**Study Plan**

**School:** School of Sciences and Technology  
**Degree:** Master  
**Course:** Zootechnical Engineering (cód. 447)

### 1st Year - 1st Semester

<table>
<thead>
<tr>
<th>Component code</th>
<th>Name</th>
<th>Scientific Area Field</th>
<th>ECTS</th>
<th>Duration</th>
<th>Hours</th>
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<tbody>
<tr>
<td>MAT10167M</td>
<td>Experimental Design</td>
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<td>Semester</td>
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<tr>
<td>ZOO10419M</td>
<td>Advanced Studies in Animal Physiology</td>
<td>Animal Science</td>
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<td>Semester</td>
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### 1st Year - 2nd Semester

#### Group of Options

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<tr>
<td>ZOO10423M</td>
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<td>Current Issues and New Trends in Meat Production</td>
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### 2nd Year - 3rd Semester

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<td>ZOO10435M</td>
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### Mandatory alternatives

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## 2nd Year - 4th Semester

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### Conditions for obtaining the Degree:

*** TRANSLATE ME: Para aprovação na componente curricular é necessário a aprovação (através de avaliação ou creditação) das seguintes unidades curriculares: {\ }newline

1º Semestre:
- 4 UC obrigatórias num total de 24 Ects

2º Semestre:
- 2 UC optativas do Grupo I num total de 12 Ects
- 2 UC optativas do Grupo II num total de 12 Ects
- No 1.º ano tem de obter aprovação a uma UC obrigatória anual num total de 12 Ects

3º Semestre:
- 2 UC obrigatórias num total de 12 Ects
- 1 UC optativa do Grupo III num total de 6 ECTS

Para obtenção do grau, é necessário também a aprovação na Dissertação, Estágio ou Trabalho de Projecto, com um total de 42 ECTS, no 3.º e 4.º Semestre. ***

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**Program Contents**
Experimental Design (MAT10167M)
Scientific method and experimental design.
Analysis of variance models: fixed effects (single and multiple factor), random effects (single and multiple factor) and mixed
effects.
Split-plot and nested designs.
Multiple comparisons.
Complete and incomplete block designs. Latin square designs.
Non-parametric approaches.
Simple linear regression model and multiple regression model (estimation, inference, prediction, model adequacy and validation).
Diagnostics for influence points, outliers, multicollinearity and autocorrelation. Model selection.
Analysis of Covariance.
Nonlinear Regression.

Advanced Studies in Animal Physiology (ZOO10419M)
Regulation of cellular growth and death.
Intercellular communication: neurotransmitters and hormones. Cellular mechanisms of hormone action. Regulation of hormonal
secretion.
Immune mechanisms.
Relevant topics on digestive physiology: regulation of intake, effects of anti-nutritive factors, effects of functional foods.
Relevant topics on reproductive physiology and lactation: endocrine control of reproduction and lactation, assisted reproductive
technologies.
Animal neurobiology: nature, feeling and behaviour- foundations for sensient animal.
The influence of environmental factors on animal physiology.

Advanced Studies in Animal Nutrition (ZOO10420M)
ENERGY: Energy utilization. Systems for expressing the energy value of foods and the energy requirements.
PROTEIN: Protein utilization. Systems for expressing the protein value of foods and the protein requirements.
FIBER: Concept. Effects of dietary fiber in nutrition.
FOOD INTAKE: Control. Voluntary food intake and diet selection
Prevention of digestive and metabolic disorders.
Equine and animal companion animal nutrition.
NUTRITION AND ENVIRONMENT: Feeding strategies for reducing environmental impacts.
RATION FORMULATION: Methods of formulating rations. Formulation of rations for monogastrics. Ration formulation and
analysis of diets for dairy and beef cattle.
Advanced studies in animal breeding (ZOO10421M)
1. Animal breeding from the top down
   1.1. What is the "best" animal?
   1.2. How are animal populations improved?
2. Animal breeding from the bottom up
   2.1. Genes in population
   2.2. Simply-inherited and polygenic traits
3. Quantitative genetics
   3.1. Selection
      3.1.1. the genetic model for quantitative traits
      3.1.2. Heritability and repeatability
      3.1.3. Factors affecting the rate of genetic change
      3.1.4. Genetic prediction
      3.1.5. Large-scale genetic evaluation
      3.1.6. Correlated response to selection
      3.1.7. Multiple-trait selection
   3.2. Mating systems
      3.2.1. Mating systems for simply-inherited traits
      3.2.2. Mating strategies based on animal performance: random and assortative mating
      3.2.3. Mating strategies based on pedigree relationship: inbreeding and outbreeding
      3.2.4. Hybrid vigour
      3.2.5. Crossbreeding systems
4. Biotechnology and mole

Research Project (ZOO10915M)
1. Research Project: Objectives
2. The phases of a Research Project
3. The literature and its sources
4. The structures of a Dissertation, a Project Work, and a Training Report
5. The references
6. The reading of articles. Critical reading
7. Oral and written communication: poster, paper, reports, graphics, pictures ...
8. The techniques of developing and managing project(s)
9. Types of research and information sources
10. Honesty and Ethics in Scientific Research
11. Preparation and development of a Research Project.

Sustainable Aquaculture (ZOO10423M)
i) Fundamentals of aquatic ecology
ii) Introduction to the aquatic production
   ii) Water quality parameters and environmental constraints to the aquatic production
iii) Productivity factors and intensity of the aquaculture systems
iv) Environmental impacts of the aquaculture systems
v) Sustainability purposes in animal production
vi) Sustainability in Aquaculture projects: design and characteristics of the production system and management practices.
Current Issues and New Trends in Meat Production (ZOO10424M)
Characterization of the current situation and future opportunities inherent to the various animal production sectors, following along these lines: sustainability and interrelation with different environments, bio-economic efficiency (breeds; potential and adequate selection; production systems and modalities; and problematic of production approaches) and innovation, end-product segmentation and additional added value.

Current Issues and New Trends in Dairy Production (ZOO10425M)
Basic economic principles of dairy production in Portugal, Europe and in the World. Market analysis. Milk production and biosynthesis. Management of dairy cow (feeding, milking, reproduction and breeding). Feeding dairy cows to reduce nutrient excretion Milk production constrained the soil and climatic conditions in some world regions. New management techniques (focused on reproductive, molecular biology, mammary gland biology, nutritional physiology, dairy nutrition and the environment, breeding, dairy cow welfare and production).

Animal Products Technology (ZOO10426M)

Apiculture (ZOO10427M)
Evolution, diversity and biogeography; individual and colonial systems of self-regulation; intra- and extra-colonial communication; foraging and regulation of resource collection; replacement of individuals and colony reproduction; diseases, predators and intoxications; intensification and/or conciliation of various bee production systems or services; processing, transforming, evaluating and certifying bee products; monitoring of production systems towards increased added-value products; opportunities, threats and new horizons for beekeeping; new bee technologies and key bee research vectors.

Horse Production and Uses (ZOO10428M)

Agro-Food Marketing (GES10429M)
Module 1- Evolution of Marketing and Agro-Food marketing Concept
Module 2 – Understanding Customers and Markets
Module 3 - Marketing Management: Creating; Communicating and Delivering Values
Module 4 - Understanding Dynamics and Challenges of Agro-Food Marketing
Agri-Business Planning (GES10430M)
1. Context and general issues of agri-business
   - Concepts, organizations, firms and agri-business
   - Agricultural, food, industry and agri-business management
   - Commodity systems, supply chain and value

2. Strategic planning
   - Organizational external and internal Environment and behaviour analysis
   - Business Plan
   - Business portfolio
   - Structures and business organizational types

3. Project and product planning and management
   - Product and project strategic development and management
   - Research and development processes and products
   - Logistics and marketing channels

4. Operations management
   - Operational planning and production management
   - Stocks and logistics of raw-materials and products

5. Future challenges and issues of agri-business
   - Territorial, environmental and ecological issues
   - Social accountability, ethics and law
   - Sustainability and policy

Analysis and Modelling of Agricultural Systems (ZOO10431M)
i) General systems Theory and systemic perspective in agriculture; System concept; Static and dynamic systems; Characteristics of systems; Types of systems; Holistic/modular systems; Representation and symbolism; Flow diagrams; Study and analysis of different systems.

ii) Model concepts; Classification and types of models; Limitations in modelling; Study and analysis of different models; Elementary modelling and simulation with various computer applications.
Animal Housings Design (ERU10432M)

1. Environment and animal production
   - Physiological reactions and adaptation to adverse environments
   - Influence of environmental factors on the animal performances and welfare.
2. Phases of a project.
3. Planning of animal housings
   - Aspects related with legislation (welfare and environmental protection)
   - Aspects related with the construction (localization, orientation, dimensions and quantification, layout)
   - Aspects related with production systems
   - Animal housing, environmental comfort and energy consumption
   - Waste management.
4. Environmental control of animal buildings
   - Energy and mass balances
   - Construction materials. Thermal insulation
   - Ventilation: temperature, humidity and air quality
   - Natural and artificial lighting
   - Heating, cooling and energy saving systems

Computers and Electronics in Precision Livestock Farming (ZOO10435M)

1. Equipment utilized in Precision Livestock Farming
   1.1. Fundamentals of control and automation
   1.2. Transponders and identification
3. Application of basic electronic equipment in the livestock Farming
   3.1. Control of biological processes and key elements of Animal Science Precision;
   3.2. Operation of automatic feeding systems;
   3.3. Workability of the various innovations and technologies in dairy farms;
   3.4. Workability of the various technologies and innovations that contribute to the accuracy of the handling of animals;
   3.5. Technological advances in equipment used in production and fodder conservation;
   3.6. Technological advances in equipment used in distribution and application of by-products of livestock farming.
4. Computer Technology in Agro-livestock management
5. Genetic-statistical packages
6. Traceability in Animal Production

Instrumentation (FIS10359M)


Electrical analogue instruments: galvanometer, voltmeter, ammeter, ohmmeter, wattmeter, phase meter, oscilloscope, etc. ...

Measurements of electrical quantities (voltage, current, resistance, impedance, etc ....)

Measurement of quantities other than electrical: displacement, velocity, force, temperature ...

Geophysical measurements and environmental parameters.

Introduction to digital instrumentation.

Signal processing algorithms: DFT, FFT, Adaptation of models.