WORLD BANK AFRICA CENTRE OF EXCELLENCE IN AGRICULTURAL DEVELOPMENT AND SUSTAINABLE ENVIRONMENT (CEADESE)

REVISED CURRICULUM FOR POST–GRADUATE DEGREES 2015

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1.0 INTRODUCTION

1.1 BRIEF HISTORY

Following a competitive application for the establishment of Centres of Excellent in the West-African/Central African Sub-region, the Federal University of Agriculture, Abeokuta was awarded the Centre of Excellence in Agriculture in 2013. The Centre named as Centre of Excellence of Agricultural Development and Sustainable Environment (CEADESE) officially took off in FUNAAB on 16th February, 2014, following approval at a University Special Senate Meeting.

The objective of CEADESE is to strengthen human and material capacity for agricultural development. The Centre is focused on teaching, learning and research excellent in agricultural productivity in the face of climate change challenges. The proposed action plans to achieve these objectives are divided into two broad activities: capacity building and research activities in collaboration with industry and other stakeholders in Agriculture. The capacity building programme involves introducing new post-graduate curricula leading to Master & Doctoral Degrees in Agricultural Development and Sustainable Environment – (M.AgSE/PhD.AgSE) in response to specific productivity challenges, short-term skill acquisition for industry stakeholders, specialized workshops and to introduce internships during post-graduate studies. The action plan for research programme consists of partnering with regional and international centres to conduct post-graduate students' research that are demand-driven and will lead to regional development. This is intended to forge closer relation with industry and stakeholders in Agriculture in order to respond to their developmental needs through demand-driven research projects. In addition, the Centre is embarking on thematic agricultural research projects of international interests targeted at mitigating climate and environmental challenges in the sub-region.

The M.AgSE /PhD AgSE degrees started with 6 programmes namely:

1. Crop Improvement and Seed Enterprise Development,
2. Livestock Science and Sustainable Environment,
3. Food Processing and Value Addition,
4. Hydrology and Climate Change and
5. Agricultural Mechanization and Sustainable Environment.
6. Agricultural Development and Environmental Policy

1.2 PURPOSE OF REVIEW AND NEW OPTIONS

The FUNAAB/CEADESE Implementation Plan specifies that there should be a review of the Academic Curriculum of each Programme. With the recent rationalization of programmes as directed/agreed with the subject experts of the

World Bank, the following programmes are those approved for the next session (2015/2016) and for which their curriculum was reviewed:

1. Livestock Science and Sustainable Environment with Options of Animal Nutrition, Animal Biotechnology and Animal Physiology and Livestock Production Systems.
2. Crop and Pasture Production and Sustainable Environment with Options in Crop Production, Crop Pathology, Crop Protection, Pasture Production,.....
3. Agricultural Economics and Environmental Policy
4. Food Processing and Value Addition
5. Environmental Systems and Agriculture with Options in Environmental Management, Hydrology, Waste Management, Water Resources Management, ...

1.3 ELIGIBILITY

1. Candidates of all nationalities within and outside Africa possessing qualifications equivalent to recognized first degrees in relevant disciplines are eligible to apply.

2. The M. AgSE programme will generally be open to Science, Engineering and Agriculture graduates of B.Sc, B.Eng, B.Tech., B. Agric, B.Sc Agric and B. Tech Agric with a minimum of CGPA of 3.0. Holders of HND and other Degrees/Classes of Degree with PGD in any of Agriculture disciplines with a minimum weighted average score of 60% (or CGPA of 3.0 on a 5point scale) shall also be eligible for admission into the programme, on the condition that both set of candidates met basic university matriculation requirements of five (5) O' level credits including English Language and Mathematics, and any other three (3) Science or Social Science subjects.

3. Applicants with degrees from Pure and Applied Sciences, Environmental Sciences and Agricultural Engineering are eligible to apply for Environmental Systems and Agriculture.

4. Admission into M.AgSE – Agricultural Economics and Environmental Policy - shall be open to Bachelor Degree holders in Agricultural Economics, Economics, Agricultural Economics with Agricultural Extension.

5. The PhD AgSE programme will be open to Masters Degree holders in relevant courses to the different options in the programme.

1.4 DURATION

M.AgSE

1. Course work along with dissertation for 4 Semesters
2. 3 - 6 months of Internship starting at the end of second semester
3. The third and fourth semesters are solely for research projects
4. M. AgSE candidates that are World Bank scholars will not be funded beyond the 4th semester.

PhD AgSE

1. PhD AgSE programmes will be research based, spanning maximum of 6 semesters.
2. Funded PhD AgSE programmes from the World Bank's grant shall not be funded beyond the 6th semester (3 years).

To enable a PhD student complete the programme within 2/3years of admission into PhD, it is advisable that they keep to following timeline in the presentation of the various seminars and thesis defence.

- ***Submission of Research Concept Note***. This should be done within 6 weeks of direct admission into PhD or within one semester of admission into Master/PhD programme.
- ***Presentation of the First Non-thesis Seminar***. This should be done within the first semester of admission into PhD candidacy.
- ***Presentation of Research Proposal Seminar***. This should be done within the Second semester of admission into PhD candidacy.
- ***Presentation of the Second Non-thesis Seminar***. This should be done within the third semester of admission into PhD.
- ***Presentation of the Post-Data Seminar***. This could be done towards the end of the third semester or during the fourth semester of admission into PhD candidacy. Note however, that a Post Data Seminar can only be presented after 6 months of presenting the Pre-Data Seminar.
- ***Presentation of the Final Public Defence of thesis***. PhD candidates should work towards presenting the Final Public Defence of the Thesis before the end of their fourth semester or during the fifth semester of admission into PhD candidacy.

1.5 REGULATIONS GOVERNING THE AWARD OF HIGHER DEGREES

All Post Graduate Programmes run in the University of Agriculture, Abeokuta are subject to the rules and regulations guiding the award of higher degrees. It is therefore pertinent to note the general regulations guiding the award of higher degrees enumerated below:

i. Admission

To be eligible for admission into any postgraduate programme in FUNAAB, a candidate must have satisfied the basic University Undergraduate Matriculation requirements.

The Postgraduate Board shall have authority to consider application from Departments/Colleges in respect of this Section as at when necessary.

ii. Postgraduate Diploma

To be eligible for admission in the Postgraduate Diploma programme, candidates must be first-degree holders in a relevant discipline from any recognized University, or holders of HND with minimum of Upper Credit and not less than 3 years post-qualification experience.

iii. Professional Masters

To be eligible for admission into Professional Masters Degree programme, candidate must be a graduate of this University or any other University recognized by Senate and shall normally have obtained a minimum of Second Class (Lower Division) degree in the relevant field. Candidates with Third Class Degree/HND with Postgraduate Diploma from FUNAAB or other recognized Universities with minimum weighted average score of 60% or equivalent CGPA may be considered for admission into Professional Masters Degree.

vi. Academic Masters

To be eligible for admission into Academic Masters Degree programme, candidate must be a graduate of this University or any other University recognized by Senate and shall normally have obtained a minimum of Second Class (Upper Division) degree in the relevant field (in exceptional cases, candidates with Second Class, Lower Division).

Holders of Postgraduate Diploma (or Professional Masters Degree) from FUNAAB or other recognized Universities with minimum weighted average score of 60% may be considered for admission into Academic Masters Degree.

vii. Doctor of Philosophy (Ph.D)

To be eligible for admission to the Doctor of Philosophy degree programme, a candidate must have obtained an Academic Masters/M.Phil with research degree of two years duration with a minimum weighted average score of 60% from this University or its equivalent from any other university/institution recognized by Senate of FUNAAB.

Candidates from other Universities running Masters Degree of less than 2 years duration and Masters Degree holders from FUNAAB with less than 60% weighted average can only be admitted into M.Sc/PhD or M. Agric/PhD programme, and shall be required to pass a PhD qualifying examination before proceeding to full PhD programme. For such candidates, the Department shall specify a minimum of 10 Units Course Work per session. No such candidate shall present a Pre-data seminar

until having passed all prescribed courses, each of which the candidate must take and pass at 50% or higher grade. A Department may also specify a minimum weighted average score that such candidates must achieve before a conversion into PhD programme, provided that such benchmark has been approved by the Postgraduate School Board on the recommendation of the Department through the College Postgraduate Committee. Courses to be taken by a candidate in this regard shall be presented to and approved by the College PG Committee.

Candidates that have successfully completed academic Masters Degree programme within a session and satisfied the PhD admission requirements may be allowed to proceed to PhD programme on the recommendation of the College Postgraduate Committee and approval of same by the Postgraduate School Board.

viii. In addition to above requirements, prospective candidates for admission into Postgraduate Diploma and Masters Degree programmes may be required to undertake oral and/or written examinations before admission.

2.0 CENTRE CORE COURSES

2.1 MAIN COURSES

The M.AgSE programme will have 8 units of 3 core courses compulsory and 2 units of elective English Language or French Language short course for all programmes :

ACE 801: Climate change and Agriculture (2 Units, 1st Semester)
ACE 802: Information Systems and Agricultural Knowledge Management (3 units, 2nd Semester)
ACE 804: International Trade and Commercial Policy (3 units, 2nd semester)

Electives
GES 801 - Short English Language Course I (1 Unit, 1st Semester)
GES 803 - Short French Language Course I (1 Unit, 1st Semester)
GES 802 - Short English Language Course II (1 Unit, 2nd semester)
GES 804 -Short French Language Course II (1 Unit, 2nd semester)

2.2 SUMMARY

Total Centre Course Units	= 10
Programme Specific Course Units	= 26 (Max)
Dissertation & Seminar Units	= 8
TOTAL UNITS	**= 44**

You have provided information for the requirements to obtain MAgSE only. No information on number of units required for the award of Phd.AgSE.

I can only see the possibility of just 25 Units for Phd. (please refer to computation by Agric Economics Programme.

Dissertation & Seminar Breakdown

Internship Report	-	2 units
Seminars	-	2 units
Research Project	-	4 units
		8 units

The number of Units allocated to Seminars and Research for Phd is unrealistic. A phd thesis of 3 years cannot be rewarded with just 4 Units (same as MAgSE). Even an undergraduate project is worth more than 4 Units in FUNAAB. Please revise??????

The Course codes and acronyms adopted for the General courses are stated below:
Climate change and Agriculture - **ACE 801 -** CEADESE1
Information Systems and Agricultural Knowledge Management - **ACE 802 -** CEADESE2
International Trade and Commercial Policy - **ACE 804 –** CEADESE4

Short English Language Course I - **GES 801 -** CEADESE5
Short French Language Course I **- GES 803 -** CEADESE7
Short English Language Course II **- GES 802 -** CEADESE6
Short French Language Course II **- GES 804 -** CEADESE8

The Course codes for the other general requirements are:

Internship	-	**ACE 896**
Seminar 1	-	**ACE 897**
Seminar 2	-	**ACE 898**
Dissertation	-	**ACE 899**

2.3 SYNOPSIS OF CENTRE CORE COURSES

ACE 801 Climate change and Agriculture (2 Units)

Climatic attributes in the plant environment; Man- environment interactions and agricultural systems in a changing climate; Climate change impacts on soil, crop, livestock, fisheries and forestry, emerging diseases of crop plant and animal diseases; Epidemiology of common crop and animal diseases and climate change impacts; Modelling variability and change of

climatological indices for agriculture. Early warning systems for agricultural production; Reciprocal relationships between climate change and agriculture; Concept of sustainable agriculture in a changing climate; Methods of ameliorating climate change impacts on soils, crop plants, livestock, fisheries and forestry including agroforestry; Aspects of economics of climate change in Agriculture (regulatory methods of farming systems, animal husbandry, farm housing design , impact of climate change on wage labour, migration, conflicts , pollution, flood, drought and desertification control including environmental subsidy)

ACE 802 Information Systems and Agricultural Knowledge Management (3 units)

Information Systems- Analysis, Design, implementation, and management of a computer-based information system that support a wide spectrum of key policy and investment priorities for effective Agriculture.

Agricultural Knowledge Management - Basic concept of Agricultural Knowledge & Knowledge Management system(KMS) life cycle, exploration of tacit knowledge creation and capture, codification of knowledge and implementing systems to make use of knowledge base, technical aspects of Knowledge Management in Agriculture - ***Business Intelligence and Data Analytics techniques - data mining, Knowledge-based/ Expert systems, Machine learning, fuzzy-logic, data visualization, content management systems and Web 2.0 technologies***.

Laboratory Practical: Hands–on productivity software Applications- Word processing, Database, Spreadsheet, presentation & Graphics software, GIS mapping Software, OLAP (on-line Analytical Processing), use of statistical packages e.g. SAS /SPSS, Matlab software tool boxes e.g. Bioinformatics, fuzzy-logic etc

ACE 804: International Trade and Commercial Policy (3 Units)

This course offers a multi-disciplinary approach to understanding historical and analytical treatment of Trade; Instrument of Trade Policy; International Trade and Economic Expansion; Theories and Conceptual Framework in Agricultural Policy Analysis; Theoretical Models of Agricultural Development; Challenges of Agricultural Development in Africa; ICT in Agricultural Development Policy; Export and Import Policies; Agricultural Trade Policy; Marketing/Commodity Boards; Balance of Payment Adjustments;

Tariffs and Infant Industry Argument; Trade between Agriculture and Industry; International trade Agreements; Cartels and Economic Regionalism; International Organization; Technology Transfer and Impacts on Commodity Development in Developing and Developed Countries. The course analytically examines current empirical research in the area of agricultural trade; analyze how the agricultural sector changes over time, interacting with government policies in both the farm and nonfarm sectors. It draws on the theories and insights of economics to examine the agricultural policy process and its outcomes. Our goal is to explain and predict major trends and differences across countries, using economic theory to explain and predict what governments will do and how agents operating in the food and farm sectors are likely to respond. It helps students to develop a better understanding of policy-making entities at various levels of government. It also provides a broad understanding of how policy actions in agriculture impact not only farmers' incomes, but also the well being of consumers, the economic viability of rural communities, and the quality of our nation's environmental resources. It deals with the Theories and Policies of Agricultural Development; the Role of Agriculture in the Economy; Problems of Agricultural Development and Planning.

3.0 INFORMATION ON PROGRAMMES

3.1 PROGRAMME 1: LIVESTOCK SCIENCE AND SUSTAINABLE ENVIRONMENT

3.1.1 INTRODUCTION

The West African region is attributable to adverse climate conditions like low rainfall, frequent droughts, deforestation and environmental degradation due to population growth and civil strife. Livestock sector is one of the potential areas to accelerate agricultural growth. A systematic approach and methodology to climate change effects in the region is to promote training in sustainable livestock production through demand driven and globally competitive research and development. The curricula are designed for teaching and to promote collaborative and sustainable research with relevance to the region, livestock industry, relevant organizations and agencies. The proposed option has a total of 44 unit courses including 10 units of Centre courses, 16 units of compulsory option courses and 4 units of elective option courses. Research projects, Seminars, Dissertation and internship reports carry 4, 2 and 2 units respectively.

3.1.2 PHILOSOPHY OF LIVESTOCK SCIENCE AND SUSTAINABLE ENVIRONMENT PROGRAMME

The primary philosophy of this programme is to pursue the training of skilled manpower for sustainable animal production, focusing on the appropriate research technology, resource, climate and environmentally friendly production of foods of animal origin. The Livestock Science options will provide knowledge and skills necessary to alleviate identified challenges to livestock productivity, research and development under sustainable environments.

3.1.3 OBJECTIVES (this section needs serious revision). It does not flow well in content and grammar.

The options have the following training objectives:

I. To enhance the production and processing of animal products with emphasis on relevant, appropriate and manageable technology to modernize animal production, processing, storage, preservation and distribution.

II. Introducing a new postgraduate programme leading to gaining knowledge about the interrelated processes in the production of animal originating food and its impact on the environment and society,

III. Acquiring production methods and gains of the skills which enable our students to work for research and consulting companies and to apply for leading positions in industries dealing with animal agriculture and environment,

Acquiring knowledge about problems resulting from the production of food of animal origin, treatment and recycling of waste materials and harmful gas as well as bio-energy production.Acquiring ability to check and balance the interests of all parties involved in the food production, regarding also agrarian and environmental standards

Degrees to be awarded

M.AgSE or Phd.AgSE Livestock and Sustainable Environment (Option???????)

3.1.4 LIST OF PROGRAMME-SPECIFIC COURSES AND UNITS FOR M.AgSE

APL 801	Biostatistics (3 Units, 1st Semester)
APL 802	Tropical Livestock Feed Resource a**n**d Commercial Feed Milling (3 Units, 2nd Semester)
APL 803	Poultry Farming Systems and Sustainable Environment (2 units 1st Semester)
APL 804	Ruminant Livestock Production Systems and Environmental Sustainability (2 Units, 2nd Semester)
APL 805	Environmental Physiology of Farm Animals (2 Units, 1st Semester)
APL 806	Animal Biotechnology (2 Units, 2nd Semester)
APL 898	Internship Reports (2 Units)

APL 899 Research Projects and Dissertations (4 Units)
APL 897 Seminar I (1 Unit)
APL 898 Seminar II (1 Unit)
APL 896 Internship (2Unit)

Electives (minimum of 2 courses of 2 units each to be selected)

APL 807 Quantitative Genetics (2 Units, 1st Semester)
APL 808 Poultry Nutrition and Organic Animal Agriculture (2 Units, 2nd Semester)
APL 809 Sheep and Goat Production Enterprises (2 units, 1st Semester)
APL 810 Sustainable Integrated Livestock Farming Systems (2 units 2nd Semester)
APL 811 Animal Behaviour and Welfare dynamics in a changing climate. (2 Units, 1stSemester)

Students can take more electives to gain knowledge and experience in their areas of interest

Total Option Units = 24 Units

For Phd.AgSE, how many Units??????? For Non FUNAAB Graduates, what happens? Any courses to audit??? Please specify.

Please insert Tables with courses for First and Second semesters and the units/course and total units per semester.

3.1.5 SYNOPSIS OF COURSES

APL 801 Biostatistics (3 Units)
Planning of experiments. Ways of increasing accuracy of experiments. Regression and correlation. Mixed models, completely randomized designs, randomized complete block, Latin squares, factorial experiments, confounding variables, split plots designs. Lattice designs, lattice squares, missing data, and analysis of results of a series of experiments. Analysis of data arising from animal production/breeding. Use of package programmes for analysis of data arising from animal experimentation.

APL 802 Tropical Livestock Feed Resource and Commercial Feed Milling (3 Units)
Conventional, alternative and new feed resources. Tropical feedstuffs type, availability and extent of utilization, feed

microscopy, and feedstuff standardisation and quality assessment. Feedmill operation and design. General aspects of livestock feed formulation for various classes of livestock. Computer in feed formulation and least cost diets. Recycling of waste and their nutritional potentials.

Seminars: Two topics per student

Practicals: Feedmill operations.

- Common types of potentially problematic ingredients
- Livestock Feed Formulation
- Poultry Feed Compounding
- Identification and use of agro-industrial by-products

APL 803 **Poultry Farming Systems and Sustainable Environment (2 Units)**

This course aimed at different poultry production systems and the attendant effects of climate change on the efficiency of production. Students are expected to understand the problems of and opportunities available in systems of poultry production as well coordinate livestock issues with other agricultural disciplines. Students will therefore have a practical knowledge and appreciation of the contribution of poultry production systems to the agricultural industry worldwide.

Past and present scenario of poultry industry

1. Domestication of poultry
   Genetic classification of chickens and other species of poultry- layers, broilers,[day old chicks, breeder egg, broilers] and other class of poultry- Hybrids available[turkey]
2. Terms used in poultry farming
3. Growth of poultry industry in Nigeria
   Poultry population and other poultry related statistics, per capita meat and egg availability
4. Poultry systems: small and large scale
5. Systems of rearing: free-range, free-to-range, semi-intensive, intensive rearing (deep litter, cage and slate floors), etc.
6. Nutrition and management of poultry species in the different rearing systems
7. Introduction to rearing of Turkeys, Ducks, Japanese Quails, Guinea fowls and Geese for meat production
8. Poultry integration, Contract farming and linkages
9. Scavenge-able Feed Resource Base

Poultry Housing

1. Layout
2. Orientation
3. Water source
4. Different house designs
5. Roof and roof material
   Selection of poultry farm site and ideal location
6. Future expansion facility- electricity – farm equipment – clearing methods
7. Housing and different growing programs; All in and all out systems, batch system etc.

Environment

Macro Environment

1. Poultry house temperature
2. Humidity, cross ventilation, radiation, ammonia concentration, air flow, environmentally controlled house

Micro Environment

1. Heat and moisture production from poultry house, cooling/ heating of poultry houses- movement of air, system of ventilation, lighting management, critical temperature
2. Seasonal management

Climate Change

1. Observed climate change
2. Complex interactions of temperature and precipitation
3. Impact of climate change on poultry production and food safety
4. Adaptation and best management practices

PRACTICALS

Basic training and experience in hatching operation: setters, hatchers, egg grading, branding, processing of egg to egg powder

APL 804 Ruminant Livestock Production Systems and Environmental Sustainability (2 Units)

1. Land and livestock resources
2. Characteristics of ruminant production systems
3. Classification of ruminant production systems

a. Traditional ruminant production systems

i. Pastoral and agro-pastoral systems

ii. Mixed system in the semi-arid, sub-humid and humid zones

b. Non-traditional production systems
i. Ranching systems
ii. Smallholder beef and dairy systems
iii. Production parameters of ruminant in non-traditional systems- Beef and Dairy systems
iv. Feed resources in ruminant production systems
4. Ruminant production and climate change
Future impacts of climate change on the ruminant livestock industry
5. Greenhouse gas emissions and their role in ruminant production systems
Key features of livestock farming that relate to greenhouse gas emissions
Dairy, Beef, Goats and Sheep sectors
6. Research measures to reduce net greenhouse gas emissions and the potential for further adoption by the industry
Measures for reduction of greenhouse gas emissions, removals and measures that avoid or displace greenhouse gas emissions
Carbon sensitive farming
7. Organic ruminant production and climate change
Management-related differences in greenhouse gas emissions and differences in relation to farming system, such as organic versus conventional farming
8. Definitions of farming systems. Roles of legumes in crop-livestock systems. Integration of pastures in plantation and annual crops intensive feed garden fodder bank. Enhancing dry season feeding in farming systems. Fast growing nitrogen fixing trees and browse plants. Pastures and animal production systems.

APL 805 Environmental Physiology of Farm Animals (2 Units)

Climate and livestock production. Influence of climatic factors on animal productivity. Acclimatization and adaptation. Physiological basis of adaptation, heat stress, physiological responses to heat stress; determination of heat stress index; modification of the microclimate to enhance animal productivity; management of exotic breeds in tropical environment.

Seminar: Four topics per student.

Practicals:

- Factors of the environment that affect animal production processes and a description of the regulator mechanisms within the animals. Methods of monitoring these processes and

practical methods of alleviating environmental stress in commercial farm animals.

APL 806 Animal Biotechnology (2 Units)

Animal cell and tissue culture, maturation of oocytes, *in vitro* oocytes fusion, cloning, species hybridization, inter-species embryo transfer and artificial insemination, DNA sequences, blood group analysis and genetic polymorphism, electrophoretic techniques, genes and genetic markers. Linkage mapping by recombination. Mapping and map distances, chi-square test, mitotic segregation and recombination, analysis of single meiosis, sex chromosomes and sex linkages. Extensive practical sessions on relevant sections to be carried out.

Practicals:

Artificial Insemination: Semen collection using AV, analysis, dilution, and preservation procedures [cryopreservation].
Insemination techniques in farm animals and poultry.

APL 898 Internships Reports (2 Units)

APL 899 Research Projects Seminars and Dissertations (4 Units)

Electives

APL 807 Quantitative Genetics (2 Units)

Genetics and phenotype variations. Genetic basis of qualitative traits, heritability and repeatability, correlation among traits. Selection in long and short term. Cross breeding and selection for crossing ability. Inbreeding depression and heterosis, genetic conservation.

APL 808 Poultry Nutrition and Organic Animal Agriculture (2 Units)

Feed resources and nutrient quality of ingredients for poultry feeding standards/NRC requirement vs requirements in tropics for all classes of and/specie of poultry. Methods for metabolic studies and determination of protein utilization and quality of proteins utilized by poultry. Importance of vitamins and minerals for poultry and associated deficiency symptoms.

- Definitions and general principles of Organic Livestock Nutrition
- Nutritional management standards in organic farm
- General principles of conversion from conventional to organic livestock nutrition
- Prospects and challenges of organic livestock nutrition

- Nutrition: feeding standards and characteristics of feed resources for organic farm animal
- Organic feed formulation and compounding, feed preservation and storage
- Housing: housing standards and materials, adaptation and ecosystem, perimeter fencing and predator control
- Organic livestock nutrition system and health management
- Manure and waste management composting, ensilage
- Management of mitigating environmental greenhouse gases in organic farming systems

Practicals:
Rendering of organic manure production from litters

APL 809 Sheep and Goat Production Enterprises (2 units)

Some considerations in raising sheep and goats. Breeds of sheep and goats. Production records. Determining the age of sheep and goats. Housing and equipment, fences, plans etc. sheep and goat feeding. Functions of vitamins and minerals. Feeding the dry and lactating ewe/doe. Management practices. Managing the kids/lambs, doe/ewe, tethering, dehorning, hoof trimming, castration. Identification practices. Goat/sheep disease: internal parasites, brucellosis, mastitis, foot rot, mange, bloat, poisonous plants etc.

Feeding habits of small ruminants. Conventional and non-conventional feed resources for sheep and goats. Feed conservation and improvement techniques. Nutrient requirements of sheep and goats for various productive purposes. Feed production for small-holder small ruminant feeding in crop-livestock integrations. Recent advances in sheep and goat nutrition.

APL 810 Sustainable Integrated Livestock Farming Systems (2 Units)

What is Sustainable Agriculture / Farming system?
Concept and themes of sustainable Agriculture:
Farming and Natural Resources; water, energy, air and soil
Plant Production Practices; selection of site, species and variety, diversity, soil management, Efficient use of inputs, concerns about practitioners' goals and choices.
Animal Production Practices; Management planning, animal selection, animal nutrition, reproduction livability of animals, pasture? Paddock, confinement of animals.
Economic, social and political considerations; food and agric policy, land use, consumers and food value chain.

Integrated farming/Integrated biosystems
Perspectives
Case studies of integrated farming systems

Practicals:
Students to be part of a model sustainable integrated livestock farming system for at least 2 weeks, then write a report of their observations criticisms and lessons learnt

APL 811 Animal Behaviour and Welfare dynamics in a Changing Climate (2 Units)

Animal welfare is an integral part of livestock production which is often underestimated especially in a developing economy like Africa which is experiencing a continuous changing climate like the rest of the globe. Animal ethics including the rules and regulations guiding the production of animals in Nigeria and Europe should be taught. This course will deal with issues bothering down on impact of changing climate on the behaviour and welfare of different species of animals in their ecological niche.

Animal law/Ethics

- Comparing rules and regulations guiding the production and handling of animals in Nigeria (Africa) and Europe

Global warming

- Climate change
- Sustainability and probable effect on production of animals

Seasonal changes and effect on the welfare of animals viz a viz the:

- Physical response of different species of animals
- Behavioural response of the animals
- Physiological response of different species of animals
- Nutritional adaptation of animals
- Reproductive capacity of different species of animals
- Hormonal balance

Controlling the environment, insulation and ventilation:

- Energy exchange with the environment
- Thermo-neutral zone
- Air flow
- Air distribution
- Diffused Systems

Freedom: Behaviour of Animals

- What is normal behaviour?
- Do animals have behavioural needs?
- How can behavioural needs be assessed?
- What is environmental enrichment?
- How can it be supplied?
- Does it always improve an animal's welfare?

3.2 PROGRAMME 2: CROP/ PASTURE PRODUCTION AND SUSTAINABLE ENVIRONMENT

3.2.1 PHILOSOPHY

To produce world class students with knowledge in Crop /pasture production with a well balanced education and industrial experience.

The graduates must be such that they can be self-reliant in all aspects of crop production, particularly; forage, crop improvement, crop protection, crop processing and agronomy, and the student is tailored to be a job creator and not job seeker with sufficient industrial background to fit to the current need of today's industry and practice.

3.2.2 OBJECTIVES

- To inculcate into our students that crop/pasture production should be viewed and practiced with agro –business inclination.
- To promote professional development of graduates in Agriculture, by providing students with understanding and hands-on experience of different discipline within the realms of crop/pasture production.
- To develop crop varieties that are adaptable to our various biotic and abiotic stresses of the environment.

- To train students who will focus on research and development in crop/pasture production.
- To train students to meet the industrial need and achieve enhanced entrepreneurial skills.

Degrees to be awarded
M.AgSE or Phd.AgSE Crop Production and Sustainable Environment (Option???????)

3.2.3 LIST OF PROGRAMME-SPECIFIC COURSES AND UNITS FOR M.AgSE

CRP 801: Cropping Systems (2 Units)
CRP 802: Seed Production (2 Units)
CRP 803: Principles of Cultivar Development (2 Units)
CRP 804: Research methods (2 units)
CRP 805: Crop Protection and Productivity (2 units)
CRP 806: Soil Fertility Management and Crop Nutrition (2 Units)
CRP 807: Physiology of Crop Production (2 units)
CRP 808: Agronomy, ecology and physiology of pastures (3 units)
CRP 809: Pasture production, evaluation and utilization (3 units)
CRP 810: Engineering Application in crop/pasture production (3 units)
CRP 811: Crop/pasture processing technology (3 units)

Electives (maximum of 2 elective courses of 2 units each)

CRP 812: New Frontiers in Crop Production (2 units)
CRP 813: Pasture in farming systems and environmental management (2 units)
CRP 814: Biometrical Genetics (2 units)

CRP 898: Internship Reports (2 units), Seminars (2 units)
CRP 899: Research Projects (4 units)

Total Option Units = 24 Units

For Phd.AgSE, how many Units??????? For Non FUNAAB Graduates, what happens? Any courses to audit??? Please specify.

Please insert Tables with courses for First and Second semesters and the units/course and total units per semester.

3.2.4 SYNOPSIS OF COURSES

CRP 801 Cropping Systems (2 Units)

Land tenure systems in West Africa, Soil and water conservation, Mechanized farming for various cropping systems e.g. Agroforestry, Alley farming, Mixed vs sole cropping systems, Mixed farming, Zero-tillage farming (Conservation agriculture), Plantation agriculture and Organic Agriculture. Greenhouse (controlled environment) crop production, Agronomy of specific crops of importance to African food security. Crop protection, Crop nutrition. Thematic term papers and seminars on regional cropping systems of West Africa, developing resilient farming systems in West Africa etc. Tractor operation and licensing practicals under AMS 700.

CRP 802 Seed Production (2 Units)

National and regional variety release systems in West African countries; ECOWAS Harmonized seed laws. Conditions for seed production, Controlled seed multiplication, Evaluating and maintaining genetic purity during seed production; Seed Certification; Principles of seed processing, Outlay of seed processing plants, Seed Pre-cleaning, conditioning, grading and sizing equipment and operations. Commercial seed treatments. Seed store and gene bank operation: seed germination testing, viability and quality control. Viability modelling, seed drying, packaging and transportation. Hybrid seed production: Genetic basis of hybrids, Population genetic analysis in hybrid production, Hybrid purity and GMO testing. Thematic term papers and seminars on specialized seed industries like organic seed production, Seed cooperatives, Public-private partnerships (PPP), National and regional seed business incentives, Farm management/cost benefit analysis and other topical seed enterprise development issues etc.

CRP 803 Principles of Cultivar Development (2 units)

Plant Genetic Resources, Line development and recurrent selection, Plant breeding methods-back crossing, cultivar developments for dicot and monocot crop plants, mutation breeding and hybridization, introduction to genetic engineering, exploiting cytological and genetic methods in crop improvement (induction and utilization of male sterility, polyploidy, double haploids breeding, apomixes), Variety release and variety integrity maintenance, Analysis of crosses, expectation for line cross means, heterosis, inbreeding depression, Analysis of mating designs, North Carolina (NC) designs I, II and III, diallel mating designs; Hayman-Jinks analysis, Marker based analysis; molecular markers, Genetic maps, Marker-trait association; Recombinant inbred lines

CRP 804 Research Methods (2 units)

Hypothesis testing**,** Experimental designs: Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design, Factorial experiments, Split plots designs, Analysis of Variance (ANOVA) and Mean comparisons. Regression and correlation. Mixed models, confounding variables, Use of statistical package programmes.

CRP 805 Crop Protection and Productivity (2 units)

Pests and pathogens in crop protection and productivity. Plant-nematode relations or interactions; population dynamics of nematodes; methods of nematode control in agricultural soils. Definition and categorization of insect pests; development of pest status. Economics of insect pest attack; forecasting Insect pest outbreak. Fungi diseases of national and international importance. Classification and nomenclature of plant parasitic fungi. Morphology, Biology and Ecology of fungi. Classification and properties of plant pathogenic bacteria. Growth, reproduction and genetics of plant pathogenic bacteria. Kinds of inoculum produced and dissemination. Bacteria diseases of national and international importance. The nature of viruses' growth and reproduction. The genetics of viruses. Kinds of inoculum produced. Dissemination, Virus diseases of national and international importance. Control measures, quarantine, cultural, chemical, host plant resistance, etc.in crop protection and productivity. Basic crop protection equipments, maintenance and repairs.

Practicals: - Sampling for nematodes and nematodes extraction from soil and plant. Isolation, purification and identification of major plant pathogens (bacteria and fungi). Creation of insect museum of agricultural importance. Identification of insect body parts. Virus isolation and transmission. Virus purification. Application of molecular and plant tissue culture techniques in plant disease diagnosis.

CRP 806 Soil Fertility Management and Crop Nutrition (2 Units)

Soil characterization, Soil mapping, Land use planning, Soil fertility management, Integrated soil fertility management, Organic fertilizer and compost production and use, Soil microbiology, Carbon sequestration, Plant nutrition, soil management and climate change, Soil chemistry, Soil Ecology and environment

CRP 807 : Physiology of Crop Production (2 units)

Physiological mechanism underlying crop yield: growth, development, assimilate partitioning and carbon economy, Canopy carbon assimilatory process and effect of environmental factors; light (Photosynthetic photon flux density), water and nutrient availability, Irradiance response curve model and analysis of canopy carbon assimilation, Canopy architecture and carbon assimilation, coefficient of extinction, LAI, Sun-lighted leaf area, leaf orientation and canopy carbon assimilation, Leaf area duration, relative leaf growth rate, Canopy respiration and yield; growth and maintenance respiration, factors affecting them and implication towards yield, Carbon balance and yield, Stress physiology and ameliorative process, Water balance: water deficit and flooding. Physiology of crop response, adaptation and acclimation and its consequent on crop yield, water use efficiency and yield. Irrigation and yield, Energy balance: UV and other lethal electromagnetic radiation, shading. Physiology of crop response and effect on yield. Radiation use efficiency and yield. Nutrient response curve, indicating different zones of uptake; deficiency, poverty adjustment, luxury consumption and toxicity zone with emphasis on essential macro nutrients. Nutrient use efficiency; nutrient uptake and utilization, dimensions of nutrient use efficiency (Agronomic, Partial factor productivity, Physiological, internal, recovery and economic nutrient efficiency). Iron and aluminium toxicity specifically in rice production and its implication on crop yield. Fertilizer application (inorganic and organic agriculture) and

crop yield, Effect of reactive oxygen species on crop yield, Crop Ecophysiology and Introductory crop modelling, Environmental factors and crop yield, System theory, system dynamics concepts and principles, Crop simulation models in Agricultural research and management, Fundamentals of DSSAT model, Yield analysis of some selected field crops; yield component of some selected arable crops and its implication towards yield formation, Physiological bases of agronomic management practices; spacing, fertilizer application, irrigation, variation in planting date etc.

CRP 808 : Agronomy, Ecology and Physiology of Pastures (3 units)

Agronomy and adaptation of tropical pasture plants and their pattern of geographical distribution. Origin and domestication of forage plants. Genetic variation and mode of reproduction in pasture plants. Natural and sown pasture compared. Establishment and management of improved pastures - land requirement, land preparation, planting materials and planting, etc. Degradation and persistence of pastures. Role of legumes in tropical pasture production. Pasture condition, species inter- relations environmental influences. Pasture as an ecosystem, species interrelationships and succession. Animal-soil-plant interactions. Influence of edaphic, physiographic and biotic factors in pasture productivity

CRP 809 : Pasture Production, Evaluation and Utilization (3 units)

Role of pastures in animal production, factors influencing choice of species for sown pastures. Steps in pasture establishment and management - weed management, fertilizer management and grazing management. Pasture research methodology and evaluation techniques. Pasture quality evaluation and factors affecting quality. Animals and pasture measurements under experimentation and statistical analysis. Utilization techniques - *in situ* grazing and grazing systems, cut-and-carry system, conservation and utilization techniques

CRP 810: Engineering Application in Crop/Pasture Production (3 units)

Field mechanization: Land clearing operations; Tillage operations –

ploughing,
harrowing, planting; Equipment for mechanized agricultural production – The tractor and accessory implements, Conservation agriculture equipment; Intensive mechanization equipment for large scale farming
Irrigation: Classifications & types of irrigation system; Merits & demerits of irrigation system; Criteria for the selection of irrigation system; water use efficiency; C***rop water requirements, crop coefficient, field water requirements, field irrigation methods; irrigation scheduling, conveyance structures, Soil, water and plant relationship***
Drainage: Principles of soil and land drainage; Surface drainage, drainage methods, crop row drain system, Subsurface drainage criteria, Drainage and erosion control, Drainage types and classifications; selection of drainage systems Soil and water conservation on cropland, Soil and water conservation on pasture and rangeland,
Flood control: Causes of flood; Flood and the associated disasters; Identification of flood prone areas; Climate change and flood; Flood control techniques and facilities
Farm structures for crop/ pasture production: Dams, canals and other hydraulic systems; Farm workshop for equipment servicing, repairs and maintenance; Storage structures for crops and hays, Selection criteria for location of farm structures and construction materials.

CRP 811: Crop/Pasture Processing Technology (3 units)

Crop/ Pasture Harvesting Equipment: Traditional harvesting equipment; tractor mounted harvesters; combine harvester, Principles and techniques of handling crop/ pasture production equipments
Primary processing equipment; Choppers, grain shellers and threshers, grain separators and sorters, dryers, pelletizers; Maintenance and servicing of the identified equipment;
Secondary processing equipment: Types and principle of operation of expellers, extractors, extruders, hay balers; Maintenance and servicing of the identified equipment;
Storage Facilities: Classification of storage systems, Traditional storage system – Bags, guard traditional crib, rhombus, etc; Improved storage system – Improved crib,
Evaporative Coolant system; Modern storage system – Refrigeration, cold storage system, silo, ware house; cooling vans; Storage facilities for root and tuber crops – barn, shelf, pit or underground storage system, etc.

CRP 812: New Frontiers in Crop Production (2 units)

Marker Assisted Selection (MAS), DNA technology on tissue culture in Crop and forage production, Genetic Engineering, Genotyping and phenotyping of crop and pasture of essential attributes.

CRP 813: Pasture in farming systems and environmental management (2 units)

Role of crop-livestock system in sustainable production, role of legumes, integration of pastures in plantation and animal crops. Intensive feed garden, fodder bank system. Sustainable use of crop residues in enhancing dry season feeding. Animal grazing and crop productivity. Managing animals in crop production environments. Animal grazing and ecosystem stability, traditional animal production system, environmental health, and rural livelihoods. Effect of fire in natural pasture management. Ruminant production and global warming, desertification

CRP 814: Biometrical Genetics (2 units)

Sources of variation, Additive Dominance Model, Epistasis, Interaction, G x E, Line x tester analysis, Experimental population-BIPS, NC I, NC II, Diallel

CRP 898 Internship Reports and Seminars (4 units)

CRP 899 Research Project (4 units)

3.3 PROGRAMME 3: AGRICULTURAL ECONOMICS AND ENVIRONMENTAL POLICY

3.3.1 INTRODUCTION

The Federal University of Agriculture, Abeokuta (FUNAAB) has become the World Bank Centre of Excellence in Agriculture and Sustainable Environment. The University is thus, entrusted with the responsibility of offering specialized international postgraduate courses leading to the award of Masters of Agriculture and Sustainable Environment (M.AgSE) and Doctorate Degree in Agriculture and Sustainable Environment (PhD AgSE). In this pursuit, and in consonance with the ongoing efforts to enhance international relevance and impacts of the University, the programme will lead to award of M.AgSE and PhD AgSE in Agricultural Economics and Environmental Policy through the Centre of Excellence in Agricultural Development and Sustainable Environment (CEADESE).

3.3.2 MISSION STATEMENT

Programme of excellence in Manpower development for industrial enterprise management.

3.3.3 VISION STATEMENT

The proposed postgraduate programmes are designed to train highly skilled manpower for value chain development and sustainability in industry.

3.3.4 JUSTIFICATION

The dearth of suitable manpower to manage Agro-industrial enterprises profitably and sustainably in the nation, informed the floating of the programme. It will thus be a bridge builder producing well grounded products that will manage agro-industrial enterprises sustainably coupled with sound knowledge on theory and practice.

Degrees to be awarded
M.AgSE and PhD.AgSE **Programme in Agricultural Economics and Environmental Policy**

3.3.5 PHILOSOPHY

The Masters programme in Agricultural Economics and Environmental Policy is designed to combine sound knowledge of economic theory, entrepreneurship, planning, marketing, financing, monitoring and evaluation, and scientific methodologies with in-depth understanding of sustainability science in training skilled professionals that can support private, public and international decision making and policy analysis on issues relating to livestock production and sustainable exploitation of natural resources. Holders of the Degrees would be able to solve marketing, production and financial related problems in management of Livestock production.

3.3.6 OBJECTIVES

1 To produce sound and well informed managers of Agro-Industrial enterprises.
2 To produce graduates that will be sound in policy formulation and be asset in both public and private decision making.
3 To produce graduates that can be self employed rather than job seekers.
4 To produce graduates that will formulate policy for sustainable agro-industrial production.
5 To produce graduates that will explore our natural resources sustainably.

3.3.7 PROGRAMME STRUCTURE

The Masters Programme in Agricultural Economics and Environmental Policy is structured to have general center courses of 10 units, programme courses of 26 units, dissertation (4 units), seminars (2 units) and internship (2 units).

3.3.8 LIST OF PROGRAMME-SPECIFICCOURSES AND UNITS FOR M.AgSE

Programme is designed to provide the postgraduate students ability to manage Agro- industrial enterprises sustainably. Courses taken must be passed at 50% or higher grade before graduation.

The courses are as follow:-

Course Code	Course Title	Units	Status
AES 801	Advanced Agricultural Economics (Micro& Macro)	3	C
AES 802	Resource and Environmental Economics	2	C
AES 803	Econometrics, Statistical Theory and Analysis	3	C
AES 804	Research Methodology and Experimental Design	3	C
AES 805	Agricultural Development and Policy Analysis	3	C
AES 807	Agricultural Production Economics	2	C
AES 808	Farm Planning, Monitoring and Evaluation	2	C
AES 810	Marketing & Agro-industrial Supply Chain Management	2	C
AES 811	Financial Management and Accounting	2	C
	TOTAL should be	**24**	

Note: All the odd coded number courses are First Semester courses while the even are second semester courses

Elective Courses

In addition to the core courses, students pursuing Masters Programme in Agricultural Economics and Environmental Policy are expected to take, and pass at 50% or higher grades, a minimum of four (4) units of elective courses selected from the following:

Course Code	Course Title	Units	Status
AES 806	Applied Welfare Economics	2	E
AES 809	Ecology of Food & Health Economics	2	E
AES 812	Organization & Management of Cooperative	2	E
FPV 721	Food Business Management and Entrepreneurship	2	E
	TOTAL	8	

Note: All the odd coded number courses are First Semester courses while the even are second semester courses

Seminar Courses/ Dissertation

In addition to the general courses and programme core and elective courses, students pursuing Masters Programme in Agricultural Economics and Environmental Policy are expected to develop and conduct a research to address some problems of major policy concern and/or of interests for the expansion of the frontier of knowledge in sustainable Livestock Production. In this pursuit, each student is expected to achieve satisfactory performance (50% or higher), in each of the following sequence of dissertation related/supporting courses:

Course Code	Course Title	Units	Status
AES 896	Internship	2	R
AES 897	Pre-data Seminar	1	R
AES 898	Post-data Seminar	1	R
AES 899	Dissertation Defense	4	R
	TOTAL	**8**	

Above courses will be defended before CEADESE Board at the Centre.

All M.AgSE students are encouraged to follow the following schematic guide in the presentation of the various seminars and Dissertation defence.

- F**irst Semester of Year 1**: *Submission of Research Concept Note*. This should be done within 6weeks of resumption to enable the Programme Leader appoint appropriate supervisory committee for the student
- **Second Semester of Year 1**: *Presentation of Proposal Seminar*. Thesis proposal should ideally be of no more than 30 pages, and should present Background Information, Problem Statements, Research Questions and/or Hypotheses, and Research Objectives in Chapter 1. A comprehensive Review of Literature should be in Chapter 2, while Chapter 3 should present the methodology.
- F**irst Semester of Year 2:** *Presentation of the Post-data Seminar*.
- **Second Semester of Year 2**: *Dissertation Defence*

PhD. Programme

- ***Objectives***

PhD programme in Agricultural Economics and Environmental Policy is designed to train students to design, perform, lead, and implement economic research in Agricultural Economics and Environmental Policy. It exposes students to an in-depth knowledge and application of economic theory, econometrics, and quantitative techniques in decision making, policy analysis and expansion of the frontier of knowledge as they relate sustainability of

Livestock Production.

- ***Admission Requirements***

Admission into a PhD programme shall normally be after a successful completion of Masters programme in Agricultural Economics and Environmental Policy or a similar programme in other specialty areas of Agricultural Economics, with an achievement of a weighted average score of 60% or higher in the Masters level coursework.

However, candidates who fail to make the 60% average at M. AgSE can be admitted into M.AgSE/PhD AgSE programme but would be required to take additional courses as it will be recommended by the Programme Leader based on their transcript.

- ***Structure of the PhD Programme***

A PhD programme in Agricultural Economics and Environmental Policy shall be by a combination of taught courses, seminar courses, supervised teaching and research. Every PhD student is expected to take and obtain satisfactory performances in all the following compulsory courses in addition to Seminars and Internship:

Course Code	**Course Title**	**Units**	**Status**
ACE 801	Climate change and Agriculture	2	C
ACE 802	Information Systems and Agricultural Knowledge Management	3	C
ACE 801	International Trade and Commercial Policy	3	C
AES 902	Advanced Macro-Economics, Analysis and Application	3	C
AES 903	Advanced Micro-Economics	3	C
AES 904	Data Processing and Statistical Software and Packages	3	C

Seminars and Internship

Course Code	**Course Title**	**Units**	**Status**
AES 996	Internship	2	R
AES 997	Pre-data Seminar	1	R
AES 998	Post-data Seminar	1	R
AES 999	Dissertation Defense	4	R
	TOTAL	**8**	

Total for Phd =25 Units????????? Too low!!!!!

For Phd.AgSE, how many Units??????? For Non FUNAAB Graduates, what happens? Any courses to audit??? Please specify. Please refer to my earlier remarks on Units for Phd thesis.

3.3.9 COURSE SYNOPSIS

AES 801 Advanced Agricultural Economics (Micro & Macro)

Fundamental principles & tools of economic analysis; Price theory, theory of consumer behaviour, theory of production & costs with emphasis on applications in agriculture; General equilibrium analysis; Fundamentals of welfare economics. Poverty, income inequality, discrimination and gender issues in development. Market based and social policies for enhancing social inclusion and sustainable development.

AES 802 Resource and Environment Economics

The course provide a graduate-level survey of the two prevailing contemporary themes in environmental economics: the measurement of the demand for environmental resources as input into benefit-cost analyses, and the design of incentive-based, cost-effective policy instruments to achieve environmental goals. Core topics include market failure, conceptual foundations for valuing changes in environmental quality, empirical applications of nonmarket valuation methods, and cost-effective market mechanism design for reducing pollution. Additional topics include information asymmetries and mechanism design for nonpoint source pollution, and international/global environmental issues.

AES 803 Econometrics, Statistical Theory and Analysis

Econometric Techniques; The Classical Least Squares, Correlation Analysis, Regression Methods (Simplex Regression Model, Assumption of OLS) Violations of basic least squares assumptions: Consequences and remedies. Special (Probit, Logit and Trobit). Model in regression analysis- Dummy variables, Time as a trend variable, Distributed lag models with endogenous lagged variables. Maximum Likelihood, Generalized Least Square and Instrumental Variable Methods; Limited Dependent Variable Models; Multiple Equation Models. Estimations and Hypothesis testing, Prediction.

AES 804 Research Methodology and Experimental Design

Discusses the research process and scientific method as applied in agricultural economics. Topics include problem identification, stating hypotheses, sources of data, sampling concepts and designs, methods of collecting data, questionnaire design and testing, field organization, and analysis of data. During the semester, each student develops a research proposal that may be associated with his or her

thesis. Completely randomized designs randomized complete block design, lattice squares, factorial experiments, confounding variables. Analysis of data from animal production based research using statistical packages.

AES 805 Agricultural Development and Policy

Economic Growth and Economic Development: concepts, measurement and emerging issues including sustainability and wise use of ecosystem services. The Classical, Neoclassical and Endogenous growth models; the economics of agricultural policies. Methods for analyzing costs and benefits of price supports, import restraints, and other policies for producers, consumers, and taxpayers. Policy interventions in the Food and Farm Sectors in Nigeria as well as other developing and developed countries including their motivations, policy instruments and consequences for factor owners and related commodity markets.

AES 806 Applied Welfare Economics

Review of measures of household welfare, willingness to pay, and notions of Pareto optimality, aggregate welfare and market failure. Practical methods of comparative static analysis of the effect of public policies on consumer and firm behaviour, and on market equilibrium. Theory of externalities and welfare implications of market versus non-market allocation of public goods with emphasis on Livestock. Applications include evaluation of such policies as taxes, price supports, quotas, pollution controls, environmental damage liability, and intellectual property rights.

AES 807 Agricultural Production Economics

Theories of production; agricultural production functions; resources returns in agriculture; agricultural cost and supply function; Optimization of production and farm planning under uncertainty; efficiency and innovation in agriculture. Fixed asset theory, dynamics and technology change.

AES 808 Farm Planning, Monitoring and Evaluation

Application of concepts and tools of Farm Business Management in Farm Planning and firm management. Feasibility Studies and Business Plan. Business Analysis and Planning. Interpretation and use of information for decision making in organizing and operating farm business to achieve goals. Methods of Farm Planning. Planning under risk and uncertainties. Farm Finance and Appraisal. Capital requirement in Agriculture. Monitoring and Evaluation. Cost Benefit Analysis. Time value of money.

AES 809 Ecology of Livestock, Food and Health Economics

This course explores economic aspects of food safety, quality and nutrition and the ways in which economics can aid understanding of food safety, quality and nutritional issues. Food and Nutrition Security: Concepts, Measurements and Health Links; Environmental and Public Health Implications of Industrial Food Production ; Social, Economic & Policy Consideration in Food Production; Cultural & Political Considerations in Food Consumption; Sustainable Food Production System; Public Health Management.

AES 810 Marketing and Agro-Industrial Supply Chain Management

Marketing Concepts. Marketing Mix. Industrial Organization. Competition for Agricultural Products in Domestic and Foreign Trade. Current development affecting market structure including effect of contractual agreement. Vertical Integration. Government Policy and Regulation. Traditional Livestock Supply Chain.

The global Agrifood system; The traditional supply chains & its "bullwhip" effect; Food supply chain networks; Supply Chain Management and Logistics; Supply chain redesign; Case Studies of Supply Chain Management in the Agrifood Sector; Critical Success Factors in Supply Chain Management.

AES 811 Financial Management and Accounting

Principles and concepts of Financial Management of Farms and Agri-business firms. Strategies for acquiring and using capital resources. Business Records and Accounts. Book Keeping, Petty cash administrative. Reconciling financial records and Accounts. Creditor and Debtor Invoicing. Preparing and Processing Banking documents. Data entry for ledger, and sub-ledger compliance. Meeting an Auditing requirement. Preparing and Interpreting Financial reports including Budget, cash flow statement, trial balance, Profit and Loss Account and Balance Sheet. Finance and Insurance Institution.

AES 812 Organization and Management of Cooperative

Nature, Type of Cooperatives as a Business Enterprises. Cooperative Movement and Laws in Nigeria. Problems and Prospects in Organizing and Managing Cooperative. Leadership Conflict Resolution and Financial Management.

3.4 PROGRAMME 4: FOOD PROCESSING AND VALUE ADDITION

3.4.1 PHILOSOPHY

The current changes in the food industries is the shift of their mode of operation from supply-oriented into demand-oriented processing activities leading to substantial value addition to raw agricultural products. This is especially important in a changing environment like ours where satisfying consumers'

demands is becoming of higher priority. In addition, global demand for safe food is predicated by rapid demographic changes worldwide. In order for the food and its allied industries to cope with these changes, there is need to improve the capacity of graduates in the specialized areas of Food Processing and Value Addition in the sub-region of West Africa. The food processing of the raw agricultural materials is expected to add substantial value to the livelihood of all stakeholders in the products value chain and ensure value added products are made from livestock primary products like meat, chicken, milk and fish are available all year round in varieties, the right quality and quantity.

3.4.2 OBJECTIVES

The objectives of the Food Processing and Value Addition programme are:

(i) To produce competent food processors and value addition experts who will take up challenges in the areas of research, training and developmental needs in the private sector, academia and research institutes.
(ii) To produce competent food processors and value addition experts with high entrepreneurship orientation who can utilize their scientific and research orientation to create jobs and exploit science and technology for national food sufficiency and development.
(iii) To produce graduates with adequate knowledge and skills in livestock food processing and value addition to products derived from meat, chicken, milk and fish.

Degrees to be awarded
M.AgSE and Phd.AgSE Food Processing and Value Addition

3.4.3 SUMMARY OF COURSE REQUIREMENTS

The M.AgSE programme has a total of 44 unit courses which comprises 10 units of centre courses, 24 units of compulsory option courses, 4 units of elective courses and theses seminar and research project carry 2 units and 4 units, respectively.

For Phd.AgSE, how many Units??????? For Non FUNAAB Graduates, what happens? Any courses to audit??? Please specify.

Please insert Tables with courses for First and Second semesters and the units/course and total units per semester.

3.4.4 COURSE SYNOPSIS

FPV 897: Thesis Seminar I - 1 Unit

This is essentially a pre-data seminar on the research focus of the student's project covering the title, objectives and scope of the work, review of relevant literature, experimental design and methodology.

FPV 801 & FPV 899 Research Projects and Seminars
M.Sc. (4 Units)

Ph.D. (4 Units)

Students will carry out an original research project under the supervision of one or a panel of academic staff. The research, which outcome should contribute to knowledge, could be investigative, basic or applied and would in most cases be directed at solving an identified problems related to food processing and value addition. The student will be expected to make an oral presentation of the project plan and/or its progress before or during the investigation and of the outcome at the completion of the research at the departmental level. The provision of a project supervisor notwithstanding, the student should be made to demonstrate independent initiative and motivation as this will be considered in the project assessment.

A final report of the project will be typed and bound in an approved format and the student will be expected to satisfy a panel of internal and external examiners at a viva voice defense.

FPV 896: Internship - 2 Units
Students will be placed in selected food processing industries to acquire practical experience and the rudiments of managing food processing business, human relations and troubleshooting. The students will also have vivid experience leading to identification of researchable issues affecting the industry.

FPV 803: Food Processing Technology - 3 Units

Principles of food processing; pasteurization, sterilization, thermal process, food dehydration, food freezing, food extraction, food extrusion, food irradiation and preservatives. New technologies in food processing. Emphasis should be made on the possible effects of the different processing technologies on food structure and quality. Changes in food products during storage.

FPV 805: Special Topics in Food Chemistry and Biochemistry- 2 Units

Developments in food flavours and analysis. Developments in food protein research. New sources of proteins and their use. Non-Enzymic browning in foods – chemistry, causes and control. Lactose – chemistry and nutritional implications. Food lipids and surfactants in foods

FPV 819: Special Topics in Food Microbiology and Safety Synopsis - 2 units

Microbial growth and factors that affect microbial growth; Gram - positive and gram - negative bacteria; Microorganisms in foods Food borne pathogens; Food spoilage, poisoning and preservation; Definition and Terminologies use in Food Safety; Food contaminants; Food Safety Management System; Food safety and international standards; GMP, GHP, GAP and ISO; Importance of Food Safety for Developing Countries;

FPV 821: Food Business Management and Entrepreneurship – 2 Units

Management peculiarities of food industries. Marketing concept and marketing mix. Food business law. Preparation of feasibility studies for food – based industries. Business analysis, financial and cost analyses, technology selection, marketing analysis, product management, food safety and regulation, waste management in food industries, proposal preparation, general management and project management, management of information system.

Electives:

FST 809: Food Laws, Legislation and Policy - 2 Units

Food law, its philosophy and development. Food standards, codes to practice and statutory regulations. Food export and regulations. Legislations on food additives. Toxic substances in food. Detoxification of food and avoidance of contamination. Legislation on pesticide application to food raw materials and products. Food, Nutrition and Economic development. Conceptual framework for food policy development. Food and Nutritional situation appraisal. Policy formulation and implementation. Organization and coordination, monitoring and evaluation of food and nutrition policy. Review of Agricultural Policy in Nigeria.

FPV 817: Special Topics in Sensory Analysis - 2 Units

Recent developments on taste, odour and flavor assessments in food products. Principles of consumer acceptability studies. Interrelationship between physical, chemical and sensory attributes of foods. Automation in sensory analysis.

FPV 898: Thesis Seminar II - 1 Unit

This is a follow-up seminar/post-data or bench work findings. It should cover detailed analysis and interpretation of research results, discussion of findings in view of previous reports and new ideas emanating from the study, conclusion and recommendations for future work.

FPV 802: Seminar on Recent Development in Food Processing, Value Addition and Value Chain Development – 1 Units

Students will be expected to carry out a survey of available literature and information on developments in an areas of current interest in the field of Food Processing, value addition and value chain development. The area of the review should not be directly related to the student's research project. An oral presentation of the review will be presented at an organized Departmental Seminar. The review (typed and bound records) should be submitted to the Department and should be comprehensive, containing historical developments and current perspective of the topic as well as offer possible suggestions on areas of future research needs.

FPV 804: Planning and Analysis of Experiments – 2 Units

Basic concept of experimentation: experimental variables and Statistical procedure, data description, random variable and some distributions. Sampling distribution concept. Principles of experimental design. Analysis of variance, single factor experimental design, multifactorial designs, Fractional Factorial Design, Nested Design and Response Surface Methodology (RSM). Process optimization and control limits. The course will emphasize design concepts and the presentation of results.

FPV 806: Livestock Products Processing Practical - 2 Units

Practical exercises will be organized for students on value addition to livestock products such as chicken, meat, egg, and fish. The practical exercises shall be organized jointly by the faculty and relevant food manufacturing companies. The exercises will consist of practical instructions by industry based experts and

hand-on product processing by students using industrial or pilot scale facilities obtainable in the partner food manufacturer's premises. Practical reports shall be graded by the facilities.

FPV 808: Food Product Development - 2 Units

Product development concept: basic considerations for new products development – strategies and methods. Multidisciplinary approaches for developing new food products and the context of industry-cooperated projects. Group dynamics and interpersonal skills. Feasibility report preparation. Influence of process factors on product quality. Rudiments of market and consumer surveys for new and renewed food products.

FPV 810: Physical and Engineering Properties of Foods and Biomaterials- 2 Units

Topics involve concept in physical and engineering properties of food and biomaterials, i.e. physical characteristics, surface, functional, mechanical, thermal, electrical and optical properties. Phase transition is also included. Measurements and application of these properties to food processing system including harvesting, handling, processing, storage and quality evaluation. A relevant integrated program of practical works is conducted.

FPV 812: Process and Plant Design for the Food Industry- 2 Units

Principles of process design including material and energy balance, flow sheeting, utilities systems, equipment specification and materials selection. Technical and economic aspects of plant design. Optimization of process and plant design. Students are required to undertake an independent investigation of a food processing system.

FPV 822: Advanced Quality Management - 2 Units

Evolution of quality concepts, customer focus, total quality management, operational quality management, quality control and quality improvement. Evolution of quality management methodologies, i.e. statistical technique, Hoshin management. Quality function deployment, standards on quality management system i.e. ISO 9000 Standard. Effects of raw material quality and the various types of food processing on yield and quality of product. Sanitation in the food industry.

Electives:

FPV 812: Topics in Raw Material Sourcing- 2 Units

Raw material source – implications in food processing. Raw material needs of different sectors of the food industry. Developments in local sourcing of raw materials in Nigeria's food industry. Raw materials alternatives.

FPV 823: Industrial Drying of Food - 2 Units

Fundamental principles of drying – thermodynamic properties of air-water mixtures and moist solids, equilibrium moisture content, drying kinetics and mathematical modeling of drying process; classification and selection of industrial dryers; dryers for particulate solids, slurries and sheet-form materials; drying of selected food products: grains, fruits, vegetables and meat products; innovation in drying technologies.

3.5 PROGRAMME 5: ENVIRONMENTAL SYSTEMS AND AGRICULTURE

3.5.1 BACKGROUND

This programme provides opportunities for graduates with backgrounds in water related scientific, engineering and environmental disciplines to enhance their knowledge of the water environment as it affects agricultural development and management. The programme is aimed to train a new breed of scientists capable of new thinking to proffer demand-driven solutions to hydrological and environmental problems. This training is designed to involve theoretical, practical, computational and internships that will be very relevant to address emerging environmental challenges. The proposed option has a total of **44** unit courses including **10** units of Centre courses, **26** units of compulsory/elective courses. Seminars and internship report carry **2** units each while dissertation carry **4** units.

3.5.2 PHILOSOPHY

The philosophy of this programme is to improve and sustain livestock farming within the hydrological zones in Sub-Saharan Africa.

Deriving from the foregoing philosophy the major objectives of this programme are:

1. To train graduates who are sufficiently knowledgeable in hydrological systems and environment.
2. To produce graduates who are practically and theoretically adept in environmental aspects that meets the needs of agro-industries.
3. To produce skilled and competent graduates who will effectively manage, critically assess information and issues relating to environmental pollution.
4. To produce skilled professionals capable of hydrological forecasting and prediction for sustainable agriculture and national development.

Degrees to be awarded
M.AgSE and Phd.AgSE Environmental Systems and Agriculture (Option?????)

3.5.3 LIST OF PROGRAMME-SPECIFIC COURSES AND UNITS FOR M.AgSE

Course Code	Course Title	Units	Status
FIRST SEMESTER COURSES			
ESA 801	Mathematical methods and numerical applications	3	OSC
ESA 803	Fluid Mechanics	2	OSC
ESA 805	Hydrological Measurements and Analysis	3	OSC
ESA 807	Environmental Simulation Modelling	3	OSC
ESA 809	Climate Change Processes, history and Contemporary issues	2	OSC
ESA 811	Remote Sensing, GIS and Land Management	3	OSC
ESA 813	Waste Water Management and Pollution Control	3	OSC
			CCC
			CCC
TOTAL UNITS FOR FIRST SEMESTER		**19**	
SECOND SEMESTER COURSES			
ESA 802	Environmental Economics	1	OSC
ESA 804	Environmental Safety and Protection	2	OSC
ESA 806	Soil Processes Assessment and Management	2	OSC
ESA 808	Climate Change Impacts, Ecosystem Management and Sustainability	2	Elective
ESA 810	Internships Reports and Seminars	4	OSC
ESA 899	Research Project	4	OSC
			CCC
			CCC
			CCC
TOTAL UNITS FOR SECOND SEMESTER		**15**	

3.5.4 SUMMARY OF REQUIREMENT FOR M.AgSE

CENTRE CORE COURSES (CCC)	12 UNITS
OPTION SPECIFIC OPTION (OSC)	24 UNITS
INTERNSHIP REPORTS AND SEMINARS	4 UNITS
RESEARCH PROJECT	4
TOTAL UNITS	44

For Phd.AgSE, how many Units??????? For Non FUNAAB Graduates, what happens? Any courses to audit??? Please specify.

3.5.5 SYNOPSIS OF COURSES

ESA 801: Mathematical methods and numerical application (3 Units)

Mathematical methods, Numerical methods, Statistics and probability and Computer application. Matrix algebra, Laplace transforms and Fourier series, Z-transforms, differential and partial equations Classification of differential equations (elliptic, parabolic, hyperbolic), Differential equations, Solution methods (finite difference and introduction to finite elements), Initial and boundary conditions. Probability problems in hydrology, Statistical parameters, Distributions, Extreme values, Regression and correlation, Likelihood and hypothesis testing. Applications to surface water and groundwater problems.

ESA 803: Fluid mechanics (2 Units)

Types of fluids, Physical properties of fluid. Flow mechanism in hydrological studies. Fluid mechanics: Mechanics of ideal fluid, Potential flow, flow nets, Laplace equation, Flow in porous media, Mechanics of viscous flow, Navier-Stokes equation, Reynold stresses, Reynold's equation, Boundary layer theory, velocity distribution. Physical properties of water, Uniform flow in open channels, Equation of continuity and motion, Gradually varied uniform flow, back water curves), Hydraulics, Flow in hydraulic structures, hydraulic jump and head losses, Hydraulic models, Theory of groundwater flow and mathematical treatment of a number of important flow problems.

ESA 805: Hydrological Measurements and Analysis (3 Units)

Hydrometric Networks: Gauging networks; design considerations; precipitation networks; evaporation networks; surface water networks and groundwater networks. Precipitation: Storage gauges; rainfall recorders; siting the rain gauge; international practice and recent developments. Evaporation: Factors affecting evaporation, measurement of evaporation from an open water surface and

measurement of evaporation loss from transpiration from vegetation (evapotranspiration) and measurement of potential evaporation. Soil moisture: Soil structure and composition; soil properties; water in soil; soil water retention and methods of measurement. River flow: River gauging; stage-discharge relationship; flumes and weirs; dilution gauging and modern gauging techniques. Groundwater: Infiltration; groundwater flow equations; flow nets; groundwater measurement and groundwater exploration. Precipitation Analysis: Determination of areal rainfall; depth-area analysis; depth-area-duration; rainfall frequency; intensity-duration-frequency analysis and extreme values of precipitation. Evaporation Calculations: Calculation of E_o; Calculation of E_t; Calculation of PE and Soil moisture deficit. River Flow Analysis: River regimes; peak discharges; flow frequency; flood frequency; flood probabilities; analysis of an annual maximum series; flood prediction; droughts and frequency of low flows. Rainfall-Runoff Relationships: Rational Method; Time-area method; hydrograph analysis. Catchment modelling and Stochastic hydrology

ESA 807: Environmental Simulation modelling (3 Units)
Criteria for the use of data for modelling: Accuracy, Time intervals, Error detection and correction. Classification of models: Terminology, model technique (physical models, analog and mathematical models),model-prototype relationship, limitations, Deterministic and stochastic principles, Lumped and distributed models, Linear and non-linear models. Stochastic models: Introduction to stochastic processes, Random events, stationarity, Time series analysis, Markovian processes, Filtering. Deterministic models: Deterministic methods in system hydrology, Analytical and numerical solution of equation of motion and continuity, Black box analysis, Conceptual models Mathematical physical models, Flood routing models, Optimization of model parameters, criteria, techniques. Environmental forecasting:, Hydrological forecasting, Forecast methods: short-term forecast, on-line systems, updating of parameters; long-term forecast for seasonal runoff, off-line systems. Application to floods, draught, low flow, water temperature.

ESA 809: Climate Change Processes, history and Contemporary issues (2 units)
An overview of Paleo-climatology; Atmospheric components , structure and the general circulation of the atmosphere; History of climate, natural and anthropogenic greenhouse gases, global warming, climate variability and change; Formation of ozone and interaction with UV radiation; Tropospheric photo-chemistry (NOx, VOCs, formation of tropospheric ozone and impacts on radiation balance/ budget quantities on the earth and atmosphere systems); Causes of climate change (Natural and anthropogenic/human activities); Factors influencing climate change including interactions within the atmosphere, ocean, solid earth and biosphere; Stability and sensitivity of climate system, global

warming, ozone depletion, and other human influences; Green house effects, remediation techniques, air pollution consequences of global warming, acid rain and acidification; Evidences of climate change.

ESA 811: Remote Sensing, GIS and Land Management (3 units)
Mapping, photo interpretation: Cartography, projections, Hydrological legends, Presentation on maps of variables in space and time, computer maps; presentation of three-dimensional problems, Surface water maps, water quality maps, groundwater maps, continental, hydrogeological maps, Remote sensing, aerial surveying; interpretation of aerial photographs and space imagery, Global Positioning Systems (GPS),Geographical Information Systems (GIS), yield monitor, variable rate technology, and remote sensing. Applications, Adaptation and implementation of GPS and GIS for precision livestock farming.

ESA 813: Waste water management and Pollution Control (3 units)
Water chemistry and water biology: Composition and characteristics of surface and groundwater, Biochemical cycles, C , N, P and S, Main chemical and bacteriological water quality parameters, Introduction to instruments, Genetics, breeding of plants and animals, Ecosystems (principal system, baseline surveys), Aquatic ecology, Population dynamics, carrying capacity; Surface water quality: Factors affecting water quality and pollution by human, industrial and Agricultural wastes, Water quality criteria, Stratification and eutrophication in lakes and reservoirs, Thermal pollution, Self-purification, Water-related diseases, Water quality monitoring; water quality classification, accumulation of heavy metals and toxic organic metals in sediments; Groundwater quality: Processes determining groundwater quality, Sources of groundwater pollution and effects on groundwater quality (N-,P-organic micro-pollutants, heavy metals, nuclear wastes), Artificial groundwater recharge, Flow lines and residence time of polluted groundwater, Leaching from waste disposals, Protection of groundwater, sanitation and prevention, Groundwater quality monitoring, sampling techniques. Soil conservation and erosion control: Continental erosion and sediment transport to the ocean, Factors affecting surface erosion, Soil loss tolerance, Surface and linear erosion control, Wind erosion, erosion modelling. Environmental impact assessment: Environmental conservation and public health objective for water resources and civil engineering projects, Environmental planning and conservation strategies, Land use and soil conservation; groundwater protection Case studies (implementation of irrigation schemes; dam construction; land reclamation), Identification, prediction and assessment of environmental impacts.

ESA 802: Environmental Economics (1 Unit)

Economics of water resources planning: Engineering economy; financial and economic analysis, Cost-benefit analysis and rate of turnover criteria, Cost models for water resources schemes, Tarification policy, Analysis of project returns. Systems analysis: Analysis of linear input-output systems, Identification of objectives, economic benefits, cost and decision variables, Application of systems analysis to problems of water resources engineering, and environmental management Optimization methods (linear programming, dynamic programming, simulation, Sensitivity analysis etc.)

ESA 804: Environmental Safety and Protection (2 Units)

Major issues and public policy in environmental protection. Managerial problems associated with the prevention, mitigation and cleanup of environmental problems. Governmental involvement and regulation and emerging trends as they influence decision-making in the public and private sector. Physical, political, legal, economic and technological factors that help shape and constrain environmental protection policy. Rules that govern the management of hazardous and other solid wastes, including industrial, household and livestock wastes. Requirements governing solid waste generation, storage transportation, processing, treatment and disposal as well as the closure and remediation requirements for livestock waste sites. The course will also examine the relationship between federal and state rules as they apply to the management of waste and enforcement issues to waste management.

ESA 806: Soil Processes Assessment and management (2 Units)

Soils in the ecosystem, soil genesis and factors of soil formation. Soil Resources Inventories: soil morphology and characterization. Physical and morphological properties of soils. Main soil processes. Physical and Chemical properties of soils: colour, texture, structure, consistency, porosity, permeability, drainage. Soil reaction, soil clays, Cation Exchange Capacity, Anion absorption and exchange, soil buffering, organic colloids. Soil classification and mapping. Soil data interpretations and multi-criteria evaluations: Soil Fertility Assessment and Management, Soil Organic Matter (SOM) Management (continuation) and Soil Carbon and Carbon Sequestration, Soil Erosion and Soil Conservation Measures. Soil Toxicity and Soil Contamination*:* Land Degradation Assessment

Electives

ESA 808: Climate Change Impacts, Ecosystem Management and Sustainability (2 units)

Climate change and disasters/hazards consequences (erosion, floods, storms, axis rain, heat waves, resource depletion, etc); Challenges on agricultural production and food security - soils, cropping/farming systems, food and animal production, distribution and accessibility; Impacts on livestock, fisheries, forestry, post harvest and farm produce storage, water resources; Land use, savanna and forest fires and implications for ecosystem structure, food chain and

biodiversity loss; Climate change , ecosystem degradation and food security situation in sub- Saharan Africa; Vulnerability assessment and strategies for ecosystem management in a changing climate (adaptation, mitigation, resilience, etc); adaptive management of ecosystems for sustainable development; Principles and concept of sustainability and carrying capacity; Climate change and sustainability of environmental resources (soil, vegetation and forest resources, water resources and aquatic organisms, agriculture and crop biodiversity); Climate change- human activities nexus and concept of ecological rehabilitation.

LABORATORY EXERCISES

(i) pH, acidity, alkalinity
(ii) Total and calcium hardness
(iii) Chemical Oxygen Demand
(iv) Biochemical Oxygen Demand
(v) Jar tests (coagulation and flocculation)
(vi) Chlorine demand
(vii) Phosphorous
(viii) Coliform count