Agron. 1.1 : Introductory Agriculture and Principles of Agronomy 3 (2+1)

Theory
Art, Science and business of crop production, Basic elements of crop production; Factors affecting crop production; History of Agricultural Development; Ancient India Agriculture in Civilization Era, Chronological Agricultural Technology development in India. Indian Agriculture, balance sheet, liabilities; Assets and Contrasting trends (DATA), Agril. growth, contrasting food chains, Diversity in physiography, Soil groups, marine, livestock and water; Liabilities: Soil factors, weather factors, Economic ecology, dry and irrigation agriculture, Farming Systems approach, value addition, requirements in new technology; Women in Agriculture: multifaceted roles and tasks, work stress factors, Nutritional and rural life standards, role in house hold design making, drudgery reduction for farm women, women friendly agricultural technology; Empowerment of women; Group dynamics for farm women, rural women; The nucleus of Agricultural Extension and Training.

Meaning and scope of Agronomy: National and International Agricultural Research Institutes in India, Agro-climatic zones of India and Rajasthan. Tillage, crops stand establishment, Planting geometry and its effect on growth and yield cropping systems, Harvesting.

Practical
Study of tillage implements; Practice of ploughing; Practice of puddling; Study of seeding equipments. Different methods of sowing; Study of manures, fertilizers and green manure crops / seeds (including calculations); Study of intercultivation implements and practice; Practice of methods of fertilizer applications; Participation in ongoing field operations.

Agron. 1.2 : Field Crops-I (Kharif) 3 (2+1)

Theory
Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield of kharif crops, Cereals – rice, maize, sorghum, pearl millet and minor millets; Pulses : pigeonpea, mungbean and urdbean; Oilseeds: groundnut, sesame and soybean; Fibre crops: cotton, jute and sunhemp; and Forage crops: sorghum, maize, cowpea, cluster bean and napier.

Practical
Rice nursery preparation and transplanting/seed bed preparation and sowing of Kharif crops; Calculations on seed rate; Sowing of soybean, pigeonpea, mungbean, maize, groundnut, and cotton; Eff ect of seed size on germination and seedling vigour of soybean/groundnut; Eff ect of sowing depth on germination of soybean; Identification of weeds in rice, maize and soybean fields and study of weed control experiments in these crops; Top dressing of nitrogen in maize and rice and study of fertilizer experiments on rice, maize, sorghum and millets; Study of yield contributing characters, yield calculations, harvesting and yield estimation of above crops; Study of crop varieties and important agronomic experiments; Study of forage experiments.

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

Theory
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)**

**Practical**

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**

**Theory**

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 johson grass; Economics of weed control practices; Tours and visits of problem areas.

**Agron.4.6 : Practical Crop Production II (Rabi Crops)**

**Practical**

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**

**Theory**

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, bicarbonates, Ca++ and Mg++ in irrigation water (quality parameters).

**Agron.6.8 : Organic Farming**  
**Theory**
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**  
**Theory**
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.

**PBG 1.1 : Economic Botany**  
**Theory**
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 ad 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 3 (2+1)

Theory
Mendel’s laws of inheritance and exceptions to the laws; Types of gene action, Multiple alleles, Pleiotropism, Penetration and expressivity; Quantitative traits, Qualitative traits and differences between them; Multiple factor hypothesis; Cytoplasmic inheritance, it’s characteristic features and difference between chromosomal and cytoplasmic inheritance; Mutation and it’s 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 it’s 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 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 3 (2+1)

Theory
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 incomparability 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

Theory

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, Emasculaton 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

Theory

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 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, construtional 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, roguing etc.

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

Theory


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-electrophoricsis techniques.

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

Theory

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**


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

**Theory**


**Practical**


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

**Theory**

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**

**Theory**

History of Entomology in India. Factors for insects' abundance. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda.


**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 importances
9. Study of characters of orders Isoptera, Thysanoptera and their families of agricultural importances
10. Study of characters of orders Hemiptera and their families of agricultural importances
12. Study of characters of orders Coleoptera and their families of agricultural importances.

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

**Theory**

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.


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, pheremone 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 3 (2+1)

Theory
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 (Eleucine coracana), wheat, sugarcane, cotton, sun hemp, pulses, groundnut, castor, gingerly, safflower, sunflower, mustard, cumin, fennel, spinach, 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 2 (1+1)

Theory
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, colocasia, moringa species crops viz., chillies, onion, turmeric garlic, ginger, coriander and curry leaf; fruit tress 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 colocasia; 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 (2+0)
Theory

Ag.Econ.3.2 : Agricultural Marketing, Trade and Prices 2(1+1)
Theory

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 2 (1+1)
Theory
periods, cooperative credit structure: PACS, FSCS. Reorganisation of single window system. Successful cooperative systems in Gujarat, Maharastra, 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 Agril. Business Management** (Including Project Development, Appraisal and Monitoring) 2(1+1)

**Theory**


**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** 2 (1+1)

**Theory**


**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.
Ag.Engg.2.1 : Fundamentals of Soil-Water Conservation Engineering  3 (2+1)

Theory

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 sprinkler irrigation systems; Uniformity of water application in drip and sprinkler systems; Study of soil and water conservation measures.

Ag.Engg.3.2 : Farm Power and Machinery  2 (1+1)

Theory
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  2 (1+1)

Theory
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 deorticators, hand operated and

**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**

**Theory**


**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.

**Ag.Met. 2.1 : Agricultural Meteorology**

**Theory**


Practical

PLANT PATHOLOGY

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

Theory

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 Oidiopsis, Ovulariopsis, Erysiphe, Phyllactinia, Uncinula and Podosphaera; Study of Puccinia (different stages), Uromyces, Hemileia; Study of Sphacelotheca, Ustilago and Telosporium; 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 2 (1+1)

Theory
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 3 (2+1)

Theory
Economic importance, symptoms, cause, epidemiology and disease cycle and integrated management of diseases of rice, sorghum, bajra, maize, wheat, sugarcane, turmeric, tobacco, groundnut, sesameum, 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 sesameum & 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 2 (1+1)

Theory
Introduction: History of phytonematology. Economic importance. General characteristics of plant pathogenic nematodes. Nematode general morphology and biology. Classification of nematodes up to family level with emphasis on groups containing economically important genera. Classification of nematodes by habitat. Identification of economically important plant nematodes up to 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 symptomtolgy – 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 3 (2+1)

Theory
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 3 (2+1)

Theory

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 3 (2+1)

Theory
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; Transplanting of vegetable seedlings in main field; Layout of lawns and maintenance; Depotting, repotting and maintenance of house plants; Visit to commercial vegetable farms; Training and pruning of rose (standards, hybrid 'T' roses, cented roses) and chrysanthemum (pinching and disbudding); Planning and layout of gardens and garden designs for public and private areas; Intercultural operations in vegetable plots; Seed production in vegetable crops; Harvesting indices of different vegetable crops; Grading and packing of vegetables; Prolonging the shelf life of cut flowers.

Hort.4.3 : Production Technology of Spices, Aromatic, Medicinal and Plantation Crops

Theory
Plantation Crops Importance and cultivation technology of Spices – ginger, turmeric, pepper, cardamom, coriander, cumin, fenugreek; Aromatic crops – lemon grass, citronella, palmarose, vetiver, geranium, dawana; Plantation crops – coconut, arecanut, betelvine, cashew, cocoa, coffee, oilpalm; Medicinal plants – diascoria, ocimum, perwinkle, aloe, guggul, belladonna, nuxvomica, Solanum khasiamum, aonla, senna, plantago, stevia, coleus and Acorus.

Practical
Botanical description and identification of aromatic plants; Identification of varieties in spices and plantation crops; Identification of medicinal plants; Propagation techniques in aromatic and spice crops; Selection of mother palm, and seed nuts in coconut and oil palm; Study of identification of aromatic plants; Distillation procedures for aromatic crops; Propagation methods in plantation crops; Propagation and planting methods in turmeric; Propagation and planting techniques in ginger; Harvesting procedures in aromatic plants; Processing and curing of spices (ginger, turmeric and black pepper); Training methods in betelvine; Rejuvenation practices in cashewnut; Products – byproducts of spices and plantation crops; Procedures for oleoresin extraction; Visit to local commercial plantations. Aromatic & medicinal plant nurseries and seed spices field.

Hort.5.4 : Post Harvest Management and Value Addition of Fruits and Vegetables

Theory

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

**Ag.Extn.3.1: Dimensions of Agricultural Extension**

**Theory**

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 programe. 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 Programme – (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 Janyothi 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), Rashtiya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS) and Mahila Samriddhi 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**

**Theory**

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

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

Theory

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


Practical


Ag.Extn.6.4 : Entrepreneurship Development 2 (1+1)

Theory


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

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BIO-MATHEMATICS

Maths.1.1 : Bio-Mathematics 2 (2+0)

Theory
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.

MICROBIOLOGY

Ag.Micro.2.1 : Agricultural Microbiology 3 (2+1)

Theory

Practical

Pl.Phys.3.1 : Crop Physiology-I 3 (2+1)

Theory

Practical

Pl.Phys.4.2 : Crop Physiology-II 2 (1+1)

Theory
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. Nutriophysicsiology – 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

Biochem.4.1 : Biochemistry

Theory

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

Theory
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 
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 Organization / 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 2 (1+1)

Theory
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, 
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 Databa 

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,
Ag.Stat.2.2 : Agricultural Statistics

Theory
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).

LPM .4.1 : Principles of Livestock Production and Management

Theory
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
Theory

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 scorecard. 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.

Eng.1.1 : Comprehension and Communication Skills in English
(Non-credit course)

Theory

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.

A Text-book as per the recommendation of the course teacher to give the students structural exposure in writing.

Listening Comprehension - Listening and writing, Filling in the blanks – Listening and answering the questions

**Reading Comprehension and Vocabulary**
Filling in the blanks - Cloze Exercises – Vocabulary building – Reading and answering questions.

**Speaking:**
Phonetics: Intonation – Ear Training – Correct Pronunciation – Sound recognition exercises - Common Errors in English
Conversations: Face to Face Conversation - Telephone conversation – Structuring the resume / report – Letter writing / E-mail communication

**Eng.4.2 : English for Special Purpose (Non-credit course)**

2 (1+1)*

**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**

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

**PE 1.1 & 2.2 : Physical Education-I**

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.
**National Cadet Core (NCC)**


**National Service Scheme**

NSS Historical Background, 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**

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

Warming up and conditioning exercise are compulsory for each student.

**National Cadet Core (NCC)**

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.

**National Service Scheme**

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.
During RAWE 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 (RAWE) (0+20) - 7th Semester- As Per following Model

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<th>Sr. No</th>
<th>Subject</th>
<th>CREDITS</th>
<th>Phase wise work (period-days)</th>
<th>TOTAL</th>
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<td>PBG.7.7</td>
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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 RAWE 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 is to be implemented in the VIII semester.

Features of New Curriculum
- Six semesters coursework, one semester electives in interdisciplinary courses for entrepreneurship development and one semester RAWEP. In the electives, students have flexibility to choose courses. These courses have higher practical exercises for skill updating. 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.
A student has to register total 20 credits from following any one group in the Eighth semester
B.Sc. (Hons.) Agri.

**GROUP- I**

**CROP PRODUCTION AND COMMERCIAL AGRICULTURE**

**Agron.8.11 : Seed Production Technology**

**Theory**
Introduction and importance of seed production. Seed structure and morphology. Seed viability and dormancy-types, methods to breaking seed dormancy. Maintenance of genetic purity during seed production, isolation and roughing techniques, selling. Seed quality-concepts, importance and characteristics-Physical and genetic. Classes of seeds-Hybrid seed (F1), Nucleus see, Breeder seed, Foundation seed, Certified seed. Genetic and agronomic principles of seed production. Production of hybrid seeds of important crops-maize bajra, cotton, castor, jowar. Seed production of self pollinated crops. Seed classification-Phases of seed production-procedure, field inspection and seed law. Seed processing, post harvest processing, seed blending, seed storage- Problems of storage- Seed testing and certification, quality control, seed treatment.

**Practical**
Field visit of seed production plot, Field visit of seed testing laboratory, Study of roughing and isolation, Methods of seed production-Bajra, Wheat, Maize, Castor, Vegetable crops, Study of seed germination, seed vigour and seed viability. Study of seed Sampling-Principles and procedure. Study of seed purity analysis, germination test, moisture test and conventional purity tests of different crops. Seed treatment, methods of breaking seed dormancy. Identification of seed certification tags and its importance.

**Agron.8.12 : Cultivation of Commercially Important Medicinal and Aromatic Plants.**

**Theory**
Importance of medicinal plants, historical account, origin, distribution, present status and future prospects, active principles, crop improvement, cultivation practices, organic farming techniques, GAP, GMP, protected cultivation of high value crops. Integrated pest and disease management, post harvest handling, extraction of active principles, bioprospection and uses of Clinchona, Senna, Catharanthus, Dioscorea, Solanum, Datura, Atropa, Rauwolfia, Acorus, Digitalis, Ephedra, Aconitum, Opium Poppy, Cannabis, Neem, Kaempferia, Plumbago, Artemesia, Long pepper, Alpinia, Adhatoda, Asparagus, Indigofera, Holostemma, Isabgol, Liquorice, Aloe, Safed musli, Sapan wood and Withania. Emerging plant drugs-future and prospects of medicinal plants. Plants used in local health traditions. Role of aromatic plants in Indian economy-important aromatic plants in India. Origin, distribution, Botany & crop improvement, cultivation practices, GAP, GMP organic farming techniques, integrated pest and disease management, protected cultivation of high value crops, post harvest handling, extraction of essential oil and active principles, bioprospection and uses of Lemon grass, Java citronella, Palmarosa, Vetiver, Japanese mint, Artemisia, Rose, Tuberose, Basil, Eucalyptus, Sandalwood, Geranium, Jasmine, Patchouli, Abelmoscus moschatus and under exploited and miscellaneous essential oil yielding plants.
Practical
Medicinal plants-Identification of species and varieties of medicinal plants - maintenance of herbal garden-propagation techniques-post harvest handling, techniques of extraction of active principles-study of field problems. Visit to national and regional institutes dealing with research and development of medicinal plants. Aromatic plants-Identification of species and varieties of major aromatic plant-planting and maintenance of garden-propagation techniques-post harvest handling, techniques of extraction of active principles-study on field problems. Visit to national and regional institutes dealing with R & D of aromatic plants.

Agron.8.13 : Commercial Spices Production  3 (1+2)

Theory
Importance, origin, distribution, botany, crop improvement, varieties, agro-ecological requirements, nursery techniques, establishment and maintenance of spice gardens-cultural practices- water and nutrient management, protected cultivation of seed and herbal spices-shade regulation-weed control, organic spices, integrated pest and disease management, GAP, protected cultivation of high value crops, harvesting and post harvest handling, grading, packing and marketing, commercial products, value addition, quality control in spices, problems and prospects of cultivation, medicinal and other properties, bioprospection, problem & prospects of cultivation of the following crops: Ginger, turmeric, chilli, seed spices, (coriander, cumin, fennel, fenugreek, mustard) and herbal spices.

Practical

Agron.8.14 : Integrataed Farming system  3 (2+1)

Theory
Farming system-Definition, scope and characteristics-classification-Historical development of F.S's in India under different situations- concepts and components of farming system-Interaction between components- cropping system-complementary and competitive interaction-Effect of preceding crops and associated crops-Indices for evaluation for cropping system-Agronomic requirements in management of cropping system, cropping scheme-Sustainable agriculture, role of farming systems in sustainable agriculture-Integrated farming systems, factors governing choice and size of enterprises and resource allocation in Integrated farming system- Models of integrated farming systems for irrigated coastal ecosystems and rainfed ecosystems. Importance and role of IFS’s in organic farming, low Input sustainable agriculture and low cost agricultural technologies.

Practical
1. Preparation of cropping system for different farming situations having varying resource availability.
2. Working out input requirement and preparation of calendar of operations
3. Case studies on Integrated Farming Systems (IFS) and development of IFS for different resource situations.
4. Visit to different units of IFS.
Theory

Agronomic measures-Suitable cropping systems, Conservation tillage techniques- In situ conservation measures.
Micro irrigation-Introduction, scope, Different types of micro irrigation systems, conventional surface and micro irrigation systems, Principles, Advantages, limitation and adoptability to crops, soil water availability, irrigation, frequency and irrigation scheduling in micro irrigated crops, Wetting pattern and wetted area under sprinklers and emitters, Fustigation -Water soluble fertilizers-Specialty fertilizers. Components of micro-irrigation system. Design and installation of systems, operation and maintenance of systems, Fustigation equipment, Uniformity coefficient, monitoring and evaluation of the systems.


Practical
1. Analysis of rainfall
2. Study of agronomic measures of soil and moisture conservation
3. Demonstration of land treatments for moisture conservation
4. Study on erosion resistant and erosion permitting crops
5. Evaluation of treatment effect on moisture conservation
6. Estimation of run off
7. Estimation of soil loss
8. Study and design of conservation structures – Contour bunds
9. Study and design of graded bunds and terrace system
10. Study of Water harvesting structures
11. Visit to CRIDA watershed
12. Visit to ICRISAT watershed
13. Estimation of crop water requirement for different vegetable crops
14. Estimation of crop water requirement for different orchard crops
15. Study of different components of sprinkler irrigation
16. Study of layout of sprinkler irrigation
17. Field determination of distribution pattern and uniformity coefficient of sprinkler system
18. Field visit to study the operation and maintenance of sprinkler system
19. Study of different components of drip irrigation
20. Study of layout of drip irrigation
21. Calculation of application rate
22. Field study of wetting patterns under an emitter in different soil types
23. Calculation of fertilizer nutrient requirement
24. Calculation of acid requirement for acid treatment
25. Calculation of chlorine requirement for chlorination
26. Field visit to study the operation and maintenance of drip system
27. Assessment and interpretation of water quality data for use in irrigation
28. Analysis of water for EC, PH
29. Determination of chemical properties of water
30. Study of economic of micro irrigation
31. Field visit to study the operation of sewerage irrigation systems
32. Practical Examination

**Ag.Met.8.2 : Remote Sensing GIS and Land Use Planning**

**Theory**


**Practical**
Study of aerial photographs (optional) – study of photo scale – identification of cultural features using mirror stereoscope, study of heights of objects etc.


**Ag.Chem.8.5 : Soil Management**

**(Conservation, Problematic Soil, Soil Quality)**

**Theory**


problems due to use of fertilizers and agricultural chemicals for crop production. Biological degradation – soil sickness.


Practical

GROUP- II
CROP PROTECTION

Cr.Prot.8.1 : IPM and IDM (Pest Disease Scouting) 4 (2+2)

Theory

Practical
1. Study of physical and mechanical methods of control
2. Study of biological control of insects
3. Study of chemical insecticides
4. Calculation of dosages of different formulation of insecticides
5. Sampling techniques of different pests
6. Estimation of population of different pests
7. Preparation and application of NPV.
8. Efficacy of BT and fungal pathogen formulations under field conditions
9. Study of pheromone and light traps
10. Preparation of poison baits
11. Study of IPM practices of Rice.
12. Study of IPM practices of cotton
13. Study of IPM practices of Groundnut
14. Study of IPM practices of coconut
Cr.Prot.8.2 : Management of Post Harvest Insect- Pests and Diseases

**Theory**

Importance of stored grain pests. Source and kinds of infestation and types of damage of stored product insects. Distribution, commodities attacked, systematic position, marks of identification, nature of damage, biology and management practices of pests associated with stored seeds/grains of cereals, pulses, vegetables, condiments, spices and dried fruits viz., Angoumois grain moth, rice moth, potato tuber moth, ware house moth, Indian meal moth, lesser grain borer, Khapra beetle, pulse beetle, groundnut bruchid, long headed flour beetle, cigarette beetle, drug store beetle, rice weevil, maize weevil, sweet potato weevil, grain lice and flour grain mite. Important species of rodents, marks of identification, nature and extent of damage and their management. Methods of household and bulk storage of food grains. Storage structures – methods of disinfection – preventive and curative measures.


**Practicals**

1. Estimation of pest damage
2. Methods of monitoring of storage pests
3. Estimation of moisture content of grains
4. Methods of testing germination of seeds
5. Identification of damage to stored grain/seed by Lepidopteran pests and Psocopteran pests
6 & 7 Identification of damage to stored grain/seed by Coleopteran pests
8-9. Visit to NSC/ FCI/ WHCG
10. Study of important species of rodents
11. Storage structures for household and bulk storage of food grains
13. Acquaintance with handling of equipment used in post harvest pathology.
15. Study of the symptoms, etiology of post harvest diseases of seeds, fruits, vegetables and flowers
16. Demonstration of different methods used in the management of post harvest diseases

Cr.Prot.8.3 : Bio-Control Agencies and Bio-Pesticide

(Mass Multiplication and Uses)

**Theory**

engineered baculoviruses. Safety of insect pathogens to beneficial insects, man and other vertebrates. Safety testing and registration of biological control agents. Scope and limitations of microbial control in IPM. Advantages and limitations of biological control in pest management. Role of biological control in IPM – future needs.


Practicals
1. Basic insectary facilities and equipment to promote biological control
2. Characters of important orders and families of parasitoids
3. Characters of important orders and families of predators
4. Mass rearing techniques of important host insects of parasitoids and predators.
5–6. Mass rearing techniques of important parasitoids
7. Mass rearing techniques of important predators
8. Collection, preservation, shipment of biotic agents and storage of natural enemies.
10. Natural enemies of insect pests in rice and cotton ecosystems
11. Field trip for collection of natural enemies
12. Visit to biological control laboratory
13. Visits to mass production and biological control programme centers.
14. Description of the principal groups of infectious organisms
15. Collection of diseased insects and mites from field and Study of symptoms
16-17. Isolation and identification of pathogens
18. Preparation of culture media for fungi and culturing the fungi
19. Preparation of culture media for bacteria and culturing them
20-22. Production of NPV of Helicoverpa armigera and Spodoptera litura – extraction and purification, standardization and storage counting of PIB and larval equivalents. Formulation of microbial insecticides.
24-26. Basic techniques of isolation and testing of bioagents. A) Dilution phase technique B) Isolation of antibiotic producing organisms 1) testing antibiotic production in culture 2) Antibiotics in culture filtrate 3) Antibiotic production in soil.
27. Quantitative and qualitative analysis of rhizosphere and phyllosphere microflora.
28. In-vitro screening of fungal and bacterial antagonists
30. Mass multiplication of biocontrol agents a) For soil treatment b) For seed treatment
31. Mass multiplication by liquid, solid and semisolid fermentation technologies.
32. Measuring various quality parameters of biopesticides.

Ag.Ento.8.6 : Non-Insect Pests and Their Management 3 (1+2)

Theory

Rodents: Introduction and history of rodents in Indian Agriculture. Role of rodents in the economy of Country. Rodent pests of agricultural importance. Field and storage losses due to rodents. Taxonomy, distribution, habitat behavior, burrowing pattern, breeding potential, territoriality, activity pattern, host range, adaptation to various environments, population dynamics including population cycles. IPM- Factors controlling rodents, availability of food, cropping patterns harbourage migration, pest damage assessment and monitoring pest population. Methods of rodent management - mechanical, physical, biological, chemical bait shyness, bait preferences, placement of baits, evaluation of efficacy of bait. Poisons - anticoagulant rodenticides, fumigants antifertility agents etc. Other methods - sanitation, rodent proof structures, electromagnetic repellents etc. Rodent management in crops like rice,
sugarcane, coconut and threshing floors, industrial premises and godowns. Organization of rodent management campaigns.

**Agricultural Ornithology**: Introduction and importance of birds in Indian Agriculture, phytophagous bird species, yield losses, seasonal activity, host range, feeding behavior and management of bird pests.

**Fruit Bats**: Seasonal activity, host range, nature of damage and management.

**Snails and Slugs**: Important species of agricultural importance, nature of damage, host range, seasonal activity, chemical and biological methods of control.

**Crabs**: Important species of agricultural importance, nature of damage, host range and management.

**Phytophagous Nematodes**: Importance and systematic position of nematode. General morphology and biology. Important species of phytophagous nematodes, nature and extent of damage and management.

**Phytophagous Mites**: General morphology and biology in brief. Important species of mites of agricultural importance, nature and extent of damage and their management.

**Practicals**
1. Identification of important rodent species in different habitats.
2. Burrow patterns and feeding habits of important rodent species.
3. Pre baiting and baiting with poisons.
4. Fumigation of burrows.
5. Rodent management in rice and sugarcane field.
6. Identification of birds associated with agricultural crops.
7. Breeding biology and food habits of birds.
10. Diagnostic study of symptoms caused by different groups of mites on different crops.
11. Assessment of efficacy of acaricides.
12. Soil sampling methods and storage of soil samples for nematode extraction.
13. Extraction of nematodes from soil – Baermann funnel.
14. Study of important species of nematodes.
15. Study of symptoms caused by nematode species.
16. Study of snails, slugs and crabs.

**Ag.Ento.8.7: Apiculture**

**Practicals**
1 & 2. Study of important species of honey bees
3. Study of Langstroth’s bee hive and Newton’s bee hive
4. Study of the equipment for handling of bees
5. Method of honey extraction by using honey extractor
6 & 7. Study of nectar and pollen yielding flora
8. Starting of a new Apiary
9. Study of management of bee colonies in dearth period
10. Study of management of bee colonies in winter season
11. Division and uniting of colonies
12. Rearing of new queens by artificial queen grafting technique
13. Methods of Queen introduction into a new colony and Queen replacement
14. Method of artificial queen bee insemination
15. Transport of bee colonies and migratory bee keeping
16,17 & 18. Study of effect of honey bees as pollinators on the yield of crops
19. & 20. Study of effect of pesticides on honey bees
21. Methods of honey analysis
22. Study of bacterial diseases of honey bees
23 & 24. Study of viral and fungal diseases of honey bees
25. Study of parasitic mites on honey bees
26. Study of wax moths, bee eater birds and other enemies of bees
27. Method of collection of Royal Jelly
28. Method of collection of Bee Venom
29. Economics of bee keeping
30. Visit to honey processing unit
31. & 32. Visit to apiaries

**Ag.Ento.8.8 : Pesticides and Plant Protection equipment**

**Theory**


**Practicals**

1. Study of contact, stomach and fumigant toxicity of insecticides.
2. Preparation of dust and EC formulation of insecticides
3. Demonstration of methods of application of insecticides
4. Calculation of concentration/doses of different formulations of insecticides.
5. Demonstration of methods of application of fungicides
6. Calculation of concentration/doses of fungicides and herbicides
7. Preparation of Bordeaux mixture, Bordeaux paste and Chestnut compound
8. Bioassay of fungicides/herbicides-demonstration of poisoned food technique
9. Bioassay of fungicide-demonstration of slide germination and inhibition zone methods
10. Biocontrol of plant pathogens- demonstration of dual culture technique using Trichoderma viride, T. harzianum against any soil borne plant pathogen
11. Demonstration of seed treatment with biocontrol agent and fungicide
12. Demonstration of methods of application of herbicides
13. Study of types of herbicide treatments
14. Demonstration of non-selective control of weedy vegetation in non-cropped areas
15. Methods of treating bush and trees by herbicides
16. Visit to pesticide manufacturing units.
Practical:

1. Importance of Mushrooms and types of cultivated Mushrooms
4. Preparation of media and slants
5. Isolation and maintenance of Mushrooms cultures
6. Spawn preparation
7. Preparation of materials for Mushrooms beds
8. Hot water treatment, shade dry and Mushrooms bed laying
9. Cultivation of different species of pleurotus
10. Cultivation of paddy straw Mushroom
11. Casing soil preparation and cultivation of temperature tolerant button Mushroom (Agaricus bitorquis)
12. Disease and pests of Mushroom identification and their management
13. Post harvest handling of Mushrooms different methods of drying and packing of Mushrooms.
14. Collection of locally available Mushrooms and their identification
15. Enumeration of microbial population of Spawn, Compost, Casing soil of Mushrooms
16. Mushrooms culture preservation Techniques
17. Problem in Spawn preparation and their management
18. Machinery, Equipment and Instruments in the Mushrooms production and processing
19. Preparation of spore prints of Mushrooms
20. Visit to private Mushrooms firm.
HORTICULTURE AND POST HARVEST TECHNOLOGY AND VALUE ADDITION

Hort.8.6 : Commercial Vegetable Production 3 (1+2)

Theory
Importance of Vegetables in human diet. Vegetable regions and climatic requirement. Seed treatment, preparation of germination media, containers and growing of nurseries of different vegetables. Hardening of seedlings. Soil requirement, planting and after care, manures, fertigation, irrigation, inter cultural operations such as weeding, mulching, training and pruning, use of plant growth regulators, harvesting, post harvest handling, curing, storage, marketing and exports in vegetable crops like tomato, brinjal, chillies, sweet pepper, okra; cucurbitaceous crops like cucumber, gherkins, gourds, watermelon and muskmelon; leguminaceous vegetables like beans and peas; cole crops like cabbage and cauliflower; root crops like radish, carrot and onion; leafy vegetables like palak and lettuce.

Practical
1. Identification and description of different varieties of vegetables.
2. Planning and layout of Commercial vegetable garden.
3. Preparation of nursery beds and raising of nursery of different solanaceous vegetables.
4. Raising nursery of cole crops.
5. Sowing of cucurbitaceous vegetables.
7. Hardening of vegetable seedlings.
8. Methods of transplanting of vegetable seedlings.
10. Different methods of fertilizer application.
11. Study of different irrigation practices.
12. Attending the weed management practices in different vegetables.
13. Harvesting of different vegetable crops.
15. Visit to Commercial vegetable gardens.
16. Evaluation of vegetable crops raised by the students.

Note: Each student will be allotted one plot for raising vegetable crop.

Hort.8.7 : Commercial Floriculture (To be prepared later on by the department) 3 (1+2)

Theory
Selection of varieties, commercial propagation methods, preparation of field and bed, Spacing for different commercial flowers, Special horticultural techniques like stalking, pinching, disbudding, bending. Nutrition, water requirements through open as well as drip irrigation. Weed control, mulching, Use of growth regulators for higher quality production. Pre harvest treatments, harvesting techniques, post harvest management, grading and packing for internal and export markets and storage of major flower crops like rose, chrysanthemum, carnation, gladiolus, gerbera, tuberose, marigold, gaillardia, jasmin, spiderlily, golden rod etc.

Practical
1. Identification of various cultivars of rose, chrysanthemum, carnation, gladiolus, gerbera, tuberose, marigold, gaillardia, jasmin, spiderlily, golden rod etc.
2. Commercial propagation methods in rose, chrysanthemum, carnation, gladiolus, gerbera, tuberose, marigold, gaillardia, jasmin, spiderlily, golden rod etc.
3. Manure and fertilizer application in commercial flower crops.
4. Irrigation and fertigation practices in commercial flower crops.
5. Special horticultural techniques like stalking, pinching, disbudding, bending for commercial flower crops.
6. Use of growth regulators in commercial flower crops for higher quality production.
7. Different harvesting techniques, grading, packing for commercial flower crops.
8. Post harvest management for important flowers.
9. Working out benefit cost ratios for important flowers.
10. Visit to local commercial floriculture farm.

**Hort.8.8 : Commercial Fruit Production**

**Theory**
Selection of varieties, commercial propagation methods, root stocks for different purposes, preparation of field, digging and filling of pits, role of high density planting, training and pruning, nutrition, water requirements through open as well as drip irrigation. Weed control, mulching, flowering and fruit set. Use of growth regulators for various purposes, harvesting indices, harvesting techniques, pre harvest treatments, post harvest management, grading and packing for internal and export markets and storage of major fruit crops like mango, banana, citrus, guava, sapota, papaya, pomegranate, ber, litchi and apple.

**Practicals**
1. Commercial propagation methods in mango, citrus, sapota and guava.
2. Fertilizer application and field observation of deficiency symptoms of micro nutrients in major fruit crops.
3. Irrigation and fertigation practices in fruit crops.
4. Canopy management in mango (pruning, training, application of paclobutrazol etc.)
5. Training and pruning studies in grape, ber and pomegranate.
6. Studies on flower and fruit drop and their control in mango and citrus.
7. Papain extraction in papaya.
8. Hormonal application to improve fruit set, fruit thinning, fruit size and quality in major fruit crops.
9. Study of harvesting indices in mango, banana, sapota, papaya, and grape.
10. Studies on harvesting methods in fruit crops.
11. Harvesting, desaping, pre cooling, grading and palletisation and storage in mango.
12. Ripening methods in mango, banana and sapota.
13. Cold storage studies for different fruits.
14. Visit to commercial orchards to study cultural practices of important fruit crops.
15. Working out benefit cost ratios for mango, citrus, banana and grape.
16. Visit to local cold storage and export units of fruits.

**Hort.8.9 : Nursery Management of Horticultural Crops**

**Theory**
1. Introduction to plant propagation, basic genetical concepts concerning to plant propagation.
2. Choice of propagation methods, structure of vascular plants.
3. Importance of commercial nurseries in India and abroad.
4. Planning of a commercial ornamental plants nursery and its execution.
5. Planning and execution of commercial fruit plants nursery.
6. Study of different methods of propagation including micropropagation.
7. Propagation by specialized vegetative structures specially in flower crops.
8. Seed and vegetative propagation. Commercial methods of multiplication of flowers and fruit crops.
9&10 Plant propagating structures their importance in propagation - shade houses, tunnels, poly houses, fan and pad type of poly houses.
11. Propagation media, characteristics, types of media, natural and synthetic.
12. Use of plant growth regulators in rooting of cuttings.
13. Study of tools, accessories and other equipment necessary for nursery production of ornamental and fruit crops.
14. Micropropagation of plants, aseptic cultures advantages and disadvantages, preparation of different types of media and explants.
15&16 Propagation methods of some important plants. Indoor ornamental plants, ornamental bulbous plants, shrubs and trees, fruits and nuts, medicinal and aromatic plants, succulents and cacti.

Practicals
1. Preparation of lay out in establishing of commercial nurseries for fruit plants.
2. Preparation of lay out in establishing of commercial nurseries for ornamental plants.
3. Preparation of lay out for establishment of mother plant block.
4. Study of pre germination treatment of seeds- scarification and stratification.
5. Study of seed viability tests.
6. Preparation of raised and flat seed bed to test germination parentage of seeds treated with pre germination treatments.
7. Preparation of potting mixtures and study of characteristics of individual items of media.
8. Study of different types of containers.
9. Preparation of different types of cuttings (ornamental and fruits)
10. Study of different types of bulbs, tubers, and corms.
11. Study of dormancy breaking techniques in bulbs, tubers, and corms.
12. Different methods of multiplication of bulbs, tubers and corms.
13. Study of different methods of layering in ornamental and fruit crops.
15. Pre curing techniques and preparation of root stocks for budding and grafting of important ornamental and fruit crops.
16 to 22. Commercial propagation - practice of important methods of propagation of the following crops.

Fruits: (1) mango (2) guava (3) chiku (4) sweet orange & mandarins (5) litchi (6) fig (7) ber (8) anona (9) pomegranate

Ornamental plants: (1) roses (2) indoor decorative plants (3) shrubs and bushes

23. Planning and execution / study of construction of shade houses and poly tunnels.
24. Study of poly houses and development of furniture suitable for propagation in poly houses and tunnels.
25 to 28 Visit to commercial nurseries and study of different methods of propagation in and around the location of study.
29. Preparation of media for micropropagation.
30. Preparation of aseptic cultures for propagation of important ornamental plants like gerbera and chrysanthemum and fruit crops like banana.
31. Hardening of plants propagated through tissue culture.
32. Visit to tissue culture labs for study of multiplication of plants.
Hort.8.10  :  Protected Cultivation of Horticultural Crops

Theory
Introduction, history, definition, world scenario, greenhouse effect, uses of greenhouses, status and scope of greenhouse technology in India, choice of crops for cultivation under greenhouses, problems/constraints of greenhouse cultivation and future strategies. Planning and designing for greenhouses-site selection, greenhouse orientation, plan, layout. Greenhouse utilities-water, electricity, etc.


Practicals
1. Study of various types of greenhouses/ poly house and their suitability for different crops.
2. Study of various framework materials used in the greenhouse construction
3. Study of various cladding materials used for covering the greenhouse
4. Study of various equipments used in the greenhouses
5. Study of various growing media used in raising of greenhouse crops and their preparation and pasteurization/ sterilization.
6. Testing of soil to study its suitability for growing crops in greenhouse
7. Testing of water to study its suitability for growing the crops in greenhouse
8,9 & 10. Light, humidity and temperature management in greenhouse
11&12. Nutrient requirement calculations for different crops for fertigation
13,14&15. Study of fertigation requirements for greenhouse crops
16. Working and requirement for reducing the water PH
17. Estimation of E.C. in the fertigation solution
18,19,20, 21&22. Practicing training and pruning in rose, carnation, tomato, cucumber etc.
23,24&25. Study of post-harvest handling of greenhouse crops
26,27&28. Visit to commercial greenhouses.
29&30. Visit to flower markets

Ag.Pros.8.1  :  Unit Operation for Quality Value Addition Processing and Development of New Products

Theory
Introduction to unit operations size reduction – Equipment. Crushers, Hammar mills, Ball mills. Mixing- Mixing of solids, pastes and liquids. Mechanical separation – Filtration, sedimentation,

Practicals
1,2,3,4 Study of different size reduction equipment
5,6,7,8 Study of different mixing equipment
9,10 Study of filtration equipment
11,12 Study of sedimentation equipment
13,14 Study of cyclone separator
15,16 Study of centrifugal separator
17,18,19 Study of storage distillation equipment
20,21,22 Study of steam distillation equipment
23,24,25,26 Study of vacuum distillation equipment
27,28,29,30 Study of batch distillation equipment
31,32 Practical examination

GROUP- IV

SOCIAL SCIENCES AND AGRI-BUSINESS MANAGEMENT

Ag.Extn.8.6 : Agricultural Journalism 3 (2+1)

Theory
Journalist – Meaning, Roles, Qualities, Types.
Print Media – Concept, Role, Trends, Principles, Laws, Ethics, History of Print media in India
Readership analysis- Meaning, Importance, Methods
Writing New stories, Feature articles and Success stories- Planning & Writing
Electronic media – Concept, Types, Trends, Principles, Ethics, History of Electronic Media in India
Listeners / Viewers analysis- Meaning, Importance, Methods
Radio – Scope and Importance, History, Script writing for Radio, Treatment, Recording and Broad Casting
Television – Scope and Importance, History, Script writing for TV, Planning, Recording and Telecasting.
Photo Journalism – Concept, Scope and Importance, Principles, Selection and Editing of photographs, writing photo features and captions.
Video Production Technology – Concepts, Types of Cameras & Parts, Different formats, Techniques of Planning, Production and Editing, Types of Shots, Audio & Video mixing.
Public Relations – Meaning, Concept, Scope and Dimensions, Scenario in Organizations.
Practicals
1. Designing of layout and Preparation of Agricultural Information Materials
2. Testing the readability of prepared Agricultural Information materials.
3. Gathering of news by using different methods.
4. Exercise on writing of different forms of news reports in print media.
5. Editing Process in Print Media.
6. Testing the readability of printed literature.
7. Visit to a newspaper office.
8. Visit to All India Radio Station / a TV Studio.
11. Preparation of Story board for TV
12. Method of holding and Exposing a Still camera.
13. Writing captions for Photographs.
14. Writing Photo features for photographs.
15. Studying various parts of video camera and Handling of video camera.

Ag.Extn.8.7 : Visuals and Graphic Communications 3 (2+1)
Theory
1. Meaning, Definitions and the Role of Visuals in communication
2. Characteristics of Visual aids
3. Classification of visual aids
4 & 5. Principles and Production of visuals
6. Contribution of visual perception in learning process
7 & 8. Planning, Preparation, Presentation and evaluation of visual aids
9 & 10. Designing of messages and titles for visuals
11. Layout of visual aids
12. Selection and use of graphic formats
13 & 14. Preparation and use of low cost visuals based on the local situation
15 & 16. Preparation and use of photographs and pictures
17. Reprographic visuals
18-20. Computer based visuals and digitized video materials
21-23. Use of drawing techniques for different visuals
24-27. Selection and use of animation tools in transfer of technology
28 & 29. Preparation and use of resource maps for extension work
30-32. Designing of visuals for print and electronic media

Practicals
1–3. Preparation of low-cost visuals
4. Designing and layout of visual aids
5 & 6. Generating computer aided presentation of graphics
7. Scanning of visuals
8 & 9. Image editing and script writing for telecasts
10. Development of agricultural video films
11 & 12. Editing of video visuals
13. Visit to animation production center
14 & 15. Visit to print and electronic media centers
Presentation and evaluation of low cost visuals

Ag.Extn.8.8 : Behavioral Skills 3 (2+1)

Theory

Factors influencing Behaviour – Personal, Psychological, Social, Cultural and Environmental factors.
Reading skills – Meaning, Importance, Techniques
Writing Skills – Meaning, Importance, Techniques
Listening skills - Meaning, Importance, Techniques
Presentation skills - Meaning, Importance, Techniques
Transactional Analysis and Interpersonal Communication Skills – Meaning, Importance, Methods, Strategies.
Conflict Management skills – Meaning, Role of conflicts, Sources of Conflicts, Management of Conflicts.
Negotiation Skills – Meaning, Need for Negotiation, Types.
Human Relations Skills – Meaning, Importance, Techniques.
Planning skills – Meaning, Importance, Types and Techniques
Decision making skills – Meaning, Importance, Steps, Techniques of Decision making.
Observation Skills – Meaning, Importance, Types.
Facilitation skills – Meaning, Importance, Techniques
Counseling Skills - Meaning, Importance, Techniques
Leadership skills - Meaning, Importance, Techniques
Time Management skills – Meaning, Importance, Techniques.
Stress Management skills – Meaning, Sources, Coping mechanisms.
Motivation skills – Meaning, Importance, Needs, Techniques of Motivation.
Emotional intelligence – Meaning, Importance, Dimensions.
Team building skills – Meaning, Characteristics, Formation of Teams, Factors affecting team work.
Creativity Development Skills - Meaning, True creativity, Creative thinking, Seven habits of Successful creative thinkers
Preparation for Examinations – written and oral examinations.

Practicals

1. Exercise on Reading, Listening, Writing, Presentation, (2)
2. Exercise of Interpersonal Communication Skills (1)
3. Exercise on Conflict Management and Negotiation skills (2)
4. Exercise on Planning Skills (1)
5. Exercise on Problem Solving Skills (1)
6. Exercise on Leadership development Skills (1)
7. Exercise on Decision Making Skills (1)
8. Identification of skills through mutual observation (1)
9. Exercise on Time Management skills (1)
10. Stress Relaxation Techniques (1)
11. Team building Exercise (1)
12. Exercise on facing interviews (1)
Ag.Econ.8.7 : Management of Agro-based industry  

**Theory**

Types of Agribusiness input sector, seed industry world scenario, Indian scenario, seed production marketing, supply demand, quality standards, various agencies involved, public-private sector role, distribution network, seed policy, fertilizer industry scenario role, trends, demand supply condition, subsidies, pesticides and chemicals industry scenario types and benefits of pesticides, role of bio-pesticides, supply-demand conditions. Farm machinery and equipment, various types, industry growth –Government policy, taxes and subsidies. Agricultural credit structure, magnitude of agricultural credit, components of credit profile, various schemes under NABARD and commercial banks, various promotional activities in agri input sector-impact of WTO on agri input industries, changing strategies of agri input sector. Agri output marketing and processing industry, raw material procurement, problems, marketing of the processed foods, distribution logistics, value addition, promotional tools, pricing techniques, packaging, branding.

**Practicals**

1. Study of functioning of fertilizer industry
2. Study of functioning of pesticide industry
3. Study of functioning of seed industry
4. Study of functioning of farm machinery and equipment industry
5. Study of functioning of food processing industry
6. Study of functioning of livestock and poultry industry
7. Study of functioning of sugar industry
8. Study of functioning of horticulture based industries
9. Study of functioning of processing industry
10. Study and functioning of various institutional agencies financing agro based Industries.

Ag.Econ.8.8 : Financial Management of Agri-Business  

**Theory**

Financial resources of an organization, importance and need for financial resources. Financial Management, scope of finance, finance functions, financial manager’s role, financial goal, profit versus wealth. Agribusiness financial management, role of the financial manager, Recording Agribusiness transactions, Accounting definition and meaning, users of accounting information, forms of business organization, the accounting equation. Accounts, classification of commonly used accounts, the double entry system, recording transactions, journals and ledgers, trail balance, basic accounting considerations, assets and liabilities, capital and owners equity, revenue, cost of sales and net profit. Operating and incidental expenses, inventory, depreciation, Accounting cycle. Income measurement, the adjustment process, preparing financial statements from the adjusted trial balance. Preparing an income statement and balance sheet, profit and loss statement. Financial ratio analysis, users of financial analysis, Nature of financial ratios - types of ratios. Financial planning, objectives of profit planning (or budgeting), essential of profit planning, types of budgets, preparation of profit plan or budgets.

**Practicals**

1. Accounting equation.
2. Classification of accounts
3. Double entry system
4. Journals and ledgers
5. Trail balance
6. Preparing income statement
7. Preparing balance sheet
8. Profit and loss statement
9. Financial ratio analysis
10. Case studies
**Ag.Econ.8.9 : Farm Planning and Budgeting** 3 (2+1)

**Theory**
- Farm Planning – Objectives
- Characteristics of good farm plan
- Components of farm plan
- Statement of the objective function
- Inventory of scarce resources and constraints

**Planning Technique**
- Steps in farm planning
- Planning
- Implementation
- Control

**Budgeting**
- Types of Farm Budgeting
- Partial Budgeting
- Enterprise Budgeting
- Cash Flow Budgeting
- Complete Budgeting
- Limitations

**Linear Programming**
- Assumptions
- Concepts
- Estimation of optimal solution by linear programming
- Illustrations
- Limitations

**Practicals**
1. Preparation of Partial budgets for different activities
2. Preparation of alternative plans
3. Identification of Planning techniques
4. Preparation of Cash flow statement
5. Exercise on Enterprise budgeting
6. Exercise on Complete budgeting
7. Exercise on Linear Programming Techniques for optimal solution
8. Balance Sheet and Income Statement

**GROUP- V**

**BASIC SCIENCES**

**PBG.8.8 : Molecular Breeding** 3 (1+2)

**Theory**
- Introduction
- Nucleic acids as genetic material
- DNA structure
- Types
- Replications
- Restriction endonucleases
- Molecular analysis of Nucleic acids
- Molecular analysis of genes and chromosomes
- Amplification of DNA by polymerase chain reaction
- Molecular markers
- RFLP, AFLP, RAPD, SSR, DNA finger printing
- DNA probes
- Mapping QTLS
- Marker assisted selection

**Practicals**
1. Isolation of plant DNA
2. Quantification of DNA
3. Isolation of mitochondrial DNA and quantification
4. Isolation of chloroplast DNA and quantification
5. Restriction enzyme digestion
6. Polymerase chain reaction technique
7. RAPD analysis
8. AFLP analysis
9. SSR analysis

**PBG.8.9 : Plant Tissue Culture** 4 (1+3)

**Theory**
- In-vitro selection of mutants for biotic and abiotic stress resistance
- Accomplishments
- Somatic embryogenesis and synthetic seed production technology
- Protoplast isolation
- Culture manipulation
- Fusion
- Products of somatic hybrids and cybrids
- Applications in crop

Practicals
1. Micro-propagation of important crops
2. Anther culture
3. Pollen culture
4. Ovary culture
5. Ovule culture
6. Embryo culture
7. Endosperm culture
8. Protoplast culture
9. Hardening / Acclimatization of regenerated plants

PBG.8.10 : Recombinant DNA Technology 3 (1+2)

Theory

Practicals
1. DNA extraction
2. Restriction enzyme digestion
3. Gel electrophoresis
4. Southern Hybridization
5. Extraction of proteins and isozymes
6. Polymerase chain reaction and its application in molecular analysis
7. Techniques for plant gene transfer
8. Detection of transgenes

PBG.8.11 : Bioinformatics 3 (1+2)

Theory
Historical introduction on Bioinformatics as a science and overview, Bioinformatics and computing for innovative scientific discovery, Data application and management, Use of data bases in biology, Sequence data base, Structural data bases, Sequence analysis- protein and nucleic acid, Structural comparisons, Alignment of pairs of sequences, Multiple sequence alignment, Primer design tools, Repeat regions and domain identification, Phylogenic and gene prediction, Database searching for similar sequences.

Practicals
Basic principles of computing in Bioinformatics, Drawing Bar charts and presenting data in different formats, Making spread sheets and doing transformations, scoring for similarity index data, Collecting and storing sequences in the laboratory, BLAST search, Identification of consensus sequences and domain identification, ORF finding, Microarray data analysis.

Biochem.8.2 : Molecular Diagnostics 3 (1+2)

Theory
1. Introduction-Molecular make-up of cell structure-Ultra structure of cell wall memebranes.
2. Molecular organelle- Chloroplast and mitochondrial genomes, microsatillites, micro assays
3. Plant cell interaction with environment—Abiotic stresses: drought, flooding heat and cold stress, salinity, heavy metal and oxidative and anaerobic stress leading to molecular changes.

4. Impact of stresses on plant growth, development and productivity potential.

5. Physiology and biochemical markers in crop plants tolerant to salt stress (glycine betaine aldehyde, betaine aldehyde dehydrogenase)—cold stress, heat shock, (heat shock proteins), high moisture stress, oxidative stress (PPO, PO, SOD), herbicide stress (acetate lactate synthase, Glutathione-S-transferase, heavy metal stress, deficient nutrient stress, herbivore stress (methyl jasmonate)).

6. Diagnosis of stresses by specific molecular proteins or isozyme profiles: Salt stress—glycine, proline BADHase, drought dehydration, starch (in roots); Oxidative stress—PPO, POD, SOD, IAAOase; Heat shock—heat shock proteins (protein profiles); Cold stress—dehydrogenases, specific proteins, herbivore stress—astringent alkalide, flavinoids; Herbicide stress—methyl jasmonates, acetalactate synthetase, GST etc; Excess carbon dioxide stress—starch granules in chloroplast; disease susceptibility—ABA accumulation in leaves, peroxidases; Nutrient deficiency—tissue tests, biochemical markers; Molecular responses to flooding, anaerobic conditions and defence against plant pathogens and pests.


9. Molecular Diagnostics application to Plant Health. Molecular identification tools for pests and diseases, Molecular Markers (SSRs, RFLPs, AFLP, RAPDs, CAPS)—Mitochondrial DNA, nuclear DNA, DNA finger printing, Bio-sensors, DNA Biosensor chips.

Practicals

1. Diagnosis for drought tolerance in crop plants.
2. In vitro salt tolerance in crop plants using glycine betaine (GB).
3. Salt tolerance in crop plants through physiological and biochemical markers.
4. Herbicide tolerance in crop plants through physiological and biochemical markers.
5. Identification of physiological and biochemical markers under water deficient and high moisture stress in crop plants.
6. Oxidative stress and identification of Isozyme variation for SOD
7. Oxidative stress and identification of Isozyme variation for POD
8. Oxidative stress and identification of Isozyme variation for Catalase
9. Oxidative stress and identification for betaine aldehyde dehydrogenase
10. Identification of low photo respiring plants based on glycolate oxidase activity
11. Screening of photosynthetic inhibitor herbicide by Hill reaction method
12. Nitrogen—use-efficient crop plant based on nitrate reductase activity
14. Techniques on
   a. Electrophoresis
   b. Blotting methods
   c. ELISA
   d. Immuno-assays.
   e. PCR techniques.

Ag.Micro.8.2 :Microbial & Environmental Technology

4 (1+3)

Theory

(a) Microbial Technology
1. History and Development of Microbial Technology
2. Typical fermentation and types of fermentations
3. Microbial production of Biofuel, alcohol and alcoholic beverages
4. Production of microbial inoculants such as Biofertilizer, Biocontrol agents, Microbial pesticides, Integrated nutrient, pest and disease management
5. Role of Microorganisms in production of Antibiotics, Organic acids, Amino acids, Vitamins, food and feed supplements such as Spirulina
6. Microbial degradation of pesticides and bioremediation
7. Treatment of industrial waste and sewage
8. Biogas production
9. Microbiology of fermented foods: -Curd, Idli, Saurecraut, etc.

(b) Environmental Technology
Introduction, history and concepts of Environmental Technology
Water Pollution: Water quality standards. Technologies for purification in the public water supply system. Sources of waste water. Waste water treatment technologies and recycling. Soil Pollution: Sources and treatment technologies
Industrial wastes: Wastes from primary industries (Agriculture, live stock & mining) primary industries (Food & chemicals) and from hospitals. Management of Industrial Wastes: Treatment technologies and 3 R’s Golden Rule of industrial waste management. Preventing industrial waste and pollution through cleaner production technology.
Bio remediation: Production of value added products (single cell protein and Biofuels) by waste recycling.
Green technologies and environmental protection.
Environmental Protection Act: Air, water, wild life protection and forest conservation acts

Practicals
(a) Microbial Technology
1. Isolation and purification of microbial cultures
2. Isolation of bacterio phages
3. Microbial examination of water
4. Production of wine
5. Production of microbial inoculants with Rhizobium, PSB, Trichoderma, Pseudomonas, BGA, Bacillus thuringeneses and Evaluation of quality of microbial inoculants
6. Ethanol production from agricultural waste
7. Measurement of organic matter decomposition in soil
8. Demonstration of pesticides degradation activity
9. Bio degradation of crop residues
10. Biogas production
11. Microbiological examination of fermented foods
(b) Environmental Technology
1. Physical characterization of industrial sludge
2. Estimation of Bio-chemical Oxygen Demand (BOD) of an effluent sample.
3. Estimation of fluorides in ground water
4. Estimation of alkalinity of water
5. Estimation of total inorganic phosphate in water
6. Visit to Sewage Treatment Plants
7. Pit method of composting by using farm waste
8. Compost maturity test – physical and chemical
9. Understanding loss of biodiversity in crop plants by Electrophoretic technique
10. Response to seasonal variation (temperature) in species composition by biotechnology application
11. Determination of respirable and non respirable dust in the air.
12. Assessing the comparison between TDS and EC of an effluent sample and fresh water sample.
13. Visit to Effluent treatment plants.
14. Preparation of Biopesticide (Neem seed kernel extract)
15. Learning of techniques of inoculation of Biofertilizers

Visit to sanitary land fill site incineration site of an industry