Syllabus

B. Sc. (Ag.) Hons

Part-I: Core Courses
Part-II: Experiential Learning

Palli-Siksha Bhavana
(Institute of Agriculture)
Visva Bharati
Sriniketan
Part-I: Core Courses

AGR 111  Introductory Agriculture (Ancient Heritage, Agricultural Scenario and Gender Equity in Agriculture)  1(1+0)

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), Agricultural growth, contrasting food chains, Diversity in physiographic, 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.

AGR 112  Principles of Agronomy and Agricultural Meteorology  3(2+1)


Practical: Study of tillage implements; Practice of ploughing and puddling; Study of seeding/planting equipments, Different methods of sowing; Study of manures, fertilizers and green manure crops / seeds (including calculations); Study of inter-cultivation implements and practice; Methods of fertilizer applications; Participation in ongoing field operations. Site selection for Agromet observatory; Measurement of temperature, rainfall, evaporation (atmospheric/soil), atmospheric pressure, sunshine duration and solar radiation, wind direction and speed and relative humidity; Study of weather forecasting and synoptic charts, tabulation and calculation of meteorological data, visit to meteorological observatory.
AGR 121 Water Management Including Micro Irrigation 3(2+1)

Irrigation: definition and objectives, water resources and irrigation development in India and West Bengal; 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, pigeon pea, rapeseed-mustard, sugarcane, potato, and jute); Excess water and agricultural drainage; Rain water management - water harvesting, moisture conservation and utilization.

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).

AGR 211 Weed Management 2 (1+1)

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 management: physical, cultural, chemical and biological methods. Biotechnology in weed management. Integrated weed management; Herbicides: advantages and limitations of herbicide usage in India, Herbicide classification, formulations, methods of application; Introduction to Adjuvants and their use in herbicides; Introduction to selectivity and mode of action 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 management.

Practical: Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of weed herbarium; Study of seed production potential of major 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; Herbicide inventory; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, bermuda grass, Parthenium, Echinocloa and parasitic weeds; Economics of weed management practices; Tours and visits of problem areas.
AGR 212  Field Crops-I (Kharif)  3(2+1)
Origin, geographic distribution, morphology, classification, economic importance, soil and climatic requirement, varieties, cultural practices and yield of *kharif* crops; Cereals: rice, maize, sorghum, pearl millet and finger millets; Pulses: pigeonpea, mungbean and urdbean; Oilseeds: groundnut, sesame, soybean and castor; Fibre crops: cotton, jute, mesta and sunhemp; and Forage crops: sorghum, maize, cowpea, cluster bean, napier, rice bean, pasture grasses and legumes; preservation of forage crops.

**Practical**: Rice nursery preparation and transplanting/seed bed preparation and sowing of *kharif* crops; Calculations on seed rate and fertilizer dose; Studies on germination/sprouting and seedling vigour; Effect of sowing depth on germination and emergence; Identification of associated weeds in *kharif* crops; Top dressing of nitrogen in major *kharif* crops and study of fertilizer experiments; Study of growth attributes, yield components, harvesting and yield estimations; Study of crop varieties and agronomic experiments; Study on nodulation in legumes.

AGR 221  Field Crops- II (Rabi)  3(2+1)
Origin, geographical distribution, morphology, classification, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *rabi* crops; Cereals: wheat, barley; Pulses: chickpea, lentil, peas and lathyrus; Oilseeds: rapeseed-mustard, sunflower, safflower and linseed; Sugar crops: sugarcane; Commercial crops: potato and tobacco, Forage crops: berseem, lucerne and oats.

**Practical**: Seed bed preparation and sowing of *rabi* crops; Calculations on seed rate and fertilizer dose; Top dressing of nitrogen in *rabi* crops and study of fertilizer experiments; Identification of crop associated weeds in *rabi* crops; Study of growth attributes, yield components, harvesting and yield estimations; Yield and quality analysis of sugarcane; Study of crop varieties and agronomic experiments and visit to research stations related to *rabi* crops.

AGR 311  Organic Farming  3(2+1)
Introduction, concept, principles, components, relevance in present context; Organic production requirements; Biological intensive nutrient management-organic manure, vermicompost, green manure, 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; Concept of bio-village.

**Practical**: Preparation of enriched Farm Yard Manure and vermicompost; Visit to urban waste recycling unit; Study of profitable utilization of agricultural wastes; Raising of vegetable crops organically through nutrient, diseases and pest management; vegetable and ornamental nursery raising; macro quality analysis, grading, packaging, post harvest management. Visit to an organic farm to study various components and utilization.
AGR 312  Practical Crop Production I (Kharif Crops)  1(0+1)

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed treatment, nursery raising, sowing, nutrient, water and weed management and management of insect pests 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.

AGR 321  Practical Crop Production II (Rabi Crops)  1(0+1)

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests 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.

AGR 322  Farming Systems and Sustainable Agriculture  2(1+1)

Sustainable agriculture: Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures; Land degradation and conservation of natural resources, Low External Input Agriculture (LEIA) & High External Input Agriculture (HEIA); Irrigation problems, waste lands and their development; Farming systems: definition, principles, components and types; Farming systems in India; Agroforestry systems; IFS for wetland, irrigated land and dryland situations.

Practical: Preparation of cropping scheme for irrigated and dryland situations; Study of existing farming systems in nearby villages; Preparation of integrated farming system model for wetlands, drylands and irrigated lands; Visit to different farm enterprises to study resource allocation, utilization and economics. Studies on agroforestry systems.

GPB 211  Principles of Genetics  3 (2+1)

Mendel’s laws of inheritance and exceptions to the laws; Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Quantitative traits, Qualitative traits and differences between them; Multiple factor hypothesis; Cytoplasmic inheritance, it’s characteristic features and difference between chromosomal and cytoplasmic inheritance; Sex determination and sex linkage, sex limited and sex influenced traits: Mutation and it’s characteristic features; Methods of inducing mutations and C I 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); 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.

**GPB221 Principles of Plant Breeding 3(2+1)**

Historical development of plant breeding, plant breeding concept, nature and role of plant breeding, major achievements and future prospects, Aims and objectives of Plant Breeding; Modes of reproduction, Sexual, Asexual, Apomixis and their classification; Significance in plant breeding; Domestication, centres of origin, centres of diversity, acclimatization; components of genetic variations; Modes of pollination, genetic consequences, differences between self and cross pollinated crops; Methods of breeding – introduction and acclimatization. Selection, Mass selection Johansson’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, recurrent selection, synthetics and composites; Clonal selection;Mutation breeding; Ploidy breeding; Wide hybridization, significance in crop improvement.

**Practical:** Botanical description and floral biology; Study of megasporogenesis and microsporogenesis; Fertilization and life cycle of an angiospermic plant; Plant Breeder’s kit; Hybridization techniques and precautions to be taken; Floral morphology, selfing, emasculation and crossing techniques; Study of male sterility and incompatibility in field plots; Rice Maize and Wheat; Sugarcane, Groundnut, and Sesamum; Redgram, Bengalgram and Greengram; Soybean and blackgram; Chillies, Brinjal and Tomato; Bhendi.

**GPB 311 Principles of Plant Biotechnology 3(2+1)**

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

**Practical:** Requirements for Plant Tissue Culture Laboratory; Techniques in Plant Tissue Culture; Media components and preparations; Sterilization techniques and Inoculation of various explants; Aseptic manipulation of various explants; Callus induction and Plant Regeneration; Study of different micropropagation approaches viz. meristem shoot tip culture *etc.* Anther, Embryo and Endosperm culture;

**GPB 321 Breeding of Field and Horticulture Crops 3(2+1)**

Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Hardy-Weinberg Law; Study in respect of origin, distribution of species, wild relatives and forms, Cereals (rice, wheat, maize); Pulses (redgram, greengram, blackgram, soybean); Oilseeds (Groundnut, sesame, sunflower, rapeseed-mustard) etc. Fibers (Cotton and jute); Vegetables (Tomato, bhindi, chilli, cucumbers); Flowers crops (Chrysanthemum, rose, & marigold); Fruit crops (guava, mango, banana, papaya); Major breeding procedures for development of hybrids / varieties of various crops; Plant Genetic Resources their conservation and utilization in crop improvement; Ideotype concept in crop improvement; Breeding for resistance to biotic and abiotic stresses variability in pathogens and pests; Mechanisms of resistance in plant to pathogens and pest; 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:** Emasculation and Hybridization techniques; Handling of segregating generations, pedigree methods; Handling of segregating generations, bulk methods; Handling of segregating generations, 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; Parentage of released varieties/hybrids; Problems on Hardy-Weinberg Law; 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
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, Seed health; 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 certification, phases of certification, procedure for seed certification, field inspection and field counts etc.; Seed Production, Foundation and certified seed production in maize, rice, sorghum and bajra, cotton and sunflower, castor, tomato and brinjal, chillies and bhendi, onion, bottle gourd and ridge gourd; Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories; Duties and powers of seed inspectors, offences and penalties; Seed control order: Seed Control Order 1983, Seed Act 2000 and other issues related to seed quality regulation. Intellectual Property Rights, Patenting, WTO, Plant Breeders Rights, Varietal Identification through Grow–Out Test and Electrophoresis; Seed Drying: Forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air, Heated air drying, building requirements, types of air distribution systems for seed drying, selection of crop dryers and systems of heated air drying, recommended temperature and depth of the seeds, management of seed drying, Planning and layout of seed processing plant; Establishment of seed processing plant. Seed processing: air screen machine and its working principle, different upgrading equipments and their use, Establishing a seed testing laboratory. Seed testing procedures for quality assessment, Seed treatment, Importance of seed treatment, types of seed treatment, equipment used for seed treatment (Slurry and Mist–O–matic treater), Seed packing and seed storage, stages of seed storage, factors affecting seed longevity during storage and conditions required for good storage, General principles of seed storage, constructional features for good seed warehouse, measures for pest and disease control, temperature control, Seed marketing, marketing structure, marketing organization, sales generation activities, promotional media, pricing policy; Factors affecting seed marketing.

Practical: Seed sampling principles and procedures; Physical Purity analysis of Field and Horticultural crops; Germination analysis of Field and Horticultural crops; Moisture tests of Field and Horticultural crops; Viability test of Field and Horticultural crops; Seed health test of Field and Horticultural crops; Vigour tests of Field and Horticultural crops; Seed dormancy and breaking methods; Grow out tests and electrophoresis for varietal identification; Visit to Seed production plots of different 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, rouging, etc.
SSC 111  Introduction to Soil Science 3(2+1)

Theory: 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.


SSC 121 Soil Chemistry, Soil Fertility and Nutrient Management 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 bentiocarb; Fungicides – Major classes – Properties and uses of carbandazim, carboxin, captan, tridemorph and copper oxychloride – Insecticides Act, Plant growth regulators. Effect of insecticides on soil, water and air.

forms. Significance of pupal stage. Diapause. A brief outline on insect anatomy.


AEN 221: Insect Ecology and Integrated Pest Management (including Beneficial Insects) (2+1)


handling and maintenance. Estimation of exact quantity of required commercial formulation, determination of doses from the total requirement of pesticide in a particular area. Bioefficacy studies of some new generation insecticides against some major lepidopteran pests and beneficial coleopteran predators.

AEN 321        Crop Pests and Stored Grain Pests and Their Management    3(2+1)

Nature and extent of damage and injury caused by insect-pest. Life cycle, seasonal history, host range, distribution and management of the major insect pests attacking field crops: Cereals (rice, wheat and maize); Pulses (gram, green gram, arahar pea); Oilseeds (mustard, sesame, sunflower, ground nut); Fibre crops (jute, cotton), Sugar crops (sugarcane); Vegetable crops (brinjal, okra, tomato, chilli, potato, cole crops, cucurbits); Fruit crops (citrus, banana, mango, coconut, litchi, jack fruit, papaya, guava, pomegranate, apple, pineapple, cashew nut); Spices and condiments (zinger, turmeric, black pepper and cardamom) and Plantation crops (tea, coffeee). A brief introduction, importance (National and International), life cycle, major species observed and extent of damage of the polyphagous pests like Locust and Termite. Economic importance and general control of plant parasitic mites & rodents and their general control measures. A brief out line on economic importance of Molluscs, Aves, Amphibian and higher Vertebrates in agriculture. Stored grain insect-pests, taxonomic position & identification, their biology, nature of damage and their management.


AEC            AGRICULTURAL ECONOMICS

AEC 121        Principles of Agricultural Economics    2 (2+0)


**AEC 211 Agricultural Finance and Co-Operation 2(1+1)**


**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.

**AEC 221 Agricultural Marketing, Trade and Prices 2 (1+1)**

Practical: Identification of marketing channels; Study of regulated markets; Study of unregulated markets; Price spread analysis; Visit to market institutions; Study of SWC, CWC and STC; Analysis of information of daily prices; Estimation of marketed and marketable surplus, cost of cultivations.

AEC 311 Fundamentals of Farm Business Management (Including Project Development, Appraisal and Monitoring) 2(1+1)


AEC 321 Production Economics and Farm Management 2 (1+1)


AEG  AGRICULTURAL ENGINEERING

AEG 121  Fundamentals of Soil, Water and Conservation Engineering  3(2+1)

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

Practical: Acquaintance with chain survey equipment; Ranging and measurement of offsets; Chain triangulation; Cross staff survey; Plotting of chain triangulation; Plotting of cross staff survey; Plotting compass survey; Plotting plane table 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 drip and sprinkler irrigation systems; Uniformity of water application in drip and sprinkler systems; Study of soil and water conservation measures.

AEG 221  Farm Power and Machinery  2(1+1)

Farm power and its sources in India; 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 sowing implements - seed drills, paddy transplanters; Plant protection equipment and harvesting equipment; Threshing equipment - threshers for different crops, parts, terminology, care and maintenance. Winnowing, manual and power operated winnowers, care and maintenance. 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, maintenance and operation of tractor; Learning of tractor driving; Study, maintenance and operation of power tiller; Study of M.B. plough, measurement of plough size, different parts, horizontal and vertical suction; Study of disc plough; Study of seed–cum-fertilizer drills-furrow opener, metering mechanism and calibration; Study of paddy transplanters; Study of different inter cultivation equipment in terms of efficiency, field capacity; Repairs, adjustments and operation of sprayers and dusters; Study of different parts, registration, alignment and operation of mower; Study of threshers, their components, operation and adjustments. Estimation of operation cost of farm equipment.
AEG311  Protected Cultivation and Post-Harvest Technology  2(1+1)

Green house technology - Introduction, types of green houses; Planning and design criteria of greenhouse for cooling and heating purposes; Green house equipment, materials of construction for low cost green houses; Passive solar green house, hot air green house for heating systems, greenhouse drying; Choice of crops or plants response to green house environment; Irrigation systems used in greenhouses; Cost estimation and economic analysis; Constraints/problems of greenhouse cultivation and future strategies. Importance of post harvest technology; Engineering properties of agricultural materials; Measurement of grain moisture content – methods, equilibrium moisture content; Seed processing – unit operations such as cleaning, grading, separation and its equipment; Grain drying – theory of grain drying, types of grain dryers; Grain storage practice – bag and bulk storage structures; Paddy processing – parboiling, merits, demerits, methods of parboiling; Milling of paddy, equipment for milling; Size reduction, equipment for size reduction care and maintenance.

Practical: Study of different types of green houses based on shape, construction and cladding materials; Calculation of rate of air exchange in an active summer and winter cooling system; Testing of soil and water to study its suitability for growing crops in greenhouses; Study of fertigation requirements for greenhouses crops. Visit to commercial green houses. Determination of engineering properties of agricultural products- such as angle of repose, coefficient of friction, hardness, etc; Measurement of grain moisture content by direct and indirect methods; Study of seed cleaners, graders and separators; Study of different grain dryers; Study of improved grain storage structure; Study of milling equipment- rubber roll dehusker, engleburg huller; Visit to seed processing plant.

AEG321    Renewable Energy                 2(1+1)

Energy sources - classification, energy from biomass, agricultural wastes, biogas plants and their constructional details, biogas production and its utilization; Principles of combustion, pyrolysis and gasification, types of gasifiers, producer gas and its utilization. Briquetting- machines for briquetting, uses of briquettes; Solar energy - solar flat plate and focusing plate collectors, solar air heaters, solar space heating and cooling, solar energy applications/solar energy gadgets, solar cookers, solar water heating systems, solar grain dryers, solar refrigeration system, solar ponds, solar photo voltaic systems, solar lantern, solar street lights, solar fencing, solar pumping systems. Wind energy - types of windmills, constructional details & application of windmills. Liquid bio fuels-bio diesel and ethanol from agricultural produce and its production & uses.

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

**CPH  CROP PHYSIOLOGY**

**CPH 121  Crop Physiology  3(2 + 1)**


**Practical:** Preparation of solutions; Measurement of water potential by Chardakov’s method and Gravimetric method; Measurement of Osmotic potential by Plasmolytic method, Measurement of photosynthetic rate; Measurement of photosynthetic pigments: chlorophyll and carotenoids; Stomatal frequency and index; Measurement of respiration; Leaf anatomy of C₃ and C₄ plants; Measurement of transpiration, Imbibition of seed; Optimum conditions for seed
germination; Breaking seed dormancy; (a) Chemical method (b) Mechanical method; Seed viability and vigour tests. Measurement of leaf area by various methods; Growth analysis - study of growth parameters: LAI, LAD, CGR, RGR, LAR, NAR; Preparation of Hoagland’s solution for hydroponics and to study mineral deficiency, Study of mineral nutrient deficiency in field crops; Effect of ABA on regulation of stomata of stomatal movement.

PPC PLANT PATHOLOGY

PPC 111 Agricultural Microbiology 3(2+1)


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

Isolation of soil microflora:
i) Isolation of fungi and bacteria from soil.
ii) Isolation of fungi from infected plant tissue, preparation of PDA.
iii) Identification of common fungi and their characterization.

PPC121  Introductory Nematology  2 (1+1)

Introduction: History of phytonematology. Economic importance. General characteristics of plant pathogenic nematodes. Nematode general morphology and biology. Digestive and reproductive system in nematode. Classification of nematodes upto family level with emphasis on groups containing economically important genera. Classification of nematodes by habitat. Identification of economically important plant nematodes upto generic level with the help of keys and description. Symptoms caused by nematodes with examples. Interaction between plant parasitic nematodes and disease causing fungi, bacteria and viruses. Nematode diseases: Root knot of vegetables, ufra disease of rice, tundu or ear cockle of wheat, golden nematode of potato; List of other important nematode diseases in India. Basic knowledge of nematode management.

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

Note: Students should submit pressed, well mounted diseased specimens (at least 5) during the semester end practical examination.

PPC 211  Plant Pathogens and Principles of Plant Pathology  4(3+1)


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 Mucor and Rhizopus. Study of Oidium, Oidiopsis, Ovulariopsis, Erysiphe, Phyllactinia, Uncinula and Podosphaera; Study of Puccinia (different stages), Uromyces, Hemilea; Study of Sphacelotheca, Ustilago and Tolyposporium; Study of Agaricus, Pleurotus and Ganoderma; Study of Septoria, Colletotrichum, Pestalotiopsis and Pyricularia; Study of Aspergillus, Penicillium, Trichoderma, and Fusarium; Study of Helminthosporium, Drechslera, Alternaria, Stempyllium, Cercospora, Phaeoisariopsis, Rhizoctonia and Sclerotium; 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.

PPC 221 Diseases of Field Crops and Their Management 3 (2+1)


Practical: Study of symptoms, etiology, host-parasite relationship and specific control measures of the following crop diseases. Presentation of disease samples survey and collection of Diseases of rice, sorghum; Diseases of wheat, bajra & maize; Diseases of sugarcane, turmeric & tobacco; Diseases of groundnut, castor & sunflower; Diseases of sesamum & cotton; Diseases of redgram, greengram, blackgram, bengalgram & beans; Field
visits at appropriate time during the semester.
Note: Students should submit pressed, well mounted diseased specimens during the semester end practical examination.

**PPC 311: Diseases of Horticultural Crops and Their Management  3(2+1)**

Economic importance, symptoms, cause, epidemiology and disease cycle and integrated management of the following crop diseases:
- Citrus: Canker, die-back, Greening, anthracnose, gummosis, shooty mould.
- Mango: Anthracnose and die-back, malformation, Black tip, Red rust. shooty mould
- Banana: Panama disease, Sigatoka leaf spot, moko disease, bunchy top.
- Grapevine: Downy mildew, anthracnose.
- Pomegranate: Bacterial blight.
- Papaya: Anthracnose, stem and foot rot, papaya mosaic (ring spot), leaf curl.
- Apple: Fire blight, scab
- Guava: Anthracnose, wilt.
- Coconut: Leaf spot, root wilt, fruit rot, stem bleeding.
- Turmeric: Leaf spot
- Sapota: shooty mould
- Chilli: Damping –off of vegetables, anthracnose and ripe fruit rot, mosaic, leaf curl
- Brinjal: Bacterial and fungal wilt, *Macrophomina* rot, *Phomopsis* blight, little leaf
- Bhindi: Yellow vein mosaic
- Potato: Late blight, early blight, scab, wart, black scurf and wire stem, bacterial soft rot, mild mosaic, severe mosaic, rugose mosaic, acuba mosaic, leaf roll, hairy sprout.
- Crucifers: Alternaria leaf spot, black vein, boron and molybdenum deficiency.
- Cucurbits: Powdery mildew, downy mildew, mosaic
- Tomato: Early blight, bacterial and fungal wilt, mosaic, leaf curl.
- Beans: Mosaic, anthracnose, rust
- Onion: Alternaria leaf spot, potash deficiency.
- Betel vine: Stem and foot rot, bacterial leaf spot
- Mulberry: Powder mildew, leaf spot.
- Coffee: Rust.
- Tea: Rust, blister blight, red rust of tea.
- Rose: Die-back, black spot.
- Crysanthemum: Leaf spot
- Jasmine: Leaf spot
- Tube rose: Collar rot and leaf blight.
- Marigold: Leaf spot and bud rot

**Practical:** Diseases of citrus, guava, sapota, papaya, banana, pomegranate, mango, grapes & apple; Diseases of chilli, brinjal, beans, bhendi, potato, tomato, crucifers, cucurbits & onion. Diseases of betelvine, coconut, tea, coffee & mulberry; Diseases of rose, chrysanthemum, tube rose & jasmine. Field visits at appropriate time during the semester.
Note: Students should submit pressed, well mounted diseased specimens during the semester end practical examination.
HOR  HORTICULTURE

HOR 111  Production Technology of Fruit Crops 3(2+1)


Practical:
1. Study of horticultural tools and implements and their uses.
2. Containers, potting mixture, potting and repotting.
4. Propagation by cuttings, layering and grafting.
5. Layout and planting systems.
6. Methods of pruning and training.
7. Description and identification of important major fruit crops.
8. Irrigation methods in fruit crops.
10. Visit to local commercial orchards.

HOR 121  Production Technology of Vegetables and Flowers 3(2+1)


Importance of ornamental gardens. Planning of ornamental gardens. Types and styles of ornamental gardens. Use of trees, shrubs, climbers, palms, houseplants and seasonal flowers in the gardens. Package of practices for rose, jasmine, chrysanthemum, marigold and tuberose.

Practical
1. Planning and layout of kitchen garden
2. Identification of important vegetable seeds and plants
3. Raising of vegetable nurseries / seed beds.
4. Identification of ornamental plants (trees, shrubs, climbers, house plants, palms etc.).
5. Transplanting of vegetable seedlings in main field, intercultural operations & other practices
6. Seed extraction in tomato and brinjal
7. Visit to commercial vegetable farms
8. Planning and layout of gardens and garden designs for public and private areas.
10. Intercultural operations in vegetable plots.

HOR 221 Production Technology of Spices, Aromatic, Medicinal and Plantation Crops 3 (2+1)

Importance and cultivation technology of Spices – ginger, turmeric, black pepper, cardamom, coriander, cumin, fenugreek; Aromatic crops – lemon grass, citronella, palmarosa; Plantation crops – coconut, arecanut, betelvine, cashew; Medicinal plants – diascoria, rauvolfia, opium, ocimum, periwinkle, Solanum khasiamum, aonla, senna and plantago.

Practical
2. Identification of spices and plantation crops.
3. Identification of medicinal plants.
4. Propagation techniques in aromatic and spice crops.
5. Study of identification of aromatic plants.
6. Distillation procedures for aromatic crops.
7. Propagation methods in plantation crops.
8. Propagation and planting methods in ginger and turmeric.
10. Processing and curing of spices.
11. Visit to local commercial plantations.

HOR 321 Post Harvest Management and Value Addition of Fruits and Vegetables 2(1+1)


Practical
1. Practice in judging the maturity of various fruits and vegetables.
3. Determination of physiological loss in weight (PLW), total soluble solids (TSS), total sugars, acidity and ascorbic acid content in fruits and vegetables.
4. Different packing methods and methods of prolonging storage life.
5. Effect of ethylene on ripening.
6. Identification of equipment and machinery used in preservation of fruits and vegetables.
8. Preparation of jam, jelly and marmalades.
12. Preparation of squash, cordials and syrups.
13. Preparation of chutneys, pickles, sauces and ketchup.
14. Visit to local processing units / market yards / cold storage units / market and packing industries

AEX AGRICULTURAL EXTENSION

AEX 211 Fundamentals of Rural Sociology and Educational Psychology 2(2+0)


AEX 221 Dimensions of Agricultural Extension 2(1+1)


**Practical:** Visits to a village and kisan mandal to study the ongoing development programmes. Visits to Panchayat Raj Institutions to study the functioning of Gram Panchayat (GP). Participation in monthly workshops of Training and Visit (T & V) System. Visit to Watershed Development Project area. Visit to a village to study the Self Help Groups (SHGs) of DWCRA. Visit to a voluntary organization to study the developmental activities. Visit to villages.

**AEX311 Extension Methodologies for Transfer of Agricultural Technology 2(1+1)**


**AEX 321 Entrepreneurship Development and Communication Skills 2 (1+1)**

Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government policy on Small and Medium Enterprises (SMEs) /SSIs. Export and Import Policies relevant to agriculture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of agri inputs industry. Characteristics of Indian agricultural processing and export industry. Social Responsibility of Business. Communication Skills: meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

**Practical**

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations.
ACB AGRICULTURAL BIOCHEMISTRY

ACB111 Biochemistry 3(2+1)


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.

AST Agricultural Statistics

AST 311 Statistics 3(2+1)

Unit I: 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; 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. Probability: Definition and concept of probability; Expectation and Variance of a random variable, A brief introduction of Binomial, Poisson, Normal distribution and their properties.

Unit II: 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; ANOVA: one way and two way analysis, Experimental Designs: Basic Designs, Completely Randomized Design(CRD), Layout and analysis with equal and
unequal number of observations, Randomized Block Design (RBD).

**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 Standard Deviation, Variance and Coefficient of Variation for Un-Grouped and Grouped data; Computation of Correlation Coefficient ‘r’ and its testing; Fitting of regression equations- Y on X and X on Y; 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.

CMA COMPUTER APPLICATION

**CMA111 Introduction to Computer Applications** 2(0+2)


ANS ANIMAL SCIENCE

**ANS 121 Livestock Production and Management** 3(2+1)

etc. with prevention and control. Common idea of A.I. Zoonotic diseases. Livestock farm and environment. Breeding, feeding and production records. Poultry science: Breed characteristics of poultry, their methods of rearing, breeding, feeding and management, incubation, hatching and brooding, vaccination and prevention of diseases, preservation and marketing of eggs, its economics and keeping quality. Cost of production of milk, economical units of cattle, buffalo, sheep, goat and swine.

**Practical:** External body parts of cattle & fowl. Identification, handling and restraining of animals; Judging and culling; Feeding and ration formulation; Identification of feeds & fodder. Hatching, housing and management of poultry; Estimation of specific gravity and fat percentage of milk. Familiarity with A.I. system. Visit to livestock farms. Economics of livestock production.
Part-II: Experiential Learning

MODULE: CROP PRODUCTION

ELCP 01  Seed Production Technology         4 (2+2)

Importance of seeds, Seed quality, Different classes of seed, Nucleus, Breeder, Foundation, Certified and Truthfully labeled seeds, Seed dormancy–types, methods to break seed dormancy, Maintenance and multiplication of released varieties in self and cross- pollinated crops, Seed certification, Seed Legislations in India and Quarantine; Genetic and agronomic principles of seed production, hybrid seed production, Seed Sampling and Testing, Central and State Seed Testing Laboratories; Importance of seed treatment, Seed treatment, types of seed treatment, equipments used for seed treatment, Seed storage and packaging, Seed processing, Measures for pest and disease control, Seed marketing.

Practical: Study of floral biology of monocots and dicots, external and internal structures of monocot and dicot seeds; Preparation of seed album and identification. Seed testing – taking seed samples –germination test, moisture test and conventional purity tests of different crops, Seed treatment–methods of breaking seed dormancy, treatment against systemic disease, seed priming, coating, treatment with beneficial microorganisms. Hand emasculation and pollination in pulses, detasseling in maize, identification of rogues and pollen shedders; Pollen collection, storage, viability and stigma receptivity; gametocide application; Seed production in different crops – Cereals, pulses, oilseeds and vegetable crops (crops suitable to the season only). Maintaining isolation distance–roguing practices–harvesting, cleaning and packing; Visits to seed production plots and Seed Testing Laboratory; Specifications of tags and labels for different types of seeds; Identification of equipments for seed processing and seed testing.

ELCP 02  Integrated Farming Systems              3(1+2)

Farming system– Concept, definition, characteristics, classification and objectives; 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; Role of farming systems in sustainable agriculture – Integrated farming systems, different enterprises in a farming system, factors governing choice and size of enterprises, resource allocation in IFS; Merits of IFS; Models of IFS for irrigated and rainfed ecosystems. Importance and role of IFS in organic farming.

Practicals: Studies on farming systems prevailing in different agroecological situations in West Bengal. Package of practices and management of various components in IFS. Studies on ancillary activities. Computation of economics of IFS. Record keeping for IFS models. Visit to different units of IFS. Recycling of farm residues. Cropping system analysis.
ELCP 03 Water Management (Watershed, Micro Irrigation, Problematic Water) 4(1+3)

Watershed management- concept, component, objectives, delineation, problems and deterioration; Watershed development planning, watershed based cropping system; Soil and water conservation, water harvesting and recycling, ground water recharge, roof water harvesting; Concept of conservation agriculture. Importance of irrigation; Methods of irrigation – surface, subsurface and overhead irrigation; Micro irrigation methods – sprinkler and drip irrigation, localized irrigation; Irrigation management in different soil types. Water conveyance structures; Irrigation of principal crops; Water logging and drainage; Quality of irrigation water and management of problematic water for crop production.

Practicals: Delineation of watersheds- soil survey for land capability classification; Water harvesting structures; Preparation of watershed development plan; Different methods of ground water recharge and monitoring of ground water level; Analysis of rainfall data and determination of length of crop growing period; Field demonstration of surface and subsurface irrigation systems; Installation, operation and maintenance of sprinkler and drip irrigation systems; Demonstration of aqua fertilizer application, localized irrigation and micro sprinkler, mist, foggers, bubblers, etc; Water conveyance structures; Measurement of irrigation water; Quality testing of irrigation water; Crop management under limited irrigation and deficit rain; Crop raising under conservation agriculture; Visit to watersheds under National Watershed Development Project; Field study of ongoing schemes on watershed and irrigation management.

ELCP 04 Integrated Nutrient Management 3 (2+1)

Concept and objective of INM. Components of INM- soil nutrients, crop residues, green manure, organic manures, chemical fertilizers and biofertilizers; Soil properties and INM, INM under Indian context, FAO models, strength, weakness, opportunities and threats of INM, Fertilizer use efficiency, Biofertilizer, Site specific nutrient management, soil quality, soil degradation and its management. Concept of IPNS, importance on nutrient availability, Water- nutrient interactions and Diagnosis and Recommendation Integrated System (DRIS). Evaluation of soil fertility under INM, Soil testing and fertilizer recommendation.


ELCP 05 Soil Management (Conservation, Problematic Soil, and Soil Quality) 3(2+1)

Introduction; Need for soil conservation; Forms of soil erosion; Factors affecting soil erosion; Estimation of soil erosion; Methods of soil conservation: Agronomical and engineering measures; Land capability classification; Understanding the need of soil conservation in arid, semi-arid, humid, hilly and waterlogged areas. Concepts of problem soils; Types and distribution of problem soil; development and characteristics of problem soils; Effect on soil condition and plant growth; Management of problem soils; Quality and management of irrigation water; Concept of soil quality and soil health; Soil resilience; Elements of soil quality: indicators and their quantification; Approaches for interpreting soil quality and health indicator data; pedotransfer function; Fuzzy logic; Soil quality and health assessment and management.
Practicals: Determination of different soil erosivity indices: Suspension percentage, dispersion ratio, clay ratio, erosion ratio, clay/moisture equivalent ratio, percolation ratio, raindrop erodibility index. Characterization of problem soils; Determination of cations (Na+, K+, Ca++, Mg++) and anions (Cl-, SO4-, CO3-, HCO3-) in ground waters and soil samples; Lime and gypsum requirements of acid and sodic soils, Rainfall erodibility, Estimation of soil loss. Physical and chemical test for monitoring soil quality; Preparation of a soil health score card.

ELCP 06 Remote Sensing and Geographical Information System for Natural Resource Management and Land Use Planning 3(1+2)

Remote Sensing: Introduction to remote sensing and aerial photography; Definition and principles of remote sensing; Energy sources and radiation principles; Nature of electromagnetic and thermal radiations; Active and passive remote sensing systems; Propagation of radiations through the atmosphere; Atmospheric window; Types of remote sensors and scanners; Satellite data products; Spatial, temporal, spectral, and radiometric resolutions; Spectral signature of different earth features; Remote sensing in optical infrared region for study of vegetation, soil, and water; Crop stress detection and crop yield modeling; Vegetation indices. Background and history of Indian space programme; Satellite imageries; Digital image processing: Image pre-processing, image processing, and image transformation; Image interpretation: True colour. Pseudo colour, and False colour compositions; Image classification: Supervised and unsupervised classifications. Global Positioning System (GPS): Introduction and applications of GPS navigation techniques; GPS satellites; Segments of GPS systems; Principles of GPS navigation; GPS broadcast signals; Accuracy of GPS systems; Sources of error in GPS; Error corrections; Pseudo range and differential GPS systems. Geographic Information System (GIS): Definition and objectives; Components of GIS; Types of data: Geographic and attribute data; Data structures in GIS: vector and raster based data models; Analysis tools in GIS: Buffer analysis, overlay analysis, and network analysis. Natural Resource Management and Land Use Planning: Objectives, methods, and interpretation of land use planning; Applications of geoinformatics for natural resource management and land use planning.

Practical: Familiarization with remote sensing and GIS equipments, softwares (ERDAS Imagine/Geomatica/ENVI; IDRISI/Arc Info/Arc View/Arc GIS), and data products; Topographic sheets; Creation of data files in a geographic database system; Onscreen digitization technique; Map projections; Image interpretation and enhancement techniques; Supervised and unsupervised classifications; Distance and area measurement; Soil survey and interpretation of satellite imageries, topographic sheets, and reports towards natural resource management and land use planning.

ELCP 07 Farm Mechanization 3 (1+2)

Farm mechanization - importance, objective, scope, benefits and impact of farm mechanization; Evolution and present status of farm mechanization in India; Prospects and constraints of farm mechanization in West Bengal; Mechanization policies and strategies of Government or concerned agencies; Prospects of different machines, tools and implements useful for agricultural mechanization; Equipment for tillage, sowing and planting operations; Intercultural tools and equipment; Spraying and dusting machinery; Irrigation equipment; Harvesting machinery-reaper, mower, potato digger and harvester, combine harvester; Threshing machinery- pedal and power threshers, multicrop thresher, groundnut decorticator, maize sheller; Cost economics of farm machines & equipment.
**Practicals:** Study of different tillage equipment including subsoiler and chisel plow; Adjustments, care and maintenance of different tillage equipment; Calculation of draft & hp requirement for operating implements; Testing of Rotavator; Testing of seed cum fertilizer drill to different crops; Study of zero till drill; Calibration of seed drill; Problems on seed drill & planters; Testing of paddy transplanter and potato planter; Study of commonly used sprayers and dusters- knapsack sprayers, compression sprayers, boom sprayers and centrifugal duster; Study of vertical conveyor reaper, combine harvester, potato digger and harvester, and flail mower; Study of different threshing equipments- pedal thresher, power thresher, multicrop thresher, maize sheller, and groundnut decorticator. Identification of different parts of tractor; Care and maintenance of tractor; Tractor driving; Hitching of implements, control of implements during operation; Operation of tractor with MB plough, disc plough, disc harrows, cultivators, chisel plough, leveler, puddler and intercultural equipment; Operation of bund formers, levelers, ridgers and trenchers; Operation of mower; Operation of power tiller with rotavator and its care and maintenance.

**MODULE: CROP PROTECTION**

**ELCPT 01: Integrated pests and disease management** 4 (2+2)

**GROUP -A**

History and development of pest and disease management. Concepts of pest and disease management; Strategies for development of pest and disease management programmes. Plant protection organizations in India. IPM - Pest sampling and sampling programmes; survey and surveillance; Methodology of development.Problems and constraints in implementation of IPM. Biotechnological and other innovative approaches in IPM and IDM. Common and safe fungicides and their field application relevant to IPM. Phytotoxicity and compatibility among pesticides

**GROUP -B**


**Practicals**
1. Study of physical and mechanical methods of control
2. Study of biological control of insects
3. Sampling techniques of different pests
4. Estimation of crop loss, yield loss, population of different pests
5. Study of pheromone and light traps
6. Study of IPM practices of rice, cotton, cabbage and chilli
Importance of stored grain pests. Source and kinds of infestation and types of damage caused by pests of stored product. Distribution, commodities attacked, systematic position, marks of identification, nature of damage, biology and management practices of pests associated with stored grains of cereals, pulses, vegetables, condiments, spices and dried fruits viz., Angoumois grain moth, rice moth, potato tuber moth, Indian meal moth, lesser grain borer, Khaira beetle, pulse beetle, groundnut brunched, cigarette beetle, drug store beetle, rice weevil and flour grain mite. Important species of rodents, marks of identification, nature and extent of damage. Methods of rodent management - mechanical, physical, biological, chemical. Bait shyness, bait preferences, placement of baits, evaluation of efficacy of bait. Poisons – acute & anticoagulant rodenticides, fumigants etc. Methods of storage of food grains. Storage structures – methods of disinestation –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. Identification of damage to stored grain by Lepidopteran & Coleopteran pests
5. Visit to NSC/ FCI/ WHCG
6. Estimation of pest damage
7. Storage structures for household and bulk storage of food grains
8. Calculation of concentration/dosages of insecticide for treatment in godowns.
9. Identification of important rodent species.
10. Burrow patterns and feeding habits of important rodent species.
11. Pre baiting and baiting with poisons.

ELCPT 03 Industrial Entomology (Apiculture, Sericulture & Lac Culture)
3 (2+1)


**Sericulture:** Silkworm species of commercial values, morphological character, systemic position, and distribution. Wild and semidomesticated and domesticated species- their host plants and types of silk produced by them. Mulberry silk production- Moriculture including different species, variety, their propagation, cultivation methods and picking of leaves. Silk worm rearing-Requisites for local and scientific rearing. Grainage- Procedure for production of Dfs and commercial cocoon production. Protection from hazards.

**Lac culture:** Lac insect, economic importance of lac and its products, life history of lac insect, host plants, lac culture (local and improved methods), diseases and pests of lac and their management.
Practical
1. Management of apiary- general management (e.g. division, uniting, swarm management, control of robbing, queen introduction, transportation of apiary box, honey extraction, pests & disease control), seasonal management. Preparation of bee calendar.
3. Calendar for scientific lac cultivation.
4. Visit to institute devoted to Apiculture/ Sericulture/ Lac culture.

ELCPT04 Bio-control of Insect Pests 2(1+1)

Practicals
1. Mass rearing of important parasitoids and predators of insect pests.
2. Preservation, shipment of bio-control agents.
3. Methods of releasing parasitoids and predators in crop fields.
4. Field trip for collection of natural enemies
5. Isolation, identification and mass production of entomopathogens.
7. Visit to biological control laboratory
8. Visits to mass production and biological control programme centers.

ELCPT 05 Insecticides and Plant Protection Appliances 3(2+1)

Practicals
1. Demonstration of methods of application of insecticides
2. Calculation of concentration/doses of different formulations of insecticides.
3. Visit to insecticide manufacturing units.
4. Operation and testing of hand operated knapsack sprayer, foot pump sprayer, rocker sprayer, hand compression sprayer and their maintenance.
5. Determination of droplet size & Calculation of lethal concentration
7. Testing of nozzles for discharge rates, volume measurements & pressure influence
8. Operation, testing and maintenance of hand operated duster
9. Visit to National Plant Protection Training Institute (NPPTI)

ELCPT 06  Postharvest Diseases and their Management  3(2+ 1)

2. Loss in durables and perishables – assessment and methodology
3. Postharvest diseases of durables – type of diseases and their control.
4. Postharvest diseases of perishables -Important pathogens, their role, factors affecting postharvest of perishable diseases
5. Host - pathogen relationships - role of pathogens, mechanisms of damages caused by pathogens in durables and perishables.
7. Selected postharvest diseases of fruit crops - Citrus, banana, mango, papaya, apple, grapes, litchi; Other important diseases of India.
8. Selected postharvest diseases of important vegetable and condiments crops – Curcubits, brinjal, tomato, beans, bhindi, potato, onion, garlic, ginger, 
9. Spoilage in spices – health problems
10. Management of post harvest diseases of fruits and vegetables

Practical:
1. Isolation of grain and seed deterioration fungi by different techniques
2. Survey for occurrence and loss of perishables
3. Study of symptoms of postharvest diseases and their isolation
5. Selected exercises on ecology and host parasite relationship
6. Management of storage diseases –role of sanitation, botanicals and volatile oils;
7. Visit of cold storage and storage structures
8. Submission of catalogued disease specimens

ELCPT 07  Mushroom cultivation  3 (1+2)

1. Mushroom- Definition, history and importance of mushroom cultivation; present scenario of mushroom cultivation in India.
2. Types of mushrooms- edible, poisonous, medicinal mushroom; puff balls, truffles and false truffles. food value of mushroom.
2 General morphological features, life cycle pattern of cultivated mushroom.
4. Pure culture of mushroom fungi and their nutritional requirements.
5. Mushroom terminologies - spawn, spawn run period, substrate, supplements, casing, composting, cropping, weed mushroom
6. Spawn - types, characteristic of a good quality spawn, methods of spawn production
storage of spawn.
5. Cultivation of button mushroom - different Agaricus species, composting and its formulation, casing, preparation of casing mixture, sterilization.
6. Cultivation of Oyster mushroom - different Pleurotus species, substrate selection and cultivation technique
7. Cultivation of paddy straw mushroom – different Volvariella species and their cultivation
8. Other cultivated mushroom - Lentinus, Calocybe, Auricularia and Ganoderma
9. Identification and management of different pests and diseases of mushrooms.
11. Packing and processing – Different methods of processing, fortification in other food items
12. Economics of mushroom cultivation

**Practical**
1. Identification of common edible and poisonous mushrooms
2. Equipments used in mushroom laboratory and farms
3. Physical and chemical sterilization techniques
4. Preparation of spore print and spore culture
5. Preparation of culture media from tissues and spore
6. Preparation of spawn - mother spawn and bed spawn
7. Visit to a commercial spawn production unit
8. Cultivation of different mushrooms depending upon facilities
9. Casing soil preparation for milky mushrooms
10. Commonly used compost formulae, long and short method of composting
11. Familiarization with other edible mushroom varieties
12. Identification and management of different pests and diseases of mushroom.
13. Post harvest treatment and preservation of mushrooms

**ELCPT 08: Biological control of plant diseases and mass multiplication of microbial biocontrol agents** 3(1+2)

1. Definition, history, importance and concepts of biocontrol of plant diseases.
2. Understanding of ecological equilibrium in relation to biocontrol
3. Biological balance – attributes of ideal and successful pathogen and parasites; Different biocontrol agents and their characteristics.
7. Carrier materials and their importance in maintaining the shelf life of wettable powder formulations.
8. Different types of biocontrol formulation and their efficacy under field level. 9. Legislature Acts in the production and marketing of biocontrol agents and biopesticides.
10. Organic amendments, culture filtrates and botanicals etc. for plant disease management.
11. Entrepreneurship development in biocontrol unit
Practicals:
1. Visit to biological control laboratory and private industry
2. Isolation of antagonistic microorganisms from phyllosphere, rhizosphere.
3. Pure culturing and evaluation of biocontrol potential of isolates
   *Pseudomonas* spp., *Bacillus* spp., *Trichoderma* spp., Actinomycetes.
4. Testing antibiotic production in culture; Antibiotics in culture filtrate.
5. In-vitro screening of fungal and bacterial antagonists
6. Mechanisms of biological control- antibiosis, lysis, parasitism, competition
7. Mass multiplication of biocontrol agents a) For soil treatment b) For seed treatment
8. Mass. multiplication by liquid, solid and semisolid fermentation technologies.
10. Use of various organic amendments in the management of plant diseases

**ELCPT 09   Phytosanitation and Quarantine   3 (2+1)**

1. Plant quarantine - History; Principles and concepts of plant quarantine PQ organization chart and its functioning in India.
2. Definitions of plant quarantine terms.
3. Avenues of pest/pathogen introduction.
4. Phytosanitation inspection and issue of phytosanitary certification.
5. General conditions required for import of germplasms and transgenics, insects, microbial cultures; Plant quarantine treatments for salvaging germplasm infected with insects and mites
7. Phytosanitary measures – General conditions for import. Plants and plant products subjected to phytosanitary inspection at growing site.
8. Plant quarantine surveillance and list of intercepted plant pests into India.
9. Current plant quarantine regulations in India and FAO. Problem of their implementation in India.
10. Role of domestic plant quarantine in relation to germplasm movement in India. Future requirements of plant quarantine.

**Practical:**
1. Visit to plant quarantine unit
2. Detection of plant pathogens from seed, food grains and other imported fruits and vegetables.
3. Sample and sampling techniques
4. Preparation of check list for phytosanitary measures adopted by the farmers.
5. Different treatment methods for quarantine.

**ELCPT 10   Fungicides in Plant Disease Management   3 (2+1)**

1. Fungicides - Concept and Classification; History of fungicidal development
2. Non-systemic fungicides- Copper, Mercury and other heavy metals, Sulphur, Heterocyclic compounds oils
3. Systemic fungicides – all groups including development
4. Antibiotics in plant disease management - different groups and mode of action.
5. Host resistance modifiers – Chemical approach and others; advantages and problems
6. Brief studies of nematicides and other chemicals in vector control
7. Resistance of plant pathogens against chemicals and their management

**Practicals:**
1. Application of different fungicides and assessment of efficacy
2. In vitro and In vivo testing of candidate fungicides and antibiotics
3. Use of host modifies at the field level and assessment of efficacy
4. Adaptation for resistance
5. Calculation of doses etc. for field application
6. Study of new product catalogues
7. Visit to farmers field and suggestion on spot management

**MODULE: HORTICULTURE**

**ELHOR 01 Commercial vegetable production 4(1+3)**


**Practical:** Hands on training related to above topics

**ELHOR 02 Commercial flower production and landscaping 4(1+3)**

Status and prospects of commercial cultivation of flowers. Protected cultivation of commercially important flower crops. Selection of varieties, planting, cultural practices, propagation and post harvest handling techniques of important flower crops. Seed production in annual flower crops. Value addition in cut flowers and loose flowers. Flower arrangements. Production techniques of dry flowers. Production of pot plants. Hi-tech cultivation of commercial flowers and export oriented units (EOU). Organic cultivation of flowers. Integrated pest and disease management practices in cut flowers and foliage. Layout and preparation of different types of garden. Identification of different plants. Preparation of herbaceous border and colour scheme. Different garden operations like pruning of shrubs, hedges etc. Visit to various gardens, commercial production units, flower markets etc. Preparation of projects for starting a commercial unit of cut flowers and foliage.

**Practical:** Hands on training related to above topics
ELHOR 03  Commercial fruit production  4 (1+3)


Practical: Hands on training related to above topics

ELHOR 04  Nursery management of horticultural crops  4(1+3)


Practical: Hands on training related to above topics

ELHOR 05  Post harvest technology of horticultural crops  4(1+3)

Postharvest loss assessment of fruits and vegetables. Processing and dehydration of pepper, ginger, turmeric, preparation of white pepper, green pepper, preparation of spice oil and oleoresins. Familiarization of postharvest indices in various fruits and vegetables. Familiarization on the various harvesting devices employed in fruits and vegetables. Exposure to various packaging materials in fruits and vegetables. Packaging – storage studies in selected fruits and vegetables. Preparation of field level storage structure and its functions Exposure to various storage structures for the storage of horticultural crops. Postharvest handling and value addition of fruits, flowers, vegetables, spices, medicinal and aromatic plants etc. Drying techniques and various driers. Processing of spices – viz pepper, ginger, turmeric etc. Visit to various processing factories and exposure to commercial processing.

Practical: Hands on training related to above topics
MODULE: AGRI-BUSINESS MANAGEMENT

ELABM01 Introduction to Agri-Business Management 3 (1+2)


Practicals: Hands on training on rural entrepreneurship development in vermicomposting, handicrafts, seed production, fruit and vegetable processing, etc. Development of projects for agriculture and allied activities. Market survey.

ELABM 02 Information Communication Management 3(2+1)

Information - definition and meaning, information as a strategic resource, changing conceptions of information and Information systems. Need for information and communication systems. Approaches to management of information – technical approach, behavioral approach, socio-technical approach. The New role of information systems in organisations, the changing nature of information and communication on technology, the need to plan the information architecture of an organisation. Affect of Information systems on organisations, organizational resistance to change – implications for the design and understanding of information systems. Information management and decision, making – information management for structured and unstructured decisions, ethical and social impact of information systems. Ethics in an information society – responsibility, accountability and liability – moral dimensions of the information age – information rights, privacy and freedom in an information society. Technical foundations of information systems, computers and information process, information systems software, managing data resources – Organising data in traditional file environment. A modern data base environment (DBMS), Logical and Physical views of data, advantages of data base management systems. Telecommunications- the telecommunications revolution, components and functions of a telecommunications system. Telecommunications system components, types of signals – Analog and digital, types of communication channels, characteristics of communication channels, communication processors, telecommunications software. Enterprise wide computing and Networking.

Practicals
1. Visit to an organization to study information and communication system
2. Visit to an institute to study and analyse different approaches to management of information
3. Study of information storage and information retrieval both in traditional and modern information and communication system
4. Hands on practice with computers in information storage, retrieval and use
5. Study of relevant Websites for information
6. Information networking through computers

**ELABM 03 Organizational Behaviour and Human Resource Management 3(2+1)**


**Practical**
1. Exercise on Organisational Communication
2. Analysis of organisational process- attitudes, values, motivation, achievement motivation and leadership
3. Visit to three different organisations- government, public and private
4. Study of organisational structure of different development departments
5. Exercise on delegation of authority
6. Exercise on team building process
7. Training need assessment of employees of different development departments

**ELABM 04 Management of Agro-based Industry 3(1+2)**

Agribusiness - concept, meaning, function. Agro-industry in India and West Bengal- types and classifications trends, quality standards, agencies involved, public-private sector role, distribution network, demand supply condition, etc. Agro-processing industry- importance, status, constraints, policies, present role and future prospects. Rural entrepreneurship development. Financing agribusiness-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. Important laws relevant for agro-industries. Company Law – Nature of company, definition of company, kinds of companies – private company, public company, promotion and incorporation of a company.

Practicals: Study of functioning of rice mills, seed firms, food processing industry, dairy processing industry, livestock and poultry industry, sugar industry, horticulture based industries. Study of functioning of various institutional agencies financing agro based industries. The students are expected to attach themselves to one of the selected agri-business units.

ELABM05 Marketing Management 3(1+2)
Marketing Management-Concept, importance, scope, history and evolution and philosophies. Marketing mix- 5P’s of marketing mix, environmental variables of marketing, market segmentation and targeting, marketing planning process, marketing research and information system, consumer market and consumer behaviour, market measurement and forecasting, product management, new product development, product life cycle. Pricing of the product- various pricing strategies, physical distribution, various channel members and their role, personal selling, publicity, direct and on-line marketing. New export import policy- special provision for agricultural exports, export promotion, WTO & AoA.


ELABM06 Financial Management of Agri-Business 3(1+2)
Financial Management: Concepts and objectives. Importance and need for financial resources, 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, accounts classification, 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. Financial efficiency measures, financial planning, objectives of profit planning (or budgeting), essential of profit planning, types of budgets, preparation of profit plan or budgets.


ELABM07 Natural Resource Economics and Management 3(1+2)
Concept, subject matter and importance of Natural Resource Economics. Classification of natural resources. Natural resources and economic growth. Issues in natural resource use and management: depletion of natural resources and its conservation, preservation, externality problem, market failure, free riding of open access resources, common property resources, property rights. Time element in decision making for temporal resource allocation. Social welfare function and criteria of economic policy.
Practicals: Collection and analysis of relevant data on various natural resources. Visits to prominent reserves of natural resources. Classification and analysis of environmental problems in developing countries. Working out different approaches to measure agricultural sustainability. Methods of valuation of environmental costs and benefits. Analyzing the benefit cost ratio of environmental and resource improvement projects. Taxes, subsidies and markets – inter relations. Study of legislative issues, treaties, conventions on natural resource and environmental management.

**ELABM08 Project Formulation, Evaluation and Monitoring 3(1+2)**

Project – concept and meaning, characteristics of a project. Project classification – Quantifiable and non-quantifiable projects, sectoral projects, techno-economic projects, service projects. Importance of a project, dimensions of a project, project location and its criteria, project formulation, project implementation. Project identification and selection – technical feasibility, financial feasibility, marketing feasibility, legal feasibility, social acceptability; different selection criteria – Efficiency criterion: Net Present Value, Benefit-Cost Ratio, IRR, Payback Period; Equity criterion, Employment criterion, Physical environmental criterion. Evaluation and monitoring: objectives, methodological issues, approaches, uses and monitoring.


**ELABM09 International Trade and Indian Agri-Business 4 (2+2)**


Practical: Visit to Agri-Export houses and AEZs/SEZs. Visit to a Food Processing Enterprise. Measurement of export competitiveness of major agricultural commodities in India. Collection and analysis of data on export, import, tariffs and FDI. Estimation of BOP, BOT and TOT over time. Group Discussion on EXIM Policy.

**MODULE: SOCIAL SCIENCES**

**ELSS01 Agricultural Journalism 3(2+1)**

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.

ELSS02 Visual and Graphic Communication 3(2+1)

1. Meaning, Definitions and the Role of Visuals in communication
2. Characteristics of Visual aids
3. Classification of visual aids
4. Principles and Production of visuals
5. Contribution of visual perception in learning process
6. Planning, Preparation, Presentation and evaluation of visual aids
7. Designing of messages and titles for visuals
8 Layout of visual aids
9. Selection and use of graphic formats
10. Preparation and use of low cost visuals based on the local situation
11. Preparation and use of photographs and pictures
12. Reprographic visuals
13. Computer based visuals and digitized video materials
14. Use of drawing techniques for different visuals
15. Selection and use of animation tools in transfer of technology
16. Preparation and use of resource maps for extension work
17. Designing of visuals for print and electronic media

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

ELSS03  Project Development, Appraisal and Monitoring  3 (2+1)


Practicals
1. Identification of Agro Based Projects
2. Visit to NABARD
3. Preparation of Statement of Balance Sheet, Profit Loss Statements
4. Financial ratios
5. Visit to Micro Finance Institute (MFI)
6. Preparation of Agricultural and Rural Development Projects
7. Application of Project Evaluation Techniques
8. Presentation of projects Prepared
9. Report Writing

ELSS04  Emerging Trends in Agricultural Extension  2(1+1)


Practicals
1. Analyzing the roles of Change Agents in State Department of Agriculture
2. Visit to a village to observe the extension activities at the field level
3. Visit to an ATMA district
4. Identification of technological needs of farmers through participatory approach
5. Identification of Suitable Alternative Extension approaches for solving extension problems in a specific farming situation
6. Preparation of Research and Extension plan using PRA, FSR/E and FSBE (03)
7. Analyzing the functions of a selected VO
8. Studying Role of Farm Women and Rural Youth in Agriculture in a selected Village
9. Studying RMGs & SHGs in a Selected Village

ELSS05 International Trade 3 (1+2)


Practicals: Visit to Export units, Regional Export Promotion council, AEZs and SEZs. Collection and analysis of data on Exports, Imports and Prices. Exim Policy of the Govt – Group Discussion. Estimation of BOP, BOT and TOT over time.

ELSS06 Government Policies and Programmes related to Agriculture 3(1+2)

Importance of Agriculture in India- Status and contribution in economic development. Agricultural Policies of the State and Central government- Agriculture policy, water policy, price policy, land policy, seed policy, fertilizer policy, credit policy, EXIM policy, industrial policy, etc. Major schemes in agriculture- Central schemes, state schemes, others. Need for restructuring Agriculture policy in the globalized era.
Practicals: Group discussion on National Agricultural Policy, Seed Policy, Fertilizer Policy, Credit Policy, EXIM Policy, Industrialization Policy, Fiscal and Monetary Policy. Visit to PRIs, DRDA and Financial Institutions.

ELSS07  Livestock, Fish and Poultry Trade and Marketing 4 (2+2)

Sources of poultry, fishery and livestock products in India - its importance in national economy, various systems of production and systems of farming, poultry, fish and dairy production and supply – its marketing and distribution, export and import of poultry, fishery and dairy products, Structure of allied agricultural industries – public and private sector, demand for allied agricultural products, pricing of allied agricultural products, allied agricultural product policies, WTO and allied agricultural products industries, promotion of grading and standardization of allied agricultural products, state trading of allied agricultural products – objectives, types of state trading, livestock investment opportunities in India. Marketing Environment of allied agricultural products, Exchange and Transactions, Needs, Wants and Demands, Product or Offering, Brand, Brand Image, Brand Strength and Brand Equity, Competition, Relationships and Networks, Marketing Channels, Supply Chain of allied agricultural products, Value and Satisfaction, Target Markets and Segmentation, Marketing Mix; Company Orientations towards the Market Place - Production Concept, Product Concept, Selling Concept, Marketing Concept, Societal, Marketing Concept, Difference between Selling and Marketing.


ELSS08  Farm Planning and Budgeting 3 (1+2)

Theory
Farm Planning and Budgeting – Concepts and importance, types of farm budgeting, characteristics of good farm plan, tools and techniques of farm planning. Linear Programming- Concept, definition, assumptions, limitations and formulation of problems. Farm Budgeting – Types, partial budgeting, complete budgeting, enterprise budgeting. Record keeping. Cost of cultivations. Financial analysis of farm plans.


ELSS09  Multimedia Technology 3 (2+1)

Multimedia – Definition, scope and importance in agricultural development: Important concepts in multimedia technologies Computers in agriculture: Cyber extension – Definition, successful models of cyber extension Introduction to basics in computers: MS PowerPoint Internet applications for multimedia: Multimedia file formats – HTML, audio, photo, video and image file formats and file posting Computer Assisted Information Basics: Story boarding and application Multimedia databases, Relational Database model, distributed and networks model Audio- production editing, photo editing, production and editing Animation tools and graphic tools Development of multimedia project – Resource development, integration and presentation Web based presentation Vs CD presentation
Practicals
1. Basics in computer: MS Office
2. MS PowerPoint and internet applications
3. CAI application and story board writing
4. CAI presentations, Multimedia file formats
5. Audio, photo and video production, editing and using the software
6. Animation and graphic tools software
7. Developing multimedia project using authoring tools
8. Development of multimedia project and presentation
9. Visit to multimedia technology centre

ELSS10 Behavioral Skills 3 (2+1)


Practicals
1. Exercise on Reading, Listening, Writing, Presentation
2. Exercise of Interpersonal Communication Skills
3. Exercise on Conflict Management and Negotiation skills
4. Exercise on Planning Skills
5. Exercise on Problem Solving Skills
6. Exercise on Leadership development Skills
7. Exercise on Decision Making Skills
8. Identification of skills through mutual observation
9. Exercise on Time Management skills
10. Stress Relaxation Techniques
11. Team building Exercise
12. Exercise on facing interviews
MODULE: BASIC SCIENCES

ELBS 01 Techniques in Genetics and Plant Breeding 4(3+1)

Genetics:
(1) Architecture of the chromosome and organization of genetic material in eukaryotes and prokaryotes.
(2) Euchromatin and heterochromatin, supernumerary chromosome and plasmids, position effect.
(3) Nucleic acids - DNA its chemistry and types (A, B and Z forms), structure, replication and role as genetic material, RNA its chemistry and structure. RNA maturation/splicing
(4) Gene expression- Protein synthesis: Transcription and translation, Genetic code,
(5) Genetic regulation-inducible and repressible systems in prokaryotes. Differences in gene expression between prokaryotes and eukaryotes
(6) Biochemical mutations and gene-enzyme relationship, Molecular interpretation of the mutation processes.
(7) Recombination in bacteria; Transformation, transduction (F-duction) and conjugation
(8) Fine structure of gene-genetic units of recombination, mutation and function.

Plant Breeding:
(1) Polyploidy – Types, causes, induction and their uses in plant breeding and distant hybridization.
(2) Heritable and nonheritable components of continuous variation- additive, nonadditive and interaction components.
(3) Concept of heritability and genetic advance under selection.
(4) Gene frequencies and Hardy-Weinberg equilibrium. Changes in the gene frequencies
(6) Systems of mating- Assortative, disassortative and random mating and their genetic consequences.
(7) IPR-definition, concept and components- plant breeders’ rights & farmers’ rights, UPOV, PPV & FR Act.

Practicals
(1) Pollen sterility, germination of pollen grain in artificial media and study of pollen tube growth.
(2) Linkage analysis; pedigree analysis; problems on probability theory
(3) Problems on Hardy-Weinberg law
(4) Study and analysis of quantitative characters through suitable statistical techniques. – Estimation of components of genetic variance, heritability (broad sense and narrow sense), genetic advance; t- test,
(5) Estimation of gene frequencies and changes in gene frequencies
(6) Preparation of different fixatives and stains for chromosome study.
(7) Critical study of various stages of mitosis and meiosis and determination of chromosome number with the help of smearing and squash methods.
(8) Preparation of permanent slide;
(9) Visit to AICRP trials and programme, visit to grow out test plots; visit to various research station and Institutions.
ELBS 02  Plant Tissue Culture  3(1+2)


Practicals: Requirement for Plant Tissue Culture Laboratory; Techniques in Plant Tissue Culture Media components and preparation; Aseptic manipulations of various explants; Inoculation of various explants; Callus induction; Micropropagation, anther culture, pollen culture etc.

ELBS 03  Breeding for Biotic and Abiotic Stresses  3(2+1)


Practical: Screening techniques for insect resistance. Screening techniques for disease resistance. Screening techniques for abiotic stress drought, salinity, nutrient stress. Screening for through biochemical methods – proline. Invitro screening techniques Transfer of resistance through conventional and innovative techniques

ELBS 04  Molecular Diagnostics  3(2 + 1)

Introduction and importance of molecular diagnostics. Molecular make-up of cell structure-Ultra structure of cell wall membranes. Molecular organelle- Chloroplast and mitochondrial genomes, microsatillites, micro assays. Plant cell interaction with environmental stresses – biotic and abiotic stresses like drought, cold, salinity, heavy metal- their physiology and molecular bases. Studies on biochemical and molecular markers in crop plants under various stresses – cold stress, heat shock, herbicide stress, and defense against plant pathogens and pests. Signal transduction in plants and transduction molecules in plants. Molecular identification tools for plant diseases, biosensors and their application. DNA fingerprinting and DNA chips.


ELBS 05  Bioinformatics  3(2+1)

Bioinformatics as a science and overview. Applications. Data application and management. Use of data bases in biology; genome database, sequence data base. Sequence analysis- genome sequencing, Structural comparisons, Alignment of pairs of sequences, Multiple sequence

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, FASTA format primer designing, Genome sequence analysis, Identification of consensus sequences and domain identification, ORF finding, Microarray data analysis.

ELBS 06 Diagnostic Physiology 3(1+2)

Role of plant physiology in plant diagnosis-systematic approach to diagnosing plant damage; Factors causing plant damage – living (biotic) and non living (abiotic); Response of plants to adverse abiotic factors- deficiency and toxicity of nutrients, light, water, temperature, carbondioxide, pollutants, heavy metals, salinity, acidity and radiation; Mechanism of tolerance of plants to different abiotic stresses; Plant identification and characterization- growth and appearance of identified plants- normal and abnormal. Deficiency and toxicity symptoms of mineral nutrients in plants. Physiological disorders in major crops. Symptoms- identification, testing, correction and indicator plants; Foliar application of plant nutrients; Hydroponics; Storage disorders- identification, management.

Practical: Identifying the cause of the field problems, Hydroponics under controlled conditions (polyhouse)- preparation and development of symptoms due to nutrient, light and temperature stress, Nutrient diagnostic techniques- deficiency and toxicity symptoms, Identification of physiological disorders in major crops, field identification, Symptoms due to acidity alkalinity and radiation, Rapid tissue testing for nutrient deficiencies, Quantifying the stress damage using instruments- chlorophyll fluorescence meter, infrared thermometer- SPAD meter, Biochemical methods to assess stress damage, Storage disorders- pre-harvest and post harvest techniques for post harvest management, Application techniques/ mitigation techniques to manage the stress, On-farm diagnosis of plant damage patterns

ELBS 07 Plant Growth Regulators 3(2+1)

Definition and classification of plant growth regulators- Hormones, endogenous growth substances and synthetic chemicals; Endogenous growth regulating substances other than hormones; Tricontanol, Phenols – polyamines, jasmonates, concept of death hormone. Site of synthesis, biosynthetic pathways and metabolism and the influence on plant growth and development of individual group of hormones- Auxins, Gibberlins, cytokinins, Abscisic acid, Ethylene and Brassinosteroids; Signal perception, transduction and effect at functional gene level of different hormones- Auxins- cell elongation, Gibberellins- germination of dormant seeds, Cytokinins- cell division and retardation of senescence of plant parts, Abscisic acid-Stomatal closure and induction of drought resistance, Ethylene- fruit ripening. Synthetic growth regulators-Classification, their effect on plant growth and development. Practical utility in agriculture and horticulture.

Practical: Survey of plant growth regulators available in the market. Study of the nature of compounds in commercially available formulations. Methods of application of growth regulators. Extraction of hormones from plant tissue. Auxins- effect on rooting of cuttings, abscission, apical dominance, Gibberellins- effect on germination of dormant seeds, Cytokinins effect on apical
dormancy and senescence, ABA effect on stomatal movement, Ethylene-effect on breaking dormancy in sunflower and groundnut. Study of the effect of novel plant growth regulators (Brassinosteroids, Triacontanol, Polyamines etc.) on crop plants.

ELBS 08     Biochemical Techniques     3(1+2)

3. Enzyme technology: function and mechanism of action, immobilization techniques.
4. Nucleic acids: isolation methods, DNA sequencing, oligonucleotide synthesis, PCR, cDNA, molecular probes.

Practical:
1. Space filling and ball & stick modeling of different bio-molecules viz. amino acids, proteins, lipids and nucleic acids.
2. Preparation of various buffers of different pH, standard solutions and reagents.
4. Separation of amino acids by and HPTLC.
5. Separation of plant pigments by column chromatography.
7. Agarose gel electrophoresis.
8. Isolation & quantitative determination of albumin from chicken egg.
10. Determination of phosphatase activity from potato.
11. Isolation & quantitative determination of nucleic acids (RNA & DNA).

ELBS 09 Pesticides and Techniques of Residue Analysis in Agriculture     3(1+2)

1. Brief basic chemistry of pesticides.
2. Fundamentals of Toxicology. Physicochemical and biochemical decomposition of pesticides.
3. Principles of pesticide residue analysis, significant aspects of pesticide residues related to human health, Effects on soil fertility, Statistical implication of pesticides residues, Problems and management. Decontamination and detoxification of pesticides
4. Basic principle of different instruments viz., TLC, Column chromatography, GC,HPLC,HPTLC and Spectrophotometer etc and techniques used for isolation and characterization of pesticides and their metabolites.
5. Biopesticides in plant origin -Introduction, brief chemistry of flavonoids, pyrethrum, nicotinoidis and terpinoids

Practical:
1. Methods of pesticide residue analysis: Basic steps involved Familiarization of apparatus and equipments; Extraction of soil, plant and water; Concentration of extract; Preparation of Glass column for chromatographic clean up, clean up by liquid-liquid partitioning.
2. Qualitative and quantitative estimation of Cu, S, Zn and Mn present in agrochemicals.
3. Identification of agro-chemicals using TLC: Preparation of TLC plates, Spotting and development, Visualization and calculation of $R_f$.
4. Estimation of pesticide residues using spectrophotometer, GLC, HPLC.
5. Identification of metabolites of pesticides using GC-MS, Mass spectrophotometer, NMR etc

**MODULE: ANIMAL SCIENCE**

**ELANS 01  Commercial Poultry Production and Management  3(1+2)**

Poultry population and production statistics in India; Commercial poultry farming to alleviate rural poverty; Poultry birds and hybrids developed for commercial uses; Improvement of indigenous stocks; Nutrient requirements and feeding of poultry at various stages; feed restriction; Antibiotics and growth promoters; preparation of economic rations; Incubation and hatchery management. Care and management of poultry. Layer and broiler farming. Protection of poultry against epidemic & parasitic diseases; Processing, preservation and marketing of eggs and meat. Factors affecting profitability. Economics of poultry farming. Commercial poultry enterprises of India. Vaccination schedule. Farming and Environment.


**ELANS 02  Animal Production and Management  3(1+2)**


ELANS 03  Disease Diagnosis and Management  3(1+2)

Livestock disease: Bacterial, viral, parasitic and other important diseases of cattle & their preventive measures Remedial measures: Application of Principle & supportive medicines. Vaccine Schedule, sanitary & other control measures.

Practical: Method of diagnosis, application of medicines & supportive therapy. Regular visit to veterinary hospital for case study. Application of vaccines to the cattle.

ELANS 04  Small Ruminants, Pig Production and Management  3(1+2)

Breeds of Goat, Sheep & Pig; housing, feeding. Preventive & controlling measures of different diseases. Preparation of small project/scheme, marketing etc.

Practical: Visit to farmer’s house Regular study in regards to Breeding & feeding housing etc. with appropriate management. Vaccine schedule, treatment and culling procedure.

ELANS 05  Duck Keeping and Pisciculture  3(1 + 2)

Duck breeds, their habitat, feeds and diseases. Important bacterial, viral & other diseases. Special housing system to nearby ponds. System of farming with fish production. Breeds of sweet water fish, rearing, diseases, control & marketing. Fish product technology. Pond ecosystem and fish husbandry.

Practical: Learning hand to hand management at farmer’s house in neighboring villages.

ELANS 06  Livestock Production with Mixed Farming Concept  3(1+2)

Study for suitable components of mixed farming. Different breeds, feeding, housing and utilization by products for lowering the cost of production. Study for rearing fishes, bee keeping, Piggery & duckery with pisciculture.

Practical: Study at farmer’s house where crop-husbandry & Animal husbandry practices are available. Utilization of ponds, by product of crop & Animal husbandry.