BACHELOR OF CROP IMPROVEMENT & PROTECTION

COURSE DESCRIPTION

Level 100

KCU 100: History and Development of East Africa Agriculture
Climate and soils of East Africa; history and development of agriculture in Kenya: agricultural production systems, agriculture and the Kenyan economy; factors limiting crop and animal production in Kenya; agriculture and enterprise development: nature of entrepreneurship development in agriculture, characteristics of entrepreneurs; agricultural organization and research.

KCU 101 Fundamentals of Mathematics
Basic concepts and application of algebra; equations and inequalities; functions; matrices; systems of equations; linear programming; differential and integral calculus in agriculture; introduction to probability and agricultural statistics.

KST 101: Agricultural Zoology
Introduction to invertebrates and vertebrates of agricultural importance; animal body plan; diploblastic and triploblastic body layers, cells and tissues, organs and functions (digestion, excretion, respiration, circulation, thermoregulation and homeostasis). Introduction to animal classification and phylogeny; animal diversity: subdivisions of animal kingdom, concepts and mechanism of evolution; inventory techniques of animals.

KST 103: Fundamentals of Physics
Properties of matter; force and motion; thermodynamics: heat transfer, thermal property of matter, laws of thermodynamics; gas laws; waves, sound and environment; basic radiation laws; electromagnetic spectrum; radioactivity; energy; methods and units of measurement; waves and acoustics: mechanical waves and wave interference, normal modes, sound and hearing; optics and their application in Agriculture.

KST 104: Fundamentals of Chemistry
Basic principles and techniques of analytical chemistry: volumetric, gravimetric, ionic equilibria and qualitative group analysis; spectroscopy: chemistry of water: acidity and alkalinity; properties of colloids: cation and anion exchange; intermolecular forces; thermodynamics; kinetic and quantum theory and chemical equilibrium: introduction to organic compounds; functional groups; electronic structure of carbon; bonding, hybridization; synthesis and simple reactions; and their application to Agriculture.

KST 110: Introduction to Crop Protection
Principles of crop protection; sources of loss; symptoms and signs; infectious diseases; non-infectious disorders; epiphytology and disease forecasting; symptomatology; etiology: nematodes, fungi, bacteria, viruses; biology of major invertebrate, bird and mammal pests of field crops and stored products; damage; yield loss; crop protection techniques; chemical, cultural, biological, mechanical, crop scouting.

KST 111: Plant Growth and Development
Plant structures, functions and differentiation of stems, leaves, roots; reproduction: asexual, vegetative and apomixis; sexual; floral structures, pollination: self and cross pollination,
fertilization, self sterility; embryo and endosperm development. Seed: seed dormancy, seed germination; emergence; seed viability; early growth, seed dispersal; senescence; juvenility. Role of tropisms in ontogenic changes, germination, response to water, gravity, touch and fertilizers.

**KST 112: Agricultural Botany**

A study of the plant kingdom; Cell biology; cell division: mitosis and meiosis; tissue and tissue systems; root structure and functions; stem structure and functions; inflorescence; flower pollination and fertilization; seed: fruit; principles and systems of classification; characteristics of agricultural important families: Malvaceae, Brassicaceae, Leguminosae, Compositae, Solanaceae, Cucurbitaceae, Convolvulaceae, Gramminae, Liliaceae and Musasea.

**KST 130: Field Course 1**

Visit mid and high altitude agro-ecological zones in Western region; land fragmentation; farming systems; soils, degradation, conservation; vegetation types; large scale; tea, coffee, rice; Horticulture: flowers, vegetables, fruits. Small scale: maize, beans, yam, banana, cotton; livestock management: zero grazing, fish farming; water harvesting; Irrigation; crop-soil-climate relationships; agriculture versus poverty alleviation; The course will take a minimum of 5 days.

**KBT 100: Principles of Agribusiness Economics**

Interactions between business firms and society; aims of business vis a vis those of society; forms of business ownership: sole-proprietorship, partnership, companies, government corporations and cooperatives; sources of business finance; stock exchange markets; social responsibilities of business; characteristics of foreign companies operating in Kenya; major management functions: planning, organizing, directing, controlling and staffing; delegation of authority and responsibility, marketing, personnel and production.

**LEVEL 200**

**KCU 200: Statistics for Agriculture**

Definition and importance of statistics; population; sample; methods of data collection and presentation; concept and types of variability, parameters and estimates, frequency distributions, measures of central tendency and dispersion; probability: some probability distributions, estimation and testing of probability; simple linear regression and correlations; normal distributions; concept of hypothesis testing separation of means, Z, F and t-tests; studying linear relationships simple linear regression and correlation; computer assisted data analysis.

**KCU 201: Principles of Crop Production**

Economic importance of crops in Kenya; crop environment and effects on yields, crop propagation methods, crop husbandry, land preparation; examples of annual and perennial crops; cropping systems: monoculture, crop rotation, polyculture etc; importance of crop calendar; fertilizers, manures and plant nutrition; crop-water relations; weeds, crop pests and their control; crop storage.

**KCU 202: Principles of Soil Science**

Introduction to soil science, soil forming factors and processes; soil components; minerals
and organic matter; forms of soil aggregate; peds and pores; chemical reactions on the soil colloidal surfaces; soil aeration; drying and wetting of soil; soil physical properties; water holding capacity, bulk density electrical conductivity and texture; soil chemical properties: pH, cation exchange capacity; bases and soil oxides; plant nutrients; soil organisms.

**SBC 120: Introduction to Genetics**

**KST 202: Plant-Pathogen Interactions**

Introduction; definition of terminologies including the concept of interaction; types of plant – pathogen interactions; mechanisms of pathogenesis ; disease development ; effects of pathogens on the physiological functions and morphology of plants; plants’ defense mechanisms; biochemical, molecular and genetic basis of plant – pathogen interactions including the Gene - for – Gene concept; Role of environmental factors, other pathogens, pests and microorganisms in plant – pathogen interactions.

**KST 206: Principles of Agricultural Biotechnology**

Biotechnology in agriculture; doubled haploids; embryo culture; In vitro selection; creation of variability (induced variation, somaclonal, protoclonal, gametoclonal variation); Protoplast culture and fusion; micropropagation; cryopreservation; somatic embryogenesis; organogenesis; secondary metabolites; Mutagenesis: Physical and chemical mutagens, point mutation, gross mutations; DNA, proteins and central dogma of biology; DNA sequencing and diagnostics; genetic engineering: vectors; Genetically modified organisms (GMOs), regulation, biosafety, legal and ethical issues of GMOs; DNA Molecular markers and applications.

**KST 208: Insect Biology and Ecology**

Economic importance of insects; insect dominance and success; insect abundance; categories of insects; exopterygota; endopterygota; insect biology; morphology; function; modifications; relationships to man and plants; Ecology; population; natality; mortality; fecundity; species diversity; species richness; insect community; social insects; abiotic and biotic factors for insects abundance, growth, predator-prey and host-parasite interactions; intra and interspecific competition; mimicry; commensalism.

**KST 209: Principles of Crop Improvement**

Introduction to botanical nomenclature and botanical terminology; reproductive organs; vegetative organs; vegetative morphology; Family characters of field crops; survey of the plant kingdom; taxonomy and ecology of plant families; domesticating of plants; Plants and plant products and human history and civilization; Genetic improvement, principles and methods, seed production of agronomic crops; cultivar and systems selection, diagnosis and adjustment of nutritional status; use of physical, chemical and cultural aids; clone; propagation; stems, roots, pruning; management of cultivars; harvesting; handling; marketing operations.

**KST 214: Plant Physiology and Biochemistry**

Introduction; Osmotic regulations; Ascent of Sap; Transpiration; mechanism and relevance; Translocation: path, source, sink and strengths; Photosynthesis; pigments; light and carbon reduction reactions, photosystems; carboxylation pathways; Noncyclic and cyclic photophosphorylation; Biosynthesis and degradation: carbohydrates, Lipid (including inter-
conversions), Vitamins; characteristics, nomenclature and classification; Amino acids and proteins; essential and nonessential amino acids, protein structures; Respiration; respiratory mechanisms and substrates; ETS, Enzymes and coenzymes; Photorespiration and plant adaptations; Plant growth substances: identification, structure and synthesis.

**KST 230: Field Course 2**

Visit mid and low altitude agro-ecological zones; land fragmentation; farming systems; soils types, zonation, use, degradation, conservation; Dry land farming: cowpea, sorghum, green grams, fruits, cassava; livestock management: ranching, rangelands, fish farming; vegetation types, grassland, open savanna, forests; wildlife management; large scale farms; sisal, coconut. Water management: harvesting, use, conservation; agroforestry; marine environment and resources, mangrove swamps. The course will take a minimum of 40 hours.

**KRM 201: Agricultural Machinery**

Land suitability for agriculture; types of land development and preparations, timing of cultivation, seedbed establishment; seeding, planting, weeding; farm operations and performance; machinery and farm tools; land survey and design of foundations; suitable farm structures for different types of uses, engineering drawings and farm structures, tillage and soil consistency, overview of machines and mechanized systems for agricultural production.

**KBT 203: Agricultural Production Economics**

The production function and management process; production models; basic concepts of microeconomics; entrepreneurs’ choice of what to produce; the pricing mechanism; determination of output level in the various market structures; national income and expenditures according to neoclassical and Keynesian theories; inflation, economic growth; money supply; applications in agricultural enterprises.

**SBT 202: General Microbiology**

**LEVEL 300**

**KCU 300: Field Attachment**

Exposure of students to actual issues, problems and opportunities in agricultural science and technology; students will have the opportunity to utilize their knowledge, skills and techniques in real situations under the guidance of those practicing; the internship/outreach will normally last for a duration of three months.

**KST 300: Principles of Seed Science and Technology**

Seed physiology: seed development, seed maturation, seed germination, dormancy and deterioration; Functional concept of seed: chemical composition of seed, physical properties and their significance; Principles and practices of seed production: seed harvesting, drying, storage, treatment and packaging; Seed distribution and marketing; seed testing and quality control; plant breeders’ rights; laws and regulations in the seed industry.

**KST 301: Agricultural Entomology**

Population biology of insect pests; insect morphology; reproduction; life cycles; taxonomy of insects; principles of insect pest management; pest control practices: chemical, cultural, biological, predators, parasitoids, microbial; host plant resistance; integrated insect pest management (IPM); bionomics of insect pests; examples of pests of agricultural importance.
KST 302: Plant Diseases and Management
History of plant pathology and economic importance; Crop loss assessment; biotic and abiotic plant disease causing agents; Koch’s postulates and pathogenicity tests; epidemiology; predisposition of plants to diseases, pathogen vectors and dissemination pathways, pathogen survival; diseases of seedlings, field crops and post-harvest products: fruits, flowers and vegetables, cereals, pulses; perennial crops; major symptoms of infected crops, specific disease control and management methods; phytosanitary issues and trade.

KST 304: Weed Science and Management
Definitions; effect of weeds on production, management and quality of agricultural crops; origin and botany of major agricultural weeds in tropics; dissemination; survival of weeds under various environmental conditions; competition between weeds (both free-living and parasitic) and crops; weeds as alternative hosts to crop pests and diseases; weed control methods in agricultural crops.

KST 305: Plant Breeding
Genetic basis for plant breeding; approaches; sources of plant genetic variation; plant genetic resources and their conservation; reproduction systems in relation to plant breeding; quantitative inheritance and selection theory; genetic basis and breeding strategies for improving self-and cross-pollinated plants; breeding for disease and insect resistance; special techniques in plant breeding including biotechnology; improved seed; Cultivar development: registration, release, maintenance and distribution; plant breeder's rights; intellectual property rights and associated policy issues.

KST 307: Crop Production in Controlled Environment
Greenhouse structures and function; design; construction; heating; ventilation; cooling; environmental control; growing media; pest management; sterilization; plant nutrition; hydroponics; growth regulation; irrigation systems; post-harvest handling; physical screens; pest control; protected crop propagation facilities: tissue culture, grafting, in-vitro screening; GMO research facilities; quarantine areas and facilities; policies and regulation; Production technologies for fruit, vegetables and protected crops.

KST 309: Pesticide Formulation, Use and safety
Categories and classification of pesticides: insecticides, nematicides, organophosphaes, carbamates, organochlorides, bio-pesticides; pesticide formulation; mode of action; classification by activity; systemic and contact pesticides; soil-applied; pre-plant incorporated; pre-emergent post-emergent herbicides; pesticide efficacy; application methods; safe and effective use of pesticides; legislation; legal use of pesticides; maximum residue limits (MRLs); phyto-toxicity; crop selectivity; resistant plants; bioassay of pesticides.

KCU 301: Agricultural Research Methods
Role and objectives of research in agriculture; Problem identification; Situational analysis; Project proposal: objectives, literature review, research area/ materials, methodologies, expected results, discussion; Project work: design and layout of experiments in agriculture, data collection techniques, evaluation of results, information presentation methods; Research organisation: planning, budgeting, and costing of research projects; Principles of
experimental designs and analysis; completely randomized design, randomized complete block design.

**KST 313: Principles of Organic Farming**

Introduction: problems of conventional agriculture production; principles of sustainable agriculture; overview of organic agriculture; soil as a basis of organic plant production; integration of agriculture and nature; pest and disease management in organic agriculture; organic seed production and plant breeding; organic food chains; economics of organic plants; food safety; international regulations on organic plant and livestock production; Global-GAP; niche market, international trade on organic food production and products. Prospects, challenges and constraints.

**KRM 300: Soil Fertility and Plant Nutrition**

Definition of soil fertility; essential plant nutrients and their availability in soil; essential elements and their influence on plant growth; non-essential elements and elements toxic to plant, nutrient uptake by plant; physiological functions of essential elements in plants, their deficiency symptoms and toxicity; soil organic matter and importance of humus in soil, microbiological transformation in the soil and nutrients cycling; Methods of manure and inorganic fertilizers and their fate in soil, crop response and fertilizer use recommendations.

**KBT 300: Applied Agribusiness**

Concepts of management; role of marketing, marketing management in farm business; ideal farm layout and applications; inventory taking and valuation techniques of farm assets; elementary farm accounting, net income net worth statements; planning and budgeting techniques: partial budget, capital budgeting, total farm budget, cash flow budget, price and yield information; farm management techniques

**EMS 438: Agro-Meteorology**

**LEVEL 400**

**KCU 400: Research Project (equivalent to 2 units)**

Introduction to integrated agriculture for research; undertaking of a research project; The choice of topic will be made after a visit and interaction with a farming community or an agricultural enterprise and in consultation with assigned supervisors in the Department; developing and presenting research proposals, collecting, analysing data, writing and submitting final project reports in journal paper format; Making oral and or poster presentations in the Department.

**KST 401: Post Harvest Technology**

Importance in food security; Pre-and post-harvest physiology and biochemistry; maturation, ripening and senescence; role of hormones in shelf life of fruits; pre-harvest factors affecting
quality and shelf life; sites of losses and loss management techniques; harvesting techniques; post-harvest handling: pre-cooling, packaging and storage techniques for fruit, vegetables, grains, medicinal and plantation crops. Physiological disorder, prevention and management; specific post-harvest treatments for locally important crops; traditional methods of post-harvest technology.

**KST 407: Integrated Pest and Disease Management Strategies**

Principles of Integrated Pest Management (IPM) and the applications of these principles for insect pest and disease management; surveys of pests, diseases and weeds, alternative practices and non-chemical means of control, monitoring and forecasting methods, and strategies for management and their implementation; examples of existing IPM programs in practice; emphasis on the integration of different methods for maintaining pests, diseases and weeds below damaging levels, with the goal of minimizing the use of chemical pesticides that disrupt the environment.

**KST 408: Agriculture Extension and Rural Development**

Meaning of rural development and rural poverty; gender and poverty; development theories and strategies in rural development; nature and scope of agricultural development; role of agriculture in socio economic development; theories of agricultural development; approaches and strategies to rural development, e.g Millennium Development Goals, decentralization, community development, integrated rural development, gender approaches to development etc. rural project planning, identification, design, monitoring and evaluation.

**KST 412: Plant Mycology and Bacteriology**

Cell morphology, structure, nutrition, (saprophytism, parasitism, mutualism), reproduction and taxonomy of fungal plant pathogens. Isolation, culture preservation, and epidemiology of fungal plant pathogens; disease management methods unique to fungi. Morphology, structure, reproduction, growth, nutrition and spread of bacterial plant pathogens. Isolation, culture, staining, microscopic examination, culture preservation and taxonomy of bacteria; disease management methods unique to bacteria.

**KST 413: Agricultural Policy and Law in Kenya**

Agricultural laws of Kenya and the National Agricultural policy; functions of government and other stakeholders in agricultural policy setting and implementation; role and functions of agricultural boards and other organs; legal impediments to agricultural development; relationship with Environmental and Coordination Act(EMCA); formulation, planning and execution of agricultural programmes; implementation and evaluation; legal considerations in the design and implementation of multi-purpose projects.

**KST 416: Field and Industrial Crops Production**

World distribution; economic importance; utilisation of industrial crops; requirements; genetic improvement; propagation; cultural practices; pests and diseases and their control; harvesting; post harvest handling; processing; storage; marketing of industrial crops: coffee, tea, sugarcane, cashew, coconut, macadamia, pyrethrum, sisal, cotton and tobacco.

**KST 417: Plant Virology and Nematology**

Classification; plant viruses; symptoms; ecology of nematodes; detection and diagnostic techniques; multiplication and replication; infection process; genetic properties of plant virus; viral transmission and spread; viral diseases and nematodes of economic importance; molecular plant virology; serology; electron microscopy in virology; control measures of...
plant virus diseases and nematodes; biological, chemical; cultural; use of parasitic nematodes to control insects; significance of virology and nematology in agriculture; practicals

**KST 418: Breeding Plants for Biotic and Abiotic Stress**

Definition and history; Types of genetic resistance; Genetic interaction of the plant and pest; Races and biotypes of pests; Mechanisms of disease resistance; Mechanisms for insect resistance, Minimizing occurrence and impact of new pest races; Breeding for general resistance, Breeding for resistance/tolerance to cold, drought, salinity, acid soils, advantages and limitations of resistance breeding; germplasm screening techniques.

**KST 420: Pests and Pathogens of Stored Products**

Economic importance of pests of stored products: recognition of stored grain pests: legumes, pulses, grains; factors influencing abundance and distribution: behaviour, adaptability, life cycle, reproduction, mode of attack: outbreak and damage: assessment of damage; control methods: Regulation and enacted laws for inspection and prevention of spread of insect pests in imported and exported products. Fungal pathogens of stored products; pathogen establishment and spread; predisposing factors; loss assessment; mycotoxins; interaction with insect pests; prevention and management measures; phytosanitary issues and trade.

**KST 421: Horticultural Crops Production**

World distribution; economic importance; ecological requirements; genetic improvement; propagation; cultural practices; pests and diseases; control methods: chemical, biological, cultural, mechanical; harvesting; post harvest handling; processing; packaging; storage; marketing of industrial crops; fruit production; vegetable production; medicinal production; herbs and spices.

**KBT 414: Agribusiness Entrepreneurship and Management**