Courses to be offered from different sections of the Department of ASEPAN, PSB in the M. Sc.(Ag.) Sem-I, 2010 programme

Agronomy

Course No.	Course Title	Credits
AGR 501	MODERN CONCEPTS IN CROP PRODUCTION	3 + 0
AGR 503	PRINCIPLES AND PRACTICES OF WEED MANAGEMENT	2 + 1
AGR 506	CROP GROWTH ANALYSIS AND PRODUCTIVITY MODELLING	1 + 1
AGR 509	AGRONOMY OF OILSEED CROPS	2 + 1
AGR 515	DRYLAND FARMING AND WATERSHED MANAGEMENT	2 + 1

Soil Science & Agril. Chemistry

Course No.	Course Title	Credits
SSC - 503	SOIL CHEMISTRY	3 + 1
SSC- 504	SOIL MINERALOGY, GENESIS, CLASSIFICATION AND SURVEY	3 + 1
SSC-508	SOIL, WATER AND AIR POLLUTION	2 + 1
SSC-509	ANALYTICAL TECHNIQUES AND INSTRUMENTAL METHODS IN SOIL AND PLANT ANALYSIS	1 + 2

Crop Physiology

Course No.	Course Title	Credits
CPH 502	MINERAL NUTRITION OF PLANTS	2 + 1

Agril. Engineering

Course No.	Course Title	Credits
AEG 501	POST-HARVEST TECHNOLOGY	2 + 1

M. SC.(Ag.) IN AGRONOMY

Course No.	Course Title	Credits
AGR 501*	MODERN CONCEPTS IN CROP PRODUCTION	3 + 0
AGR 502*	PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT	2 + 1
AGR 503 *	PRINCIPLES AND PRACTICES OF WEED MANAGEMENT	2 + 1
AGR 504*	PRINCIPLES AND PRACTICES OF WATER MANAGEMENT	2 + 1
AGR 505	AGROMETEOROLOGY AND CROP WEATHER FORECASTING	2 + 1
AGR 506	CROP GROWTH ANALYSIS AND PRODUCTIVITY MODELLING	1 + 1
AGR 507	AGRONOMY OF MAJOR CEREALS	2 + 1
AGR 508	AGRONOMY OF PULSE CROPS	2 + 1
AGR 509	AGRONOMY OF OILSEED CROPS	2 + 1
AGR 510	AGRONOMY OF FIBRE, SUGAR AND TUBER CROPS	2 + 1
AGR 511	AGRONOMY OF MEDICINAL, AROMATIC AND UNDER-UTILIZED CROPS	2 + 1
AGR 512	AGRONOMY OF FODDER AND FORAGE CROPS	2 + 1
AGR 513	AGROSTOLOGY AND AGRO-FORESTRY	2 + 1
AGR 514	CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE	2 + 0
AGR 515	DRYLAND FARMING AND WATERSHED MANAGEMENT	2 + 1
AGR 516	PRINCIPLES AND PRACTICES OF ORGANIC FARMING	1 + 1
AGR 517	CROP ECOLOGY AND GEOGRAPHY	2 + 0

*** core courses**

AGR 501 : MODERN CONCEPTS IN CROP PRODUCTION 3 + 0

Objective

To teach the basic concepts of soil management and crop production.

Theory

UNIT I

Crop growth analysis in relation to environment; agro-ecological zones of India, Crop distribution.

UNIT II

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

UNIT III

Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield.

UNIT IV

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

UNIT V

Integrated farming systems, organic farming and resource conservation technology including modern concept of tillage; rainfed farming; determining the nutrient needs for yield potentiality of crop plants, concept of balanced nutrition and integrated nutrient management; precision agriculture.

AGR 502: PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT 2 + 1

Objective

To impart knowledge of fertilizers and manures as sources of plant nutrients and to appraise integrated approach of plant nutrition and sustainability of soil fertility.

Theory

UNIT I

Soil fertility and productivity – factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming – basic concepts and definitions.

UNIT II

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

UNIT III

Preparation and use of farm yard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates; their composition, availability and crop responses; recycling of organic wastes and residue management, role of organic matter in maintenance of soil fertility.

UNIT IV

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

UNIT V

Time and methods of manures and fertilizers application; relative performance of organic manures and inorganic fertilizers; economics of fertilizer use; integrated nutrient management; use of fertilizers in intensive cropping systems.

Practical

- Determination of soil pH, ECe, organic C, total N, available N, P, K and S in soils.
- Determination of total N, P, K and S in plants
- Interpretation of interaction effects and computation of economic and yield optima

AGR 503 : PRINCIPLES AND PRACTICES OF WEED MANAGEMENT 2 + 1

Objective

To familiarize the students about the weeds, herbicides and methods of weed management.

Theory

UNIT I

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

UNIT II

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

UNIT III

Herbicide structure – activity relationship, factors affecting the efficiency of herbicides, herbicide formulations, mixtures, herbicide resistance and management, herbicide rotation, adjuvants, antidotes and protectants, degradation of herbicides in soil, plants and environment; herbicide resistance in crops and weeds, weed management through bio-herbicides, myco-herbicides and allelochemicals; application of biotechnology in weed management.

UNIT IV

Weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed management, quarantine regulations of weed management.

UNIT V

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

Practical

- Identification of important weeds of different crops
- Preparation of a weed herbarium
- Weed survey in crops and cropping systems
- Crop weed competition studies
- Calculation of herbicidal requirement
- Preparation of spray solutions of herbicides for high and low-volume sprayers
- Use of various types of spray pumps and nozzles and calculation of swath width
- Economics of weed control
- Herbicide residue analysis in plant and soil
- Bioassay of herbicide residue
- Precautionary measures in herbicide use

AGR 504 : PRINCIPLES AND PRACTICES OF WATER MANAGEMENT 2+1

Objective

To teach the principles of water management and practices to enhance the water productivity.

Theory

UNIT I

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

UNIT II

Soil water relations; water retention by soil, soil moisture characteristics; moisture conservation, soil water movement in soil and plants; soil-water-plant relationships; concept of evaporation and evapotranspiration; different approaches of ET determination; development of crop water deficit, plant response to water stress, crop adaptation to water deficit, morpho-physiological effect of water deficit, crop plant adoption to moisture stress condition.

UNIT III

Soil, plant and meteorological factors determining water needs of crops; principles and methods of irrigation; concepts of irrigation scheduling; different approaches of irrigation scheduling, depth and micro-irrigation system; fertigation; management of water in controlled environments and poly houses.

UNIT IV

Water management of the corps (rice, wheat, sugarcane, potato, mustard, sesame and mung) and cropping systems; quality of irrigation water and management of saline water for irrigation; irrigation and water use efficiency; fertilizer use in relation to irrigation.

UNIT V

Excess of soil water and plant growth; water management in problem soils, drainage requirement of crops and methods of field drainage; water table in relation to crop production, rain water harvesting, storage and recycling.

Practical

Determination of soil water by thermo-gravimetric and volumetric methods.
Measurement of soil water potential by using tensiometer, pressure plate and membrane apparatus.
Determination of evapo-transpiration by Blaney-Criddle and Thornthwaite.
Measurement of evaporation by USWB class A pan evaporimeter.
Soil moisture characteristics curves.
Water flow measurement using different devices.
Determination of irrigation requirement.
Calculation of irrigation efficiency.
Determination of infiltration rate.
Laying out fields for irrigation by border strip, check basin and furrow methods.
Determination of quality of water.
Determination of saturated/unsaturated hydraulic conductivity.
Field drainage.

AGR 505 : AGROMETEOROLOGY AND CROP WEATHER FORECASTING 2 + 1

Objective

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

Theory

UNIT I

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

UNIT II

Characteristics of solar radiation; energy balance of atmosphere system; radiation distribution in plant canopies, photosynthesis and efficiency of radiation utilization by field crops; energy budget of plant canopies;.

UNIT III

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

UNIT IV

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

UNIT V

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

Practical

- Visit to agro-meteorological observatory and to record sun-shine hours, wind velocity, wind direction, relative humidity, soil and air temperature, evaporation, precipitation and atmospheric pressure
- Measurement of solar radiation outside and within plant canopy
- Measurement/estimation of evapo-transpiration by various methods
- Measurement/estimation of soil water balance
- Rainfall variability analysis
- Determination of heat-unit requirement for different crops
- Measurement of crop canopy temperature
- Measurement of soil temperatures at different depths
- Remote sensing and familiarization with agro-advisory service bulletins
- Study of synoptic charts and weather reports, working principle of automatic weather station
- Visit to solar observatory

AGR 506 : CROP GROWTH ANALYSIS AND PRODUCTIVITY MODELLING 1+1

Objective

To teach students regarding system approach through growth analysis of crop plants for achieving higher yield.

Theory

UNIT I

Crop growth analysis : concept, CGR, RGR, RLGR, NAR, LAD, LAI; validity and limitations in interpreting crop growth and development.

UNIT II

Canopy architecture, light interception and utilization, energy use efficiency optimum LAI, critical and ceiling LAI.

UNIT III

Photosynthetic system, factors influencing transport and partitioning of photosysnthate; source-sink relationships.

UNIT IV

Concept of plant ideotypes, characteristics of ideotype for rice, Maize, Arhar; Physiological basis of yield variation of Rice, Potato, Sugarcane.

UNIT V

Crop growth models – empirical models testing and yield prediction.

Practical

- Plant sampling for measurement of biomass, LAI, LAD, CGR, NAR.
- Measurement of light interception, light extinction coefficient and critical LAI.
- Preparation of growth curves based on growth analysis data
- Study of crop growth and productivity modeling based on crop growth analysis data

AGR 507 : AGRONOMY OF MAJOR CEREALS 2 + 1

Objective

To teach the crop husbandry of cereals.

Theory

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirement, nutrition, quality components, handling and processing of the produce for maximum production of

UNIT I

Rabi cereals (wheat, barley, *boro* rice)

UNIT II

Kharif cereals (Rice, maize)

Practical

- Phenological studies at different growth stages of crop.
- Estimation of crop yield on the basis of yield attributes.
- Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities.
- Working out growth indices (CER, CGR, RGR, NAR, LAD) and competition functions (aggressiveness, relative crowing coefficient, monetary yield advantages and ATER) of prominent intercropping systems of different crops.
- Preparation of rice nurseries
- Planning and layout of field experiments.
- Intercultural operations in different crops.
- Judging of physiological maturity in different crops.
- Determination of cost of cultivation of different crops.
- Working out harvest index of various crops
- Study of seed production techniques in various crops
- Visit of field experiments on cultural, fertilizer, weed and water management aspects.
- Visit to nearby villages for identification of constraints in crop production.

AGR 508 : AGRONOMY OF PULSE CROPS 2 + 1

Objective

To teach the crop husbandry of pulse crops.

Theory

Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for the maximum production of

UNIT I

Rabi pulses (chickpea, pea, lentil and lathyrus)

UNIT II

Summer and *Kharif* pulses (pigeon pea, mung bean, urdbean and cowpea)

Practical

- Phenological studies at different growth stages of pulse crops.
- Estimation of crop yield on the basis of yield attributes.
- Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities.
- Working out growth indices (CER, CGR, RGR, NAR, LAD) aggressiveness, relative crowding coefficient, monetary yield advantages and ATER of prominent intercropping systems of different crops.
- Nodulation studies.
- Planning and layout of field experiments.
- Judging of physiological maturity in different pulse crops.
- Intercultural operations in different pulse crops.
- Determination of cost of cultivation of different pulse crops.
- Working out harvest index of various pulse crops
- Study of seed production techniques in various pulse crops
- Visit of field experiments on cultural, fertilizer, weed and water management aspects.
- Visit to nearby villages for identification of constraints in pulse production.

AGR 509 : AGRONOMY OF OILSEED CROPS 2 + 1

Objective

To teach the production technology of oilseed crops.

Theory

Origin and history; area, production and productivity; classification; improved varieties; adaptability; climate, soil and water requirement; crop nutrition; weed management, cultural practices; quality component; handling and processing of the produce and the value added products.

UNIT I

Rabi oilseeds – Rapeseed and mustard, linseed, sunflower and safflower.

UNIT II

Kharif oilseeds – Groundnut, sesame, castor and soybean.

Practical

- Planning and layout of field experiments
- Judging of physiological maturity in different crops and working out harvest index.
- Working out cost of cultivation of different oilseed crops.
- Estimation of crop yield on the basis of yield attributes, formulation of cropping schemes for various farm sizes and calculation of cropping intensities.
- Study of seed production techniques of various oilseed crops.
- Interculture operations in different oilseed corps.
- Determination of oil content in oilseeds and computation of oil yield.
- Formulation of cropping schemes.

AGR 510 : AGRONOMY OF FIBRE, SUGAR AND TUBER CROPS 2 + 1

Objective

To teach the crop husbandry of fibre and sugar crops.

Theory

Origin and history; area and production, economic importance, classification, improved varieties, adaptability; climate, soil, agro techniques, cropping systems, quality component; handling and processing of the produce, constraints in production.

UNIT I

Fibre corps – jute, cotton, mesta, sisal, sunhemp.

UNIT II

Sugar crops – Sugarcane and sugar-beet.

UNIT III

Tuber crop : Potato

Practical

- Planning and layout of field experiments.
- Preparation of sugarcane setts, sett treatment and methods of planting, tyinig and propping of sugarcane.
- Determination of cane maturity and calculation of purity percentage, recovery percentage and sucrose content in cane juice, phenological studies at different growth stages of crop.
- Intercultural operations in different crops.
- Working out growth indices (LER, CGR, RGR, NAR, LAD), aggressivity, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems.
- Judging of physiological maturity in different crops and working out harvest index.
- Working out cost of cultivation of different crops.
- Estimation of crop yield on the basis of yield components.
- Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities.
- Estimation of quality of fibre of different fibre crops.
- Study of seed production techniques in various crops.
- Visit to field experiments on cultural, fertilizer, weed and water management aspects.
- Visit to nearby villages for identification of constraints in crop production.
- Production of seeding materials.

AGR 511 : AGRONOMY OF MEDICINAL, AROMATIC AND UNDER-UTILIZED CROPS **2 + 1**

Objective

To apprise students about different medicinal, aromatic and under-utilized crops, their package of practices and processing.

Theory

UNIT I

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

UNIT II

Climate and soil requirement; cultural practices; yield and important constituents of medicinal plants (Rauwolfia, Poppy, *Aloe vera*, Satavar, *Stevia*, Kalmegh, Black pepper, Brahmi, Mango ginger, Ekangi and Turmeric).

UNIT III

Climate and soil requirements; cultural practices, yield and important constituents of aromatic plants (Citronella, Palmarosa, Mentha, Basil, Lemon grass, Geranium and Lavander).

UNIT IV

Climate and soil requirements; cultural practices; yield of under-utilized crops [Grain Amaranth, Bhringaraj (Wedelia), Broom grass, Fennel, Jowan (Trachyspermum), Senna (Cassia), Butterfly pea (Clitoria), Thankuni (Centella), Mehedi, Latkan and Sabai grass].

Practical

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

AGR 512 : AGRONOMY OF FODDER AND FORAGE CROPS 2 + 1

Objective

To teach the crop husbandry of different fodder and forage crops along with their processing.

Theory

UNIT I

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops like sorghum, oats, cowpea, ricebean, berseem, clusterbean, maize, dinanath.

UNIT II

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasses – napier, panicum, cenchrus and stylo.

UNIT III

Year round fodder production and management, preservation and utilization of forage crops.

UNIT IV

Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage, use of physical and chemical enrichments and biological methods for improving nutrition and value addition of poor quality fodder.

UNIT V

Economics of forage cultivation, uses and seed production techniques.

Practical

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

AGR 513 : AGROSTOLOGY AND AGRO-FORESTRY 2 + 1

Objective

To teach crop husbandry of different fodder, forage and agroforestry crops/trees along with their proceedings.

Theory

UNIT I

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

UNIT II

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

UNIT III

Agroforestry : definition and importance; agroforestory systems, agri-silviculture, silvipasture, agrisilvipasture, agrihorticulture, aqua-silviculture, alley cropping and energy plantation.

UNIT IV

Crop production technology in agro-forestory and agrostology system; silvipastoral system : meaning and importance for wasteland development; selection of species, planting methods and problems of seed germination and nursery management in agro-forestry systems; irrigation and manuring in agro-forestry systems, associative influence in relation to above ground and underground interferences; lopping and coppicing in agro-forestry systems; social acceptability and economic viability, nutritive value of trees; tender operation; desirable tree characteristics.

Practical

- Preparation of charts and maps of India showing different types of pastures and agro-forestry systems.
- Identification of seeds and plants of common grasses, legumes and trees of economic importance with reference to agro-forestry.
- Seed treatment for better germination of farm vegetation.
- Methods of propagation/planting of grasses and trees in silvipastoral system.
- Fertilizer application in strip and silvipastroal systems.
- After-care of plantation.
- Estimation of protein content in loppings of important fodder trees.
- Estimation of calorie value of wood of important fuel trees.
- Estimation of total biomass and fuel wood
- Economics of agro-forestry.
- Visit to importance agro-forestry research stations.

AGR 514 : CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE 2 + 0

Objective

To apprise about different enterprises suitable for different agroclimatic conditions for sustainable agriculture.

Theory

UNIT I

Cropping systems : definition, indices and importance; classification of cropping systems according to type of rotation, degree of commercialization, water supply, enterprises, land use assessment.

UNIT II

Production potentials of different cropping systems, Interaction and mechanism of different production factors; stability in different systems through research; eco-physiological approaches to intercropping, yield advantage in intercropping systems.

UNIT III

Simulation models for intercropping; soil nutrient in intercropping; preparation of different cropping system models; evaluation of different cropping systems.

UNIT IV

New concept and approaches of farming systems and cropping systems and organic farming; case studies on different farming systems.

UNIT V

Concept of sustainability in cropping systems; efficient farming systems.

UNIT VI

Concerns of natural resources and their management; modern agriculture and sustainability; LEIA vs. HEIA; LEISA; agrobio-diversity and sustainable agriculture; diversification in cropping systems and its importance; IWM and INM in cropping system for sustainable crop production.

AGR 515 : DRYLAND FARMING AND WATERSHED MANAGEMENT 2 + 1

Theory

UNIT I

Definition, concept of dryland farming; dryland farming vs rain-fed farming; significance and dimensions of dryland framing in Indian agriculture.

UNIT II

Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, drought syndrome, effect on plant growth; crop planning including contingency, crop diversification, varieties, cropping systems, conservation cropping for erratic and aberrant weather conditions.

UNIT III

Physiology of moisture stress and drought resistance, drought avoidance, drought management; mid-season corrections for aberrant weather conditions.

UNIT IV

Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage and agriculture; precipitation-collection, conservation and utilization; techniques of moisture conservation in situ to reduce evapo-transpiration (mulching and anti-transpirants), runoff control to increase infiltration, time lines and precision key factors timely sowing, precision in seeding, weed control; fertilizer placement, top dressing and foliar application.

UNIT V

Definition, concept, objectives, approach, components and problems of watershed management; steps in implementation of watershed; development of cropping systems for water shed areas.

Practical

- Seed soaking, seed treatment with chemicals, seed germination, seeding depth and crop establishment in relation to soil moisture contents.
- Effect of plant density, thinning, leaf removal under moisture stress condition on crop growth.
- Study of the salient features of a model watershed; methods of measurement and determination of run-off.
- Estimation of stress index through plant analysis like proline, chlorophyll, relative leaf water content, chlorophyll stability index.
- Spray of anti-transpirant and their effects on crops.
- Practical utility of mulches, their mode of application and effects on soil and crop growth.
- Water use efficiency.
- Preparation of crop plans for different drought conditions.
- Study of field experiments relevant to dryland farming.
- Visit to dryland research stations and watershed projects.

AGR 516 : PRINCIPLES AND PRACTICES OF ORGANIC FARMING 1 + 1

Objectives

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

Theory

UNIT I

Organic farming – concept and definition, its relevance to India and global agriculture and future prospects.

UNIT II

Land and water management – land use, minimum tillage, shelter zones, hedges, pasture management, Agroforestry, organic farming and water use efficiency.

UNIT III

Organic farming and soil fertility management, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and biofertilizers.

UNIT IV

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

UNIT V

Management of weeds, diseases and insect pests by non-chemical materials, use of biological agents, fire, water, pheromones and bio-pesticides.

Practical

- Aerobic and anaerobic methods of making compost.
- Making of vermicompost
- Effect of use of biofertilizers, techniques of treating legume seeds with *Rhizobium* cultures, use of *Azotobacter, Azospirillum* and PSB cultures in field.
- Visit to organic farms.
- Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms.
- Preparation and use of different bio-products for weed management, seed preservation, rodent and insect repelling and bird scaring.

AGR 517: CROP ECOLOGY AND GEOGRAPHY 2 + 0

Objective

To acquaint the students about the agricultural systems, agro-ecological regions, and adaptation of crops to different agro-climatic conditions.

Theory

UNIT I

Concept of crop ecology, agricultural systems, ecology of cropping systems, principles of plant distribution and adaptation, crop and world food supply.

UNIT II

Ecosystem characteristics, types and functions, terrestrial ecology, flow of energy in ecosystem, ecosystem productivity, biomass, succession and climax concept.

UNIT III

Physiological response of crop plants to light, temperature, CO_2, moisture and solar radiation; influence of climate on photosynthesis and productivity of crops; effect of global climate change on crop production.

UNIT IV

Exploitation of solar energy in crops; vertical distribution of temperature; efficiency in crop production.

UNIT V

Competition in crop plants; environmental pollution, ecological basis of environmental management and environment manipulation through agronomic practices; improvement of unproductive lands through crop selection and management.

UNIT VI

Agro-climatic zones and agro-ecological regions in India, Geographic distribution of crop plants, factors determining crop distribution – agro-climatic, socio-economic and infrastructure development, access to processing, preservation and marketing; Shifts of ecosystems, extent and result; Changes in flora and fauna and their management strategies; Impact of short duration HYVs and hybrids on shift in agro-ecosystems.

Courses to be offered by Plant Physiology Section

CPH 501 : STRESS PHYSIOLOGY 2 + 1

Objective

To study various types of stresses in crop production and strategies to overcome them.

Theory

UNIT I

Response of plants to abiotic stress : Abiotic stresses affecting plant productivity, interactions between biotic and abiotic stresses.

UNIT II

Drought characteristic features, water potential in the soil-plant-air continuum. Development of water deficits, energy balance concept.

UNIT III

Transpiration and its regulation – stomatal functions.

UNIT IV

Physiological processes affected by drought. Drought resistance mechanism: Escape, dehydration postponement (drought avoidance), dehydration tolerance and characteristics of resurrection plants, osmotic adjustment, osmoprotectants, stress proteins, water use efficiency as a drought resistant trait. Water logging and flooding injury. Molecular responses to water deficit: expression of regulatory and functional genes and its significance.

UNIT V

Stress and determined hormones – ABA as a signaling molecule – Cytokinin as a negative signal. Oxidative stress : Relative Oxygen Species (ROS), role of scavenging systems (SOD catalase etc.).

UNIT VI

Stress due to high temperature : heat wave tolerance mechanisms – role of membrane lipids in high temperature tolerance, functions of HSP's.

UNIT VII

Low temperature stress : Chilling and freezing stress, frost and cold injury effects on physiological process, crucial role of membrane lipids.

UNIT VIII

Salinity : Species variation in salt tolerance, salinity effects at – Cellular and whole plant level, tolerance mechanisms, salt tolerance in – Glycophytes and halophytes.

UNIT IX

Heavy metal stress : Aluminum and cadmium toxicity in acid soils, role of phytochelatins (heavy metal binding proteins).

Practical

1. Determination of proline content of plant parts.
2. determination of Relative Leaf water content of plants
3. Quantification of anti oxidative enzymes like Super oxide desmutase (SOD).
4. Determination of membrane injury index (MII).
5. Determination of chlorophyll stability index (CSI).
6. Studying the effect of ABA / Cytokinin on stomatal behavior.

CPH 502 : MINERAL NUTRITION OF PLANTS 2 + 1

Objective

To impart knowledge about physiological and molecular aspects of carbon reduction cycle and nitrogen assimilation

Theory

UNIT I

Overview of essential mineral elements, forms of plant nutrients, Role of mineral nutrients in plants, Deficiency Symptoms, Mechanism of nutrient uptake by plants, Factors influencing mineral absorption in plants.

UNIT II

Nutrient uptake by root cells and foliar absorption of nutrients, long distance transport in plants and movement into developing grains, Nutrient transport from vegetative to reproductive organs during reproductive stage of growth and maturity.

UNIT III

Molecular mechanism of ion uptake, ion transporters, specific examples of transporters for Nitrate, Phosphate, Potassium and other nutrients.

UNIT IV

Molecular physiology of micronutrient acquisition, Genes encoding mineral ion transporters. Strategies plants adopt to acquire and transport minerals under deficient levels.

UNIT V

Physiological and molecular mechanisms underlying differential nutrient efficiency in crop genotypes, Phosphorous, Iron and Zinc efficient crop varieties.

UNIT VI

Plant responses to mineral toxicity.

Practical

Physiological and biochemical changes in plants under nutrient sufficiency and deficiency levels. Quantification of pigment levels, enzyme activities.

Courses to be offered by Agricultural Engineering Section

AEG 501 : POST-HARVEST TECHNOLOGY 2 + 1

Objectives

To acquaint and equip the students with post harvest processing and technology of cereals, pulses, oil seeds, spices & condiments and equipment used for their processing.

Theory

UNIT I

Processes and machines for operations involving cleaning, grading, separating and treating of cereals and pulses. Hydrothermal treatment and conditioning of grains, parboiling systems of paddy & wheat and their equipment.

UNIT II

Crop drying principles, moisture migration theories, crop drying methods/systems and crop dryers and selection. Milling, sizing and packaging of cereals (paddy, wheat, maize and millets) and pulses.

UNIT III

Technology of processing of oil seeds, oil extraction and its methods, solvent extraction and oil milling equipment. Processing of spices and condiments (turmeric, garlic, ginger, pepper, cardamoms, etc.)

UNIT IV

Principles and practices of storage – storage losses, factors affecting the grain and seed quality, insects, pests and rodents-control. Types and functional requirements of storage structures – village level and improved structures, sheds and silos. Aeration system for various storage structures. Management and maintenance of grain storage, grain handling equipment and their design and operational features, cold storage of tubers for consumption and seed purposes.

Practical

Study of various seed processing equipment such as cleaners, graders, separators, seed treater and their performance evaluation. Study of rice shellers and dal mills, study of parboiling of paddy and wheat and their performance evaluation. Study of different crop dries. Extraction of oils. Study of processing of spices. Design of bag and bulk storage. Study of grain handling equipment and problems on handling equipment.

Courses to be offered by Agricultural Economics

AEC 505 : ECONOMICS OF CROP CULTIVATION 2 + 1

1. Concept of B/C analysis
2. Background of B/C analysis
3. Fundamental principle of B/C analysis
4. Agricultural Development Projects under their characteristics, formulation of agricultural development projects.
5. Identification and selection of Agricultural Development Projects :

    A. Efficiency criterion – Benefits – cost analysis :

        a. Net present Value (NPV)
        b. Benefit – cost ratio (BCR)
        c. Internal Rate of Returns (IRR)

        Private and social points of view, types and measurement of benefits and costs at farm level and at aggregate level; approaches – with (treatment) and without (control) approach, before and after approach.

    B. Equity criterion –

        a. Subsistence criterion
        b. Contributing criterion

    C. Employment criterion

    D. Physical Environmental criterion

6. Application of Benefit – Cost analysis in the selection of agronomic practices, selection of developmental schemes viz. Installation of irrigation system, establishment of orchard, purchasing of tractors, establishment of Poultry, Dairy Farm, etc.

AST 550 : STATISTICAL METHODS FOR APPLIED SCIENCES 2 + 1

Objective

To impart knowledge of statistical methods and their applications in agricultural science

Theory

UNIT I

Normal distribution and its application

UNIT II

Linear regression, fitting quadratic curve, multiple linear regression, partial and multiple correlation upto two independent variables.

UNIT III

Concepts of sampling, sample survey vs. complete enumeration, planning of sample survey, sampling from a finite population.

Practical

- Problems related to the topics mentioned in the theory syllabus.

AST 551 : EXPERIMENTAL DESIGNS 2 + 1

Objective

To acquire knowledge of various types of designs, analysis and interpretation of data, estimation of optimum levels of inputs etc.

Theory

UNIT I

pxqxk Factorial Experiments, Split – Splot Design, Strip – Plot Design, Analysis of Co-variance in CRD and RBD.

UNIT II

Direct assay, quantitative dose response relationship, Analytical assay, Parallel line assay, Stop – ratio assay.

UNIT III

Dose Response Curve, Quantal Response, Probit Transformation, Estimation of Median Effective Dose, Relative Potency.

Practical

- Problems related to the topics mentioned in the theory syllabus.

Courses on Computer Application

CAA 501 : Computer Applications in Agriculture 1 + 2

Objective

To explore the evolution and principles of Computer Application in Agriculture. Students will acquire working knowledge of software, presentation for Web, data recording, processing and integrating with the presentation.

Theory + Practical

UNIT I

Introduction – a brief history of the development of Computer; Computer Hardware & Organization : Central Processing Unit, Primary and Secondary memory, Input / Output devices.

UNIT II

Software categories : System Software : Operating Systems, Compilers, debuggers, interpreters, linkers, text editors; Application Software – Business software, Databases, Expert System (ES), Decision Support Softwares(DSS), Agro-based software, SPSS etc.

UNIT III

Operating system & Structure : Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection; System Components, System structure, Operating System Services, File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues. MS WINDOWS commands, editing and saving files, word processing, file management.

UNIT IV

Presentations : Principles and technologies – Introduction to Microsoft Word, Gaining Proficiency, Enhancing Documents, Advanced Features, Desktop Publishing; Introduction to PowerPoint, Creating presentations for various output devices, working with presentation components, presentation design, presentation techniques and formats; Introduction to Microsoft Excel, Gaining Proficiency, Formatting Relative and Absolute Addresses, Spreadsheets in Decision Making, Using Spreadsheet Functions, Graphs and Charts.

UNIT V

Microsoft Access – Introduction Microsoft Access, Creating a Database, Relational Databases, Table and Forms, Reports and Queries.

UNIT VI

Internet and World Wide Web – Introduction to Internet, www, Internet browsers (Netscape, Explorer, Firefo etc); Introduction of services e.g. FTP, Telnet, Search Engines;, Hypertext Markup Language (HTML), Tags, Frames, Creating HTML documents, DHTML; Creation of WWW pages, static and dynamic pages, multimedia support; Using audio and animations in WWW presentations.

UNIT VII

Introduction of C language – Basics of Compilation, Programming Structure and Style, Variables, Simple Input and Output, Program Flow, Procedures and Functions, Error Handling, The Preprocessor, Libraries, Standard Libraries, File I/O, Arrays & Strings, Basics of Pointers and relationship to arrays, String Manipulation.