual of Systematic Bacteriology. General Characters of fungi, Definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction in fungi (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions and sub-divisions.

Practical

Acquaintance to plant pathology laboratory and equipments; Preparation of culture media for fungi and bacteria; Isolation techniques, preservation of disease samples; Study of Pythium, Phytophthora and Albugo; Study of Sclerospora, Peronosclerospora, Pseudoperonospora, Peronospora, Plasmopara and Bremia; Study of genera Mucor and Rhizopus. Study of Oidium, Oidiopsis, Ovulariopsis, Erysiphe, Phyllactinia, Uncinula and Podosphaera; Study of Puccinia (different stages), Uromyces, Hemiliea; Study of Sphacelotheca, Ustilago and Tolyposporium; Study of Agaricus, Pleurotus and Ganoderma; Study of Septoria, Colletotrichum, Pestalotiopsis and Pyricularia; Study of Aspergillus, Penicillium, Trichoderma, and Fusarium; Study of Helminthosporium, Drechslera, Alternaria, Stemphyllium, Cercospora, Phaeoisariopsis, Rhizoctonia and Sclerotium.

Pl.Path. 3.2 Principles of Plant Pathology (1+1) = 2

Introduction: Definition and objectives of Plant Pathology. History of Plant Pathology. Terms and concepts in Plant Pathology. Survival and Dispersal of Plant Pathogens. Phenomenon of infection – pre-penetration, penetration and post penetration. Pathogenesis – Role of enzymes, toxins, growth regulators and polysaccharides. Defense mechanism in plants – Structural and Bio-chemical (pre and postinfection). Plant disease epidemiology. Plant Disease Forecasting – Remote sensing – General principles of plant diseases management – Importance, general Principles – Avoidance, exclusion, protection – Plant Quarantine and Inspection – Quarantine Rules and Regulations. Cultural methods – Rougeing, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage. Role and mechanisms of biological control and PGPR. Physical Methods – Heat and Chemical methods – Methods of application of fungicides. Host plant resistance – Application of biotechnology in plant disease management –Development of disease resistant transgenic plants through gene cloning. Integrated plant disease management (IDM) – Concept, advantages and importance.

Practical

Demonstration of Koch's postulates; Study of different groups of fungicides and antibiotics; Preparation of fungicides – Bordeaux mixture, Bordeaux paste, Chestnut compound; Methods of application of fungicides – seed, soil and foliar; Bio-assay of fungicides – poisoned food technique, inhibition zone technique and slide germination technique; Bio-control of plant pathogens – dual culture technique, seed treatment. Visit to quarantine station and remote sensing laboratory.

Pl.Path. 5.3 Diseases of Field Crops and their Management (2+1) = 3

Economic importance, symptoms, cause, epidemiology and disease cycle and integrated management of diseases of rice, sorghum, bajra, maize, wheat, sugarcane, turmeric, tobacco, groundnut, sesamum, sunflower, cotton, redgram, bengalgram, blackgram, greengram, soybean, castor, mustard, hill millet and jatropha.

Practical

Study of symptoms, etiology, host-parasite relationship and specific control measures of the following crop diseases. Presentation of disease samples survey and collection of Diseases of rice, sorghum; Diseases of wheat, bajra & maize; Diseases of sugarcane, turmeric & tobacco; Diseases of groundnut, castor & sunflower; Diseases of sesamum & cotton; Diseases of redgram, greengram, blackgram, bengalgram & beans; Field visits at appropriate time during the semester

Note

Students should submit 50 pressed, well mounted diseased specimens in three installments during the semester.

Pl.Path. 6.4 Introductory Nematology (1+1) = 2

Introduction: History of phytonematology. Economic importance. General characteristics of plant pathogenic nematodes. Nematode general morphology and biology. Classification of nematodes upto family level with emphasis on groups containing economically important genera. Classification of nematodes by habitat. Identification of economically important plant nematodes upto generic level with the help of keys and description. Symptoms caused by nematodes with examples. Interaction between plant parasitic nematodes and disease causing fungi, bacteria and viruses. Different methods of nematode management. Cultural methods (crop rotation, fallowing, soil amendments, other land management techniques), physical methods (soil solarisation, hot water treatment) Biological methods, Chemical methods (fumigants, non fumigants). Resistant varieties. IDM.

Practical

Methods of survey – sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following combined Cobb's decanting – sieving and Baermann funnel technique, counting and estimation of plant parasitic nematodes; Preparation of temporary and permanent mounts; Method of preparation of perineal patterns for identification of species of Meloidogyne; Study and identification of most

important plant parasitic nematodes with special reference to their characteristics and symptomatology – Meloidogyne, Pratylenchus; Heterodera, Ditylenchus, Globodera, Tylenchulus, Xiphinema, Radopholus, Rotylenchulus, and Helicotylenchus. Experimental techniques used in pathogenicity studies with root knot nematode.

Pl.Path. 6.5 Diseases of Horticultural Crops and their Management (2+1) = 3

Economic Importance, symptoms, cause, disease cycle and integrated management of diseases of: ber, cumin, fennel, coriander, cluster bean, marry gold, garlic, citrus, mango, banana, grapevine, pomegranate, papaya, guava, sapota, apple, chilli, brinjal, bhendi, potato, crucifers, cucurbits, tomato, beans, onion, coconut, coffee, tea, rose and chrysanthemum

Practical

Diseases of beans, citrus, guava, & sapota; Diseases of papaya, banana, pomegranate & ber; Diseases of mango, grapes & apple; Diseases of chilli, brinjal & bhendi; Diseases of potato, tomato & crucifers; Diseases of cucurbits, onion & betelvine; Diseases of oil palm, coconut, tea, coffee & mulberry; Diseases of rose, chrysanthemum and jasmine. Field visits at appropriate time during the semester.

Note

Students should submit 20 pressed, well mounted diseased specimens in three installments during the semester.

HORTICULTURE

Hort. 1.1 Production Technology of Fruit Crops

(2+1) = 3

Definition and importance of horticulture. Divisions of horticulture. Climatic zones of horticulture crops. Area and production of different fruit crops. Selection of site, fencing, and wind break, planting systems, high density planting, planning and establishment. Propagation methods and use of rootstocks. Methods of training and pruning. Use of growth regulators in fruit production. Package of practices for the cultivation of major fruits – mango, banana, citrus, grape, guava, sapota, litchi. Papaya, Minor fruits – pineapple, annonaceous fruits, pomegranate, ber, fig, phalsa, jack and cherry.

Practical

Study of horticultural tools and implements and their uses; Containers, potting mixture, potting, depotting and repotting; Plant propagation, seed propagation, scarification, and stratification; Propagation by cuttings (soft wood, hard wood and semi-hardwood) layering (simple layering, Air layering, stooping in guava); Layout and planting systems (Traditional system and high density planting methods); Methods of pruning and training; Training of ber, grape and pomegranate; Pruning of ber, grape, phalsa, fig, apple, pear, peach; Description and identification of varieties of mango, guava, grape, papaya, apple and sapota; Description and identification of varieties of banana, citrus, (lime lemon, sweet orange, mandarin, grape fruit) pomegranate, ber, pear and cherries; Irrigation methods in fruit crops including drip – Micro irrigation methods of establishment of orchard; Methods of Fertiliser application methods in fruit crops including fertigation technology; Visit to local commercial orchards; Preparation of growth regulators, powder, solution and lanolin paste for propagation; Application of growth regulators for improving fruit set, fruit size, quality, delaying ripening and hastening ripening. Budding and Grafting in concede crop.

Hort. 3.2 Production Technology of Vegetables and Flowers

(2+1) = 3

Importance of Olericulture, vegetable gardens, vegetable classification. Origin, area, production, varieties, package of practices for fruit vegetables –, tomato, brinjal, chillies, and okera; Cucurbitaceous vegetables cucumber, ridge gourd, bottle gourd, bitter gourd and melons, Cole crops – cabbage, cauliflower. Bulb crops – onion and garlic. Beans and peas – cluster beans, dolichos beans, cowpea. Tuber crops – potato, sweet potato, colocasia, yams; Root crops – carrot, radish and beet root; Leafy vegetables – amaranthus, palak, gogu; Perennial vegetables – drumstick and curry leaf. Importance of ornamental gardens. Planning of ornamental gardens. Types and styles of ornamental gardens. Use of trees, shrubs, climbers, palms, houseplants and seasonal flowers in the gardens. Package of practices for rose, jasmine, chrysanthemum, gladiolus gerbera marigold and tuberose.

Practical

1. Planning and layout of kitchen garden; 2. Identification of important vegetable seeds and plants; Raising of vegetable nurseries; Identification of ornamental plants (trees, shrubs,climbers,house plants,palms etc.,) and development of garden features;

drying, ultraviolet and ionizing radiations. Preparation of jams, jellies, marmalades, candies, crystallized and glazed fruits, preserves, chutneys, pickles, ketchup, sauce, puree, syrups, juices, squashes and cordials Spoilage of canned products, biochemical, enzymatic and microbial spoilage. Preservatives, Colours permitted and prohibited in India.

Practical

Practice in judging the maturity of various fruits and vegetables. Conservation of zero energy cool chambers for on farm storage. 3& 4. Determination of physiological loss in weight (PLW), total soluble solids (TSS), total sugars, acidity and ascorbic and content in fruits and vegetables. Packing methods and types of packing and importance of ventilation. Pre cooling packing methods for export or international trade. Methods of prolonging storage life. Effect of ethylene on ripening of banana, sapota, mango, sapota. Identification of equipment and machinery used in preservation of fruits and vegetables. Preservation by drying and dehydration. Preparation of jam, jelly and marmalades. Preparation of squash, cordials and syrups. Preparation of chutneys, pickles sauces and ketchup. Visit to local processing units. Visit to local market yards and cold storage units. Visit to local market and packing industries.

AGRICULTURAL EXTENSION

Ag.Extn. 3.1

Dimensions of Agricultural Extension

(1+1) = 2

Education – Meaning, Definition, Types – Difference between Formal education and Informal education and their Characteristics. Extension Education and Agricultural Extension – Meaning, Definition, Concepts, Objectives and Principles. Rural development – Meaning, Definition, Objectives, Importance and Problems in rural development. Developmental programmes of pre-independence era (Only Name of the programme, Year of starting and Name of Initiators) – Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive proprogramme. Community Development Programme and Development programmes of Post independence era- (Only Name of the programme, Year of starting and Name of Initiators) Firka Development, Etawah – Pilot project and Nilokheri Experiment, Community Development and Extension Education and National Extension service. Agricultural Development Programmes – (Only Name of the programme and Year of starting) Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), National Agricultural Technology Project (NATP). Panchayat Raj system – Meaning of Democratic – Decentralization and Panchayat Raj, Meaning of Three tiers of Panchayat Raj system. Social Justice and Poverty alleviation programmes (Only Name of the programme, Year of starting and Beneficiaries of programmes) – Integrated Tribal Development Agency (ITDA), Integrated Rural Development Programme (IRDP), Swarna Jayanthi Gram Swarojgar Yojana (SGSY), Chief Minsiter Employment Yojana (CMEY). Women Development programmes – (Only Name of the programme, Year of starting and Beneficiaries of programmes)- Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS) and Mahila Samriddi Yojana (MSY). Reorganized extension system (T&V System) – objectives, Key features, Organizational structure and limitations Meaning, objectives, needs and principles of Broad Based Extension (BBE) ATIC - Year of starting , Objectives and Major Activities ATMA- Year of starting , Objectives, Organizational Structure and role Extension Programme Planning – Meaning, Definitions of Planning, Programme, Project, Importance and Steps in Programme planning Process. – This topic is included in this course and deleted from course “Extension methodologies for transfer of agricultural technology”

Practical

Visits and study of a village Panchayat, Participation in bi-monthly workshops of Training and Visit (T & V) System. Visit to a village to study the Self Help Groups (SHGs). Visit to a voluntary organization to study the developmental activities. Visit to Sardar Smruti Kendra – As a Farmers’ Training, Information cum Communication centre. Visit to ATIC run by university. Preparation of Interview Schedule to collect information from farmers : Personal Information, Social Information, Extension Contacts, Economic, Crop Grown, Problems of Agriculture, Information of Milch animals, Problems in Animal husbandry

Ag.Extn.4.2 Fundamentals of Rural Sociology and Educational Psychology (2+0) = 2

Sociology and Rural Sociology-Meaning, Definition, Scope, Importance of Rural Sociology in Agricultural Extension and Interrelationship between Rural Sociology & Agricultural Extension. Indian Rural Society-Important characteristics, Differences and Relationship between Rural and Urban societies. Social Groups – Meaning, Definition and types of social groups Social Stratification, Meaning and Definitions, Forms of Social Stratification Definitions of Class & Caste System. Definitions of Cultural concepts – Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions. Definitions of Social Values and Attitudes Types and importance of Social Values and Attitudes in Agricultural Extension. Social Institutions – Meaning, Definition, Major institutions in Rural society, Functions and their Role in Agricultural Extension. Social Organizations – Meaning, Definition. Social Control – Meaning, Definition and mechanism Social change – Meaning, Definition. Leadership – Meaning, Definition, Classification, Roles of a leader, Different methods of Selection of Professional and Lay leaders. Psychology and Educational Psychology – Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension. Intelligence, Personality, Perception, Instincts, Emotions and Frustrations – Meaning, Definition and importance in Agricultural Extension. Motivation – Meaning, Definition, Motivation cycle, Types, Classification of Motives, Techniques of motivation and Role of Motivation in Agricultural Extension. Teaching – Learning process – Meaning and Definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics.

Ag.Extn. 5.3 Extension Methodologies for Transfer of Agricultural Technology (1+1) = 2

Communication – Meaning, Definition, Models, Elements and their Characteristics, Types and Barriers in communication. Extension teaching methods – Meaning, Definition, Functions and Classification. Individual contact methods – Meaning and definition of Farm and Home visit, Result Demonstration.

Group contact methods – Meaning and definition of Group discussion, Method demonstration, Field Trips. Small group discussion techniques – Meaning and definition of Lecture, Symposium, Panel, Debate, Forum, Buzz group, Workshop, Brain Storming, Seminar and Conference. Mass contact Methods – Meaning and definition of Campaign, Exhibition, Kisan Mela, Radio & Television – Meaning. Factors influencing in selection of Extension Teaching Methods. Innovative Information sources – Definitions of Internet, Cyber Cafes, Video and Tele conferences, Kisan call centers. Agricultural Journalism – Meaning, Scope and Importance, Sources of news, Types, Merits and Limitations. Diffusion and Adoption of Innovations – Meaning, Definitions, Steps of adoption Process, Adopter categories and their characteristics, Factors influencing adoption process. KVK in Capacity building of Extension Personnel and Farmers.

Practical

Simulated exercises on communication. Identification of farming needs. Study and Visit to KVK. Study and Visit to Information Communication Centre. Preparation of scripts for Radio and Television. Identification, Meaning, Importance and Classification of

Audiovisual aids – Organization of Group discussion and Method demonstration, Selection, Planning and Preparation of visual aids - Charts, Posters. Selection, Planning and Preparation handling - Over Head Projector (OHP), Transparencies, Power Point. Preparation of Agricultural Information materials – Leaflet, Folder, Pamphlet, News Stories, Success Stories. Handling of Public Address Equipment (PAE) System, Still camera, Video Camera and Liquid Crystal Display (LCD) Projector.

Ag.Extn. 6.4 Entrepreneurship Development

(1+1) = 2

Entrepreneur behaviour, Entrepreneur development, Entrepreneur management – Meaning, Concepts, Need for enterprise emergence and characteristics of an entrepreneur. External Environmental factors – Economic, Social, Cultural, Technological, Situational and Legal requirements for establishment of a new unit Establishment of a small business – Identification of a sound enterprise, Feasibility report and Project proposal, Availability of raw materials, technology, skills and Record keeping. Knowledge, Skill, Infrastructure and Policy support for entrepreneurship development. Marketing plan, market survey, methods of data collection, forecasting market demand, sustainability of enterprise. Technical Appraisal – Factors to be considered for technical appraisal and Personnel training. Financial Appraisal – Estimation of financial requirements, financial viability, cost benefit analysis, preparation of balance sheet

Project formulation- Project description, physical infrastructure, plant layout, pollution control, communication system, transportation, requirement of machinery and equipment, licensing procedures, tax assessment. Special issues relating to potentials and failure of enterprise in production, finance, marketing and SWOT analysis

Practical

- 1, 2 & 3 Exercise on Project – identification, preparation, management, implementation and evaluation
- 4 & 5 Identification of emerging enterprises in agricultural sector
- 6 Exercise on preparation of balance sheet
- 7 Exercise on cost benefit analysis
- 8, 9 & 10 Visit to two public sector enterprises to analyze and draw lessons
- 11 & 12 Visit to two private sector enterprises to analyze and draw lessons
- 13 & 14 Preparation of individual business plan
- 15 & 16 Presentation of enterprise and business plans

**BIOCHEMISTRY/ PHYSIOLOGY MICROBIOLOGY/
ENVIRONMENTAL SCIENCES/BIO-MATHEMATICS**

Maths. 1.1 Bio-Mathematics

(2+0) = 2

Continuous functions. Point of discontinuities of the function. Differentiation and integration of function and its applications like in making grain silo and water tank, to use minimum fencing material, to decide number of plants to get maximum yield etc. maxima and minima of one and two variables. Length of the arc of a Cartesian and Parametric co-ordinate curve, Area under the curve. Variable-Separable differential equations. Applications in pest control using specific growth and decay rate equations. Vector integration and differentiation giving applications of velocity and acceleration of a moving particle.

Ag. Micro. 2.1 Agricultural Microbiology

(2+1) = 3

History of Microbiology: Spontaneous generation theory, Role of microbes in fermentation, Germ theory of disease, Protection against infections, Applied areas of Microbiology Metabolism in bacteria: ATP generation, chemoautotrophy, photo autotrophy, respiration, fermentation. Bacteriophages: structure and properties of Bacterial viruses – Lytic and Lysogenic cycles: viroids, prions. Bacterial genetics; Gene expression; Genetic recombination: transformation, conjugation and transduction, genetic engineering, Plasmids, episomes, genetically modified Organisms. Soil Microbiology: Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur, Biological nitrogen fixation. Microflora of Rhizosphere and Phyllosphere microflora, microbes in composting. Microbiology of Water. Microbiology of food: microbial spoilage and principles of food preservation. Beneficial microorganisms in Agriculture: Biofertilizer (Bacterial Cyanobacterial and Fungal), microbial insecticides, Microbial agents for control of Plant diseases, Biodegradation, Biogas production, Biodegradable plastics, Plant – Microbe interactions.

Practical

General instructions, Familiarization with instruments, materials, glassware etc. in a microbiology laboratory: Practice of Aseptic methods: I - Evaluation of aseptic technique with Nutrient broth tubes. II- Evaluation of aseptic technique with a Nutrient agar plate. Methods of Sterilization and Preparation of media I- Preparation of nutrient broth, nutrient agar plates, nutrient agar slant and nutrient agar stab; II- Sterilization of glassware by Dry heating; III - Sterilization of nutrient broth by Filtration. Plating methods for Isolation and Purification of bacteria I - Isolation of bacteria by Streak plate method. II - Isolation of aerobic spore forming bacteria by Enrichment using Streak plate method. III - Checking of purity of a bacterial culture by Streak plating method. Identification of bacteria by staining methods and Biochemical tests: I– Morphological examination of bacteria by Simple and Differential staining. II – Different biochemical tests for identification of bacterial culture; Enumeration of bacteria: I - Enumeration of bacteria by Stain slide method. II- Enumeration of bacteria by most probable number method. III - Enumeration of bacteria by Pour plate method and Spread plate method.

Pl. Phy. 3.1 Crop Physiology-I**(2+1) = 3**

Introduction, Definition of Crop Physiology, Importance in Agriculture and Horticulture. Growth and Development – Definition, Types of growth, determinate and indeterminate growth, monocarpic and polycarpic species with examples, Measurement of growth, Growth analysis, growth characteristics, definitions and mathematical formulae. Photosynthesis – Energy synthesis, significance of C₃, C₄ and CAM pathway relationship of photosynthesis and crop productivity – Translocation of assimilates, phloem loading, apoplastic and symplastic transport of assimilates, source and sink concept, photorespiration – Factors affecting photosynthesis and productivity, Management of photosynthesis for productivity, methods of measuring photosynthesis, photosynthetic efficiency, dry matter partitioning, harvest index of crops. Respiration and its significance, importance of glycolysis, TCA cycle, Pentose phosphate pathway. Growth respiration and maintenance respiration, alternate respiration, salt respiration, wound respiration, measurement of respiration. Control of flowering – Photoperiodism and Vernalisation in relation to crop productivity, classification of plants, commercial application of photoperiodism. Plant growth regulation – occurrence, biosynthesis, mode of action of auxins, gibberellins, cytokinins, ABA, Ethylene. Novel plant growth regulators, Commercial application of plant growth regulators in agriculture and horticulture. Senescence and abscission – Definition, classification, theories of mechanism and control of senescence, physiological and biochemical changes and their significance. Abscission and its relationship with senescence. Post harvest, physiology – Fruit ripening, metamorphic changes, climacteric and non-climacteric fruits, hormonal regulation of fruit ripening (with ethylene, CCC, Polaris, Paclobuterozole) – use of hormones in increasing vase life of flowers.

Practical

Growth analysis: Calculation of growth parameters. Measurement of water potential by Chardakov's method. measurement of absorption spectrum of chloroplastic pigments and fluorescence. Measurement of leaf area by various methods. Stomatal frequency and index. Leaf anatomy of C₃ and C₄ plants. Plant growth regulators and their effect on plant growth. Yield analysis. Effect of ethylene on regulation of stomata. To demonstrate that the light is necessary for photosynthesis. To demonstrate that the CO₂ is essential for photosynthesis (Moll's half leaf experiment).

Pl. Phy. 4.2 Crop Physiology-II**(1+1) = 2**

Seed Physiology – Seed structures, Development of embryo, endosperm, perisperm and seed coat, Morphological, Physiological and biochemical changes during seed development. Physiological maturity, morphological and physiological changes associated with physiological maturity in crop with examples, harvestable maturity, seed viability and vigour, factors affecting seed viability and vigour. Methods of testing seed viability and vigour, germination, utilization of seed reserves (carbohydrates, fats and proteins) during seed germination, morphological, physiological and biochemical changes during seed germination, factors affecting seed germination. Crop water relations including absorption, translocation, active and passive absorption of water, list of factors, ascent of sap with theories. Transpiration – Definition, significance, transpiration in

relation to crop productivity-antitranspirant, list of factors. Nutriophysiology – Definition, Mengel’s classification of plant nutrients, physiology of nutrient uptake, functions of plant nutrients, deficiency and toxicity symptoms of plant nutrients, foliar nutrition, hydroponics, solution and sand culture. Post harvest physiology – Seed dormancy, definition, types of seed dormancy advantages and disadvantages of seed dormancy, causes and remedial measures for breaking seed dormancy with examples – Optimum conditions of seed storage, factors influencing seed storage (ISTA standards).

Practical

Preparation of solutions. Methods of measuring water status in roots, stems and leaves. Imbibitions of seed. Optimum conditions for seed germination. Breaking seed dormancy
i) Chemical method ii) Mechanical methods. Seed viability and vigour tests.

Biochem. 4.1 Biochemistry

(2+1) = 3

Biochemistry – Introduction and importance. Plant cell, cell wall and its role in live stock, food and paper industries. Bio-molecules – Structure, properties & applications: Amino acids, peptides and proteins –Plant proteins and their quality. Enzymes –Factors affecting the activity, classification, Immobilisation and other industrial applications. Lipids –Acyl lipids, Their industrial application in soaps, detergents, paints, Varnishes, lubricants, adhesives, plastics, nylon, Bio-diesel, Biodegradable plastics etc. Carbohydrates; Nucleotides and Nucleic acids. Metabolic energy and its generation – Metabolism – Basic concepts, Glycolysis, Citric acid Cycle, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation. General reactions of amino acid degradation. Biosynthesis – carbohydrates, Lipids, Proteins and Nucleic acids. Metabolic regulation. Secondary metabolites, Terpenoids, Alkaloids, Phenolics and their applications in food and pharmaceutical industries.

Practical

Amino acid models (atomic); Paper electrophoresis for the separation of plant pigments; Protein denaturation – heat, pH, precipitation of proteins with heavy metals, Protein estimation by Lowry method; Enzyme kinetics, competitive inhibition, enzyme immobilization; Extraction of nucleic acids, column chromatography of RNA hydrolysate; Characterization of lipids by T.L.C.; Extraction of oil from oil seeds; Estimation of fatty acids by G.L.C.; Models of sugars, sucrose & starch; Quantitative determination of sugars; Paper chromatography for the separation of sugars; Determination of phenols.

Envs. 6.1 Environmental Science

(1+1) = 2

Scope and importance of environmental studies. Natural resources: Renewable and renewable resources. Forest, Water, Food, energy and land resources. Ecosystems: Definition, concept, structure and functions. Producers, consumers and decomposers of an ecosystem. Energy flow in the ecosystem. Types of ecosystems. Bio-diversity: Definition, classification, threats to biodiversity and its conservation. Environmental pollution: Causes, effects and control of air, water, soil, thermal, noise and marine pollution. Causes, effects and management of soil nuclear hazards and industrial wastes.

Disaster management, Floods, earthquakes, cyclones and land slides. Social issues and the environment, unsustainable to sustainable development. The Environment Protection Act, The Air Act, The water Act, The Wildlife Protection. Act and Forest Conservation Act. Woman and child welfare, HIV/AIDS and Role of information technology on environment and human health.

Practical

Collection, processing and storage of effluent samples; Determination of Bio-Chemical oxygen demand (BOD) in effluent sample; Determination of chemical oxygen demand (COD) in effluent sample; Estimation of dissolved oxygen in effluent samples; Determination of sound level by using sound level meter; Estimation of respirable and non respirable dust in the air by using portable dust sampler; Determination of total dissolved solids (TDS) in effluent samples; Estimation of species abundance of plants; Estimation of nitrate contamination in ground water; Analysis of temporary and total hardness of water sample by titration; Estimation of pesticide contamination in Agro-Ecosystem; Visit to Social Service Organisation / Environmental Education Centre; Crop adaptation to environmental variables, soils conditions; Study of transpiration and water balance in plants; Visit to a local polluted site. Observations and remedial measures; Assessment of chlorophyll content of fresh water / sea water ecosystem.

STATISTICS AND COMPUTER APPLICATION

Ag.Stat. 1.1

Introduction to Computer Applications

(1+1) = 2

Introduction to Computers, Anatomy of Computers, Input and Output Devices. Units of Memory, Hardware, Software and Classification of Computers. Personal Computers, Types of Processors, booting of computer, warm and cold booting. Computer Viruses, Worms and Vaccines. Operating System – DOS and WINDOWS. Disk Operating System (DOS): Some fundamental DOS Commands, FORMAT, DIR, COPY, PATH, LABEL, VOL, MD, CD and DELTREE, Rules for naming files in DOS and Types of files. WINDOWS: GUI, Desktop and its elements, WINDOWS Explorer, working with files and folders; setting time and date, starting and shutting down of WINDOWS. Anatomy of a WINDOW, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars. Applications – MSWORD: Word, processing and units of document, features of word-processing packages. Creating, Editing, Formatting and Saving a document in MSWORD; MSEXCEL: Electronic Spreadsheets, concept, packages. Creating, Editing and Saving a spreadsheet with MSEXCEL. Use of in-built Statistical and other functions and writing expressions. Use of Data Analysis Tools, Correlation and Regression, t-test for two-samples and ANOVA with One-way Classification. Creating Graphs. MS Power Point: Features of Power Point Package. MSACCESS: Concept of Database, Units of database, creating database; Principles of Programming: Flow Charts and Algorithms, illustration through examples. Internet: World Wide Web (WWW), Concepts, Web Browsing and Electronic Mail.

Practical

Study of Computer Components; Booting of Computer and its Shut Down; Practice of some fundamental DOS Commands, TIME, DATE, DIR, COPY, FORMAT, VOL, LABEL, PATH; Practicing WINDOWS Operating System, Use of Mouse, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars; WINDOWS Explorer, Creating Folders, COPY and PASTE functions; MSWORD: Creating a Document, Saving and Editing; MSWORD, Use of options from Tool Bars, Format, Insert and Tools (Spelling & Grammar) Alignment of text; MSWORD, Creating a Table, Merging of Cells, Column and Row width; MSEXCEL: Creating a Spreadsheet, Alignment of rows, columns and cells using Format tool bar; MSEXCEL: Entering Expressions through the formula tool bar and use of inbuilt functions, SUM, AVERAGE, STDEV; MSEXCEL: Data Analysis using inbuilt Tool Packs, Correlation & Regression; MSEXCEL: Creating Graphs and Saving with & without data; MSACCESS: Creating Database, Structuring with different types of fields; MS Power Point: Preparation of slides on Power Point; Transforming the data of WORD, EXCEL and ACCESS to other formats; Internet Browsing: Browsing a Web Page and Creating of E-Mail ID.

Introduction: Definition of Statistics and its use and limitations; Frequency Distribution and Frequency Curves; Measures of Central Tendency: Characteristics of Ideal Average, Arithmetic Mean; Median, Mode, Merits and Demerits of Arithmetic Mean; Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation; Probability: Definition and concept of probability; Normal Distribution and its properties; Introduction to Sampling: Random Sampling; the concept of Standard Error; Tests of Significance- Types of Errors, Null Hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis; Large Sample Test- SND test for Means, Single Sample and Two Samples (all types); Small Sample Test for Means, Student's t-test for Single Sample, Two Samples and Paired t test. F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Correlation: Types of Correlation and identification through Scatter Diagram, Computation of Correlation Coefficient 'r' and its testing. Linear Regression: of Y on X and X on Y. Inter-relation between 'r' and the regression coefficients, fitting of regression equations. Experimental Designs: Basic Designs, Completely Randomized Design (CRD), Layout and analysis with equal and unequal number of observations, Randomized Block Design (RBD), Layout and analysis, Latin Square Design (LSD), Layout and analysis.

Practical

Construction of Frequency Distribution Tables and Frequency Curves; Computation of Arithmetic Mean for Un-Grouped and Grouped data; Computation of Median for Un-Grouped and Grouped data; Computation of Mode for Un-Grouped and Grouped data; Computation of Standard Deviation, Variance and Coefficient of Variation for Un-Grouped and Grouped data; SND test for Means, Single Sample; SND test for Means , Two Samples; Student's t-test for Single Sample; Student's t-test for Two Samples; Paired t test and F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Computation of Correlation Coefficient 'r' and its testing; Fitting of regression equations- Y on X and X on Y; Analysis of Completely Randomized Design (CRD); Analysis of Randomized Block Design (RBD); Analysis of Latin Square Design (LSD).

ANIMAL PRODUCTION

LPM 4.1 Livestock Production and Management (1+1) = 2

General discourse on origin, domestication and utility of farm animals and their role in Indian economy, Animal Husbandry methods in India and abroad, Definitions of common terms pertaining to various species of livestock, Introduction to common feeds and fodders, their classification and utility, Utility classification of breeds of cattle, Study of important breeds of indigenous and exotic cows and buffaloes, Selection and Pairing of bullocks, breaking for work , hours of work for bullocks, various types of work to which they can be put, care of neck and hoof care and management of bullocks.

Practical

Study of external anatomy of cattle and its importance in selection. Judging and Pairing of bullocks. Measuring and weighing. Use of common restraints used in different animals. System of identification of livestock. Determination of age of cattle. Methods of securing and casting of animals. Identification of common feeds and fodders.

LPM 5.2 Dairy Cattle & Buffalo Production & Management (2+1) = 3

Importance of dairy industry in India, Importance of co-operative movement of dairy industry in India, Impact of WTO on Indian dairy Industry, concepts of feeding standards, ration, balanced ration, feeds and water requirements of the herd. Preservation and storage of forages as silage and hay. Scarcity feeding of bovines, Management of pastures, Calf rearing, Care Management, feeding and housing of various classes of dairy cattle and buffaloes. Summer management of buffalo, Mammary gland, milking and clean milk production. Problems of supply and demand of milk in India, Introduction to processing, preservation and marketing of milk, Systems of mating, Selection, Aids to selection and methods of selection for improving dairy cattle and buffaloes. Artificial insemination and breeding policies, project planning, loans and subsidies, Economics of dairy farming and atomization.

Practical

Visit to a dairy farm, judging dairy cattle by outward appearance and score card. Selection by pedigree, performance and progeny testing methods, Preparing animal for show, Identification and evaluations of feeds, Calculation of water and feed requirement for dairy herd, Computation of ration, Hay and silage making, study of records on a dairy farm, Housing of dairy cattle and buffalo, dairy herd health calendar, calving event and related things, Sampling and testing of milk for fat and total solids, Separation of milk, Visit to modern commercial dairy plant and cattle feed factory.

ENGLISH

Eng. 1.1 Comprehension and Communication Skills in English (1+1) = 2

Comprehension: Text for comprehension, Current English for Colleges, By N. Krishnaswamy & T.Sriraman, Macmillan India Limited, Madras, 1995; War Minus shooting – The sporting spirit George Orwell (a) Reading Comprehension (b) Vocabulary – Synonyms – Antonyms – Often confused words and (c) Two exercises to help the students in the enrichment of vocabulary based on TOEFL and GRE and other competitive examinations. A Dilemma – A layman looks at science Raymond B. Fosdick (a) Reading Comprehension (b) Vocabulary – Homonyms and Homophones (c) Exercises on Figurative Language & Idiomatic Language (E.g.: dust and ashes, doorstep of doom, boundaries of knowledge, Apple of one's eye, in a fix etc). 5&6 You and Your English – Spoken English and Broken English G.B.Shaw (a) Reading Comprehension (b) Language study, Functional Grammar, Agreement of verb with subject. Written Skills: Mechanics of good letter, Effective business correspondence, Personal Correspondence, Preparation of Curriculum vitae and Job applications. The Style, Importance of professional writing – Choice of words and Phrases, precision, conciseness clichés, redundancy, jargon, foreign words, Precis writing and synopsis writing. Interviews, Types of interviews, purpose, different settings, as interviewer, interviewee, physical makeup and manners, appearance, poise, speech, self reliance, Evaluation process, Review or feedback.

Practical

Listening Comprehension: Listening to short talks, lectures, speeches (scientific, commercial and general in nature) Practical: listening to at least two tape, recorded conversations aimed at testing the listening comprehension of students; Communication: Spoken English, oral communication, importance stress and intonation. Practical: Spoken English practice by using audiovisual aids, the essentials of good conversations, oral exercises in conversation practice (At the Doctor, at the Restaurant, at the Market Yard); Oral Presentation of Reports: Seminars and conferences, features of oral presentation, regulating speech, physical appearance, body language posture, eye contact, voice, audience, preparation of visual aids. Practical: One presentation by individual on the given topic related to agriculture like W.T.O, Developing new technologies in Agriculture, Bio fertilizers etc.; Evaluation of a Presentation: evaluation sheet, other strategies to be considered for evaluating a presentation, Practical: Mock evaluation of a presentation; Dyadic communication, face to face conversation, Telephonic conversation, rate of speech, clarity of voice, speaking and listening politeness, telephone etiquette, Practical: Practice of Telephonic conversation; Reading skills, using Dictionary, reading dialogues, rapid reading, intensive reading, improving reading skills; Meetings: purpose, procedure participation, chairmanship, physical arrangements, recording minutes of meeting; Practice of Presentation by using power point and LCD projector; Conducting Mock interviews – testing initiative, team spirit, leadership, intellectual ability – potential for development, memory, motivation, objectives, aptitude etc., Group Discussions and Debates on current topics; Review or Feed Back; Practical examination.

NON CREDIT COURSES

ENGLISH

Eng.4.2 English for Special Purpose (1+1) = 2

Presentation Skills

Elements of an effective presentation – Structure of a presentation – Presentation tools – Voice Modulation – Audience analysis – Body Language – Video Samples

Soft Skills

Time Management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity – Stress Management & Poise – Video Samples

Group Discussion

Why is GD part of selection process? – Structure of a GD – Moderator-led and other GDs – Strategies in GD – Team work – Body Language – Mock GD – Video Samples

Interview Skills

Kinds of Interviews – Required Key Skills – Corporate culture – Mock Interviews – Video Samples

PHYSICAL EDUCATION/ NCC / NSS

PE 1.1 & 2.2 Physical Education-I (0+1) = 1

Definition, aims and objectives and principles of Physical Education, Definition Tournament, Bye and various types. Drawing lots for fixtures in various tournaments viz., Knockout, Knockout-cum-league and League-cum-knock-out, Track and field events such as sprint and throwing. Compulsory participation in any one of the games viz., Out door games – Volleyball, Basketball, Cricket, Football, Kabaddi, Khp-Kho, etc. and Indoor games- Table Tannis, Chess and badminton.

Warming up and conditioning exercise are compulsory for each student.

OR

National Cadet Core (NCC) (0+1) = 1

Introduction and aim of NCC, Military history and Organization, System of NCC Training. Foot Drill, Arm Drill, Guard of Honour, Ceremonial Parade, Weapon Training – Rifle, LMG, Stem machine Carbine. Field Training – Field Craft, Battle Craft, Fire control and Fire discipline orders Tactics.

OR

National Service Scheme

(0+1) = 1

NSS Historical Back Ground, Emblem history, Aim and objectives of NSS; NSS volunteer; Duties of NSS volunteers, Education and Recreation; Programmes for working during emergencies; Environment enrichment and Conservation; Health; Family Welfare and Nutrition programme.

PE 3.3 & 4.3 Physical Education-II

(0+1) = 1

Definition of single and double league tournaments and drawing of lots, indoor games, importance of weight and circuit training exercise. Yogasenes, Tract and field – long distance and jumping events. Preparation of running tracks, Vollyball and Kabaddi, Knowledge exercise in Physiothereaphy, First aid and health education.

Warming up and conditioning exercise are compulsory for each student

OR

National Cadet Core (NCC)

(0+1) = 1

Map readings, Civil defense, Self defense, First aid, Hygiene and Sanitation, Leadership traits, Adventure training. National integration in India, Aim, NI camps, Social service-aim, major social service, Nature awareness/ ecology – Forest, Wide life, Pollution.

OR

National Service Scheme

(0+1) = 1

Production oriented programme, Social service programme, Preserving environment free from pollution, other activities undertaken depending on local needs and priorities, songs and National Integrity Songs, One day camps, Annual camp.

**COURSES FOR EXPERIENTIAL LEARNING
(INTER DISCIPLINARY COURSES)**

A student has to register total 20 credits with major load in one area of electives (12-15) credits) and rest from among one area of electives (5-8 credits) in a relevant disciplines (Group wise) in the Seventh Semester.

Sr. No.	Group	Disciplines
1	I	Crop Production and Commercial Agriculture
2	II	Crop Protection
3	III	Horticulture and Post Harvest Technology & Value Addition
4	IV	Agri-Business Management and Social Science
5	V	Basic Science

DISCIPLINE WISE COURSES

No	Course No.	Title of Course	Credit
I. Crop Production			
1	Agron.7.10	Seed Production Technology	3 (1+2)
2	Ag.Met.7.2	Remote Sensing GIS and Land Use Planning	3 (1+2)
3	Ag.Chem.7.4	Soil Management (Conservation, Problematic Soil, Soil Quality)	3 (2+1)
II. Crop Protection			
1	Cr.Prot.7.1	IPM and IDM (Pest Disease Scouting)	4 (2+2)
2	Cr.Prot.7.2	Management of Post Harvest Insect-Pests and Diseases	3 (1+2)
3	Cr.Prot.7.3	Bio-Control Agencies and Bio-Pesticide (Mass Multiplication and Uses)	3 (1+2)
4	Ag.Ento.7.5	Non-Insect Pests and Their Management	3 (1+2)
5	Ag.Ento.7.6	Apiculture	2 (0+2)
6	Ag.Ento.7.7	Pesticides and Plant Protection Equipment	3 (1+2)
7	Pl.Path.7.6	Mushroom Cultivation	2 (0+2)
III. Horticulture			
1	Hort. 7.5	Commercial Vegetable Production	3 (1+2)
2	Hort. 7.6	Commercial Floriculture	3 (1+2)
3	Hort. 7.7	Commercial Fruit Production	3 (1+2)
4	Hort. 7.8	Nursery Management of Horticultural Crops	4 (1+3)
5	Hort. 7.9	Protected Cultivation of Horticultural Crops	3 (1+2)
6	Hort. 7.10	Seed Production of Vegetables and Flowers	3 (1+2)
7	Hort. 7.11	Procession and Value Addition on Horticultural Crops	3 (1+2)
IV. Post Harvest Technology & Value Addition			
1	Ag.Pros.7.1	Post Harvest Technology of Horticultural Crops	3 (1+2)
2	Ag.Pros.7.2	Unit Operation for Quality Value Addition Processing and Development of New Products	4 (1+3)
3	Ag.Pros.7.3	Post Harvest Technology of Spices, Plantation Crops, Medicinal and Aromatic Crops	4 (1+3)

4	Ag.Pros.7.4	Integrated Storage Management of Fruits, Flowers and Vegetables	3 (1+2)
5	Ag.Pros.7.5	Post Harvest Handling of Cut Flowers and Dry Flowers	3 (1+2)
6	Ag.Pros.7.6	Processing of Cereals, Pulses and Oilseed Crops Including Bio-diesel	3 (1+2)
V. Agri-Business Management			
1	Ag.Econ.7.6	Information & Communication Management	3 (1+2)
2	Ag.Econ.7.7	Management of Agro-based Industry	4 (1+3)
3	Ag.Econ.7.8	Marketing Management (Agricultural Import-Export Policy of Govt. of India and Business Laws)	3 (1+2)
4	Ag.Econ.7.9	Financial Management of Agri-Business	4 (1+3)
5	Ag.Econ.7.10	Natural Resources Economics and Management	3 (1+2)
6	Ag.Econ.7.11	Project Formulation, Evaluation and Monitoring	3 (1+2)
VI. Social Science			
1	Ag.Extn.7.5	Agricultural Journalism	3 (2+1)
2	Ag.Extn.7.6	Visuals and Graphic Communications	3 (2+1)
3	Ag.Extn.7.7	Behavioural Skills	3 (2+1)
4	Ag.Econ.7.12	Livestock, Poultry and Fish Marketing	3 (2+1)
5	Ag.Econ.7.13	Farm Planning and Budgeting	3 (2+1)
6	Ag.Econ.7.14	Government Policies and Programmes Related to Agriculture	2 (2+0)
VII. Basic Science			
1	PBG. 7.7	Molecular Breeding	3 (1+2)
2	PBG. 7.8	Plant Tissue Culture	4 (1+3)
3	PBG. 7.9	Recombinant DNA Technology	3 (1+2)
4	PBG. 7.10	Bio Informatics	3 (1+2)
5	Biochem. 7.2	Molecular Diagnostics	3 (1+2)
6	Ag.Micro.7.2	Microbial & Environmental Technology	4 (1+3)
VIII. Commercial Agriculture			
1	Hort. 7.12	Commercial Floriculture	3 (1+2)
2	Hort. 7.13	Commercial Fruit Production	3 (0+3)
3	Hort. 7.14	Nursery Management of Horticultural Crops	4 (1+3)
4	Hort. 7.15	Production Technology of Economic Forest Plants	3 (1+2)
5	Agron. 7.11	Cultivation of Commercially Important Medicinal and Aromatic Plants	2 (1+1)
6	Agron. 7.12	Commercial Spices Production	3 (1+2)
7	Agron. 7.13	Commercial Seed Production Technology	3 (1+2)

Note: Theory and Practical syllabus will be prepared later on by the concerned department.

RAWEP Attachment with Agro-based Industries

During RAWEP Programme the students will undergo internship in any one of the following industries / companies / institutes for a period of twelve weeks (the list is only suggestive and need based / location specific industries may be included).

- Seed industries / companies
- Fertilizer industries
- Pesticides industries
- Biotechnological industries (Tissue Culture labs)
- Bio pesticides industries
- Commercial nurseries / landscaping units
- Sericulture units
- Food processing units
- Agricultural finance Institutions / Banks / Credit Societies etc.
- Non – Governmental organizations

Rural Agricultural Work Experience (RAWEP) (0+20) - 8th Semester As Per following Model

Sr. No	Subject	CREDITS	Phase wise work (period-days)								T O T A L	
			P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	P ₈		
1	Agron. 8.10	0+2	1	4	0	3	1	-	0		9	
2	Hort. 8.5	0+2	1	1	2	2	0	-	3		9	
3	Ag.Chem. 8.4	0+2	1	3	0	2	0	-	3		9	
4	PBG 8.7	0+2	1	3	2	2	0	-	1		9	
5	Ag. Engg. 8.5	0+1	1	1	1	1	0	-	2		6	
6	Pl. Path. 8.6	0+2	1	3	0	3	0	-	1		8	
7	Ag. Ento. 8.4	0+2	1	3	0	3	0	-	1		8	
8	LPM 8.3	0+1	0.5	0	0	2	1	-	1		4.5	
9	Ag. Extn. 8.5	0+2	1	1	1	1	3	-	1		8	
10	Ag. Econ. 8.6	0+1	1	1	0	1	0	-	2		5	
11	Ag. Stat. 8.3	0+1	0.5	0	4	0	0	-	0		4.5	
12	Educational Tour	0+2						21			21	
13	Exam. Evaluation									7	7	
Total working days				10	20	10	20	5	21	15	5	106
Total Saturday for missed & extra work				2	4	2	4	1	-	3	1	17
Holidays				2	4	2	4	1	-	3	1	17
Total days				14	28	14	28	7	21	21	7	140

P₁ = Orientation, **P₂** = Research Station, **P₃** = High Tech Cell, **P₄** = Village Exposure, **P₅**= NGO **P₆**=Educational Tour **P₇** = Industries and Cooperatives **P₈**=Report and Evaluation

Evaluation of RAWEP Programme

Attendance

Minimum attendance for this programme - 85%.

Records

Students shall complete the record work based on daily field observation notebooks and weekly diaries maintained by them.

Evaluation Procedure

The students shall be evaluated by Course Coordinator as well as by a designated evaluation Committee.

Note

- i) The duration of the RAWEP is 20 weeks with a weightage of 20 credits;
- ii) Wherever facilities are not available for industrial training and / or agri-clinics, the duration of vocational training may be increased to that extent;
- iii) RAWEP can be implemented either in the VII or VIII semester as per convenience.

Features of New Curriculum

- Six semesters coursework, one semester RAWEP and one semester electives in interdisciplinary courses for entrepreneurship development. In the electives, students have flexibility to choose courses. These courses have higher practical exercises for skill updation. The proportion of theory and practical is nearly 50:50.
- Adequate expertise for agri-clinic embedded.
- Curriculum redundancy removed.
- Course curricula reoriented to develop needed knowledge skills, entrepreneurial mindset of the student to take up self employment.
- Three non-credit courses viz., Comprehension and Developing Communication Skills in English and NSS/ NCC / Physical Education are included.
- Each University may provide specialization in 4 or 5 areas keeping in view the facilities and the need.
- Introduced few new courses like Introductory Agriculture, Renewable Energy, Organic farming, Biotechnology, Agribusiness, Project Development Appraisal and Monitoring and Entrepreneurship Development.