

BACHELOR OF SCIENCE IN ANIMAL SCIENCE

1.0 INTRODUCTION

Animal production plays a major role in the economy of Kenya economy by providing food, shelter, employment and cash income, in addition to several socio-cultural functions. As food, animal protein is essential, especially for proper physical as well as mental development. The fast population growth in the country puts a high demand for increased productivity in agriculture. With Kenya's advance to industrialization under Vision 2030 and beyond, the need to increase agricultural production in order to avail adequate food for the population as well as providing raw materials for industrial processing has become even greater. Kenya's agriculture is largely based on smallholder farming systems. Consequently, mixed crop-livestock systems are the most appropriate production systems for sustainable farming within the smallholder-farming sub-sector in the country. The course programme will equip its graduates to face the challenges of the national, regional and global animal production.

The course programme has been designed to provide students with basic knowledge and skills in the fields of animal physiology, breeding, nutrition, health, ecology and management of various species of domestic animals. Supporting courses in crop production, agricultural economics and extension will also be offered.

2.0 COURSE OBJECTIVES

The overall objectives of the degree programme are to produce skilled, motivated and internationally competitive graduates to work in both private and public livestock industries.

- (a) To equip students with knowledge and skills necessary to provide human resource base for the national, regional and global animal industries.
- (b) To train students to apply and communicate acquired knowledge and skills in the fields of breeding, physiology, nutrition and management to various animal production environments in order to enhance productivity.
- (c) To prepare candidates for further academic development and careers in teaching, research, extension and animal enterprise development and management.

3.0 ADMISSION REQUIREMENTS

(a) Candidates must satisfy the minimum University requirements of mean grade of C+ in Kenya Certificate of Secondary Education. In addition to (a) above, candidates should have at least C grade or above in Biology, Chemistry, and C- grade in Physics or Mathematics.

Or

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

Or

(c) Holders of diploma in agricultural or related subjects from a recognized college.

Or

(d) Holders of a related degree from a recognized University.

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 that part of a subject described by a coherent syllabus and taught normally over a period of one semester. Its designated as a total of forty two (42) hours of study in a semester. For this purpose one 1-hour lecture is equivalent to one 2-hour tutorial or one 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 the courses prescribed for the year

(d) All courses will be taught for a total of 42 contact hours, including examinations.

(e) Students shall be required to undergo 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 School Board.

6.0 EXAMINATIONS REGULATIONS

University Senate Examinations rules and regulations shall apply.

7.0 COURSE DISTRIBUTION

YEAR 1 SEMESTER 1

Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
SCH 3111	Physical Chemistry	28	14	42	1C
SCH 3112	Organic Chemistry	28	14	42	1C
AAS 3111	Zoology	28	14	42	1C
SMA3111*	Mathematics I	42	0	42	1R
APT 3111*	Agricultural Botany	28	14	42	1C
EEL 3115*	Communication Skills	42	0	42	1R
SBI 3114*	HIV and AIDS	42	0	42	1R
SCS 3111*	Computer Organization and Applications	28	14	42	1R
Total		266	70	336	8

* Approved courses

YEAR 1 SEMESTER 2

Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AEE 3121*	Principles of Agricultural Microeconomics	42	0	42	1C
SCH 3129	Bioinorganic Chemistry	28	14	42	1C
AAB3121*	Agricultural Microbiology	28	14	42	1C

APT 3123	Ecology and Climate Change	28	14	42	1C
SMA3122*	Mathematics II	42	0	42	1C
ALS 3123*	Introduction to Soil Science	28	14	42	1C
ESD 3120*	Social Ethics and Integrity	42	0	42	1R
SLB 3121*	Development Studies	42	0	42	1R
Total		280	56	336	8

* Approved courses

YEAR 2 SEMESTER 1

Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AAS 3211	Introduction to Statistics	28	14	42	1C
AFB3213*	Climate Change and Food Security	42	0	42	1R
AAS 3212*	General Parasitology	28	14	42	1R
AAS 3213*	Animal Physiology	28	14	42	1C
AAS 3214	Animal Growth and Development	28	14	42	1C
AAS 3215*	Principles of Animal Genetics	28	14	42	1C
APT 3217*	Principles of Crop Production	28	14	42	1R
AAS 3217	Animal Housing, Farm Structures and Bioclimatology	28	14	42	1R
Total		238	98	336	8

* Approved courses

YEAR 2 SEMESTER 2

Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AAS 3221*	Principles of Animal Production	28	14	42	1C
AAS 3222	Utilization and Conservation of Animal Genetic Resources and	28	14	42	1C
AAS 3223	Principles of Animal Nutrition	28	14	42	1C
AAS 3224	Production and Utilization of Pastures and Fodders	28	14	42	1C
PSP 3226	Remote Sensing	28	14	42	1R
AAS 3228	Population Genetics	28	14	42	1C
ALS 3221	Soil and Water Conservation	28	14	42	1C
Total		238	98	336	8

* Approved courses

YEAR 3 SEMESTER 1

Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AAS 3311	Crop Residues and Agro-industrial by-Products	28	14	42	1C
AAS 3312	Analytical Methods in Animal Nutrition	28	14	42	1C
SES 3311	Farm Power and Machinery	28	14	42	1R
AAS 3313	Design and Analysis of Animal Experiments	28	14	42	1C
AAS 3314*	Livestock Production Systems	28	14	42	1R
AAS 3315	Animal Reproduction and Technology	28	14	42	1C
AAS 3316	Concentrates, Supplements and Additives	28	14	42	1C
AAS 3317	Quantitative Genetics	28	14	42	1C
BEN 3315*	Entrepreneurship	42	0	42	1R
Total		224	112	336	8

* Approved courses

YEAR 3 SEMESTER 2

Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AAS 3321	Biotechnology in Animal Production	28	14	42	1R
AAS 3326	Principles of Molecular	28	14	42	1C

	Genetics				
AAS3322	General Range Management	28	14	42	1C
AAS 3323	Ration Formulation	28	14	42	1C
AAS 3324	Aetiology of Disease	28	14	42	1C
AEE 3321*	Agricultural Extension and Technology Transfer	28	14	42	1C
AAS 3325	Apiculture and Sericulture	28	14	42	1C
AAS 3326	Fish Farming and Production	28	14	42	1R
Total		224	112	336	8

* Approved courses

YEAR 3 SEMESTER 3

Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AAS 3331	Industrial Attachment	0	480	480	6C

YEAR 4 SEMESTER 1

Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AAS 3411	Dairy Cattle Production	28	14	42	1C
AAS 3412	Poultry Production	28	14	42	1C
AAS 3413	Animal Feed Manufacturing Technology	28	14	42	1C
AAS 3414	Pig Production	28	14	42	1C
AAS 3415	Animal Breeding	28	14	42	1C
AAS 3416	Research Project I	28	14	42	1R
AAS 3417	Animal Health Management	28	14	42	1C

AAS 3418	Rabbit Production	28	14	42	1C
Total		224	112	336	8

YEAR 4 SEMESTER 2

Course Code	Course Title	Contact Hours			Weight (Unit)
		Lecture	Practical	Total	
AAS 3421	Beef Cattle and Camel Production	28	14	42	1C
AAS 3422	Sheep and Goat Production	28	14	42	1C
AAS 3423	Non-Conventional Farm Animals	28	14	42	1C
AAS 3424	Research Project II	28	14	42	1C
AAE 3425	Agricultural Policy and Laws	28	14	42	1R
AAB3421	Genetically Modified Organisms, Bio-safety and Bioethics	28	14	42	1R
AAE 3423	Intellectual Property Rights and Patents	42	0	42	1R
AEE 3427	Farm Management	42	0	42	1C
Total		252	84	336	8

* Approved courses

8.0 COURSE DESCRIPTION

YEAR 1 SEMESTER 1

SCH 3111: Basic Physical Chemistry

42 Hours

Chemical reactions, stoichiometry, equilibria and kinetics; Physical changes: solids, liquids, gasses and solutions; Gas laws: real gases and Van der Waal's equations. Solutions of inorganic compounds and colligative properties, electrochemistry; Redox reactions, electrolysis, conductance; Electromotive force of a cell and Nernst equation.

SCH 3112: Basic Organic Chemistry 42 Hours

Carbon atom and its position in the periodic table; Bond formation, orbital hybridization; Nomenclature, structure and stereochemistry; Alkanes, alkenes, cycloalkanes, alkynes; Organic reactions and functional groups; Alkanones, alkanols, alkanals, alkanolic acids and their derivatives; Alkenes, alkynes, halides, sulphur and nitrogen compounds, as well as benzene and its derivatives.

AAS 3111: Zoology 42 Hours

The diversity of animals. Histology, embryology and anatomy of vertebrates, with emphasis on domestic animals. Basic ecological principles and concepts.

SMA 3111: Mathematics I 42 Hours

Elementary set theory; Mappings and functions: definitions, domains, co-domains, 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 factorizable polynomials. Statistics: collection and representation of data. Measures of central tendencies and variability; Graphical and axiomatic approaches to probabilities. Tree diagrams. Probability: definition, axioms, and tree diagram.

APT 3111: Agricultural Botany 42 Hours

Plant cells, tissues and organs; Morphology and anatomy of angiosperms 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; Concept of artificial and natural plant classification; Role of fossil angiosperm and gymnosperms in

taxonomy; Taxonomic hierarchy; Specific variation and isolation; Nomenclature; Herbarium and its relevance/role in plant taxonomy.

A review 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 agriculturally important families: malvaceae, brassicaceae, leguminosae, compositae, solanaceae, cucurbitaceae, convolvulaceae, gramminae and liliaceae.

EEL 3115: Communication Skills

42 Hours

Study skills; Planning study time, making references, filing notes; Preparing for examinations. Library skills: organization, classification, and shelving; Using reference books, listening in lectures, speeches, instructions, understanding lectures, note taking; Speaking 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; Understanding footnotes and bibliographical references.

SBI 3114: HIV and AIDS

42 Hours

Introduction; Historical background and magnitude of HIV/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/AIDS; Opportunistic infections; HIV/AIDS prevention and infection control; Peer education for HIV; Treatment options and vaccine development; blood transfusion and HIV/AIDS; Management of HIV and related infections; Legal and ethical issues in HIV/AIDS; Factors that influence the spread of HIV/AIDS in Africa; Case studies in selected countries in Africa; HIV/AIDS as a national disaster; Impacts; myths, and emerging issues on HIV/AIDS.

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.

YEAR 1 SEMESTER 2

AEE 3121: Principles of Agricultural Microeconomics 42 Hours

Basic concepts of economics applied to agriculture; Economic systems; Scarcity, choice and opportunity costs; 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; Price system and economic role of government.

SCH 3129: Bioinorganic Chemistry 42 Hours

Perspectives of occurrence of metals in Biological systems; Concepts of metal essentiality and toxicity and abundance and availability; Sequestering and storing of essential elements; Antagonism among essential elements, ion pumps; Sodium/potassium pumps; Metalloporphyrins and related systems; Oxygen carriers: haemoglobin and myoglobin, dioxygen activating copper proteins; Ferredoxins and cytochromes; Iron carriers: transferrins and ferritins; Nitrogen fixation nitrogenase-nitrogen fixation through metal complexes; Photosynthesis: chlorophyll, its structure and function; Role of Manganese in photosynthesis.

AAB 3121: Agricultural Microbiology 42 Hours

History of Microbiology: Spontaneous generation theory; Role of microbes in fermentation; Germ theory of disease; Protection against infections; Applied areas of Microbiology; Metabolism in bacteria; Bacteriophages: structure and properties of bacterial viruses: lytic and lysogenic cycles:

viroids, prions; Microbial groups in soil; Microbial transformations of carbon, nitrogen, phosphorus and sulphur; Biological nitrogen fixation; Microflora of rhizosphere and phyllosphere; Microbes in composting; Microbiology of food, microbial spoilage and principles of food preservation; Beneficial microorganisms in Agriculture: biofertilizer (bacterial, cyanobacterial and Fungal), microbial insecticides and microbial agents for control of plant diseases; Biodegradation; Biogas production; Biodegradable plastics; Plant-Microbe interactions.

APT 3123: Ecology and Climate Change 42 Hours

The environment; Ecosystems; Energy fixation and energy budgets; Nitrogen and carbon cycles; Ecological succession; Global and local distribution of ecosystems; Analytical and synthetic characteristics of populations; Biological conversion; Water balance with applications to irrigation; Modification of microclimate; Climate change: definition, causes and potential impact on agriculture and environment; Climate change mitigation measures; Policy issues related to climate change.

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; First order DE and their application.

ALS 3123: Introduction to Soil Science 42 Hours

Fundamental concepts: The 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 and biological; Properties of soil: soil profile, horizon, pedon, epipedon, endopedon, physical, chemical, and biological. Perfectly and imperfectly drained soils

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.

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**AAS 3211: Introduction to Statistics****42 Hours**

Role of statistics in problem solving. Understanding data: source, structure, quality, type, measurement scales, ordinal, nominal, interval and ratio. Data collection and recording. Data exploration (descriptive statistics): organization, summary, presentation using tables, charts, graphs, and numerical summaries. Probability distributions, random variables and the normal distribution; Samples and sampling: variability and generalization from sample to population, sampling designs and sample size; Measures of central tendency: mean, mode median; Measures of dispersion: range, inter quartile range, mean deviation, variance and standard deviation, coefficient of variation, skewness and kurtosis.

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

Definition of climate change and global warming; Climatic 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.

AAS 3212: General Parasitology**42 Hours**

Arthropods, protozoa, and helminthes of importance in domestic animals: their life history, identification, pathogenicity, treatment and control.

AAS 3213: Animal Physiology**42 Hours**

Introduction. Homeostasis; Control system. Nervous system; Central Nervous System; Nerve conduction; Neuromuscular and synaptic transmission; Autonomic and somatic nervous system; Sense organs. Muscular system; Muscle function, contraction: Endocrine system; Hormones and hormone action; Cardiopulmonary system; Body fluids, blood and cells; Electrolyte metabolism; Cardiovascular system; Respiratory system; Gas transport and exchange. Reproductive system: male and female reproduction; Lactation; Comparative reproductive physiology (avian egg formation and production); Digestive system; Comparative physiology of digestion (monogastric and ruminant digestion, avian and fish digestion); Environmental physiology: temperature regulation and adaptation; Energy metabolism and growth.

AAS 3214: Animal Growth and Development**42 Hours**

Definitions. Compensatory growth; Assessment of growth and development: growth curves; Physiological and chronological age. Fat development and deposition: subcutaneous fat, kidney fat, intra- and inter-muscular fat; Relationship of weight and animal sex and their effects on fat deposition; Muscle growth and development; Factors affecting growth and development: nutrition, genetic, sex of animal; Effects of gonadectomy, hormones and nutrition.

AAS 3215: Principles of Animal Genetics**42 Hours**

Definitions: inheritance, gene locus, allele, polymorphism, multiple alleles, homozygosis, mitosis, meiosis, gamete, zygote etc; Mendelian laws of inheritance: segregation and independent assortment. Linkages: sex-linked traits, sex-limited traits, sex chromosomes and autosomes etc; Gene interactions: complementary genes, dominance and epistasis. Lethal genes; Environmental effects; Identification of the genetic material; Structure of DNA; Transcription; Translation; Genetic code; Replication; Organization of structural genes. DNA content and variation of eukaryotes; Gene family and gene cluster; Multiple copy gene; Pseudogenes and processed pseudogenes; Repetitive DNA (micro, minisatellites, SINE, LINE). Cloning and DNA Libraries: southern blotting, polymerase chain reaction, VNTRs and DNA fingerprinting. Gene mapping;

Genetic polymorphism; Important mutations in livestock and humans; Genotyping; Marker assisted selection; Gene farming and transgenic animals.

APT 3217: 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.

AAS 3217: Animal Housing, Farm Structures and Bioclimatology 42 Hours

Introduction to farm structures; Types of buildings: constructive, protective and productive functions of buildings. Heat exchange; Heat production; Methods of adding heat: Insulation, Heat balance problem; Environment and metabolism. Climate: macro and microclimate, site climate and climate control. Ventilation: gas and moisture production and removal; Natural ventilation; Forced ventilation; Ventilation and heat balance; Hygienic requirements: waste production and removal. Waste disposal. Relationship between air, soil and water; Environmental stress; Evaluation of housing and environmental adequacy. Animal behaviour.

YEAR 2 SEMESTER 2

AAS 3221: Principles of Animal Production 42 Hours

Animal industries in Kenya; Animal production and its contribution to the economy; Animal production systems as affected by ecological factors; Ecological definitions and concepts in relation to animal production systems and their management; The structure, function and ecology of production systems; Basic principles of the management of agricultural ecosystems; The Kenya environment; Major characteristics of the ecological zones of Kenya; Animal environment and livestock structures; Aspects of livestock design; Economics of controlled environment; Animal growth and development of various organs, tissues and fibres; Variation of growth and development of the body.

AAS 3222: Utilization and Conservation of Animal Genetic Resources 42 Hours

Biological diversity and its importance; Animal genetic resources of Kenya and diversity: origins; global, regional and national perspectives; Their roles; Links to environmental sustainability, food security and poverty alleviation; Inventory and characterization of (AnGR); Threats to AnGR diversity and counter initiatives (global, regional and national); Value enhancement; sustainable use, including conservation. Conservation methods; Policies, legal and institutional frameworks for access to and use of AnGR and materials, including equity and ownership issues; Global, regional and national collaboration, including trans-boundary and cross-boarder arrangements; Conventions.

AAS 3223: Principles of Animal Nutrition 42 Hours

The concept of nutrition; Metabolism and utilization of nutrients: carbohydrates, proteins, lipids, vitamins, minerals and water; Measures of feed quality: proximate analysis, detergent fibre technique, in vivo and in vitro digestibility, in sacco dry matter degradability; Energy systems used in animal nutrition: physiological fuel values, gross energy, digestible energy, metabolizable energy, net energy, total digestible nutrients and starch equivalent; Evaluation of protein quality: chemical score, essential amino acid index, protein efficiency ratio, net protein utilization, nitrogen balance, biological value and nitrogen balance index; Maintenance requirement, fasting catabolism, metabolic body weight and basal metabolism.

AAS 3224: Production and Utilization of Pastures and Fodders 42 Hours

Natural and ley pastures: common species, their nutritive value and factors affecting nutritive value; Establishment and management of pastures; Grazing systems; Fodder crops: common species, their nutritive value and factors affecting nutritive value. Feed conservation: hay and silage.

PSP 3226: Remote Sensing 42 Hours

Concepts and techniques of remote sensing: electromagnetic spectrum, sensors and platforms, multi-spectral, hyper-spectral and thermal sensors, aerial photography, radar and lidar sensors; Radiometric and geometric aspects of remotely sensed data; Image enhancement and visualization; Image interpretation and classification.

AAS 3228: Population Genetics 42 Hours

Genetic concept of a population; Genetic structure of populations; Random mating; Gene and genotype frequencies; Hardy-Weinberg Law and Hardy-Weinberg Equilibrium; Proof and testing of Hardy-Weinberg Law; Factors affecting gene: Systematic effects: migration, mutation, selection, non-random mating; Non-systematic effects: random genetic drift and small populations; Genetic variation and its measures: polymorphism (transient and stable) and causes, and heterozygosity. Evolution: concept and modes of evolution; General working theories.

ALS 3221: Soil and Water Conservation 42 Hours

Soil/water resources, historical erosions and sediment problems, geologic vs. accelerated erosion, erosion prediction equations, government conservation programs and water conservation; Water harvesting techniques; Irrigation, drainage and salinity; Storm-water management; Case studies in erosion and sedimentation.

YEAR 3 SEMESTER 1

AAS 3311: Crop Residues and Agro-industrial By-products 42 Hours

Types of crop residues and level of production: cereals, coffee, horticultural crops; Types of agro-industrial products: molasses, citrus and pineapple peelings and Brewers' waste. Quality, utilization and improvement methods: heating, milling and chemical treatment. Slaughter house animal by products: blood meal, bone meal and feathers.

AAS 3312: Analytical Methods in Animal Nutrition 42 Hours

Chemical handling procedures; Glassware cleaning procedures; Preparation of samples; Determination of dry matter; Evaporation; Vacuum drying, freeze drying, dessicator drying, and chemical methods. Protein analysis; Methods, theoretical principles, advantages, and limitations. Amino acid analysis; Lipids analysis; General considerations; Ether extract and crude fat determination: Soxhlet procedure, Goldfish, Bligh and Dyer methods: Fatty acid analysis: Methods, principles, advantages and limitations. Analysis of dietary fibres: Crude fibre, neutral detergent fibre, acid detergent fibre and total dietary fibre. Ash: Dry ashing and wet ashing. Analysis of macro- minerals; Colorimetric methods; Atomic absorption (AA) spectrometry. Trace

minerals; Energy: Bomb calorimetry, physiological fuel values, digestible energy and metabolizable energy.

SES 3311: Farm Power and Machinery 42 Hours

Ploughs, seed drills and reapers; Human and animal draught technologies; Four wheel and crawler tractors; Farm machinery for tillage, planting, cultivation, harvesting; Hand tools (spade, fork, rakes, hoes, trowels, shears, secateurs); Disk harrow, plow and moldboard; Grain drill row crop planter; Field chopper; Hay baler; Mowers; Horticultural hand tools; Fertilizer distributors and seed drills; Nursery machines; Sprayers; Lawn care equipment; Chain saws and hedge cutters; Equipment for threshing, drying; Soil preparation, milking, dusting, livestock feeding, handling and housing, fruit picking, feed mixing, loading and material handling. Sources of power: wind, rotor wind machines, water, animal pumping systems and electrical generating systems.

AAS 3313: Design and Analysis of Animal Experiments 42 Hours

Introduction to inferential statistics; Simple significance tests based on the normal distribution; Use of *t*-tests for small samples; Contingency tables and Chi-squared; Tests of goodness of fit and homogeneity; Simple experimental designs: completely randomised, randomised block and Factorial; Analysis of variance; SE and estimation of parameters, point and interval; Simple correlation and regression analysis.

AAS 3314: Livestock Production Systems 42 Hours

Definition and main characteristics of a system; Structure, function and ecology of animal production systems; Factors determining choice of a system: climate, soils, biological, social, physical and economic. Systems analysis, synthesis and its use in management. Description and classification of agricultural and livestock systems.

AAS 3315: Animal Reproduction and Technology 42 Hours

Physiology of the male and female reproductive tract; Hormones governing reproduction; Oestrous cycle; Mating; Gestation; Parturition; Lactation; Artificial insemination; Embryo transfer technology; Factors affecting reproductive efficiency of common animal species used for food and agriculture.

AAS 3316: Concentrates, Supplements and Additives 42 Hours

Concentrates: Classification; High energy concentrates of plant origin: Cereals and cereal by products, sugar and sugar industry by products, and stem and root tuber crops. High energy concentrates of animal origin; Animal fats (lard and tallow). High protein concentrates: Those of plant origin: leguminous seeds, oilseeds, algae and yeasts. Those of animal origin: Marine products and by-products, meat products and by-products, and milk and by-products. Use of faecal waste.

Supplements: Inorganic minerals, chelated minerals, vitamins, premixing. **Feed additives:** Growth promoters (antibiotics, antibiotics/chemotherapeutics, anticoccidials, antihelminthics, antifungals, enzymes, probiotics, metabolic stimulants and botanicals). **Other feed additives:** Flavourers, pellet binders, pigments and diluents.

AAS 3317: Quantitative Genetics 42 Hours

Quantitative traits: characteristics, measurements and importance. Pleiotropy; Genotype-environment interaction; Genotype-environment correlation; Maternal influence. Review of basic statistics: mean, mode, median, variance standard deviation, co-efficient of variation, correlation; Genotypic value and breeding values of a gene. Analysis of quantitative traits: phenotypic variance and its components; Genetic parameters: heritability and repeatability, their estimation and uses. Most probable producing ability (MPPA) and breeding value. Selection: aids to selection; Selection methods: Single and multiple trait selection; Response to selection and its prediction. Inbreeding: concept, coefficient of inbreeding and estimation; Inbreeding depression.

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, vertical integration.

YEAR 3 SEMESTER 2

AAS 3321: Biotechnology in Animal Production 42 Hours

Review of cell biology; Definition of biotechnology; Use of biotechnology in reproduction: artificial insemination, embryo transfer, cloning, transgenic animals and their value; Conservation of genetic materials. Biotechnology in animal nutrition: types of rumen microflora, modification of rumen microflora through nutrition and biotechnology; Probiotics and enzymes, metabolic modifiers: types (e.g somatotropins, bovine placental lactogen, conjugated linoleic acid) and effect on animal performance and quality of food products (e.g designer eggs); Chelation and utilization of inorganic elements. Biotechnology and animal health: Vaccines, oligosaccharides and competitive inhibition, safety and ethical issues in animal biotechnology.

AAS 3326: Principles of Molecular Genetics 42 Hours

Identification of the genetic material (history). Definition of basic terms: gene, locus, allele, gamete, zygote, palindromes etc: primary; Secondary and tertiary structure of DNA; Transcription and control of transcription(promoter, transcriptional unit, termination region, mRNA, processing, cap, poly A-tail, splicingetc) translation and the genetic code; Replication; Organization of structural genes; DNA content and variation in eukaryotes; Gene family and gene cluster (globin genes); Multiple copy gene (hitone genes) ; Pseudo genes and processed pseudo genes; Repetitive DNA (micro-, minisatellites, SINE,LINE); Cloning and DNA libraries (restriction enzymes, genomic cloning, cDNA cloning); Polymerase chain reaction (PCR). Important applications of PCR; DNA finger printing; Gene mapping; Genetic polymorphism; Important mutations in livestock and humans; Genotyping, marker assisted selection; Gene farming and transgenic animals.

AAS 3322: General Range Management 42 Hours

Rangelands: global, regional and national perspectives; Significance of rangelands; Range and ranch management; range conditions; Plant growth and response to grazing; Plants revival from dormancy; Plant reaction to grazing; Unhealthy plants and unfavourable growing conditions. Rangeland utilization: range plants and their values; sacrifices in range utilization and choice of plants to be managed; Seasonal characteristics of range management. Evaluation of use of grazing sites and range and ranch improvement programmes. Stocking rate: importance and calculation. Range

extension case studies. Credit supply and supervision; Legal regime of agricultural cooperatives; Taxation effects on production, role of law in produce markets and marketing.

AAS 3325: Apiculture and Sericulture 42 Hours

Role of bees in agriculture. Biology of the honeybee. Breeding, diseases and pests. Management of a bee colony: flowering vegetation, foraging behaviour and feeding. Swam control. Types of hives. Harvesting, handling, processing, grading and marketing of honey wax. Honey and wax industry in Kenya. Visit to a honey processing plant.

AAS 3326: Fish Farming and Production 42 Hours

The fish industry. Fresh water fishes in lakes and rivers with emphasis on selected species, their environment, feeding reproduction and techniques for harvesting and handling. Role and potential of fish farming. Techniques of culture fisheries: breeding, construction and management of fishponds, harvesting, and handling of fish. Fish diseases, parasites and their control. Seawater fishes, with emphasis on selected species, their environment, feeding habits, reproduction, harvesting and handling. Fish processing, grading and marketing. Visits to fish farms.

YEAR 3 SEMESTER 3

AAS 3331: Industrial Attachment 480 Hours

Students will be attached to firms/institutions/organisation/enterprises identified by the School as relevant to/or within animal agriculture sector for hands-on-training. The student will be given supervisors identified by the School. The student will be assessed while still on the bench at the attachment practice area and will prepare a report and finally present it orally at a seminar.

YEAR 4 SEMESTER 1

AAS 3411: Dairy Cattle Production 42 Hours

The role of dairy cattle in food production: value of milk in human nutrition; Role of dairy cattle in production of animal protein; Dairy industry in Kenya: breeds, population, distribution, production of milk; Dairy cattle production systems. Feeding and management of calves: weaning systems, housing and hygiene. Selection after weaning; Feeding and management of heifers: feeding for

early maturity, selection. Feeding and management of dairy cows: nutrient specification, ration formulation for dairy cattle, phase feeding. Factors affecting milk yield and composition. Milking parlours. Harvesting milk: hand and machine milking. Heat detection; Reproduction: AI, oestrous synchronization and embryo transfer. Herd records.

AAS 3412: Poultry production

42 Hours

Poultry industry in Kenya; Poultry production systems; Environmental control; Temperature, humidity, light and air quality. Poultry houses and equipment: behaviour, stress and welfare: Management of breeding stock. Hatchery operations: factors affecting egg fertility and hatchability. Brooding and rearing management of meat and egg birds (chickens, water fowls, turkeys, game birds). Management of laying flock. Management of indigenous poultry. Production cycle: planning and managing a poultry enterprise. Poultry performance assessment. Economics of production.

AAS 3413: Animal Feed Manufacturing Technology

42 Hours

Terms and definitions; History of the feed industry; Regulation of the feed industry. World feed trade. Physical facilities: layout and design, project proposals, financing, construction. Manufacturing operations: ingredient procurement, heat processing: dry and moist heat. Size reduction; Problems of size reduction. Mixing: proportioning and blending: batch and continuous systems; Controls. Pelleting; equipment. Heat processing systems, pellet sizing and quality. Blocking: sizing, quality and controls. Packaging: quantity and quality controls. Storage and handling of feeds. Operations management: planning and budgeting, cost control, product costing, quality assurance. Sanitation and pest management, utilities and maintenance. Computer operations: control systems, accounting systems, inventory systems and bar code applications. Power management: cost control, power audit. Environmental management: assessment, pollution control, spill control, solid and hazardous waste control. Emergency planning. Special feeds: liquid feeds, micro-ingredient pre-mixing, pet feeds, aquatic feeds. Safety and health management: fire and explosions, dust and work related disabilities.

AAS 3414: Pig Production

42 Hours

Introduction: review, terminology, classification; Kenya and world pig production; Pig production systems. Establishment: pig facilities and equipment; Environmental control; Breeds and breeding management of the multiplication herd; Gestation, feeding and other management. Farrowing and litter management; Routine procedures. Weaning and weaner (nursery) management. Management of growing and finishing pigs. Feeding pigs: Feeding programmes; Types of feeds; Feed additives for pigs. Health management. Marketing of pigs: markets and product quality. Records and productivity analysis.

AAS 3415: Animal Breeding

42 Hours

Genetics and animal breeding: An overview and history. Continuous variation, Resemblance between relatives; Genetic parameters: repeatability, heritability and correlation. Prediction of breeding values. Selection: Response to selection, estimation of genetic change, multiple trait selection including correlated response, marker assisted selection. History and development of animal breeding; Special issues in animal breeding, including genotype x environment interaction and correlation. Mating systems: inbreeding and crossbreeding. Heterosis, hybrid vigour; Breeding strategies in different livestock species for various traits; National and International breeding programmes. Breeding goals and their flexibility. Advances and application of biotechnology in the genetic improvement of livestock species: AI, embryo manipulations, production and use of clones. Policy, legal and institutional framework in animal breeding practice.

AAS 3417: Animal Health Management

42 Hours

Aetiology, symptoms, treatment and prophylaxis of common animal diseases: Viral (foot and mouth, rinderpest, MCF, rabies, Rift Valley Fever, lumpy skin disease); Bacterial (pleuropneumonia, anthrax, blackquarter, tetanus, mastitis, TB, salmonellosis, colibacillosis, Brucellosis); Rickettsial (ECF, anaplasmosis, babesiosis, heartwater); Fungal; Helminthiosis; Metabolic diseases; Infertility; Foot problems.

AAS 3418: Rabbit Production

42 Hours

Role and potential of rabbits. Breeds. Systems of rabbit production. Application of basic principles of genetics, physiology, nutrition and disease control in the management of rabbits. Harvesting and marketing.

YEAR 4 SEMESTER 2

AAS 3421: Beef Cattle Production

42 Hours

Population and distribution: global, regional and Kenya. Breeds and their characteristics for beef production. Production systems; Intensive, semi-intensive and stratified. Management of different classes of stock: breeding herd, calf, weaners and fattening stock. Use of growth promoters.

Principles of stock management in the range lands. Grazing systems. Beef cattle structures and housing. Beef quality and factors affecting quality. Performance assessment. Types, population, distribution and economic importance of the camel. Camel production in East Africa. Biology of the camel: evolution and general biology; Adaptation to and arid environments; Feeding behaviour and nutritional physiology. Camel products and productive potential. Camel breeding, feeding and health; management. Camel diseases

AAS 3422: Sheep and Goat Production 42 Hours

The biology of sheep and goats; Diversity of sheep and goat genetic resources in Kenya; Roles and relative economic importance of each. Distributions and production systems in Kenya. Sheep and goat behaviours. Mutton and wool production; Flock husbandry: breeding, feeding system, housing and health management. Wool harvesting, grading and processing. Goat meat and milk production. Meat goat breeding, feeding, housing and health management, under different production systems. Dairy goat breeding, feeding, housing and herd-health management, under different production systems, including intensive systems. Goat meat and milk products and their value.

AAS 3423: Non-Conventional Farm Animals 42 Hours

Introduction to various types of non-conventional farm animals such as ostriches, quails, crocodiles and mini-livestock (e.g. bees, silkworms butterflies, termites etc). The role and benefits of these farm animals as sources of food, income, recreation/aesthetic, enrichment of biodiversity and diversification of farm enterprises. Management practices including feeding, reproduction and breeding, housing and health. Harvesting and marketing of products and by-products from these animals.

AAS 3424: Research Project II (Research) 42 Hours

Each student will undertake problem solving research project in an area of his/her choice in Agricultural Biotechnology. The project will be conducted under supervision of teaching and technical staff; the students will prepare a research proposal guided by an appointed supervisor and continue to conduct the experiment, write a report and give an oral presentation.

AAE 3425: Agricultural Policy and Laws 42 Hours

Categories and objectives of policy; Policy and economic development; Role and problems of agriculture in developing countries; Policies to stabilize prices and incomes in agricultural sector; Policies for rapid rural development; Policies on agricultural credit, research education and dissemination technology; Agricultural policy and unemployment; Kenya's development plans and implementation; Welfare aspects of policy. Agricultural economy and development; Legal framework for development; Market regulatory types; Legal organization of agricultural land market; Structure and regulation of agricultural tenancies; Administration of agricultural land use; Organizational structure and conditions of employment of agricultural labour; Legal aspects of credit supply and supervision; Legal regime of agricultural cooperatives; Taxation effects on production; Role of law in produce markets and marketing.

AAB 3421: Genetically Modified Organisms, Biosafety and Bioethics 42 Hours

Definition; Biosafety concerns; Biosafety regulations in various countries; International agreements on 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 and animal gene banks; Climate change and conservation of plant and animal genetic resources; Global efforts for management of crop and animal genetic resources; Ethical issues in biotechnology. Regulatory framework of biosafety in Kenya; Role of Kenya Plant Health Inspectorate Services (KEPHIS) and NBA. Guidelines for recombinant DNA technology; Status, prospectus and concerns of Genetically Modified Organisms (GMOs); Biosafety of environment and human health; Guidelines for research in transgenic plants, animals and drugs. Social and ethical issues; 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 quarantine procedures of export.

AAB 3423: Intellectual Property Rights and Patents 42 Hours

Intellectual Property Rights (IPR): meaning, nature and scope of IPR; History of IPRs; Copyrights, and patents; Trademark; Geographical indications; Recent amendments in Kenyan acts and regulations related to IPR. Product patent and process patent; Recent developments in registration of inventions and protections of IPR; World Intellectual Property Organization (WIPO) and its role;

World Trade Organization (WTO) regimes; GATT agreement and its impact on agriculture and biotechnology; Trade Related Aspects of Intellectual Property Rights (TRIPS); Current status of patenting of gene and genetically engineered organisms; Patent filing-opposition-retrieval.

AEE 3427: Farm Management

42 Hours

Definition and scope; Characteristics of farm management: Planning, implementation and control; Basic economic principles in farm management; Returns to capital, labour, management and owners' equity; Personnel management; Labour laws and regulation; Motivation and group dynamics; Measures of risk: 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.

