



UNIVERSITY of
RWANDA

UNIVERSITY OF RWANDA

COLLEGE OF VETERINARY MEDICINE AND ANIMAL SCIENCES

SCHOOL OF ANIMAL SCIENCES AND BIOTECHNOLOGY

DEPARTMENT OF ANIMAL PRODUCTION

PROGRAMME HANDBOOK

Programme of Master of Science in Animal Production

Award: Master of science in Animal Production

Programme Code: MD6ANP

NQF Level: 9

Academic Year: 2026 / 2027

Campus: NYAGATARE

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1 Welcome and Introduction

1.1 Welcome message

Welcome to the Master of Science in Animal Production programme at the School of Animal Sciences and Biotechnology. We are delighted to extend our warmest greeting to our incoming postgraduate students, esteemed faculty, industry partners, and key stakeholders in livestock production. The programme offers two specialized options; Animal Nutrition and Animal Breeding & Genetics, essential for advancing sustainable livestock production and food security.

Dr. Eric HATUNGIMANA

Dean, School of Animal Sciences and Biotechnology

College of Veterinary medicine and Animal Sciences

University of Rwanda

1.2 Purpose and status of this handbook

This handbook describes the Master of Science in Animal Production programme as approved by the University of Rwanda Senate and the Rwanda Higher Education Council (HEC). It should be read together with the University of Rwanda Academic Regulations for postgraduate programs, and the Academic Calendar for the year of study. Where any statement in this handbook conflicts with the University regulations, the University regulations take precedence. The University reserves the right to amend the content of this handbook. Any amendment will be approved through the standard quality assurance channels and published on UR website.

2 Programme at a Glance

Programme title	Master of Science in Animal Production
Exit Award / qualification	Master of Science in Animal Production Option: Animal Nutrition Option: Animal Breeding and Genetics
Intermediate Award / qualification	N/A
Programme code	MD6ANP
College	College of Veterinary Medicine and Animal Sciences
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Campus(es) of delivery	Nyagatare campus
NQF / qualification level	9
Total credits required	240
Standard duration	2 years full-time
Maximum registration period	3 years
Mode of delivery	Blended
Language of instruction	English
Intake(s) per year	September only
Professional accreditation	Rwanda Higher Education Council

3 Programme Goals and Learning Outcomes

3.1 Programme rationale

The Master of Science in Animal Production is aligned with Rwanda's National Strategy for Transformation (NST2) and Vision 2050 framework to transition the country into a high-value, knowledge-based economy, and directly addresses East Africa's urgent imperative to modernize its livestock sector. Despite livestock accounting for over 14% of Rwanda's agricultural GDP, severe sector skills gaps persist in climate-smart animal husbandry, modern genetics, feed security, and disease control. This programme bridges these critical deficits by producing advanced specialists equipped to boost livestock productivity, expand commercial processing capacity, and enforce stringent food safety standards. Ultimately, the programme satisfies a clear regional labor-market demand for expert researchers, and policy leaders capable of scaling sustainable livestock value chains, reducing rural poverty, and securing national food and nutrition security.

3.2 Programme learning outcomes

On successful completion of this programme, graduates will be able to:

Code	Programme Learning Outcome
PLO1	Explain advanced principles of animal production science related to livestock growth, health, reproduction, nutrition, and productivity under diverse production systems.
PLO2	Apply appropriate statistical and research methods to animal production data to support evidence-based decision-making.
PLO3	Demonstrate appropriate use of advanced reproductive technologies and management strategies to improve breeding efficiency and genetic progress in livestock populations.
PLO4	Analyze animal nutrition and feeding strategies in relation to animal performance, product quality, and production efficiency.
PLO5	Differentiate livestock production systems based on animal welfare, environmental sustainability, resource efficiency, and economic viability.
PLO6	Evaluate research findings, production interventions, and management strategies to address contemporary challenges in animal production.
PLO7	Design scientifically sound research studies addressing contemporary challenges in animal production, including appropriate experimental designs, data collection, analysis, and interpretation.
PLO8	Develop innovative and context-appropriate solutions to animal production challenges by integrating advances in genetics, nutrition, reproduction, biotechnology, management, and sustainable agriculture.

4 Entry Requirements and Admission

4.1 Standard entry requirements

Entry requirements in this program are available on <https://ur.ac.rw/spip.php?page=admissions> and concern the following:

- Academic qualification
- Subject pre-requisites
- Minimum grade
- Language proficiency
- Other requirements: Bachelor's degree in animal production, veterinary Medicine, Aquaculture, Livestock Management and other Related fields (Upper Second-Class Division or Second-Class Lower Division with at least 2 years of experience); Proof of English Proficiency for non-English medium graduates.

For international applicants, other documentation may be required, such as equivalency requirements, visa and residence permit requirements

4.2 Application, selection and registration process

Application, selection and registration in programme follows university approved process available on <https://ur.ac.rw/spip.php?page=admissions> and concern the following

Step	Activity	Responsible
1	Application submitted through UR online admission portal	Applicant
2	Eligibility screening against published criteria	Registrar Office
3	Academic selection / interview / entrance test	Registrar Office and Colleges selection panel
4	Admission decision communicated	Registrar Office
5	Registration and enrolment	Admitted student

4.3 Programme Fees & Payments

On this link <https://ur.ac.rw/spip.php?page=university-fees-structure> you can find all updated official information about fees at the University of Rwanda. Information applies for Academic Administrative fees and Tuition fees for Undergraduate and Postgraduate programmes.

5 Programme Structure: Modules, Units and Credits

5.1 Credit framework

One credit represents 10 notional learning hours, comprising contact hours, guided independent study and assessment. The total credit load for this programme is 240 credits.

Credits per semester (normal load)	60 credits
Credits per academic year	120 credits
Total programme credits	240 credits
Minimum credits for the award	240 credits
Notional hours per credit	10 hours

5.2 Curriculum by year and semester

The Master of Science in Animal Production programme is structured over two years and offers two options: Animal Nutrition and Animal Breeding and Genetics. The curriculum is organized by year and semester to progressively develop students' knowledge, professional skills, research competencies, and specialization.

Year 1, Semester 1 comprises common foundational modules that provide advanced knowledge and skills relevant to both options. **Year 1, Semester 2** includes specialization modules, allowing students to pursue either Animal Nutrition or Animal Breeding and Genetics according to their selected option.

Year 2 comprises common modules for students from both options, with the learning activities, research work, and application of knowledge customized to the individual student's **master's thesis topic and area of specialization**. This structure enables students to integrate the knowledge and skills acquired during the programme into an independent research project, culminating in thesis writing and defense.

5.2.1 Year 1

Module code	Module / unit title	Credits	Type	Semester	Prerequisite
ANP6121	Biochemistry	10	Core	1	-
ANP6122	Biometrics	10	Core	1	-
ANP6123	Animal Genetics	10	Core	1	-
ANP6124	Animal Ethology and Welfare	10	Core	1	
ANP6125	Research Methodology	20	Core	1	ANP6122
ANP6221A	Animal Nutrition	20	Specialized	2	ANP6121,
ANP6222A	Specialized Nutrition and Feeding	20	Specialized	2	ANP6121, ANP6124, ANP6125, ANP6221A.
ANP6223A	Feed Science and Technology	20	Specialized	2	ANP6121, ANP6124, ANP6125, ANP6221A.
ANP6224B	Animal Breeding	20	Specialized	2	ANP6122, ANP6123, ANP6124
ANP6225B	Bioinformatics	20	Specialized	2	ANP6222, ANP6123, ANP6224B
ANP6226B	Animal Genetic Resources Management	20	Specialized	2	ANP6123, ANP6124, ANP6224B.

A: Option of Animal Nutrition, B= Option of Animal breeding and Genetics

5.2.2 Year 2

Module code	Module / unit title	Credits	Type	Semester	Prerequisite
ANP6321	Research Proposal Writing	20	Core	3	ANP 6125
ANP6322	Research Proposal Approval	20	Core	3	ANP 6125, ANP6321
ANP6323	Research Proposal Defense	20	Core	3	ANP6125, ANP6321, ANP6323
ANP6421	Experiment Setup	20	Core	4	ANP 6125
ANP6422	Data Collection and Analysis	20	Core	4	ANP 6125, ANP6421
ANP6423	Thesis Writing and Defense	20	Core	4	ANP6125, ANP6421, ANP6422

For option of Animal Nutrition (A), there are three modules with 60 credits in total, taken in semester two, and for option of Animal Breeding and Genetics, there are three modules with 60 credits in total, taken in semester two in year one.

5.3 Programme structure summary

Component	Number of modules	Credits	% of programme
Core / compulsory modules	5	60	25%
Elective / specialization modules	3	60	25%
Research project / dissertation / thesis	6	120	50%
Industrial attachment / practicum	-	-	-
Total	14	240	100%

6.1 ANP6121: Biochemistry

Module code and name	ANP6121: Biochemistry
School	School of Animal Sciences and Biotechnology
Department	Animal Production
Programme	Master of Science in Animal Production
Number of credits	10
Year of study and semester	Year 1, Semester 1
Prerequisites:	-

6.1.1 Module introduction and aim

This Module and related exercises and laboratory practices are designed to cover the structure and function of biological molecules, especially proteins, lipids and carbohydrates. Important concepts include bioenergetics, biological catalysis, and metabolic pathways as interacting with regulated systems.

6.1.2 Module Indicative content

Unit 1: General Biochemistry I – Biomolecules

This unit introduces cellular, subcellular, and molecular structures and their functions, with emphasis on cellular and molecular biology. It covers the structure, properties, functions, and significance of major biomolecules, including amino acids, proteins, carbohydrates, nucleic acids, lipids, and vitamins, as well as pH, buffers, and laboratory procedures for investigating biological molecules.

Unit 2: General Biochemistry II – Metabolism

This unit introduces physical chemistry concepts relevant to biology, including thermodynamics, kinetics, statistical and quantum mechanics, and spectroscopy, with applications to macromolecular structure, ligand binding, enzyme catalysis, and membrane transport. It also covers bioenergetics, enzyme mechanisms and regulation, and major metabolic pathways, including glycolysis, gluconeogenesis, the pentose phosphate pathway, citric acid cycle, and photosynthesis.

Unit 3: Laboratory Training – Instrumental Analysis

This unit provides practical training in instrumental chemical and molecular analysis techniques, including GC, HPLC, ion chromatography, atomic absorption and emission spectroscopy, capillary electrophoresis, size exclusion chromatography, spectrophotometry, PCR, DNA cloning, immunoblotting, RNA hybridization, and computer-based DNA and protein sequence analysis. Practical activities include working with animals, plants, yeast, and bacterial systems, focusing on enzymology, protein purification, gene expression, and gene organization.

6.1.3 Teaching and Learning Methods

Lectures, discussions, assignments, and self-directed reading will develop knowledge and skills, supported by blended learning through the UR E-Learning platform. Guided laboratory sessions will develop practical skills in biochemical and molecular biological methods, instrumentation, analysis, and scientific literature and genomic database searches. Group tutorials, practical exercises, dissertation work, and presentations will promote collaborative learning, student participation, and application of concepts to practical problems.

6.2 ANP6122: Biometrics

Module code and name	ANP6122: Biometrics
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production
Number of credits	10
Year of study and semester	Year 1, Semester 1
Prerequisites:	-

6.2.1 Module introduction and aim

This module teaches advanced statistics and biometry. The module is designed to provide learners with knowledge on experimental design, data collection, data exploration and analyses. The course focuses on lectures and problem sets.

6.2.2 Module Indicative content

Experimental Design and Data Exploration

Principles of experimental design and census techniques; design of field experiments, including their characteristics, merits, and limitations; principles of experimentation; data exploration; statistical tools, including statistical tests and reporting of results; distributions, including normal and other distributions and data transformation; and management of missing data.

Statistical Analysis and Modelling

Regression analysis and analysis of variance; analysis of categorical data; Generalized Linear Models; Mixed Linear Models; and Restricted Maximum Likelihood (REML).

Multivariate and Advanced Analysis

Multivariate analysis, including Principal Components Analysis (PCA), discriminant analysis, and cluster analysis; and Genotype × Environment Interaction Analysis.

6.2.3 Teaching and Learning Methods

The learning strategy will rely on lectures, self-reading, practical projects, and data exercises. Blended learning will be implemented through the UR E-Learning platform to provide learning materials, facilitate online discussions, and support students' independent learning. Students will be tested on their level of understanding of the materials covered in class through appropriate assessments and data exercises.

6.3 ANP6123: Animal Genetics

Module code and name	ANP6123: Animal Genetics
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production
Number of credits	10
Year of study and semester	Year 1, Semester 1
Prerequisites:	-

6.3.1 Module introduction and aim

This module and related exercises and laboratory practices are designed to equip students with a broad and integrated understanding of the established principles of farm animal genetics, with the ability describe and analyze the genetic constitution of animal populations, analyze and apply the principles and techniques of cytogenetics and genetic manipulation of nucleic acids (DNA, RNA) and proteins, applied to animal systems, production and breeding.

6.3.2 Module Indicative content

Unit 1: Population and Quantitative Genetics

Covers population genetics, including gene and genotypic frequencies, Hardy-Weinberg equilibrium, quantitative inheritance, genetic and environmental variation, heritability, repeatability, trait correlations, inbreeding, crossbreeding, heterosis, inbreeding depression, and an introduction to genomic selection.

Unit 2: Animal Cytogenetics

Covers principles and techniques of animal cytogenetics, including chromosome preparation, mitosis and meiosis, karyotyping, chromosome banding and mapping, chromosome structure and function, and comparative cytogenetics.

Unit 3: Molecular Biology

Covers nucleic acid structure and organization, DNA and RNA, genes and gene expression, transcription, translation, replication, DNA repair, genetic mutations and rearrangements, and evolutionary concepts such as gene divergence and gene families.

Unit 4: Practical Works (Animal Genetics)

Provides practical training in DNA extraction and purification, cDNA synthesis, electrophoresis, PCR, DNA sequencing, sequencing reactions, and sequence gel analysis.

6.3.3 Teaching and Learning Methods

Knowledge and skills will be developed through lectures, discussions, self-reading, assignments, and guided practical laboratory sessions. Students will undertake a dissertation on animal genetics and resources and participate in laboratory activities involving cytogenetic analyses and molecular techniques. Group tutorials, problem-solving exercises, presentations, and discussions will promote active student participation and application of concepts to practical problems. Blended learning will be implemented through the UR E-Learning platform to provide lecture notes and learning resources, facilitate online discussions, support self-directed learning, and complement face-to-face teaching and practical sessions.

6.4 ANP 6124: Animal Ethology and Welfare

Module code and name	ANP 6124: Animal Ethology and Welfare
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production
Number of credits	10
Year of study and semester	Year 1, Semester 1
Prerequisites:	-

6.4.1 Module introduction and aim

The course considers the protection and welfare of animals, especially scientific research in this area. The emphasis will be farm and pet animals, although much of the information will be relevant also to other categories of animals and to a wide range of different contexts e.g. housing, management, transport, competition, exhibition, slaughter, etc. Basic information on the legislation for the protection of animals and ethical views regarding animals will be provided.

6.4.2 Module Indicative content

Unit 1: Animal Behavior and Handling

This unit covers animal ethology, behavior, handling, and welfare, with emphasis on species-specific behavioral needs and their influence on domestic, pet, and captive animals. It addresses applied ethology, objective observation and recording of behavior, behavioral disorders arising from captive conditions, and the neuronal and endocrine mechanisms underlying behavior, including stress, reward and punishment, psychopharmacological, pheromonal, and nutritional influences.

Unit 2: Animal Health Management

This unit examines the interaction between animal health and behavior, including behavioral disorders with medical causes and the influence of disease on behavior. It develops professional skills in clinical communication, assessment, diagnosis, and management of behavioral disorders, including differential diagnosis and appropriate treatment planning in domestic and captive animals.

Unit 3: Animal Welfare and Ethics

This unit explores ethical frameworks and national and international laws governing animal welfare and clinical animal behavior practice. It introduces relevant animal welfare, health and safety, and employment legislation, legal processes, guidelines, and their practical application to animal-related professional activities through case studies.

6.4.3 Teaching and Learning Methods

Knowledge and skills will be developed through lectures, discussions, self-reading, assignments, exercises, and group seminars involving critical assessment of animal welfare research papers. Students will undertake group tutorials and project work involving the design of studies to improve animal protection and welfare, with presentations and discussions to encourage active participation and application of knowledge. Blended learning will be implemented through the UR E-Learning platform to provide lecture notes and learning resources, facilitate online discussions, and support self-directed learning alongside face-to-face teaching.

6.5 ANP6125: Research Methodology

Module code and name	ANP6125: Research Methodology
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production
Number of credits	20
Year of study and semester	Year 1, Semester 1
Prerequisites:	ANP6122

6.5.1 Module introduction and aim

This module is designed to provide skills in research methods for international standard scientific writing and communication. The module will equip students with skills on how to develop their thesis proposal and select appropriate methods of data collection and analysis. At the end of the module the students will be knowledgeable in the value of intellectual property rights and scientific ethics.

6.5.2 Module Indicative content

Unit 1: Research Methods

This section introduces quantitative, qualitative, and mixed-methods research approaches and the design of research projects, including formulation of research questions, hypothesis testing, and alternative research approaches. It covers quantitative procedures such as research design, field and experimental sampling in Animal Sciences, summary statistics, data analysis, correlation and regression, analysis of variance, categorical and non-parametric data analysis, and multivariate analysis. Qualitative procedures include interviewing, ethnographic methods, surveys, action research, data recording, case studies, and qualitative data analysis.

Unit 2: Scientific Writing

This section covers the preparation of research proposals, including the introduction, literature review, methodology, and budgeting. It also develops skills in the effective use of library databases and scientific resources and the appropriate use of scientific language in academic and research writing.

Unit 3: Scientific Communication and Intellectual Property Rights (IPR)

This section introduces scientific communication through peer-reviewed publication and technology transfer tools and skills. It also addresses data validity and reliability, plagiarism, study subjects, and research ethics.

6.5.3 Teaching and Learning Methods

Lectures will cover research project design, qualitative and quantitative methods, ethical considerations, and data validity in animal science research. Hands-on exercises and problem-based learning will develop skills in statistical tools, qualitative data collection, data analysis, and research software using animal science examples and existing datasets. Students will mentor undergraduate Animal Science students in developing research proposals and critique research articles to strengthen critical thinking, research evaluation, and scientific writing skills. Students will prepare a draft research proposal throughout the semester, receiving formative feedback from the instructor and research advisor to guide further development and final approval.

6.6 ANP6221A: Animal Nutrition

Module code and name	ANP6221A: Animal Nutrition
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production, Option of Animal Nutrition
Number of credits	20
Year of study and semester	Year 1, Semester 2
Prerequisites:	ANP6121

6.6.1 Module introduction and aim

The aim of this module is to increase skills of students in animal feed requirements and metabolism and relate it to physiologic functions of different organs in the ruminants and monogastric animals. The students will be able to use the knowledge and skills in animal nutrition and analytical techniques to assess the feeding value and potential role of animal feed resources.

6.6.2 Module Indicative content

Nutrient Metabolism and Digestive Physiology

This section covers carbohydrates, protein, and lipid metabolism in different animal categories, energy metabolism and requirements, endocrine regulation, nutritionally important minerals and vitamins, and enzyme functions. It also addresses digestion in monogastrics and ruminants, ruminal microbial characterization, microbial protein synthesis and utilization, carbohydrate utilization, and aerobic and anaerobic respiration.

Rumen Fermentation and Nutrient Utilization

This section covers rumen microbial fermentation, kinetic parameters, and fermentation products, including short-chain fatty acids such as acetate, lactate, and propionate. It also addresses digestibility and degradability experiments, nutrient requirements for maintenance, growth, fattening, and lactation, digestive disorders in ruminants including acetonemia, ketosis, and bloat, and mathematical modelling of nutrient utilization.

Feed Analysis, Evaluation, and Laboratory Techniques

This section covers laboratory feed analysis and feed evaluation using techniques such as Near Infrared Reflectance Spectroscopy (NIRS), *in vitro*, *in sacco*, *in vivo*, and *in vitro* gas production techniques, and proximate feed analysis. It also includes calibration and use of laboratory equipment, including NIRS and inductively coupled plasma (ICP) instruments.

6.6.3 Teaching and learning methods

Teaching and learning will be conducted through lectures, tutorials, presentations, illustrations, field trips, laboratory practicals, models, written assignments, group work, class discussions, and seminars. Blended learning will be integrated through the UR E-Learning platform to provide learning materials, facilitate online discussions, support student participation, and complement face-to-face teaching and practical activities.

6.7 ANP6222A: Specialized Animal Nutrition and Feeding

Module code and name	ANP6222A: Specialized Animal Nutrition and Feeding
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production, Option of Animal Nutrition
Number of credits	20
Year of study and semester	Year 1, Semester 2
Prerequisites:	ANP6121, ANP6123, ANP6125, ANP6221A

6.7.1 Module introduction and aim

This module covers the principles of animal nutrition, the physiological processes of digestion and metabolism, and practical livestock feeding strategies. Students learn to evaluate feed ingredients, formulate balanced rations, and optimize animal health and production efficiency. To provide students with a foundational understanding of nutrient requirements, feed evaluation, and ration formulation to ensure effective and sustainable livestock feeding management.

6.7.2 Module Indicative content

Unit 1: Ruminant Nutrition (Dairy, Beef, and Small Ruminants)

This unit covers nutrients and their metabolism in relation to milk and meat production, feeding standards, feedstuff classification, and nutrient requirements of calves, heifers, dry, pregnant, and lactating cattle, sheep, and goats. It addresses milk replacers, calf starters, feed formulation, feeding systems, strategic feeding of high-yielding dairy cows, bypass nutrients, CLA and omega fatty acids, value addition in milk, and feeding management across physiological stages, dry seasons, and agro-climatic zones.

Unit 2: Non-Ruminant Nutrition (Pigs and Poultry)

This unit covers nutrient metabolism and requirements of poultry and swine at different stages of growth and production, complete feed formulation and feeding systems, feed additives, least-cost rations, and quality control for efficient egg and meat production. It also addresses nutrition-related disease and stress, nutritional factors affecting product quality, hindgut fermentation, limiting amino acids such as lysine and methionine, the ideal protein concept, and nutritional manipulation for value-added eggs, meat, and pork.

6.7.3 Teaching and Learning Methods

Teaching and learning will be conducted through lectures, tutorials, group assignments, class presentations, discussions, and guided self-reading to develop students' knowledge and practical skills. Blended learning will be implemented through UR E-Learning platform to provide learning materials, support online discussions, and facilitate independent learning beyond classroom sessions. Assignments and self-reading exercises will encourage students to examine feeding constraints across different physiological stages of livestock and agro-ecological zones. Practical exercises will focus on ration formulation and discussion of feed resource availability, enabling students to apply nutritional concepts to practical livestock production challenges.

6.8 ANP6223A: Feed Science and Technology

Module code and name	ANP6123A: Feed Science and Technology
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production, Option of Animal Nutrition
Number of credits	20
Year of study and semester	Year 1, Semester I
Prerequisites:	ANP6121, ANP6123, ANP6125, ANP6221A, ANP6222A

6.8.1 Module introduction and aim

This module provides advanced knowledge of raw material evaluation, industrial feed processing technologies, feed safety, quality management, feed additives, and sustainable feed supply chains. It equips students with scientific and technological expertise to evaluate feed ingredients, understand processing operations and their effects on nutrient bioavailability and animal performance, and apply relevant regulatory and safety frameworks. The module aims to enable students to design optimized, safe, and sustainable feed manufacturing systems for efficient animal production.

6.8.2 Module Indicative content

Feed Evaluation and Processing Technology

This section covers the importance of feed technology in animal productivity, evaluation of the biological, chemical, and physical nutritional quality of feed ingredients, feed manufacturing operations, and familiarization with feed mill equipment, layout, and operations. It includes handling, grinding, mixing, pelleting, crumbling, flaking, popping, extrusion, equipment handling, and quarantine measures.

Feed Formulation, Quality Control, and Safety

This section addresses feed formulation, including concentrate mixtures, premixes, and computer-based ration formulation, as well as instrumentation and analytical techniques for quality control and research. It also covers problems in feed manufacturing units and control measures, feed safety systems, Codex Alimentarius, HACCP, and relevant laws and regulations governing the feed manufacturing industry.

Feed Plant Management and Automation

This section covers organization and management of small, medium, and large feed plants, including organizational structures, labour standards, planning, production programmes, and personnel management. It also examines automated feed mills, their operation, equipment management, and the merits and demerits of automation.

6.8.3 Teaching and Learning Methods

This is a theory-based module. The learning strategy will rely on lectures, tutorials, group assignments, class presentations, and self-directed reading to develop students' knowledge and understanding. Blended learning will be implemented through the UR E-Learning platform to provide learning materials, facilitate online discussions, and support independent learning beyond classroom sessions. Students will be assessed on their understanding of the materials covered through appropriate assessments.

6.9 ANP6224B: Animal Breeding

Module code and name	ANP6224B: Animal breeding
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production, Option of Animal Breeding and Genetics
Number of credits	20
Year of study and semester	Year 1, Semester 2
Prerequisites:	ANP6122, ANP6123, ANP6124

6.9.1 Module introduction and aim

This module covers the genetic principles and applied breeding methodologies used to improve livestock through selective breeding. It addresses quantitative and population genetics, breed evaluation, selection indices, and reproductive and genomic technologies such as artificial insemination, embryo transfer, and marker-assisted selection. The module equips students with knowledge and skills to evaluate, design, and implement effective livestock improvement programmes that enhance production efficiency, herd health, genetic diversity, and sustainable animal production.

6.9.2 Module introduction and aim

Unit 1: Animal Genetic Evaluation

This unit covers statistical and matrix methods for animal genetic evaluation, genetic variation and parameter estimation, genetic covariance among relatives, and prediction of breeding values using selection indices and BLUP. It also introduces genomic evaluation and genomic selection.

Unit 2: Animal Breeding Programmes

This unit covers the development, design, evaluation, modelling, and optimization of animal breeding programmes, including breeding goals, economic weights, selection criteria, genetic evaluation, mating strategies, genetic gain, inbreeding, and the long-term effects of artificial selection, with emphasis on the organization of animal genetic improvement in Rwanda.

Unit 3: Animal Reproductive Biotechnologies

This unit covers advances and applications of reproductive biotechnology, including embryo transfer, donor and recipient management, superovulation, embryo collection and cryopreservation, IVF, embryo evaluation, micromanipulation, sexing, embryo transfer methods, record keeping, and follow-up.

6.9.3 Teaching and Learning Methods

Teaching and learning will be conducted through lectures, tutorials, presentations, laboratory and computer practices, models, written assignments, group work, class discussions, and seminars. Blended learning will be implemented through the UR E-Learning platform to provide learning materials, facilitate online discussions, support self-directed learning, and complement face-to-face teaching and practical activities.

6.10 ANP6225B: Bioinformatics

Module code and name	ANP6225B: Bioinformatics
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production, Option of Animal Breeding and Genetics
Number of credits	20
Year of study and semester	Year 1, Semester 2
Prerequisites:	ANP6122, ANP6123, ANP6324B

6.10.1 Module introduction and aim

This module introduces foundational concepts, computational tools, and algorithms for analyzing and interpreting biological data. It covers retrieval of nucleic acid sequences from GenBank, EMBL, and DDBJ databases, protein sequence alignment, database searching, and structural bioinformatics. Students will also develop skills in phylogenetic analysis and interpretation of high-throughput sequencing data using practical software applications. The module equips students with theoretical and practical computational skills to analyze complex biological data for applications in genomics, molecular biology, and modern animal sciences.

6.10.2 Module Indicative content

Introduction to Bioinformatics and Biological Databases

This section introduces global approaches in biology and the fundamentals of bioinformatics, including major biological databases such as NCBI, GenBank, ExPASy, PDB, EBI, DDBJ, SCOP, CATH, SWISS-PROT, TrEMBL, and PIR-PSD.

Genomics and Genome Analysis

This section covers the structure and organization of genomes, model genomes and genome programmes, gene identification, genome composition, evolution and variation, and genomic mapping.

Sequence Alignment and Structure Prediction

This section covers protein and nucleotide sequence alignment and comparison to identify common genes, conserved regions, evolutionary relationships, and sequence changes such as insertions, deletions, and substitutions. It also introduces RNA structure and properties, RNA secondary structure, protein structure, and protein structure prediction, with emphasis on understanding protein folding, function, and molecular evolution.

6.10.3 Teaching and Learning Methods

Teaching and learning will be conducted through lectures, tutorials, presentations, illustrations, laboratory practices and models, written assignments, group work, class discussions, and seminars. Blended learning will be implemented through the UR E-Learning platform to provide learning materials, facilitate online discussions, support self-directed learning, and complement face-to-face teaching and practical activities.

6.11 ANP6226B: Animal Genetic Resources Management

Module code and name	ANP6226B: Animal Genetic Resources Management
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production, Option of Animal Breeding and Genetics
Number of credits	20
Year of study and semester	Year 1, Semester 2
Prerequisites:	ANP6123, ANP6124, ANP6324B

6.11.1 Module introduction and aim

This module focuses on the identification, characterization, sustainable utilization, and conservation of livestock and poultry biodiversity. It examines animal genetic resources and their adaptation to diverse ecosystems, climatic conditions, and production systems. The module addresses genetic erosion and strategies for evaluating, improving, monitoring, and conserving local and transboundary genetic resources. It covers breeding and conservation approaches that strengthen food production systems against climate change, emerging diseases, and changing market demands. The module equips students with scientific, technical, and policy skills to implement sustainable breeding and conservation strategies that protect livestock biodiversity and improve food security.

6.11.2 Module Indicative content

Unit 1: Genetic Resources Diversity and Conservation

This unit covers global perspectives on animal genetic resources (AnGR) and their importance for sustainable agriculture, food production, food security, and poverty alleviation in tropical regions. It addresses characterization and utilization of indigenous animal genetic resources, including on-farm surveys, indigenous knowledge, intellectual property and rights. The unit also introduces quantitative methods for AnGR, including data collection and management, statistical analysis, estimation of genetic and non-genetic effects, QTL mapping, molecular assessment of genetic diversity, and genetic relationships among populations. It further examines biodiversity, plant and animal genetic resources, their characterization, conservation, utilization, economic valuation, wildlife management, and genetic resources of rhizosphere microorganisms.

Unit 2: Concepts of Gene Banks

This unit introduces gene banks as biorepositories for preserving genetic materials for future use, with emphasis on animal genetic resources and cryopreservation of reproductive materials. It covers different types of gene banks, including seed, tissue, cryobank, pollen, field, sperm, ova, and biobanks, as well as biological databanks. The unit also introduces genetic resource information systems, including AEGIS, Genebanks, and Genesys.

6.11.3 Teaching and Learning Methods

Knowledge and skills will be developed through lectures, discussions, assignments, self-reading, and guided practical activities using available methods, equipment, hardware, and software. Students will undertake dissertation work and practical activities involving genetic resources, biodiversity, and gene banks, supported by guided literature and audio-visual sessions. Blended learning will be implemented through the UR E-Learning platform to provide learning materials, facilitate online learning and discussions, and support self-directed learning.

6.12 ANP6321: Research Proposal Writing

Module code and name	ANP6321: Research Proposal Writing
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production
Number of credits	20
Year of study and semester	Year 1, Semester I
Prerequisites:	ANP6125

6.12.1 Module introduction and aim

This module equips students with the knowledge and skills to conceptualize, structure, and develop rigorous research proposals. It covers problem identification, literature synthesis, methodological design, ethical considerations, and resource planning required for academic and institutional research. The module aims to enable students to formulate clear research questions and develop coherent, academically sound proposals that demonstrate methodological feasibility, scientific merit, and societal relevance.

6.12.2 Module Indicative content

- A solid foundation in knowledge, understanding, skills and values on which further research thesis writing can be built.
- Deep knowledge, understanding, skills and values that will enable the student to create new research ideas and translate them into practical applications.
- General capabilities to explain explicitly research ideas to an audience with various backgrounds clearly explaining the relevancy of research ideas to development.

6.12.3 Teaching and Learning Methods

Lectures will guide students in gathering relevant documentation, developing research problems and justifications, preparing budgets and timelines, and developing presentation skills, with feedback provided after each topic. Written assignments will require students to apply lecture content to develop a standard scientific research proposal, with emphasis on the quality of scientific writing. Oral assignments will assess students' presentation skills and their ability to communicate and defend a research idea. The final examination will assess both the completed and accepted research proposal and the student's ability to defend the proposal.

6.13 ANP 6322: Research Proposal Approval

Module code and name	ANP6321: Research Proposal Approval
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production
Number of credits	20
Year of study and semester	Year 2, Semester 1
Prerequisites:	ANP6125, ANP6321

6.13.1 Module introduction and aim

This module prepares students to design, write, and defend a rigorous, scientifically sound research proposal suitable for institutional approval and ethics review. It equips learners with essential skills in literature review synthesis, problem statement formulation, methodology design, data analysis planning, and research ethics compliance. By the end of the module, students will produce and present a fully structured, viable research proposal ready for formal committee evaluation and academic execution.

6.13.2 Module Indicative content

- A solid foundation in knowledge, understanding, skills and values on which further research thesis writing can be built.
- Deep knowledge, understanding, skills and values that will enable the student to create new research ideas and translate them into practical applications.
- General capabilities to explain explicitly research ideas to an audience with various backgrounds clearly explaining the relevancy of research ideas to development.

6.13.3 Teaching and Learning Methods

Lectures will guide students in gathering relevant documentation, developing research problems and justifications, preparing budgets and timelines, and developing presentation skills, with feedback provided after each topic. Written assignments will require students to apply lecture content to develop a standard scientific research proposal, with emphasis on the quality of scientific writing. Oral assignments will assess students' presentation skills and their ability to communicate and defend a research idea. The final examination will assess both the completed and accepted research proposal and the student's ability to defend the proposal.

6.14 ANP 6323: Research Proposal Defense

Module code and name	ANP6323: Research Proposal Defense
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production
Number of credits	20
Year of study and semester	Year 2, Semester 1
Prerequisites:	ANP6125, ANP6321, ANP6323

6.14.1 Module introduction and aim

This module is designed to be used (in addition to the skills acquired from Research Methodology module) by students to help them prepare scientific proposals. This module will explain the basics that need to be kept in mind when crafting a project proposal. Tips for making proposals an efficient and effective undertaking will be highlighted.

6.14.2 Module Indicative content

- A solid foundation in knowledge, understanding, skills and values on which further research thesis writing can be built.
- Deep knowledge, understanding, skills and values that will enable the student to create new research ideas and translate them into practical applications.
- General capabilities to explain explicitly research ideas to an audience with various backgrounds clearly explaining the relevancy of research ideas to development.

6.14.3 Teaching and Learning Methods

Lectures will guide students in gathering relevant documentation, developing research problems and justifications, preparing budgets and timelines, and developing presentation skills, with feedback provided after each topic. Written assignments will require students to apply lecture content to develop a standard scientific research proposal, with emphasis on the quality of scientific writing. Oral assignments will assess students' presentation skills and their ability to communicate and defend a research idea. The final examination will assess both the completed and accepted research proposal and the student's ability to defend the proposal.

6.15 ANP6421: Experiment Set Up

Module code and name	ANP6421: Experiment Set Up
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production
Number of credits	20
Year of study and semester	Year 2, Semester 2
Prerequisites:	ANP6125, ANP6321, ANP6322, ANP6323

6.15.1 Module introduction and aim

This module is designed to provide skills in research methods (quantitative and qualitative approaches) for international standard scientific writing and communication. The module will equip students with skills on how to develop their thesis proposal and select appropriate methods of data collection and analysis. At the end of the module the students will be knowledgeable in the value of intellectual property rights and scientific ethics.

6.15.2 Module Indicative content

Unit 1: Research Methods

This unit introduces quantitative, qualitative, and mixed research approaches, including research design, formulation of research questions and hypotheses, and alternative research approaches. It covers quantitative procedures in animal sciences, including field and experimental sampling, statistical analysis, summary statistics, correlation and regression, analysis of variance, categorical, non-parametric, and multivariate data. Qualitative procedures include interviewing, ethnographic methods, surveys, action research, data recording, case studies, and qualitative data analysis.

Unit 2: Scientific Writing

This unit develops students' skills in writing research proposals, including the preparation of introductions, literature reviews, methods, and budgets. It also covers effective use of library databases and other research resources, as well as the use of appropriate scientific language in research writing.

Unit 3: Scientific Communication and Intellectual Property Rights (IPR)

This unit covers peer-reviewed publication, technology transfer tools and skills, validity and reliability of research data, plagiarism, research subjects, and research ethics. It develops students' ability to communicate research findings appropriately while observing ethical and intellectual property requirements.

6.15.3 Teaching and Learning Methods

Lectures will cover research project design, qualitative and quantitative methods in animal science research, ethical considerations, and data validity. Hands-on exercises will familiarize students with statistical tools, their applications, qualitative data collection, interviewing, and data coding. Problem-based learning will enable students to explore real animal science problems through research question formulation, data collection, and analysis. Students will apply statistical methods and software to analyse existing or self-generated datasets and interpret research findings.

6.16 ANP6422: Data Collection and Analysis

Module code and name	ANP6422: Data Collection and Analysis
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production
Number of credits	20
Year of study and semester	Year 2, Semester 2
Prerequisites:	ANP6125, ANP6421

6.16.1 Module introduction and aim

This module is designed to be undertaken by a student after successful completion of proposal writing and defense. At this stage the student will be fully equipped to embark on fieldwork. This module will therefore be a tool to steer the student in the desired direction to achieve the aims and objectives stated in his / her proposal. This module will explain the basics that need to be kept in mind when collecting and analyzing data. Tips for making suitable choices relevant to the research topics given will be highlighted.

6.16.2 Module Indicative content

- A solid foundation in knowledge, understanding, skills and values on which further research thesis writing can be built.
- Deep knowledge, understanding, skills and values that will enable the student to create new research ideas and translate them into practical applications.
- General capabilities to explain explicitly research ideas to an audience with various backgrounds clearly explaining the relevancy of research ideas to development.

6.16.3 Teaching and Learning Methods

Lectures will guide students in gathering relevant documentation, developing research problems and justifications, preparing budgets and timelines, and developing presentation skills, with feedback provided after each topic. Written assignments will require students to apply lecture content to develop a standard scientific research proposal, with emphasis on the quality of scientific writing. Oral assignments will assess students' presentation skills and their ability to communicate and defend a research idea. The final examination will assess both the completed and accepted research proposal and the student's ability to defend the proposal.

6.17 ANP6423: Thesis Writing and Defense

Module code and name	ANP6423: Thesis Writing and Defense
School	School of Animal Sciences and Biotechnology
Department	Department of Animal Production
Programme	Master of Science in Animal Production
Number of credits	20
Year of study and semester	Year 2, Semester 2
Prerequisites:	All modules

6.17.1 Module introduction and aim

The module consists of a supervised scientific research project in Animal Science that prepares students for writing and defense. It enables students to identify and formulate scientific research problems and questions, independently search for and critically use relevant scientific literature, apply appropriate scientific methods, and conduct a research project within a defined framework. The module further develops students' ability to present and communicate the different components of the thesis in writing and orally, and to defend the research problem, methodology, findings, conclusions, and overall scientific contribution before an academic examination panel.

6.17.2 Module Indicative content

1. Thesis Writing

The master's thesis consists of a supervised scientific research project in Animal Science. Students are required to independently formulate a research problem, review and use relevant scientific literature, apply appropriate scientific methods, and conduct and report the study. The thesis process is guided by an approved research plan and work plan developed with the supervisor and examiner, specifying the objectives, methodology, implementation, examination requirements, timeline, and supervision arrangements.

2. Thesis Defense

The thesis defense requires students to present their research orally to an academic audience, covering the background, objectives, literature review, methodology, results, conclusions, and discussion. The oral presentation is followed by an examination in which the examiner assesses the student's understanding of the research and ability to explain and defend the findings and conclusions.

6.17.3 Teaching and Learning Methods

Teaching and learning will involve guided discussions, independent literature searches, practical research activities, and supervised thesis writing. Students will develop scientific communication skills through research presentations and mock thesis defense sessions, supported by feedback from supervisors. Blended learning through the UR E-Learning platform will provide access to scientific resources and support independent learning, thesis preparation, and defense.

7 Academic Calendar and Attendance requirements

7.1 Academic calendar — Academic Year 226/2027

UR Academic calendar is available on this link: <https://ur.ac.rw/?-Academic-Calendar-217->

Number of teaching weeks per semester is 15. Examination and assessment weeks per semester are 6.5.

7.2 Attendance requirements

Students are required to attend at least 85% of the scheduled sessions for each module. A student who falls below the minimum attendance without approved cause may be barred from the end-of-module assessment, in line with the University of Rwanda Academic Regulations. Absence must be reported to the Programme Leader in writing with supporting evidence.

8 Assessment

8.1 Assessment strategy

Assessment combines continuous assessment and end-of-semester examinations. The standard weighting is 60% continuous assessment and 40% final examination, unless a different weighting is approved for a module and stated in its description.

Assessment method	Purpose	Typical weighting
Written examination	Summative: tests breadth of knowledge	40%
Coursework / assignment	Formative	10%
Continuous assessment test	Formative: checks progress	20%
Practical / laboratory report	Formative: applied skills	10%
Group project / presentation	Formative: teamwork and communication	20%
Dissertation / thesis	Summative: independent research	100% of the component

8.2 Grading scale

Mark range (%)	Grade	Grade point
80-100	A	4-5
70-79	B	3-3.9
60-69	C	2-2.9
0-59	F	<2

Pass mark per module: 60%. Minimum weighted average for progression: 60%.

8.3 Feedback to students

Students receive written feedback on assessed work. Marks are released after confirmation by the relevant University organs at college level.

8.4 Academic integrity

All submitted work must be the student's own. Plagiarism, collusion, falsification of data and examination misconduct are academic offences under the UR Academic Regulations and are subject to disciplinary action. Submissions may be screened using similarity-detection software.

9 Progression, Graduation and Completion Requirements

9.1 Progression from one year to the next

To progress to the next year of study, a student must meet requirements set by the academic regulation available at <https://ur.ac.rw/spip.php?page=key-documents>

Where a student does not meet these conditions, the student may carry the modules in the following year, repeating the year, or discontinuation in line with the UR Academic Regulations

9.2 Graduation and completion requirements

A student is eligible to graduate with the Master of Science in animal Production after satisfying all of the requirements set by the University Academic Senate:

#	Requirement	Standard
1	Total credits accumulated	As per programme requirements
2	Modules passed	As per academic regulations
3	Financial and property clearance	All fees paid; library and laboratory items returned (As per academic regulations)
4	Approval	Results confirmed by the College Academic Committee and approved by University Academic Senate

9.3 Award of the qualification and graduation ceremony

Awards are conferred upon the satisfaction of requirement set by the University of Rwanda and Academic Senate of the University of Rwanda. Eligible students are presented at the annual graduation ceremony. Transcripts and certificates are issued by the Office of the Registrar following Senate approval.

10 Approval and Key contact

Role	Name	Email
Dean, School of Animal Sciences and Biotechnology (SASB)	Dr. Eric HATUNGIMANA	dean.sasb@ur.ac.rw
Director of Teaching and Learning Enhancement (DTLE)	Dr. Valentin MUJYAMBERE	dtle.cvas@ur.ac.rw
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