



## 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   |
| EME10359M                         | Instrumentation  | Electrotechnical Engineering | 6    | Semester | 156   |
| ZOO13042M                         | Tropical Animal Production                               | Animal Science               | 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

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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:** Utilization of energy by the animal. Energy requirements of the animal for maintenance and production (gestation, lactation, liveweight gain, eggs). Systems for expressing the energy value of foods and the energy requirements of ruminants and monogastrics.

**PROTEIN:** Digestion, absorption and use of the protein in monogastrics and ruminants. Measures of protein quality for monogastrics and ruminants. Utilization of non-protein nitrogen compounds by the ruminant. Protein and amino acids requirements for maintenance, growth and milk production. Systems for expressing the protein value of foods and the protein requirements of monogastrics and ruminants.

**FIBER:** Concept, methodologies for its quantification and characterization. Effects of dietary fiber in nutrition and feeding of ruminants and monogastrics.

**FOOD INTAKE:** Theories of voluntary intake control. Voluntary food intake and diet selection in ruminants and non ruminants.

**FEEDSTUFFS:** Evaluation of foods. Feed components and feed categories. Factors influencing the nutritive value of foods. Additives for use in animal nutrition.

**FEEDING AND NUTRITION OF NON RUMINANTS:** Amino acid digestibility in formulation of diets for pigs and poultry. Ideal protein. Utilization of exogenous enzymes, prebiotics, probiotics, organic acids and plant extracts in pig and poultry diets. Modification of carcass and meat quality and egg quality through nutrition. Particular aspects of equine and animal companion animal nutrition.

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**NUTRITION AND ENVIRONMENT:** Animal nutrition and environmental interactions. Feeding strategies for reducing environmental impact in intensive and extensive systems. Diets to reduce the excretion of nitrogen, phosphorus and methane emission.

**RATION FORMULATION:** Methods of formulating rations. Feed tables and databases of feed composition. Tables of nutrient requirements. 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)**

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### **Research Project (ZOO10915M)**

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### **Sustainable Aquaculture (ZOO10423M)**

- i) Fundamentals of aquatic ecology
- ii) Introduction to the aquatic production
- iii) Water quality parameters and environmental constraints to the aquatic production
- iv) Productivity factors and intensity of the aquaculture systems
- v) Environmental impacts of the aquaculture systems
- vi) 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)**



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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)**

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### **Apiculture (ZOO10427M)**

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

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### **Agro-Food Marketing (GES10429M)**



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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)**

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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{\}**

- Sensors{\}
- Actuators{\}
- Prototyping;{\}

##### **1.2. Transponders and identification{\}**

- Use of identifiers and transponders{\}
- Electronic Fundamentals{\}
- Encoding and decoding{\}
- Prototyping.{\}

#### **2. Electronic Identification animal. Classical systems of animal identification. Advantages of eID. Existing legislation on eID. Technological principles. Means and identification techniques. Means of reading. Comparative analysis of readers. Animal RFID Integrator. RED-OC.{\}**

#### **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{\}**

##### **4.1. Collecting data (inputs) and the production of outputs;**

##### **4.2. Computer Technology in Agriculture and Livestock: Different types of applications.{\}**

#### **5. Genetic-statistical packages{\}**

##### **5.1. How to prepare information;{\}**

##### **5.2. Synthesis of outputs in regard to the objectives.{\}**

#### **6. Traceability in Animal Production{\}**

##### **6.1. Method of collection and storage;{\}**

##### **6.2. Ways of providing the records;{\}**

##### **6.3. Traceability in the food chain;{\}**

##### **6.4. Objectives of animal welfare, quality and safety of the final product.**

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### **Instrumentation (EME10359M)**



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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. 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.
    - 5.2.3. The process of breeding, rearing and fattening.
  - 5.3. Water buffaloes
    - 5.3.1. Reproductive, alimentary, environmental and health management.