Program: B.Sc. (Hons.) Agriculture  
Semester: Sixth  
Course: Rainfed Agriculture and Watershed Management  
Course Code: 13A.359

Course Objective:
- To learn about soil and water conservation techniques
- To manage crops in rainfed areas
- To demonstrate soil moisture conservation and water harvesting structures

Unit I:
Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India.

Unit II:
Soil and climatic conditions prevalent in rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio-morphological characteristics of the plants, Crop adaptation and mitigation to drought;

Unit III:
Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions

Unit IV:
Concept, objective, principles and components of watershed management, factors affecting watershed management.

Practical:
1. Studies on climate classification
2. Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.
3. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India.
4. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.
5. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation.
7. Characterization and delineation of model watershed.
8. Field demonstration on soil & moisture conservation measures.
10. Visit to rainfed research station/watershed.
Suggested Reading:

Program: B.Sc. (Hons.) Agriculture
Semester: Sixth
Course: Principles of Food Science and Nutrition
Course Code: 13A.360

Course Objective:
1. To familiarize with basic concepts of food science, processing, preservation
2. To understand concepts nutrition and nutritional disorders
3. To provide knowledge regarding menu planning and new trends in food science

Unit I:
Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.); Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions)

Unit II:
Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods)

Unit III:
Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.)

Unit IV:
Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

Suggested Reading:
2. D.V. Reedy. Applied Nutrition
Program: B.Sc. (Hons.) Agriculture  
Semester: Sixth  
Course: Diseases of Field & Horticultural Crops & their Management-II  
Course Code: 13A.361

Course Objective:
- To understand the Symptoms, etiology, disease cycle and management of various field and horticultural crops  
- To make student identify the disease and frame a viable management plan.

Unit I:
Symptoms, etiology, disease cycle and management of following diseases:
Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, *Alternaria* blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng; Sunflower: Sclerotinia stem rot and *Alternaria* blight; Mustard: *Alternaria* blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and *Ascochyta* blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.

Unit II:
Horticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl. Strawberry: leaf spot

Unit III:
Potato: early and late blight, black scurf, leaf roll, and mosaic. Cucurbits: downy mildew, powdery mildew, wilt.

Unit IV:
Onion and garlic: purple blotch, and *Stemphylium* blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: *Botrytis* blight; Rose: dieback, powdery mildew and black leaf spot

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

Suggested Reading:
Program: B.Sc. (Hons.) Agriculture
Semester: Sixth
Course: Post-harvest Management and Value Addition of Fruits and Vegetables
Course Code: 13A.362

Course Objective:
- To raise awareness related to the major future prospects of agro-food processing industry
- To provide knowledge about the value addition of fruits/vegetables through different methods
- To impart practical skills related to preparation of value added products of fruits and vegetables

Unit I:
Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses

Unit II:
Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling.

Unit III:
Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and non-fermented beverages.

Unit IV:

Practical:
1. Applications of different types of packaging, containers for shelf life extension.
2. Effect of temperature on shelf life and quality of produce.
3. Demonstration of chilling and freezing injury in vegetables and fruits.
4. Extraction and preservation of pulps and juices.
5. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products.
6. Quality evaluation of products -- physico-chemical and sensory.
7. Visit to processing unit/ industry

Suggested Reading:
2. Amar Singh. Fruit Physiology and Production


Program: B.Sc. (Hons.) Agriculture
Semester: Sixth
Course: Management of Beneficial Insects
Course Code: 13A.363

Course Objective:
- To learn the tangible and non-tangible benefits of insects and the significance of insects in rural economies.
- To design, implement, and manage an apiary or sericulture, and lac culture units as enterprises.
- Advise on proper production, harvesting and post-harvest handling techniques to ensure high quality hive and sericulture products.
- To learn the mass multiplication techniques of major bio-agents

Unit I:
Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Unit II:

Unit III:
Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac-products. Identification of major parasitoids and predators commonly being used in biological control.

Unit IV:
Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

Practical:
1. Honey bee species, castes of bees.
2. Beekeeping appliances and seasonal management
3. Bee enemies and disease.
4. Bee pasturage, bee foraging and communication.
5. Types of silkworm, voltinism and biology of silkworm.
7. Identification of other important pollinators, weed killers and scavengers.
8. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.
9. Identification and techniques for mass multiplication of natural enemies.

**Suggested Reading:**

2. B. Vasanta Raj. *Elements of Economic Entomology*
Program: B.Sc. (Hons.) Agriculture  
Semester: Sixth  
Course: Crop Improvement-II (Rabi crops)  
Course Code: 13A.364  

Course Objective:
- To understand the origin, distribution and different breeding methods to be adopted for the development of varieties / hybrids in various rabi crops
- To study about the plant genetic resources, centers of diversity and breeding for resistance to biotic and abiotic stresses
- To learn about the influence of Genotype x Environment interaction on yield / performance
- To acquaint with floral biology, emasculation and hybridization techniques, maintenance breeding of different rabi crops
- To handle germplasm and segregating populations by different breeding methods
- To make layout of field experiments and apply field techniques for seed production and hybrid seeds production in rabi crops
- To estimate heterosis, inbreeding depression and heritability

Unit I:
Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops;

Unit II:
Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters;

Unit III:
Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional);

Unit IV:
Hybrid seed production technology of rabicrops. Ideotype concept and climate resilient crop varieties for future.

Practical:
Floral biology, emasculation and hybridization techniques in different crop species namely
1. Wheat, Oat, Barley,
2. Chickpea, Lentil, Field pea, Rajma, Horse gram,
3. Rapeseed, Mustard, Sunflower, Safflower,
4. Potato, Berseem, Sugarcane, Tomato, Chilli, Onion;
5. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods;
6. Study of field techniques for seed production and hybrid seeds production in Rabi crops;
7. Estimation of heterosis, inbreeding depression and heritability;
8. Layout of field experiments;
9. Study of quality characters, study of donor parents for different characters;
10. Visit to seed production plots;
11. Visit to AICRP plots of different field crops

**Suggested Reading:**

Program: B.Sc. (Hons.) Agriculture
Semester: Sixth
Course: Principles of Organic Farming
Course Code: 13A.365

Course Objective:
- To learn the concepts of organic farming, preparation of various non-chemical nutrient supplements
- To get acquainted with mass multiplication techniques of various bio-agents
- To gain knowledge of certification process and standards of organic farming

Unit I:
Organic farming, principles and its scope in India. Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture;

Unit II:
Organic ecosystem and their concepts; Organic nutrient resources and its fortification;

Unit III:
Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production;

Unit IV:
Operational structure of NPOP; Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical:
1. Visit of organic farms to study the various components and their utilization;
2. Preparation and quality analysis of
   a. enrich compost
   b. vermicompost
   c. bio-fertilizers/bio-inoculants
3. Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management;
4. Cost of organic production system;
5. Post harvest management; Quality aspect, grading, packaging and handling

Suggested Reading:


Program: B.Sc. (Hons.) Agriculture  
Semester: Sixth  
Course: Farm Management, Production & Resource Economics  
Course Code: 13A.366

Course Objective:
- To enable students to understand the principles required for the allocation of inputs at the level of individual farms
- To provide students with the principles required for organizing and operating the farm business in order to generate maximum possible income on a continuous basis

Unit I:
Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage.

Unit II:
Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income.

Unit III:
Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock’s enterprises.

Unit IV:
Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical:
1. Preparation of farm layout.  
2. Determination of cost of fencing of a farm.  
3. Computation of depreciation cost of farm assets.  
4. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources.  
5. Determination of most profitable level of inputs use in a farm production process.
6. Determination of least cost combination of inputs.
7. Selection of most profitable enterprise combination.
8. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises.
9. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts.
10. Collection and analysis of data on various resources in India

**Suggested Reading:**

1. V.T. Raju, D.V.S Rao. *Economics of Farm Production and Management*
Course Objective:
- To familiarize with the design of greenhouse, cost estimation and economic analysis
- To create awareness on production of horticultural crops under protected structure
- To develop skill to erect protected structure according to the requirement.

Unit I:
Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes.

Unit II:
Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying. Cost estimation and economic analysis.

Unit III:
Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.

Unit IV:
Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

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

Suggested Reading:
1. Prasad Kumar. Green House Management for Horticulture Crops
Program: B.Sc. (Hons.) Agriculture
Semester: Sixth
Course: Practical Crop Production –II (Rabi crops) (Lab.)
Course Code: 13A.368

Course Objective:
1. Crop planning
2. Raising field crops in multiple cropping systems:
3. Field preparation,
4. Seed treatment,
5. Nursery raising,
6. Sowing,
7. Nutrient, water and weed management
8. Management of insect-pests diseases of crops,
9. Harvesting, threshing, drying winnowing,
10. Storage and marketing of produce.

(The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies.)

11. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.
Electives Sem VI
Program: B.Sc. (Hons.) Agriculture
Semester: Sixth
Course: Landscaping
Course Code: 13A.371

Course Objective:
- To learn selection, propagation, planting schemes, canopy management of different plants
- To understand landscaping of different urban and rural areas

Unit I:
Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.

Unit II:

Unit III:
Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions.

Unit IV:
Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

Practical:
1. Identification of trees, shrubs, annuals, pot plants
2. Propagation of trees, shrubs and annuals
3. Care and maintenance of plants
4. Potting and repotting
5. Identification of tools and implements used in landscape design
6. Training and pruning of plants for special effects
7. Lawn establishment and maintenance
8. Layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house
9. Use of computer software
10. Visit to important gardens/ parks/ institutes
Program: B.Sc. (Hons.) Agriculture  
Semester: Sixth  
Course: Micro-propagation Technologies  
Course Code: 13A.371

Course Objective:  
- To understand different techniques of plant tissue culture.  
- To impart knowledge of different steps of micro-propagation

Unit I:  
Introduction, History, Advantages and limitations;

Unit II:  
Types of cultures (seed, embryo, organ, callus, cell),

Unit III:  
Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture), Organogenesis (callus and direct organ formation),

Unit IV:  
Somatic embryogenesis, cell suspension cultures, Production of secondary metabolites, Somaclonal variation, Cryopreservation

Practical:  
1. Identification and use of equipments in tissue culture Laboratory  
2. Nutrition media composition  
3. sterilization techniques for media, containers and small instruments  
4. sterilization techniques for explants  
5. Preparation of stocks and working solution  
6. Preparation of working medium  
7. Culturing of explants: Seeds, shoot tip and single node  
8. Callus induction  
9. Induction of somatic embryos regeneration of whole plants from different explants  
Program: B.Sc. (Hons.) Agriculture  
Semester: Sixth  
Course: Hi-tech Horticulture  
Course Code: 13A.371

Course Objective:
- To impart knowledge of mechanization, micro propagation and protected cultivation of horticultural crops
- To develop understanding of application of precision farming in horticultural crops

Unit I:
Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods,

Unit II:
Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding,

Unit III:
Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA),

Unit IV:
Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

Practical:
1. Types of polyhouses and shade net houses
2. Intercultural operations
3. Tools and equipments: Identification and application
4. Micro propagation
5. Nursery-protrays
6. Micro-irrigation
7. EC, pH based fertilizer scheduling
8. Canopy management
9. Visit to hi-tech orchard/nursery.