

BACHELOR OF SCIENCE IN HORTICULTURE

1.0. INTRODUCTION

The horticultural sub-sector in Kenya is a leading contributor to the country's GDP, and is earmarked as a key economic growth sector in the medium to long term development strategies. Realization of goals to attain the full potential of the sector will hinge on availability of adequate and suitably skilled manpower in this sector. This Bachelor of Science (BSc) degree in Horticulture program will contribute in meeting this challenge through provision of up-to-date knowledge, skills and appropriate technology in horticulture. The program offers training in fundamental horticultural knowledge and practice in the first two years of study, after which students will have a choice of specializing in one of two concentration areas of production horticulture or environmental horticulture in the final two years. The horticultural production concentration will focus on basic and state-of-the-art principles and practices in production of a variety of vegetables, fruits, flowers, other ornamental plants, organic production, postharvest, nursery and greenhouse management. Environmental horticulture concentration will focus on providing skills and state-of-the-art information in planning, design, construction, and management of urban landscapes, ornamental horticulture and restoration horticulture. Overall, the program incorporates basic management skills, with emphasis on professional standards and ethics, as well as sustainable and environmentally sound management practices.

2.0. OBJECTIVES

2.1. Overall objective

To produce internationally competent graduates who are equipped for a range of careers in the horticultural industry. Graduates will not only acquire ability to provide professional advice and services in horticulture, but also have options to specialize in chosen career paths at post-graduate level.

2.2. Specific objectives

The specific objectives of the programme are to:

- a) Equip students with an in-depth understanding of horticultural science.
- b) Train students in best practices in the horticulture industry.
- c) Equip students with state-of-the-art technical knowledge and skills in horticulture.
- d) Produce graduates to meet current and future horticulture industry needs through research, innovation and teaching.

3.0. ADMISSION REQUIREMENTS

) Candidates must satisfy the minimum University requirements of a mean grade of C+ (plus) in Kenya Certificate of Secondary Education, have at least grade C (plain) or above in Biology and Chemistry, and at least grade C- (minus) in either Physics or Mathematics.

OR

) Have two principal passes in biology and chemistry in KACE and at least a credit in Mathematics at Ordinary level.

OR

) Have a Diploma in agriculture or related fields from a recognized institution.

4.0. COURSE STRUCTURE AND DURATION

- (a) The degree shall normally take four academic years of 8 semesters.
- (b) Courses shall be offered in units. A course unit is defined as that part of a subject described by a coherent syllabus and taught normally over a period of a semester. It is designated as a total of 42 hours of study in a semester. For this purpose one 1-hour lecture is equivalent to one 2-hour tutorial or 3-hour practical or any combination as may be approved by the Board of the School of Agriculture, Food Security and Biodiversity.
- (c) Part-time students shall be allowed to take not less than 50% of courses prescribed for the year.
- (d) All courses will be taught for a total of 42 contact hours.
- (e) Students shall be required to undergo an Industrial Attachment of three (3) months at the end of 2nd semester of the third year of study.

5.0. CREDIT TRANSFER

Students may be exempted from some courses by Senate on recommendation of the University Senate.

6.0. EXAMINATION REGULATIONS

University Senate regulations on Examinations shall apply.

7.0. COURSE DISTRIBUTION

YEAR 1 SEMESTER 1					
Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AHT 3111	Introduction to Horticultural Industry	28	14	42	1C
APT 3111	Agricultural Botany	28	14	42	1C
SCH 3111	Physical Chemistry	28	14	42	1R
SMA 3111	Mathematics I	42	0	42	1R
EEL 3115	Communication Skills	42	0	42	1R
AAE 3113	Farming Systems and Rural Livelihood	42	0	42	1R
SCS 3111	Computer Organization and Applications	28	14	42	1R
SB1 3114	HIV and AIDS	42	0	42	1R
	Total	280	56	336	8

YEAR 1 SEMESTER 2					
Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AAB 3121	Agricultural microbiology	28	14	42	1R
BEN 3121	Principles of Microeconomics	42	0	42	1R

ALS 3123	Introduction to Soil Science	28	14	42	1R
SCH 3122	Organic Chemistry	28	14	42	1R
SMA 3122	Mathematics II	42	0	42	1R
ESD 3120	Social Ethics and Integrity	42	0	42	1R
APT 3125	Principles of Crop Production	28	14	42	1R
SLB 3121	Development Studies	42	0	42	1R
	Total	280	56	336	8

YEAR 2 SEMESTER 1

Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AHT 3211	Plant Genetic Resources and Conservation	28	14	42	1C
AHT 3212	Plant Biochemistry	28	14	42	1C
AHT 3213	Fundamentals of Plant Ecology	28	14	42	1C
AHT 3214	Plant Nutrition and Fertilizers	28	14	42	1C
AHT 3215	Plant Taxonomy and Identification	28	14	42	1C
AHT 3216	Introductory Statistics	28	14	42	1R
ALS 3213	Soil Survey Classification and Land Evaluation	28	14	42	1R
AFB 3213	Climate Change and Food Security	42	0	42	1R
AAE 3214	Agricultural Marketing	42	0	42	1R
	Total	280	98	378	9

YEAR 2 SEMESTER 2					
Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AHT 3221	Plant Physiology	28	14	42	1C
AHT 3222	Principles of Crop Protection	28	14	42	1C
AHT 3223	Principles of Genetics	28	14	42	1C
AHT 3224	Principles of Plant Breeding	28	14	42	1C
AHT 3225	Plant Growth Processes	28	14	42	1C
AHT 3226	Plant Propagation and Nursery Management	28	14	42	1C
AHT 3227	Farm Materials and Structures	28	14	42	1C
AAB 3226	Cell and Tissue Culture and Transgenic Technologies	28	14	42	1R
	Total	224	112	336	8
YEAR 3 SEMESTER 1					
Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
ALS 3314	Principles of Surveying	28	14	42	1R
AEE 3321	Agricultural Extension and Technology Transfer	42	0	42	1R
BEP 3315	Entrepreneurship	42	0	42	1R
ALS 3311	Research Methods	28	14	42	1C
ALS 3317	Soil and Water Engineering	28	14	42	1R
AAE 3311	Farm and firm Accounts and Planning	42	0	42	1R
<i>Production Horticulture Concentration</i>					
AHT 3311	Vegetable Crops I	28	14	42	1E
AHT 3312	Tropical and sub-tropical fruits	28	14	42	1E
AHT 3313	Cut flowers	28	14	42	1E
<i>Environmental Horticulture Concentration</i>					

AHT 3314	Landscape Plants	28	14	42	1E
AHT 3315	Landscape design	28	14	42	1E
AHT 3316	Design Communication	28	14	42	1E
	Total (Production Horticulture)	322	56	378	9
	Total (Environmental Horticulture)	336	42	378	9

YEAR 3 SEMESTER 2					
Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AHT 3321	Horticultural Machines and Farm Power	28	14	42	1C
AHT 3322	Sustainable Horticultural Management	28	14	42	1C
AHT 3323	Edible landscapes	28	14	42	1R
ALS 3328	Biometry	28	14	42	1C
ALS 3326	Principles of Irrigation and Drainage	28	14	42	1C
<i>Production Horticulture Concentration</i>					
AHT 3324	Post harvest physiology and technology	28	14	42	1E
AHT 3325	Vegetable Crops II	28	14	42	1E
AHT 3326	Temperate fruits	28	14	42	1E
<i>Environmental Horticulture Concentration</i>					
AHT 3327	Landscape establishment and maintenance	28	14	42	1E
AHT 3328	Amenity Horticulture	28	14	42	1E
AHT 3329	Ecosystem restoration and management	28	14	42	1E
	Total (Production Horticulture)	224	112	336	8
	Total (Environmental Horticulture)	224	112	336	8

YEAR 3 SEMESTER 3					
Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AHT 3331	Industrial Attachment (3months = 480 Hrs)				
YEAR 4 SEMESTER 1					
Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AHT 3410	Research Project I	28	14	42	1C
AHT 3411	Organic Production and Composting Technology	28	14	42	1C
AAB 3412	Biotechnology in Horticulture	28	14	42	1C
<i>Production Horticulture Concentration</i>					
AHT 3412	Molecular Plant Breeding	28	14	42	1E
AHT 3413	Ornamental Horticulture	28	14	42	1E
AHT 3414	Summer Cut flowers	28	14	42	1E
AHT 3415	Nuts, Beverages and Medicinal Crops	28	14	42	1E
<i>Environmental Horticulture Concentration</i>					
AHT 3416	Computer Assisted Design and Drafting	28	14	42	1E
AHT 3417	Interior-scaping and plant containerization	28	14	42	1E
AHT 3418	Arboriculture	28	14	42	1E
AHT 3419	Aquatic plants and water features	28	14	42	1E
	Total (Production Horticulture)	196	98	294	7
	Total (Environmental Horticulture)	196	98	294	7

YEAR 4 SEMESTER 2					
Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AHT 3420	Research Project II	28	14	42	1C
AHT 3421	Greenhouse production and Management	28	14	42	1C
AHT 3422	Seed Science and Technology	28	14	42	1C
AAE 3422	Agricultural Policy Analysis	42	0	42	1R
AAE 3427	Farm Management	42	0	42	1R
<i>Production Horticulture Concentration</i>					
AAB 3424	GMOs, Biosafety and Bioethics	42	0	42	1E
AHT 3423	Vegetable crops III	28	14	42	1E
AHT 3424	Herbs and Spices	28	14	42	1E
<i>Environmental Horticulture Concentration</i>					
AHT 3425	Permaculture	28	14	42	1E
AHT 3426	Turfgrass and Ground Cover Management	28	14	42	1E
AHT 3427	Landscape Construction	28	14	42	1E
	Total (Production Horticulture)	266	70	336	8
	Total (Environmental Horticulture)	252	84	336	8

C: Core course, which is central to the discipline of study.

R: Required course, which is supportive or beneficial to the programme.

E: Elective course, which is supportive to the programme or required for a particular concentration.

8.0. COURSE DESCRIPTIONS

YEAR 1 SEMESTER 1

AHT 3111: Introduction to Horticultural Industry

42 Hours

Definition and scope of horticulture; Role and importance of horticulture as a discipline; Relationship between horticulture and other agricultural disciplines; History of horticultural science and industry in Kenya and the world; Major horticultural crops in Kenya and the world; Horticultural production systems: field and controlled environments; Major horticultural sector stakeholders in Kenya: large and small scale producers, marketers, government organizations, producer and marketing organizations; Horticultural policies in Kenya; Geographical distribution of major horticultural crops in Kenya; Major international and regional markets, emerging and potential markets; Access to international markets and their influence on Kenyan horticulture industry; Introduction to concepts of environmental horticulture, horticultural practices and methods with focus on sustainability and ecological issues.

APT 3111: Agricultural Botany

42 Hours

Plant cells, tissues, organs; Morphology and anatomy of angiosperm root, stem, leaf, flower, fruit, seed and seedling; Primary and secondary growth of plants; Persistent and successive cambia; Morphogenesis and differentiation; Plasticity of plant organs; Relationship between plant structure, function, and ecological adaptation; Evolutionary trends in anatomy and morphology of crop plants; Totipotency, sectioning and staining; Preparation of main botanical agents.

SCH 3111: Physical Chemistry

42 Hours

The structure and properties of matter, origin of elements, evolution of living organisms from chemical systems, bond formation and molecules. Laws of thermodynamics, Steady state kinetics, Reaction kinetics, various functional groups of organic molecules and their biological roles. Carbohydrates; Structure and properties of mono-, di- and polysaccharides.

SMA 3111: Mathematics I

42 Hours

Elementary set theory. Mappings and functions: Definitions, domains, codomains, range and inverses and composition of functions. Trigonometry: Functions, their graphs, inverses, degree and radian measure, sine and cosine formulae, trigonometric identities and equations. Algebra: Quadratic equations. Surds, logarithms and indices. Series: Arithmetic and geometric progressions, Permutation and combinations. Binomial theorem and applications such as approximations, simple and compound interest. Remainder theorem applications to solutions of factorials polynomials. Statistics: Collection and representation of data. Measures of central tendencies and variability. Graphical and axiomatic approaches to probabilities. Tree diagrams. Probability: Definition, axioms, tree diagram.

EEL 3113: Communication Skills

42 Hours

Study Skills; Planning study time, making references, filing notes, preparing for examinations. Library Skills; Organization, classification, shelving, using reference books. Listening Skills; Asking and answering questions in lectures and seminars, making and defending arguments, agreeing and disagreeing, explaining points clearly. Academic reading skills; Skimming and scanning, notes making, understanding footnotes and bibliographical references.

AAE 3113: Farming Systems and Rural Livelihood

42 Hours

Processes of environmental, economic, social and legal change from the global, regional and local perspectives; Emergence of new forms of production, exchange, consumption, and governance; Impacts of global and regional production and consumption trends and changes on food and agriculture; Structure and dynamics of agri-food systems; Trade liberalization; Deregulation of foreign investment; Government divesture in the agricultural sector; Privatization and globalization of agricultural commodity chains; Ascendance of regional and global retailers in poor economies; Governance restrictions and operation of agri-business supplies; Agricultural commodity value chains; Consolidation of food processing and manufacturing; Farming system determinants; Pro-poor farming systems approaches and methodologies.

SCS 3111: Computer Organization and Applications**42 Hours**

Organization: Introduction to the computer and the notion of a programmable machine. The basic organization based on the von Neumann model. Functional components (CPU, memory, I/O) and their logical organization. Number systems and internal data representation. Concept software and types of software. Components of contemporary personal computer systems from end-user perspective; Application: Classical and contemporary applications of computers. Proficiency in basic computer usage and productivity/office automation applications including word-processing, spreadsheets, e-mail, web, etc. Basic first year security and maintenance issues. Ethical and societal issues.

SBI 3114: HIV and AIDS**42 Hours**

Introduction; Historical background and magnitude of HIV and AIDS; General organization of the human body; Reproduction, immune system (human physiology) and other factors; Sex and sexuality; The biology of the human immunodeficiency virus and viral transmission; Stages of infection and the development of HIV and AIDS; Opportunistic infections; HIV and AIDS prevention and infection control; Peer education for HIV; Treatment options and vaccine development; Blood transfusion and HIV and AIDS; Management of HIV and related infections; Legal and Ethical Issues in HIV and AIDS; Factors that influence the spread of HIV and AIDS in Africa; Case studies in selected countries in Africa; HIV and AIDS as a national disaster and its impacts; Myths and emerging issues on HIV and AIDS.

YEAR 1 SEMESTER 2**AAB 3121: Agricultural microbiology****42 Hours**

History of microbiology; Spontaneous generation theory; Microorganisms in fermentation; Germ theory of disease; Protection against infections; Applied areas of microbiology; Bacterial metabolism; Bacteriophages: structure and properties of bacterial viruses; Lytic and lysogenic cycles: viroids, prions; Microbial groups in soil; Microbial transformation of carbon, nitrogen, phosphorus and sulphur; Biological nitrogen fixation; Microflora of rhizosphere and phyllosphere; Microbes in composting; Food microbiology: microbial spoilage, principles of food preservation; Beneficial microorganisms in agriculture: biofertilizers (bacteria,

cyanobacteria, fungi), microbial insecticides, microbial agents for control of plant diseases; Biodegradation: biogas production; biodegradable plastics; Plant-microbe interactions.

BEN 3121 Principles of Microeconomics

42 Hours

Basic concepts of economics applied to agriculture with special reference to Kenya; Economic systems; Scarcity, choice and opportunity costs; The price theory; Demand and supply; Elements of utility; Demand and basic concepts of elasticity; Economics of production including production functions and costs of production; Market structure; Theory of distribution and factor markets; The price systems and economic role of government.

ALS 3123: Introduction to Soil Science

42 Hours

Fundamental concepts: Pedosphere, hydrosphere, atmosphere, soil, edaphology; soil phases and components; Soil as a living body; Soil as part of the environment; Factors of soil formation: Parent material, climate, organisms, topography; and time; Soil-forming processes: Physical, chemical, biological; Soil properties: profile, horizon, pedon, epipedon, endopedon, physical, chemical, and biological. Perfectly and imperfectly drained soils.

SCH 3122: Organic Chemistry

42 Hours

Introduction to amino acids: Proteins- primary, secondary, tertiary and quaternary structures. Protein denaturation, introduction to lipids, neutral lipids, polar lipids. Fatty acids: structure, properties and nomenclature. Steroids and terpenes. Chemistry of bacterial and plant cell walls.

SMA 3122: Mathematics II

42 Hours

Coordinate geometry and equations of straight lines. Matrices: definitions, matrix algebra, determinants, transpose, adjoints, inverses and solutions of systems of linear equations using matrix method. Limit continuity. Differentiation and integration of algebraic, trigonometric, exponential functions. Applications of differentiation and integration to rates of change, maxima, minima. Area under curve. 1st order D.E and their application.

ESD 3120: Social Ethics and Integrity**42 Hours**

Definitions and concepts; Categories of ethics; national cohesion; integrity; Unity; Structural injustices; ethnicity: Positive ethnicity, negative ethnicity; Peace: Peace making, peace building, peace transformation; Stake holders in national cohesion.

APT 3125: Principles of Crop Production**42 Hours**

Concept of crop production, energy/biomes transfer systems; Environmental factors determining crop performance; Cultural practices: seedbed preparation, cultivation, plant seed and seed rates, plant population; Crop protection; Maintenance of soil fertility: organic and inorganic fertilizers; soil and water conservation; Cropping systems including crop rotation, intercropping and agro-forestry.

SLB 3121: Development Studies**42 Hours**

Development Studies as an autonomous discipline; The concept of development; An overview of the theories and paradigms of development; The relationship between economic growth and development; Science and technology in development; Developed and developing countries; Issues in development: Social, economic and political; Actors in development: The state, national and international NGOs, bilateral and multilateral institutions, multinational corporations (MNCs), and social movements.

YEAR 2 SEMESTER 1

AHT 3211: Plant Genetic Resources and Conservation

42 Hours

Definition and importance of biological diversity; Measurement of biological variations, species diversity indices and gradient analysis; Centers of biological diversity; Plant Genetic Resources (PGR): definition and importance; Species conservation and management: ex-situ, in-situ, contemporary and participatory approaches; Genebank practice, the role of genebanks in conservation of PGR; Germplasm management: collection, maintenance, characterization and evaluation; The role of PGR in Food Security in the past, present and future; Indigenous PGR in Kenya and Africa: underutilized and neglected crops, use in genetic enhancement and climate change mitigation; Policy Frameworks on PGR; Problems and conflicts of PGR exploitation, conservation and resource management in ecosystems.

AHT 3212: Plant Biochemistry

42 Hours

Carbohydrates: classification, structure, biosynthesis and degradation; Lipids: classification, role in cell function, biosynthesis and degradation; Amino acids; Protein and non-protein amino acids; Proteins: structure, function and biosynthesis; Enzymes: classification, nature, function and regulation; Coenzymes and vitamins; Biosynthesis of Proteins; Nitrogen metabolism: assimilation, symbiotic and non-symbiotic nitrogen fixation, mineralization, denitrification; Plant secondary metabolites: major categories, biosynthesis and importance.

AHT 3213: Fundamentals of Plant Ecology

42 Hours

Definition and scope of ecology; Ecological levels of organization: populations, communities, ecosystems; Ecosystem components and regulation; Energy flow and trophic structures; East African plant communities; Environmental factors and human impact on vegetation; Plant population dynamics; Soil composition, texture and structure; Soil water and aeration; Assessment of plant and soil nutrient status; Effect of soil conditions on plant growth and consequences of these relationships for horticultural plant management.

AHT 3214: Plant Nutrition and Fertilizers

42 Hours

Nutrient required by plants: essential and beneficial nutrients; Sources, forms and chemistry of essential nutrients; Nutrient availability and factors governing their availability; Nutrient deficiency symptoms/disorders and their diagnosis; Mechanisms of nutrient absorption and factors influencing uptake; Methods for delivering nutrients; Soil fertility assessment: pot and field experiments, nutrient culture techniques; plant and soil analysis; Organic and inorganic fertilizer types and their physical and chemical properties; Manufacture of fertilizers; Fertilizer formulations, blending and delivery methods; Assessing fertilizer requirements; Chemical behavior of common fertilizers under various soil conditions.

AHT 3215: Plant Taxonomy and Identification

42 Hours

Significance and relationship of plant taxonomy to agricultural disciplines; Taxonomic hierarchy; Biosystematics and modern taxonomy; Artificial, natural and contemporary classification systems; Nomenclature; Sources of taxonomic evidence; Identification and herbarium techniques; Plant variation, isolation and evolution; Role of fossil angiosperm and gymnosperms in taxonomy; Survey of selected angiosperm families of East African flora; Identification of Kenyan horticultural plants.

AHT 3216: Introductory Statistics

42 Hours

Definition of statistics; Importance of statistics; Population; Sample; Methods of data collection and presentation; Measures of central tendency and dispersion; Probability, some probability distributions; Sampling distribution; Estimation and testing of probability; Estimation and testing of difference of two expectations; Goodness of fit tests; Contingency tables; Simple linear regression and correlations.

ALS 3213: Soil Survey, Classification and Land Evaluation**42 Hours**

Soil survey; Aims and importance of soil surveys, types of soil survey. Soil classification; Types and merits of soil classification, fundamental taxonomic classifications, practical evaluation of soils in relation to rain fed and irrigated agriculture, land rating and compiling soil suitability maps for specific purposes or crops. Some important Kenya soils; Properties, occurrence, distribution and use.

AFB 3213: Climate Change and Food Security**42 Hours**

Defining climate change and global warming; The climate systems: atmosphere, hydrosphere, cryosphere, lithosphere and biosphere; Mitigating factors of climate change; Climate change and the food security systems: food availability, accessibility, utilization and system stability; Adaptive responses of food security systems to climate change; Climate impact assessment tools; Designing strategies to implement adaptation options; Strengthening community resilience and managing climate change; Sequestering carbon and global response indicators.

AAE 3214: Agricultural Marketing**42 Hours**

Definition of agricultural marketing; Marketing functions: assembly, grading/sorting, transportation, risk bearing and financing; Marketing systems/channels; Structure, conduct and performance of agricultural markets; Supply/value chain analysis; Nature of rural agricultural markets: information asymmetry and infrastructure; Globalization and marketing of high value commodities; Crop and livestock products; Collective action in agricultural marketing; Agricultural marketing boards/parastatals: role, effectiveness and efficiency; Risk management in agricultural marketing; Futures markets; Role of agricultural marketing in economic development.

YEAR 2 SEMESTER 2**AHT 3221: Plant Physiology****42 Hours**

Physical and chemical properties of aqueous solutions and colloidal systems; Plant physiological processes: osmosis, guttation, water absorption, transpiration, translocation and associated gradients; Water potential concept; Photosynthesis: structure and function of chloroplast, light

and dark reactions, photosynthetic pathways, photorespiration; Cellular respiration: overview, glycolysis, pyruvate decarboxylation, tricarboxylic acid cycle, electron transport chain and oxidative phosphorylation; Pentose phosphate pathway; Stress physiology and stress tolerance mechanisms; Physiology of cultural and genetic limits to crop production.

AHT 3222: Principles of Crop Protection

42 Hours

Definition; Pest concept; Production and post-harvest losses; Weed science: weed physiology and ecology, major horticultural weeds in Kenya; Chemical and biological control of weeds; Herbicide selectivity and toxicology; Major horticultural crop pests; Storage pests and post-harvest losses; Major horticultural crop diseases and disease vectors; Chemical, cultural, physical and biological disease and vector control methods; Integrated pest management; Safe use of chemicals in horticultural crop production: environmental and food safety concerns; Phytosanitary regulations and plant material quarantine; National and international regulation of agrochemical residues.

AHT 3223: Principles of Genetics

42 Hours

Cell division; Mendelian genetics; Multiple and pseudo-alleles; Gene interactions and modifications to Mendelian ratios; Extra-chromosomal inheritance; Cell cycle; Molecular basis of inheritance; Chromosomal structure, variation and mapping; Recombination of genetic information; Evolution, diversity and variation in relation to environment Structure, synthesis and roles of nucleic acids; Genetic code; The operon concept; Gene expression and regulation; Populations genetics; Hardy-Weinberg equilibrium.

AHT 3224: Principles of Plant Breeding

42 Hours

Origin and evolution of crops; Documentation, collection, maintenance and use of genetic variation and wild relatives; Theory and estimation of genetic diversity, correlation between relatives; diallel analysis; Selection techniques: screening for heritable variation; Mating systems; Development and maintenance of inbred lines and hybrids; Special techniques for crop improvement: incompatibility, unreduced gametes, male sterility, polyploidy; Fundamentals of molecular breeding.

AHT 3225: Plant Growth Processes**42 Hours**

Growth measurement and kinetics; Cell division; Cell growth mechanisms; Organization of shoot and root growth; Developmental anatomy and phyllotaxy; Determinate and indeterminate growth; juvenility and senescence; the discovery; chemistry, metabolism, function, interaction, transport and economic importance of plant hormones; cell, tissue and organ culture; their application and relevance; plant responses to the environment; dormancy, flowering and phytochrome involvements; growth movements.

AHT 3226: Plant Propagation and Nursery Management**42 Hours**

Principles and practices of plant propagation; Seed and vegetative plant propagation methods; Environmental factors affecting plant propagation; Propagation structures, containers and media; Introduction to micro-propagation and rapid multiplication techniques; Classification of nurseries; Principles and practices of nursery establishment and management: site selection, physical facilities, labour and financial management, nursery stock inventory control; Nursery plant production, handling and marketing.

AHT 3227: Farm Materials and Structures**42 Hours**

Engineering materials in agriculture; Metal manufacturing processes; Basic metals: steel, cast iron, copper, brass, zinc etc; Cutting, fitting and joining of metal and wood; Use of plastics in agriculture; Earth, brick, stone, concrete, timber materials in agriculture; Types of farm structures; Functional, structural and environmental factors influencing building site, design and layout; Selection of construction materials; Design and construction of selected structures; farm fencing; Quantities and cost estimates; Plastic and glass materials in greenhouse technology.

AAB 3226: Cell and Tissue Culture and Transgenic Technologies 42 Hours

History, types of tissue culture, advantages and limitations; Culture environment, adhesion, proliferation, differentiation; Development of media: physico-chemical properties, complete media, serum and supplements; Principles of plant micro-propagation, scope and importance in crop improvement; The concepts of totipotency and morphogenesis, organogenesis, rhizogenesis, embryogenesis; Micropropagation pathways; *Agrobacterium* biology; Ti plasmid-based transformation; Callus induction and culture; Meristem culture; Cryopreservation and germplasm storage; Artificial seed technology; Embryo rescue; Protoplast culture and somatic hybridization; Animal cell culture techniques and applications; Primary culture: mouse, embryo, chick culture; Cloning and selection; Cytotoxicity; Specialized cells; Molecular techniques in cell culture.

YEAR 3 SEMESTER 1

ALS 3314: Principles of Surveying 42 Hours

Measurement of distance and angles, triangulation; chain surveying; leveling, plane table survey, contour survey; measurement of slope; compass surveying; air photo survey, scale, parallax, use of stereo pairs; plans and maps. Application in soil and water conservation practices.

AEE 3321: Agricultural Extension and Technology Transfer 42 Hours

Theory and need for extension; Organization and administration of extension systems; Extension methods; Individual and group methods: train and visit method; Communication channels and media; Social change: adoption and diffusion of innovations and modernization of peasant farmers; Extension programme planning, implementation, monitoring and evaluation; Government interventions influencing extension approaches in Kenya.

BEP 3315: Entrepreneurship**42 Hours**

Definition of Small and Medium Enterprise (SME); Theory and philosophy of entrepreneurship; Production efficiency: Factor resource intensity, large vs. small enterprises, and justification for small enterprises; Understanding entrepreneurship: Starting a SME, creating and managing the venture; Sources of capital in venture creation; Consumer-entrepreneur relationship: Role of product quality, innovation and skill in product quality; Marketing of SME product; Competitiveness; Scaling up; Institutional arrangements; Standards and quality; Barriers to SME development; Role of SME in economic development; Case studies of successful SME; Indicators and vertical integration.

ALS 3311: Research Methods**42 Hours**

Introduction to research; Meaning and purpose, basic terms; Deductive and inductive approaches; Planning research project; Problem, objectives, hypothesis; Literature review; Research methodology and instruments; Budgeting and work plan; Logistical and ethical issues in research; Experimental designs; Data collection and analyses; Sampling, classification of variables, pre-analysis of data, coding and entering; Research and project development; Writing research proposal; Writing a research report: components of research report; Presentation skills.

ALS 3317: Soil and Water Engineering**42 Hours**

Introduction to hydrology; Hydrological cycle; Effective rainfall: Measurements of precipitation, infiltration and runoff; Introduction to hydraulics; Types of flow; Continuity and Bernoullis equation; Water conveyance and distribution in pipes and channels; Sedimentation and scouring; water lifting devices: Types of pumps and their characteristics curves; Construction of dams and tanks; Development of groundwater; Soil erosion and conservation; Irrigation and drainage methods including micro-irrigation techniques; Soil-plant water relationships: Crop water requirement, irrigation intervals, soil water retention availability; dry land farming methods.

AAE 3313: Farm and Firm Accounts and Planning**42 Hours**

Farm planning techniques for a manager to control and monitor the firm business; Data management, their use, collection recording and analysis; Problems/difficulties in keeping farm and firm records; Designing and presenting firm accounting systems including accounting methods and components of firm accounting systems; Firm business: activities of firm business analysis; The balance sheet; The income statement; Analysis of net firm income and returns to capital; Labour; Management and equity; Enterprise budgeting: partial budgeting, complete budgeting, cash flow budgeting; Management functions; Farm accounting; labour management; Work study; Investment and financing; Partial investment calculations; Modules of simultaneous investment calculations; Farming under risk under risk and uncertainty; Modules to incorporate risk and uncertainty into farm planning e.g. linear programming.

AHT 3311: Vegetables Crops I

42 Hours

Principles and practice of vegetable growing; Commercial production of vegetables covering botany, economic importance, ecology, cultural practices, crop protection, harvesting, post-harvest handling, and marketing; Crops: French beans, Snow peas, garden peas, brassicas (kale, cabbage, cauliflower), Solanaceae (tomato, Irish potato, capsicum, brinjals), onions, carrots, lettuce, spinach, sweet corn, baby corn, Cucurbits (melons, cucumber) and asparagus.

AHT 3312: Tropical and Sub-tropical Fruits

42 Hours

Production of tropical and sub-tropical fruits: economic importance, botany, ecology, physiology, culture, crop improvement and protection, harvesting, handling and marketing; Fruits include: avocado, banana, citrus, guava, mango, passion fruit, papaya and pineapple; Underutilized indigenous fruits with commercial potential.

AHT 3313: Cut Flowers

42 Hours

Production of major cut flowers, covering botany, ecological requirements, propagation, cultural practices, plant improvement, and marketing; Summer cut flower arrangement; Flowers will include: Roses, alstroemeria, carnation, calla lilies, tulips, statice, and others.

AHT 3314: Landscape Plants**42 Hours**

Overview of planting design and plant selection; Plant selection criteria; Sources of information for plant selection; Planting design and combination to achieve aesthetic and functional goals: growth habit, ultimate size, texture effect, period of bloom, color, flower and foliage displays, cultural requirements; Identification and use of common landscape plants: evergreen /deciduous trees and shrubs, vines, ground covers, grasses, orchids, flowers, cacti and succulents, annual and perennial herbs, bamboos and palms, aquatic plants; edible and indigenous plants; Interior and potted plants.

AHT 3315: Landscape Design**42 Hours**

Landscaping styles: formal, informal, regional, natural; Theory and principles of landscape design; Design process; Landscape master planning concept; Planning and budgeting; Designing materials: plants and other elements; Planting design theory as it applies to the aesthetic, cultural, ecological, and functional use of plant materials in the landscape; Principles of irrigation design for ornamental landscapes: history of irrigation, advanced site analysis, irrigation design theory, equipment selection and layout, controller scheduling, long-term maintenance, water conservation; Basic theory, design, and installation techniques for lighting landscapes: effective use of conventional and low-voltage lighting for improving landscape aesthetics and the functional use of outdoor spaces.

AHT 3316: Design Communication**42 Hours**

Design theory; Basic graphic communication concepts; Principles of landscape graphics; Design process; Graphic mediums and tools: perspective drawing, axonometric sketching, graphic representation of the non-visual, diagrams, collage, sequence drawings, graphic layout, drawing from nature, digital media, incorporating technical drawings; Graphic vocabulary; Graphic skills; Reprographic techniques; Plan reading; Creative problem solving; Graphics used for presenting planting designs; Basic photographic equipment and techniques utilized in photographing landscapes; Basic perspective sketching for landscape design presentations. Setup and rendering of one-point and two-point perspectives, including location of horizon lines and vanishing points,

height determination, positioning of objects, and rendering techniques for plants, people, structures and hardscape; Design presentation.

YEAR 3 SEMESTER 2

AHT 3321: Horticultural Machines and Farm Power

42 Hours

Sources and applications of farm power and energy: water, wind, solar, fossil fuels, animal, human, biomass, electrical; Principles of energy conservation; Internal combustion engines: structure and operation of 2-stroke and 4-stroke petrol and diesel engines; Fuels, air, lubricants and electrical; basic maintenance of for primary and secondary tillage operations; Planting and transplanting; Fertilizer and manure application, liquid fertilizer applicators; Crop protection; Harvesting equipment; Post harvest operations: chaff choppers, cutters, grinders, sorting and grading; General purpose equipment: chain saws, hedge cutters, mowers; Greenhouse equipment.

AHT 3322: Sustainable Horticultural Management

42 Hours

Ecological principles of sustainability for efficient water, energy and other environmental resources; Nexus between horticulture and the environment: horticultural practice with minimal environmental impact; Role of horticulture in natural resource management enhancement; Species diversity, integrated pest management, water-efficient irrigation and renewable energy; Principles and practices utilized in design, implementation, and maintenance of sustainable horticulture concerns.

AHT 3323: Edible Landscapes**42 Hours**

Residential site analysis, program development, landscape; Basic design preparation, evaluation, and installation techniques; Simple landscape plans; Use of ornamental plants for functional and aesthetic improvement of home environments; Installing drip and spray irrigation systems; Evaluating performance of irrigation systems; Practice and feasibility of integrating edible (and other multipurpose) plants into landscape designs; Ornamental plant materials which produce edible fruit, foliage, flowers or other edible parts; Current concepts and trends in residential landscape design industry: methods for evaluating successful landscape designs and their implementation.

ALS 3328: Biometry**42 Hours**

Need for agricultural experiments, contribution of statistics to experimentation; Planning experiments: replication, randomization sampling; Variance, error, error reduction; Statistical designs: Completely randomized, Completely randomized blocks, Split plots, Latin squares; Factorial experiments, Nested structures, Lattice; Analysis of experiments: Partition of treatment effects; Comparison of means in each experimental design; Field research methods; Research project preparation, funding, implementation and reporting; Statistical analysis using computer packages.

ALS 3326: Principles of Irrigation and Drainage**42 Hours**

Irrigation water sources and methods of storage, water and soil relationship; Water flow through the soil, the quantity and quality of water used in irrigation systems, surface and underground irrigation, drainage, wells and its use for irrigation, water measurements, laws and legislation for irrigation.

AHT 3324: Post Harvest Physiology and Technology**42 Hours**

Physiological and biochemical characteristics of agricultural products and their changes after harvesting; Post harvest losses and their importance; Grading, packaging, storage, transportation and handling of flowers, fruits, vegetables and other horticultural products.

AHT 3325: Vegetable Crops II**42 Hours**

Importance of Asian vegetables in the local and export market. Production of unique Asian vegetable crops of commercial potential to cover botany, economic importance, ecology, crop improvement, cultural practices. Vegetables include: Dudhi, Chilli, Paprika, Leeks, Tura, Guar, Okra, Radish, Gourds (Bitter, ridge and sponge) and Karela.

AHT 3326: Temperate Fruits**42 Hours**

Production of temperate-zone fruits, covering importance, botany, ecology, physiology, culture, crop improvement and protection, harvesting, post-harvest handling and marketing; Fruits include apples, pears, peaches, plums, grapes, raspberries, blackberries, and strawberries.

AHT 3327: Landscape Establishment and Maintenance**42 Hours**

Establishment and management considerations in designed vegetation: plant quality in relation to propagation method, plant selection, cost and sourcing; Scheduling establishment and maintenance; Care for trees, shrubs, vines, ground covers, turf, herbaceous perennials, annuals and bedding plants; Pest and disease diagnosis and control; Weed management; Irrigation systems maintenance; Landscape soil management: erosion control, drainage, fertilization, mulching; Use and care of tools and equipment; Sustainability in designing vegetation for aesthetic, functional and ecological outcomes; Soil-plant-water relationship specific to ornamental plants; Working with aquatic plants; Water-efficient landscapes; Gardening techniques for landscapers; Working with containerized and boxed plants.

AHT 3328: Amenity Horticulture**42 Hours**

Overview of landscaping in parks and playgrounds: schools, kindergartens, child care centers, home gardens; Playground Philosophy; Preparing a Concept Plan; Materials; Park and playground structures and materials; Local and neighbourhood parks; Community participation in park development; Introduction to xeriscaping (water-conserving landscapes); Landscape designs which limit the need for water; Balancing softscape and hardscape elements.

AHT 3329: Ecosystem Restoration and Management**42 Hours**

Ecosystem health and degradation; Evaluating degraded ecosystems; Vulnerable ecosystems in East Africa: watersheds, wetlands, forests, mines and riparian systems; Principles of ecological re-creation and restoration: identification, seed collection, propagation and care of native plants; Invasive species control; Evaluation of aquatic for wetland restoration; Design, planning, implementation and evaluation of habitat restoration projects; restoration; Incorporating community development in restoration projects.

YEAR 3 SEMESTER 3**HRT 3331 Industrial Attachment****480 Hours**

Industrial attachment will be an extension of classroom instruction, offering students practical field experience and industry-related opportunities to explore problems and required skills. The industrial attachment will be undertaken at the end of the 2nd Semester of the 3rd Year of study for twelve (12) weeks. Students will be examined in three stages as follows: Field supervision by academic staff of work undertaken by the student while on the industrial attachment (25%); oral presentation by the student upon return to the college on completion of the attachment (25%); and a written Report on the operation of the firm following the standard university report writing format (50%). The report should cover a theoretical background and identify a problem, causes, effects, and possible solutions and opportunities created on implementation of the intervention(s).

YEAR 4 SEMESTER 1**AHT 3410: Research Project I****42 Hours**

Each student will plan and execute a relevant research project on a subject of his/her choice within his/her chosen concentration area; The project will be conducted under the guidance and supervision of teaching and technical staff; Under the guidance of an appointed supervisor, each student will prepare and present a research proposal in the first semester; The student will then conduct the experiment, analyze data, write a report and give an oral presentation on his/her

findings; The project report and oral presentation will be required in the second semester of the same year.

AHT 3411: Organic Production and Composting Technology **42 Hours**

Principles and practices of design, implementation and maintenance of sustainable organic production; Benefits of organic farming over conventional practices; Good Agricultural Practices (GAP); Local and International GAP codes of conduct and regulations; Organic certification and accreditation; Organic farming systems; Sustainable gardening practices for environmentally responsible produce; Principles and practices of composting; Humification of organic matter under controlled conditions; Composting methods; Factors influencing utilization of compost in horticultural production; Analytical methods for compost quality; Regulation of compost use.

AAB 3412: Biotechnology in Horticulture **42 Hours**

Introduction to key concepts and definitions in plant biotechnology; Importance of biotechnology in horticulture; Basic principles of plant tissue culture techniques including micro-propagation and rapid multiplication techniques; In-vitro and ex-vitro cultures; Case studies on selected genetically engineered horticultural plants; Handling and operation of biotechnology equipment and apparatus; Post-harvest molecular biology: ripening, role of ethylene (climacteric and non-climacteric fruits), fruit softening (pectinase and polygalacturonases), flavor, fragrance and senescence; Genetic engineering of plants for delayed ripening and better shelf life; Microbial contaminants and post-harvest pathology; Export quality standards; Biotechnology for recycling horticultural waste as manure and livestock feed; Phytosanitation, HACCP, GM fruits and vegetables.

AHT 3412: Molecular Plant Breeding**42 Hours**

Plant genome: nuclear and cytoplasmic; Significance of organelle genomes; Genome size and sequence components; Modern gene concept: gene structure, structural and functional genes; Molecular markers: restriction-based and PCR-based; DNA profiling using different assays: RFLP, RAPD, AFLP, ISSR, SNP, etc; Development of SCAR and SSR markers; gene flow in plants: development of mapping population; Marker assisted selection, screening and validation; Trait-related markers and characterization of genes involved; Mapping genes on specific chromosomes; QTL mapping; Gene pyramiding; Transcript mapping techniques; Development of ESTs; Molecular markers for plant genotyping and germplasm analysis; Fidelity analysis; settling IPR issues; Marker-assisted breeding of transgenics: herbicide resistance, pest and disease resistance, quality enhancement etc; Recent advances: non gel-based techniques for plant genotyping, homogenous assays, qualitative/real time analysis; DNA chip and its technology.

AHT 3413: Ornamental Horticulture**42 Hours**

Ornamental plant production covering botany, environmental requirements, propagation, establishment, acclimatization and maintenance. Use of plants for interior decoration and landscaping, including: tree, shrub, vine, liana, turf, herbaceous, rock and aquatic plants.

AHT 3414: Summer Cut Flowers**42 Hours**

Production of summer cut flowers, covering botany, ecological requirements, propagation, cultural practices, plant improvement, and marketing. Summer cut flower arrangement. Flowers will include: Lisianthus, Ornithogalums, gladiolus, gypsophilla, mollucella, orchids, sunflowers, and others.

AHT 3415: Nuts, Beverages and Medicinal Crops**42 Hours**

History, ecological requirements, physiology, distribution, economic importance, genetic improvement, agronomic practices, protection, harvesting, storage and processing of major perennial crops: coffee, tea, cocoa, sugarcane, wattle, sisal, pyrethrum, cinchona, neem, cashew nuts, coconuts, and macadamia nuts.

AHT 3416: Computer Assisted Design and Drafting**42 Hours**

Introduction to use of computer applications in landscape design; Basic commands utilized in software for computer aided design and drafting (CADD), landscape visualization, plant selection, irrigation design, estimating and management; Structuring of drawings using layers; Drawing using tool commands: walls, hardscapes, buildings, roofs, doors, stippling; Image props; Digital terrain models from survey data; Concept plans, planting plans, viewports and rendering; 3D drawing; Shortcuts to improve drawing efficiency; Customizing tool bars, expanding plant database; Importing/exporting/printing drawings.

AHT 3417: Interiorscaping and Plant Containerization**42 Hours**

Identification, taxonomy, selection and growth habit of indoor plants; Cultural requirements; Environmental effects on growth, health, appearance and longevity of indoor plants, interaction of environmental factors; Design, installation, maintenance and management for interior landscapes: airport terminals, hotel lobbies, office complexes, shopping malls, residences, special events; Interior plantscape care and maintenance; Use of container planting in interior and exterior landscapes; Selection of containers, plants and planting methods; Soil preparation and irrigation techniques.

AHT 3418: Arboriculture**42 Hours**

Definition; Tree biology: growth, transpiration, physiology, anatomy, secondary growth, growth rings, heartwood, sapwood, arboricultural terminology; Soils in relation to trees; Trees in landscapes: location, selection and establishment of trees, shrubs, vines and palms; Diagnosing tree problems: health disorders (frost/wind damage, parasites, weeds, pests, diseases); Tree protection: planning and management surveys, location mapping, inventories and protection strategies; Tree surgery: surgery safety, worker/public safety, cavity treatments, bracing, cabling, propping, bark wounds, climbing techniques, knots, anchor points; Pruning trees: objectives, branch removal, crown cleaning and thinning, crown reduction, lifting, renewal, pruning fruit trees; Tree removal: felling whole trees and sections, stump removal; Arboriculture equipment; Workplace health and safety

AHT 3419: Aquatic Plants and Water Features**42 Hours**

Identification of aquatic plants useful in landscapes; Culture and production of aquatic plants; environmental, physical, nutritional and ecological factors influencing aquatic plant growth; Commercial production techniques; Evaluation of aquatic plants for use in ecosystem and wetland restoration; Aesthetics of water features and techniques used in their design, construction, and maintenance; Using fish, plants, and natural systems in ponds and pools.

YEAR 4 SEMESTER 2**AHT 3420: Research Project II****42 Hours**

Each student will plan and execute a relevant research project on a subject of his/her choice within his/her chosen concentration area; The project will be conducted under the guidance and supervision of teaching and technical staff; Under the guidance of an appointed supervisor, each student will prepare and present a research proposal in the first semester; The student will then conduct the experiment, analyze data, write a report and give an oral presentation on his/her findings; The project report and oral presentation will be required in the second semester of the same year.

AHT 3421: Greenhouse Production and Management**42 Hours**

Types of greenhouse; Importance, functions and features of greenhouse; Scope and development of greenhouse technology; Location, planning of various greenhouse components; Principles and practices of producing plants in greenhouses; Design and construction of greenhouses; Managing the greenhouse environment; Automated greenhouse; Covering, heating and cooling techniques; Light quantity and duration controls; moisture regulation and carbon dioxide enrichment; Shade and net housing; Growth media, irrigation/fertigation, nutrition and growth regulators; Pest management.

AHT 3422: Seed Science and Technology**42 Hours**

Seed formation, development and biochemistry; Seed ecology: dispersal, dormancy, dormancy breaking; Seed germination; Seed quality parameters: purity, viability, vigor, size, health, longevity and deterioration, identifying crop and weed seeds; Principles and practice of seed production; Techniques for production of inbred and hybrid seed, annuals, biennials, perennials, vegetable, flower, herb, spice and fruit seeds; Seed organization, planning and management; Seed processing, storage, and marketing; Seed quality assurance; Seed certification; Intellectual property rights, seed laws and regulations; Seed enhancement technologies: artificial seeds, embryo rescue, protoplast culture and somatic hybridization; Cryopreservation and germplasm storage.

AAE 3422: Agricultural Policy Analysis

42 Hours

Agricultural policy and economic development; Role of agriculture in developing countries; Economic planning paradigms; Agricultural policy analysis framework; Methods of policy analysis; Domestic policy environment (factor, product, marketing, land reform and agricultural research policy); International policy environment (diversification, international credit, regional integration, globalization, international conventions and protocols, role of WTO).

AAE 3427: Farm Management

42 Hours

Definition and scope; Unique characteristics of farm management; Planning, implementation and control; Basic economic principles in context of farm management; Returns to capital, labour, management and equity; Personnel management; Labour laws and regulation; Motivation and group dynamics; Measures of risk: criteria for decision making under risk and uncertainty; Farm planning techniques; Farm enterprise studies; Performance analysis of the farm business; Value chain and value addition of agricultural products; Market driven agricultural production; Access to markets and market information; Theories of production/expansion path; Cost of production and cost curves.

AAB 3421: GMOs, Biosafety and Bioethics

42 Hours

Definition, biosafety concerns; Biosafety regulations in various countries; International agreements related to biosafety; Convention on Biological Diversity (CBD) and Cartagena

Protocol on Biosafety; International Treaty on Plant Genetic Resources for Food and Agriculture (PGRFA); Conservation strategies for seed genebank; Climate change and conservation of plant genetic resources; Global efforts for management of plant genetic resources; Ethical issues in biotechnology; Regulatory framework for biosafety in Kenya; Role of KEPHIS and NBA; Guidelines for recombinant DNA technology; Status, prospects and concerns for GM crops; Biosafety of environment and human health; Guidelines for research in transgenic plants and drugs; Social and ethical issues; Biosafety issues related to genetically modified organisms (GMOs); Gene contamination; Biosafety and risk assessment of GMOs; Public perception; Important genes of agronomic interest; Current trends in finding useful genes; Traceability; Legislative aspects; Biotechnological products in Kenya; Quality parameters and quarantines procedures for export.

AHT 3423: Vegetable Crops III

42 Hours

Production of indigenous and emerging vegetable crops of commercial potential to cover botany, economic and nutritional importance, ecology, crop improvement; Cultural practices of cowpea, nightshade, amaranth, spider plant, pumpkin, cassava, sweet potato, sunhemp, jute mallow, lablab, bamboo shoots; Anatomy, physiology, and ecology of edible and non-edible mushrooms; Kenyan mushroom industry; Principles and practice of mushroom production; Indigenous edible mushrooms.

AHT 3424: Herbs and Spices

42 Hours

Herbs and spices of commercial value; Ecological requirements, physiology, production, utilization and importance including celery, coriander, anise, dill, fennel, garlic, ginger, marjoram, mint, oregano, parsley, black pepper, clove, rosemary, vanilla, thyme, cinnamon, cardamom, rosemary, curry, mint, parsley, etc; Indigenous herbs and spices; Marketing channels for herbs and spices.

AHT 3425: Permaculture

42 Hours

Permaculture principles: location, elements, elevation, ecosystem resources, recycling, energy, diversity, sustainability; Permaculture techniques: no dig /no till planting, crop rotation, green

manuring/composting, companion planting, pest/disease management; Climate and microclimate control; Water in permaculture systems, minimizing water needs Using swales; Reed beds for waste water treatment; Reed bed species; Soil environment and care; Wildlife in permaculture; Structure of a permaculture system; Plants in permaculture; Guilds and stacking; Zone and sector planning: landscape profile, site selection, pre planning, concept design; Forests and trees: establishment, fire/ wind breaks, fire resistant plants; Water bodies in permaculture: design, containment options, water plants; Animals in permaculture: location, functions fencing; Aquaculture systems; Appropriate technologies; Design for natural disasters.

AHT 3426: Turfgrass and Ground Cover Management

42 Hours

Definition of turfgrass; Turf identification, selections, substitutes and various groundcover plants; Characteristics of good turfgrass; Turf applications in Kenya: golf courses, sports grounds, parks, and lawns for commercial buildings and private residences; Locally adapted and underutilized turfgrass species; Turf establishment and maintenance: planting, soils and fertilization, gapping, irrigation, rejuvenation, weeding, diseases and pests; Artificial turfs.

AHT 3427: Landscape Construction

42 Hours

Soils and their relevance to built structures; Water infiltration, movement and retention in soils, soil drainage and erosion control; Basic landscape construction tools and equipment; Construction materials; Plan reading; Land-scaping: surveying and grading, drainage, concrete, masonry, carpentry, electrical, plumbing, pavements, field rock placement, fences and retaining walls; Plant selection, planting and establishment; Irrigation and lighting systems; Formal and free form water features; Contracting and license requirements, business practices and legalities; Building and safety codes.