University of Nigeria, Nsukka

DEPARTMENT OF ANIMAL SCIENCE

POST GRADUATE PROGRAMMES IN ANIMAL SCIENCE

PHILOSOPHY:

The animal industry in Nigeria has many challenges which must be addressed comprehensively if Nigeria is to assume her rightful position in the global livestock industry. The postgraduate programmes of the Department of Animal Science are therefore designed to address these challenges which are militating against increased and sustainable animal production. Thus, the postgraduate programmes of the Department are carefully structured to provide rich theoretical and practical training required to be able to operate nationally and internationally in all aspects of animal production. The programmes have considerable flexibility that allows the enrolment of candidates with varying educational backgrounds and job expectations. The programmes are also structured to create a large pool of intellectuals that have been carefully trained and equipped with research skills and competencies to critically analyze issues as they affect animal agriculture nationally and internationally and be able to proffer solutions to current and emerging challenges in the livestock and poultry industry. Graduates of this programme are adequately mentored to provide research and academic leadership in all areas of animal production.

OBJECTIVES:

The aim of the programme is to train and equip Graduates of Animal Science with the requisite knowledge that will enable them to be competent in practical aspects of animal husbandry and production. Specifically the programme is designed to:

1. Upgrade the theoretical and practical knowledge of animal science graduates with third class honours degree to enable them to enrol for the master's degree programme.
2. Enable graduate students undertake higher academic pursuits in the areas of animal breeding and genetics, nutrition and biochemistry, production, reproductive physiology and feed formulation and feedmill management.
3. Train graduates with enhanced knowledge, skills and competence to operate with confidence in the national livestock industry.
4. Equip graduates of animal science with the required knowledge and skills that will enable them to face the challenging task of making more animal protein available to Nigerians on a sustainable basis.

5. Contribute significantly through researches in solving critical issues affecting animal production generally.

SCOPE:

The Postgraduate Programme of Animal Science leads to advanced, appropriate and adequate knowledge in Animal Agriculture. It exposes students to modern and practical animal production techniques. Students are acquainted with the theoretical and practical knowledge in animal breeding and genetics, nutrition and biochemistry, production, reproductive physiology and feed formulation and feedmill management. The Programme is carefully structured to provide rich theoretical and practical training required to enable graduates of Animal Science to operate nationally and internationally in all aspects of animal production. Basic principles of Animal Production and the National Policy and Problems of the Livestock and Poultry Industry are highlighted.

ADMISSION REQUIREMENTS:

a. PGD Programme

i. Graduates of the University of Nigeria or other recognized universities who have obtained B. Agric degree with a third class honours (Animal Science) only of the University of Nigeria or of other recognized Universities and who have GPA not less than 2.00 on a 5-point scale or its equivalent.

ii. Candidates with a Bachelor of Science degree in Zoology from the University of Nigeria, Nsukka or other recognized universities may also be considered.

b. M.Sc. Programme

i. Graduates of the University of Nigeria or other recognized universities who have obtained the degree of bachelor - B. Agric. (Animal Science) **only** with at least a second class honours (lower division) with GPA not less than 2.50 on a 5-point scale, or its equivalent.

ii. Also, candidates with third class honours in B. Agric. (Animal Science) and had successfully completed and obtained Postgraduate Diploma in Animal Science of the University of Nigeria or of other recognized Universities with at least a 3.50 GPA on a 5-point scale.

c. Ph.D Programme

Candidates for Ph.D programme must have academic Master's degree in relevant areas in Animal Science of the University of Nigeria or of other recognized Universities with a minimum CGPA of 3.0/4.0 or 3.5/5.0 or 60% and Project score not lower than 60% (B).

MODE OF STUDY
Full-Time and Part-Time.

DURATION OF PROGRAMMES

PGD
Maximum and minimum duration of postgraduate Diploma programme shall be:
: A minimum of 2 semesters
A maximum of 4 semesters

M.SC.
Full-Time: A minimum of 3 semesters
A maximum of 6 semesters

Part-Time: A minimum of 5 semesters
A maximum of 7 semesters

PhD (after Master's degree)
Full-Time: A minimum of 4 semesters
A maximum of 10 semesters

Part-Time: A minimum of 6 semesters
A maximum of 12 semesters

MSC / PhD
Full-Time: A minimum of 8 semesters
A maximum of 12 semesters

Part-Time: A minimum of 10 semesters
A maximum of 14 semesters

The first two semesters of the Doctoral programme shall be devoted to course work and written examinations, the remaining sessions will be devoted to periodic seminars, and field research to be embodied in a Thesis.

Requirements for graduation

PGD Programme

I) To be awarded Postgraduate Diploma in Animal Science, a student must have taken and passed the prescribed number of required courses from the approved list, a total of 30 units as follows:

Core courses 19 units

Project Report	8 units
Total	27 units

II) In all cases, PGD students must write and submit to the department a Project Report duly supervised by Teaching staff in the department who are not below the rank of Lecturer II. Such Project Report must be sent to an external examiner nominated by the department and appointed by Senate.

M.Sc. Programme

I) To be awarded the M.Sc. degree a student must have taken and passed the prescribed number of compulsory and required courses selected from the approved list, a minimum of 30 units as follows:

Core courses	18 units
Faculty Course on ICT and	
Research Methodology	3 units
Project Report	6 units
Seminar presented from	
M.Sc. Project Report	3 units
Total	30 units

II) In all cases, M. Sc. students must write and submit to the department a Project Report duly supervised by Teaching staff in the department whose qualifications are not below Ph.D. Such a Project Report must be sent to an external examiner nominated by the department and appointed by Senate for that purpose.

Ph.D. Programme

To graduate, all the Ph.D. candidates must take and pass all the requisite courses as prescribed in the Ph.D course list below, a minimum of 30 units as follows:

Coursework including 3 unit Faculty course	
On Research Grant Writing and Synopsis Writing	12 units
Thesis	12 units

Two Seminars	6 units
Total	30 units

Every Ph.D. candidate must submit a thesis on a chosen and approved topic, supervised by a member of teaching staff whose qualification is not below Ph.D, and who is not lower than Senior Lecturer in rank.

The Ph.D. thesis must be defended before an external examiner dully nominated for that purpose and appointed by Senate.

EMPLOYMENT OPPORTUNITIES

Graduates of this Department have opportunities to undertake consultancy services and employment opportunities abound in tertiary institutions (as lecturers/teaching staff), banks and industries, livestock and poultry farms, etc. Graduates of this programme can also engage in self-employment.

AREAS OF SPECIALIZATION: M.SC AND PH.D

i. Animal genetics and breeding
ii. Animal nutrition and biochemistry
iii. Animal production
iv. Physiology of reproduction in animals

LIST OF APPROVED SUPERVISORS

Professors

Arinze.G. Ezekwe, Reproductive Physiology

B. Agric. (Animal Sci.), M.Sc., Ph.D. (Nigeria).

Simeon O.C. Ugwu, Reproductive Physiology

B. Agric. (Animal Sci.) M.Sc. Ph.D. (Nigeria).

Augustine O. Ani, B.Sc.(Hons) Zoology(Maiduguri),M.Sc., Ph.D. (Nigeria).	Animal Nutrition and Biochemistry
Anslem E. Onyimonyi, B. Agric. (Animal Sci.), M.Sc., PhD (Nigeria)	Animal Nutrition and Biochemistry

SENIOR LECTURERS

Harriet N. Ndofor-Foleng(Mrs.), B.Sc.(Hons) Zoology, M.Sc., Ph.D. (Nigeria).	Animal Breeding and Genetics
Ndubisi S. Machebe, B. Agric. (Animal Sci.), M.Sc., Ph.D. (Nigeria)	Reproductive Physiology
Charles O. Osita, B. Agric. (Animal Sci.), M.Sc., PhD (Nigeria) Lecturer I	Animal Nutrition and Biochemistry

STRESS AREAS

STRESS AREAS	**CODES**
Fundamental / General Courses	0
Breeding and Genetics	1
Animal Nutrition and Biochemistry	2
Feed Formulation and Feedmill Management	3
Animal Production	4
Reproductive Physiology	5
Project Report/Thesis	9

PGD ONE YEAR PROGRAMME: ANIMAL SCIENCE

PROGRAMME STRUCTURE- COURSE OUTLINE

First Semester

Course Code.	**Course Title**	**Units**
ANS 0641	General principles of Animal Production	3
ANS 0643	Commercial Pig and Rabbit Production	3
ANS 0645	Intensive Sheep and Goat Production	3
	Total Units	**9**

Second Semester

Course Code.	Course Title	Units
ANS 0642	Beef and Dairy Cattle Management Decisions	3
ANS 0644	Poultry Industry	3
ANS 0646	Field Work and Technology Application	4
ANS 0690	Project Report	8
	Total Units	**18**

COURSE DESCRIPTIONS FOR POSTGRADUATE DIPLOMA (PGD) COURSES

ANS 0641 General principle of Animal Production 3 Units

Principles of genetics, nutrition and physiology in the breeding and production of livestock and poultry; farm records.

ANS 0642 Beef and Dairy Cattle Management Decisions 3 Units

Status and characteristics of the beef and dairy industries; integration of principles of nutrition, lactation, breeding, herd health. Etc. into a total management programme to meet the needs of the beef and dairy industries.

ANS 0643 Commercial Pig and Rabbit Production 3 Units

Status and characteristics of the pig and rabbit industries; application of principles of animal breeding, nutrition, application of principles of animal breeding, nutrition, physiology and economics to pig and rabbit production; considerations in developing a successful swine enterprise.

ANS 0644 Poultry Industry 3 Units

Current practices and production systems with emphasis on management aspects egg, broiler and turkey production; integration of principles of genetics, nutrition, physiology, economics and health care into a total management package to meet the needs of the poultry industry.

ANS 0645 Intensive Sheep and Goat Production 3 Units

Status and characteristics of the sheep and goats industries; application of principles of animal breeding, nutrition, physiology, management of sheep and goat breeding flocks; management and marketing of feedlot lambs and kids.

ANS 0646 Field work and Technology Applications 4 Units

Field technology (practical) training along the following options: feeding, nutrition, breeding, physiology, husbandry (any two species) and project evaluation and management, to be supervised by staff.

ANS 0690 Project Report 8 Units

Each postgraduate diploma student is required to submit a project report in one of the five option areas.

M.SC. PROGRAMME

PROGRAMME STRUCTURE- COURSE OUTLINE

Each student shall be required to take three compulsory courses in addition to those chosen in his/her area of specialization and in other relevant areas

COMPULSORY COURSES

First Semester

Course No.	Title	Units
PGC 601	Research Methodology and Application of ICT in Research	3
ANS 601	National Policy and Problems of the Livestock and Poultry Industry	1
ANS 603	Statistical Procedures in Animal Science Research I	2

Second Semester

Course No.	Title	Units
ANS 604	Statistical Procedures in Animal Science Research II	2
ANS 690	Project Report/Dissertation	8/18

AREA SPECIFIC COURSES

BREEDING AND GENETICS

First Semester **Units**

ANS 611	Evolution and Heredity	2
ANS 613	Biochemical genetics	2
ANS 615	Population genetics I	2
ANS 617	Applied animal breeding	3

Second Semester

ANS 612	Avian and animal genetics	2
ANS 616	Population genetics II	2
ANS 618	Methodology in quantitative genetics and animal breeding research	3

NUTRITION AND BIOCHEMISTRY

First Semester		**Units**
ANS 621	Advanced Nutritional biochemistry	2
ANS 623	Mineral and vitamin nutrition	2
ANS 625	Energy and bioenergetics	2
ANS 627	Feeds and feeding	2

Second Semester

ANS 622	Rumen physiology and metabolism	2
ANS 624	Protein and amino acid nutrition	2
ANS 626	Forage management and nutrition	2

FEED FORMULATION AND FEEDMILL MANAGEMENT

First Semester		**Units**
ANS 631	Feed resources	2

Second Semester

ANS 632	Feedmill Technology and Management	2

ANIMAL PRODUCTION

First Semester		**Units**
ANS 641	Managing Livestock Farms	2
ANS 643	Advanced Farm Management	2

Second Semester

ANS 644	Animal Behaviour	2

REPRODUCTIVE PHYSIOLOGY

First Semester		**Units**
ANS 651	Endocrinology of Reproduction	3
ANS 653	Physiology of Reproduction in Female Animals	2
ANS 655	Semen Technology	3
ANS 657	Environmental Physiology	2
ANS 659	Special Topics in Animal Reproduction	1

Second Semester

ANS 650	General Endocrinology	3
ANS 652	Physiology of Reproduction in Male Animals	2
ANS 654	Avian Reproduction	2
ANS 656	Physiology of Lactation	2
ANS 658	Physiology of Growth	3

COURSE DESCRIPTIONS FOR MASTERS DEGREE PROGRAMME

PGC 601: Research Methodology and Application of ICT in Research 3 Units

This is in-depth research work aimed at acquiring full knowledge and presentation in scholarly writing of the concepts, issues, trends in the definition and development of the study of the study area from African and Western perspectives; Major steps in research: Selection of problem, Literature review, Design, Data collection, analysis and interpretation, Conclusions, Study of various research designs, Historical, Case Studies, Surveys, Descriptive, Cross sectional, Experimental, as well as Analysis, surveys and synthesis of conceptual and philosophical foundations of different disciplines. Identification of research problems and development of research questions and or hypotheses are discussed. Detailed treatment of methods of collecting relevant research data and the format for presenting research results (from designing the table of contents to referencing, bibliography and appendix) are also part of this course; Data analysis and result presentation in different disciplines using appropriate analytical tools, Methods of

project dissertation writing. This course also considers the Application of appropriate advanced ICT tools relevant in various disciplines for data gathering, analysis and result presentation; Essentials of Spreadsheets, internet technology and internet search engines.

ANS 601 National Policy and Problems of the Livestock and Poultry Industry (1 Unit).

Overview of the livestock and poultry industries in Nigeria; characteristics of the industries; government policies as they affect the livestock sub-sector of the economy.

ANS 603 Statistical Procedures in Animal Science Research I (2 Unit).

Data handling, analysis and interpretation; introduction to computers and statistical package. Distributions; methods of analysis (analysis of variance and covariance, regression and correlation). Matrix Algebra.

ANS 604 Statistical Procedures in Animal Science Research II (2 Unit).

(prereq.: ANS. 603 - Statistical Procedures in Animal Science Research I). Experimental designs in Animal Science experiments; factorial experiments.

ANS 611 Evolution and Heredity (2 Unit).

Evolutionary theories; hereditary mechanisms that are bases for variation; biological communication between generations.

ANS 612 Avian and Animal Genetics (2 Unit).

Mode of inheritance of common traits in farm animals and their utilization in development of economically, aesthetically valuable individuals; development of a framework of theory for the study of the genetics of populations; recombination DNA and genetic engineering.

ANS 613 Biochemical genetics (2 Unit).

Biochemical basis of gene action, mutation and protein synthesis; genetic control of metabolism.

615 Population Genetics I (2 Unit).

Genetic structure of populations and nature of differences; forces which change genetic composition, mean and variability; small populations and random drifts in breeding; rates of change in mean and variability; kinds of genetic variance.

ANS 616 Population Genetics II (2 Unit).

Assortative mating based on phenotypic resemblance; inbreeding; heritability and genetic correlation; selection indexes; path coefficients; biometric relationships and mating systems.

ANS 617 Applied Animal Breeding (prereq.: ANS 531, ANS 6(2) (3 Unit).

Application of quantitative genetic principles to animal breeding; breeding parameters, testing of animal performance, selection methods and breeding values; systems of breeding different farm animal species.

ANS 618 Methodology in Quantitative Genetics and Animal Breeding Research (Prereq.:)ANS 531)

(3 Unit).

Linear models; statistical principles behind use of mixed models - least squares, maximum likelihood, breeding value prediction, BLUP, REML: variance components estimation; introduction to computers and computer programming.

ANS 621 Advanced Nutritional Biochemistry (2 Unit).

Advanced treatment of biological processes; enzyme, vitamin, mineral, protein, amino acid, lipid and carbohydrate metabolism; integration of metabolic pathways; coenzyme, nucleic acids; control of cells and organisms; biochemical genetics, disorders of carbohydrate, lipid, amino acid, nucleic acid and porphyrin metabolism.

ANS 622 Rumen Physiology and Metabolism (2

Unit).

Anatomy, physiology and biology of the rumen. Ruminant advantage - features, peculiarities and functions. Energy and protein metabolism and utilization in the ruminant. Feeding standards; rumen fistulation and in vitro techniques; rumen dysfunctions.

ANS 623 Mineral and Vitamin Nutrition (2 Unit).

Classification, natural sources, functions, deficiency of the major and trace elements; physiological and nutritional aspects of mineral balance. Mineral requirements of farm animals; mineral inter- relationships, balance, ratios, complementarity, antagonism. Classification, sources, roles and deficiency symptoms of vitamins; vitamin requirements; vitamin-mineral interrelationships, premixes in livestock feeds.

ANS 624 Protein and Amino Acid Nutrition (2 Unit).

Classification, properties, purification, hydrolysis and composition of proteins. Classification, identification, properties and separation of amino acids. The primary structure of proteins and nucleic acids. Protein quality.

ANS 625 Energy and Bioenergetics (2 Unit).

Basic principles of bioenergetics and thermodynamics; the free energy system. Energy terms and units; energy balance sheet of metabolism; energy cost of biosynthesis - lactation, lipogenesis and protein synthesis. High energy compounds. Energy partition and measures in livestock feeding. Energy content of feeds and energy requirements by farm animals.

ANS 626 Forage Management and Nutrition (2 Unit).

Forage classification and production systems. Ruminant features and ruminant advantage. Dry season feeding programmes; forage preservation. Forage quality and utilization by ruminants. Animal and plant factors affecting preference. Ecological basis of range management. Range management methods and measures. The national herd, grazing calendar and national feed security of grazing animals. Range degradation and regeneration. Forage analytical methods and metabolism studies.

ANS 627 Feeds and Feeding (2 Unit).

Voluntary feed intake and factors affecting it in ruminants and non-ruminants; livestock feed sources, processing and storage. Feeding systems, feeding standards, nutrient requirements and ration formulation for all farm animals; metabolic disorders and control in livestock; quality evaluation and control in livestock diets; selected topics in animal nutrition.

ANS 631 Feed Resources (2 Unit).

The exploitation of new feed resources - forest produce, residues, wastes, industrial effluent and by-products, animal manure; processing, detoxification, pelleting, brisquetting and extrusion of feed resources; waste recycling; feedstuff substitution.

ANS 632 Feedmill Technology and Management (2 Unit).

Feedmill machinery, layout, installation capacities and logistics; storage and stored products technology; mixing techniques, particle size, heat and humidity controls; moisture considerations; feedmill hygiene and maintenance; packaging and distribution.

ANS 641 Managing Livestock Farms (2 Unit).

Aspects of farm design and layout; housing, breeding, feeding and disease control; economics of production.

ANS 643 Advanced Farm Management - (Prereq.: ACE 502 (2 Unit).

Production Economics and Farm Management) Principles and concepts of farm management, enterprise combination, and budgeting. Analysis of risks and uncertainties in agriculture, management tools for planning.

ANS 644 Animal Behaviour (2 Unit).

'Principles of etiology; genetic, social, physiological bases of animal behaviour; systems of behaviour; physical environment and behaviour; behavioral patterns of farm animals and their practical applications; technique of measurement and evaluation of behavior.

ANS 650 General Endocrinology (3 Unit).

The concept of homeostasis and its control; a general survey of the endocrine glands and their secretions. Biological, physiological and pharmacological effects of hormones. Methods 'study of endocrine organs, unresolved problems and future trends.

ANS 651 Endocrinology of Reproduction (3 Unit).

The hypothalamus, the pituitary and the pineal as endocrine organs of reproduction. The endocrinology of the ovary, the testes, the placenta and of pregnancy. Assay techniques and applications. (3 *Units)*

ANS 652 Physiology of Reproduction in Male Animals (2 Unit).

Spermatogenesis and its control. Cycle of the seminiferous epithelium, the stages and the wave of spermato-genesis. Daily sperm production, and sperm output. Puberty in male animals; the epididymis and its functions; ejaculation and ejaculation control; libido; semen and semen composition. Spenn structure; capacitation and changes in spermatozoa in the male and female reproductive tracts. Infertility in males.

ANS 653 Physiology of Reproduction in Female Animals (2 Unit).

The ovary and the process of oogenesis. Puberty: the ovum and the Graafian follicle; the oestrous cycle and its control. Ovulation; ova transport in the female tract; fertilization; implantation, and pregnancy; pregnancy diagnosis; the structure and functions of the placenta. Signs of approaching parturition; parturition and its management. Measure of reproductive efficiency; infertility and its control.

ANS 654 Avian Reproduction (2 Unit).

Semen of birds, their composition and fertility; male: female ratios, flock fertility and its

maintenance. Oviposition and laying habits of birds; laying cycles. Circadian rhythms and laying cycles, the egg and its structure. Hormonal control of egg laying; hatching, hatchability and embryogenesis; comparative aspects of reproduction in birds.

ANS 655 Semen Technology (3 Unit).

Screening of male animals for breeding; semen collection and evaluation techniques; semen diluents and their additives; processing liquid and frozen semen; insemination techniques; comparative aspects.

ANS 656 Physiology of Lactation (2 Unit).

Biology of lactation; mammary gland structure and its development; hormonal and neural control of lactation. Mammary gland involution, milking rate and frequency; milk composition. Biochemistry of milk synthesis. Milk yield. Udder abnormalities - mastitis, etiology, control and management.

ANS 657 Environmental Physiology (2 Unit).

The tropical environment and animal production. Bioenergetics and thermoregulation. Adaptive mechanisms and animals in the tropics. Endocrinological basis of adaptation. Environmental control and environmental simulation. Stress and productivity.

ANS 658 Physiology of Growth (2 Unit).

Concept of growth. Foetal and postnatal growth, linear growth; measurement of growth.Endocrine control of growth. Physiological time and equivalence of age; energy muscle growth in different classes of stock. Aging.

ANS 659 Special Topics in Animal Reproduction (1 Unit).

Special topics and modem trends in animal reproduction. Selected topics on current trends in animal reproduction are discussed.

ANS 690 Project Report (8 Unit).

Field research to be embodied in a report.

Ph.D. PROGRAMME IN ANIMAL SCIENCE

PROGRAMME STRUCTURE- COURSE OUTLINE

1. ANIMAL BREEDING AND GENETICS

Course No.	Title	Units
PGC 701	Synopsis and Grant Writing	3
ANS 710	Advanced Statistics and Computer	3
ANS 711	Elements of Animal Bioinformatics	2

2. ANIMAL NUTRITION AND BIOCHEMISTRY

Course No.	Title	Units
ANS 721	Nigerian Animal Feed Industry	3
ANS 724	Recent Advances in Animal Nutrition	3

3. ANIMAL PRODUCTION

Course No.	Title	Units
ANS 740	Animal Waste Management	3
ANS 741	Climate Change and Animal Production	3

4. REPRODUCTIVE PHYSIOLOGY

Course No.	Title	Units
ANS 751	Application of Biotechnology in Animal Reproduction	3
ANS 752	Hatchery Operations	3

5. GENERAL

Course No.	Title	Units
ANS 760	Special Seminar	2
ANS 790	Thesis	18

COURSE DESCRIPTIONS

PGC 701: Synopsis and Grant Writing **3 Units**

This course identifies types and nature of grant and grant writing as well as meaning of grants application calls on the internet. The course Determines appropriate strategy for grant application; Study of various grant application structures and contents and writing of concept notes, detailed project description, budgeting and budget defense. Study of sample grant writings in various forms and writing of mock research and other grants are part of this course. Students are taught University of Nigeria synopsis structure and requirements, (Introduction, Methodology and Results); determining the content of each sub-unit of the synopsis; Steps in writing of synopsis from the Dissertation/Thesis document, Structural and language issues. Common errors in synopsis writing and strategies for avoiding them are discussed. The roles of the student and the supervisor in the writing of synopsis are discussed as well as writing of mock synopsis.

ANIMAL BREEDING AND GENETICS

ANS 710 APPLIED STATISTICS (3 Units)

Statistical packages in animal breeding – Harvey, DEREML, MTDFRML, SAS.

ANS 711 ELEMENTS OF ANIMAL BIOINFORMATICS (3 Units)

Definition of bioinformatics. Introduction to biological database. Sequencing alignment, molecular phylogenetics.

ANIMAL NUTRITION AND BIOCHEMISTRY

ANS 721 NIGERIAN ANIMAL FEED INDUSTRY (3 Units)

History of Nigerian feed industry, Elements of a standard feed mill, Biosecurity in the feed industry, field tests for feed ingredients. Control of pests in the feed mill environment

ANS 724 RECENT ADVANCES IN ANIMAL NUTRITION (3 Units)

Concept of probiotics and prebiotics, place of antibiotics in the livestock industry.

Green meat production, Hazard Analysis and critical control points (HACCP).

ANIMAL PRODUCTION

ANS 740 ANIMAL WASTE MANAGEMENT (3 Units)

Waste from production houses; abattoir waste; Hazards from animal waste, Waste management value chain, biogas production, gas emissions from animal waste, and their control.

ANS 741 CLIMATE CHANGE AND ANIMAL PRODUCTION (3 Units)

Effect of climate change on agriculture, impact of climate change on performance of farm animalsin Africa,Effect of climate change on animal production, Impact of Climate Change on Animal Health, mitigation strategies for reducing the impact of climate change on farm animals.

REPRODUCTIVE PHYSIOLOGY

ANS 751 APPLICATIONOF BIOTECHNOLOGY IN ANIMAL REPRODUCTION

(3 Units)

Assessment of gamete quality, sexing of gametes, processing of gametes (ova and spermatozoa); superovulation and embryo recovery, *in vitro* fertilization.

ANS 752 HATCHERY OPERATIONS (3 Units)

Handling of eggs, Grading of eggs, incubation and hatchery environment buildings and equipment, Biosafety, Handling of day old chicks.

GENERAL

ANS 760: SPECIAL SEMINAR (2 Units)

Candidates are required to present a special seminar on any topic in their areas of specialization.

ANS 790 THESIS (18 Units)

In addition to a comprehensive research leading to a thesis, the student shall give seminars on his research project proposal, on a special topic in his/her area of specialization, and on the finished research.