



## Study Plan

**School:** School of Sciences and Technology  
**Degree:** Master  
**Course:** Zootechnical Engineering (cód. 678)

### 1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT10167M	Experimental Design	Mathematics	6	Semester	156
ZOO10419M	Advanced Studies in Animal Physiology	Animal Science	6	Semester	156
ZOO10420M	Advanced Studies in Animal Nutrition	Animal Science	6	Semester	156
ZOO10421M	Advanced studies in animal breeding	Animal Science	6	Semester	156
ZOO10915M	Research Project	Animal Science	12	Year	312

### 1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
<b>Group of Options (ZOO/EAGRO)</b>					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO10423M	Sustainable Aquaculture	Animal Science	6	Semester	156
ZOO10424M	Current Issues and New Trends in Meat Production	Animal Science	6	Semester	156
ZOO10425M	Current Issues and New Trends in Dairy Production	Animal Science	6	Semester	156
ZOO10426M	Animal Products Technology	Agricultural and Food Engineering	6	Semester	156
<b>Group of Options (ZOO/GES)</b>					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO10427M	Apiculture	Animal Science	6	Semester	156
ZOO10428M	Horse Production and Uses	Animal Science	6	Semester	156
GES10429M	Agro-Food Marketing	Management	6	Semester	156
GES10430M	Agri-Business Planning	Management	6	Semester	156

### 2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO10431M	Analysis and Modelling of Agricultural Systems	Animal Science	6	Semester	156
ERU10432M	Animal Housings Design	Rural Engineering	6	Semester	156



### 2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
<b>Group of Options (ZOO/EEL)</b>					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ZOO10435M	Computers and Electronics in Precision Livestock Farming	Animal Science	6	Semester	156
FIS10359M	Instrumentation	Electrotechnical Engineering	6	Semester	156
ZOO13042M	Tropical Animal Production	*** TRANSLATE ME: ***	6	Semester	156
Dissertation					
Project Work					
Internship					

### 2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Dissertation					
Project Work					
Internship					

### 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

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1º Semestre:

4 UC obrigatórias num total de 24 Ects { \ } newline

{ \ } newline

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

3.º Semestre

2 UC obrigatórias num total de 12 Ects

1 UC optativa do Grupo III num total de 6 ECTS

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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. \*\*\*

## Program Contents



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### **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.

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### **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.

Hormones and growth. Bone growth, muscular growth and adipose growth.

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 sentient animal

The influence of environmental factors on animal physiology.

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### **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

FEEDSTUFFS: Evaluation. Feed components and feed categories. Additives.

RUMINANTS: Rumen fermentation. Modification of milk, dairy and meat products through nutrition. Health and nutrition.

Prevention of digestive and metabolic disorders.

NON RUMINANTS: Ideal protein. Enzymes and feed additives. Modification of carcass, meat and egg quality through nutrition.

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.



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### **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

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### **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.

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### **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.



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### **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.

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### **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).

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### **Animal Products Technology (ZOO10426M)**

Meat and products technology. Slaughter technology. Classification of carcasses. Meat cuts and the commercial classification. Conservation of meat. Conversion of muscle into meat. Properties of fresh meat. Maturation of fresh meat. Mechanisms of transformation of sausages. Additives. Chitterlings. Technology for processing meat products. In the fish studied is the quality of fresh fish and the main processes of transformation / conservation of fish. Egg and egg products. Are studied the physical and chemical characteristics of the chicken egg. Criteria for quality of fresh egg and processing of egg products. Chemical composition and physical properties of milk. Microbiology of milk. Processing of milk. Nat. Butter. Ice cream. Composition and ingredients. Evaporated and condensed milk. Dried milk or milk powder. Fermented milk and cheese.

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### **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.

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### **Horse Production and Uses (ZOO10428M)**

Concepts, mechanisms and flexibility of the behavior of the horse.

Outdoor, static and dynamic horse.

Breeds, vocations of use, herd books, strategies morpho-functional appreciation.

Equestrians. Learning and training specific to each modality.

Programming and reproductive management, food, hygienic-sanitary and farriery of horses.

Facilities and equipment production, use sports, leisure riding and special therapeutic riding.

Organization of national and international services production, use and appreciation of the horse.

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### **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



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### **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

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### **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.



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### **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

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### **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
2. Electronic Identification animal. Classical systems of animal 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

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### **Instrumentation (FIS10359M)**

Introduction to Metrology: History, Definition, Units and fundamental laws of physics. Notion of uncertainty and error propagation law of errors and uncertainties. Application to experimental data. Curve fitting by the least squares criterion.

Transducers measure: Definition, Physical Principles, Applications. Classifications of the measurement transducers.

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.



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### **Tropical Animal Production (ZOO13042M)**

1. The Tropical Environment
  - 1.1. Abiotic and biotic factors.
  - 1.2. Rural development and investment plans.
2. Biometeorology and Adaptation
  - 2.1. Thermal stress
  - 2.2. Heat tolerance and acclimatization
  - 2.3. Anatomic-physiological attributes of adaptation
3. Animal Health
  - 3.1. Ecto and endoparasitism
  - 3.2. Infecto-contagious diseases
  - 3.3. Telluric diseases
4. Pastures and fodder
  - 4.1. Natural and implanted pastures
  - 4.2. Pasture Management
  - 4.3. Energy, protein and mineral supplementation
  - 4.4. Silvopastoral Systems
5. Production Systems
  - 5.1. Bovines
    - 5.1.1. Pure Breeds and cross-breeds.
    - 5.1.2. Conditioners to the organization of production systems.
      - 5.1.2.1. Reproductive, alimentary, environmental and health management.
  - 5.2. Sheep
    - 5.2.1. Pure breeds and cross-breeds.
    - 5.2.2. Conditioners to the organization of production systems.
      - 5.2.2.1. The process of breeding, rearing and fattening.
  - 5.3. Water buffaloes
    - 5.3.1. Reproductive, alimentary, environmental and health management.