Study Plan

School: School of Sciences and Technology
Degree: Master
Course: Agricultural Engineering (cód. 448)

1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU10436M	Bio-system Soil-Water-Plant-Atmosphere	Rural Engineering	6	Semester	156
MAT10167M	Experimental Design	Mathematics	6	Semester	156
ERU10437M	Applied Hydraulics	Rural Engineering	6	Semester	156
ERU10438M	Environmental Control	Rural Engineering	6	Semester	156
GES08066M	Agri-Business Planning	Management	6	Semester	156

1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIT10439M	Plant Breeding and Biotechnology	Agronomy	6	Semester	156
FIT10440M	Crop Protection	Agronomy	6	Semester	156
FIT10441M	Temperate Fruit Production	Agronomy	6	Semester	156
FIT10442M	Horticulture Herbaceous	Agronomy	6	Semester	156
ERU10443M	Analysis and Technology of Irrigation Systems	Rural Engineering	6	Semester	156

2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU10444M	Project in Agronomical Engineering	Rural Engineering	9	Semester	234
ERU10445M	Dissertation Seminar	Rural Engineering	3	Semester	78

Group of Options

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIT10446M	Crop Protection II	Agronomy	6	Semester	156
FIT10447M	Conservation Agriculture	Agronomy	6	Semester	156
ERU10452M	Precision Agriculture	Rural Engineering	6	Semester	156
ERU13964M	Integrated Management of Agricultural Wastes	Rural Engineering	6	Semester	156

Dissertation

2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Dissertation					

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:

1º Semestre{\}newline

5 UC obrigatórias num total de 30 Ects{\}newline

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2º Semestre{\}newline

5 UC obrigatórias num total de 30 Ects{\}newline

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3º Semestre:{\}newline

2 UC Obrigatórias num total de 12 Ects{\}newline

1 UC optativa num Total de 6 Ects{\}newline

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Para obtenção do grau é necessário também a aprovação em Dissertação, no total de 42 ECTS, no 3.º e 4.º Semestre. ***

Program Contents

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Bio-system Soil-Water-Plant-Atmosphere (ERU10436M)

I. Climatology and Meteorology. Weather elements and factors. Climatic classifications. Radiation and radiation balance. Photoperiodism. Energy balance at the soil surface. Transport of momentum, energy and mass in the boundary layer. Modified environments. Soil temperature control. Climatic needs of crops. II. Soil intrinsic and relative characteristics. Water content and characterization of the state of water in the soil. Water retention in the soil. Infiltration and redistribution of water in the soil. Crop water requirements. New technologies in irrigation management, stress indexes. Water use efficiency. Effects of excess salts in the soil on crop productivity. Balance of salts in the soil. Control of salinity in the soil. Water quality for irrigation. III. Brief review of the anatomy and physiology of plants. The water flow in the plant. The assimilation of carbon. Growth regulators, photo-periodism and vernalization. The assessment of the physiological state of plants.

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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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Applied Hydraulics (ERU10437M)

1. Fluids physical properties. 2. Hydrostatics: Hydrostatic pressure; Pressure measurement; Manometers; hydrostatic impulsion, calculation of impulsion over floodgates (plane and radial). 3. Hydrocinematics: Types of flow; Continuity equation; Applications. 4. Hydrodynamics: Bernoulli Theorem, application to real fluids; Hydraulic power. 5. Pressurized flows: Friction losses in irrigation pipes; Local friction losses; Calculation of installations and pipe trajectory. 6. Pumps: Pump selection; Problems in centrifugal pumps: cavitation; Pump stations. 7. Free surface flow: Types of flow; Application of the Bernoulli Th. to open channels flow; Uniform flow in channels; Gradually varied flow: backwater effect and hydraulic jump; Flow control in open channels; Irrigation and drainage channels design. 8. Holes and Weirs: Control and measurement of flow.

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Environmental Control (ERU10438M)

1. Introduction. Importance of the environmental control in rural buildings
2. Energy and mass balances. General and simplified equations; Project conditions; Heat transfer processes.
3. Psychometrics. State equations; Temperature and air humidity; psychometric map; Environmental control processes.
4. Thermal insulation. Heat transfer through construction materials; Thermal resistance and global heat transfer coefficient.
5. Condensation. Surface condensation and control methods.
7. Ventilation. Objectives; methods to calculate ventilation rates; Natural and forced ventilation.
8. Acclimatization. Heating systems. Cooling systems; Resolution of problems to determine heating/cooling needs for greenhouses, animal buildings, etc.

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Agri-Business Planning (GES08066M)

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Plant Breeding and Biotechnology (FIT10439M)

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Crop Protection (FIT10440M)

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Temperate Fruit Production (FIT10441M)

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Horticulture Herbaceous (FIT10442M)

1. Introduction
Economic importance of vegetal production in Portugal
Nutritional importance of vegetables.
Nitrates in leafy vegetables
2. Ecophysiology of vegetable crops
Bioclimatic elements. Cardinal temperatures. Thermoperiod.
Vernalization. Photoperiodic response
Specific cases: frigo and fresh strawberry production; nursery of tomato plants for industry and greenhouse.
Rotations.
3. Climate change in horticultural production - adaptation and mitigation
Biophysical Impacts
Adaptation and mitigation measures
4. Organic production
Discussion on organic vs conventional production mode.
Cultural techniques, quality of raw material
5. Salinity. Practices to Prevent and Mitigate Soil Salinization
6. Sustainable fertilization of vegetable crops
Potato - a case study
Processing Tomato - a case study
7. Soilless cultivation

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Analysis and Technology of Irrigation Systems (ERU10443M)

Introduction: Soils, soil water, water retention by the soil, infiltration.
Crop water requirements: Evapotranspiration, calculation methodologies.
Water management: Management based on evapotranspiration, soil moisture content and canopy characteristics. Equipment. Irrigation scheduling. Deficit and supplemental irrigation.
Irrigation methods and systems: Performance indicators.
Sprinkler irrigation: General principles of sprinkler irrigation operation and agronomic and hydraulic design. Equipment. Systems performance evaluation.
Drip irrigation: Principles of agronomic and hydraulic design and operation. Equipment: drippers, tubing, filters, pumps, electro valves, etc. Systems performance evaluation.
Surface Irrigation: Principles of surface Irrigation and management. Principles of surface irrigation systems design. Automation and equipment. Evaluation and improvement of irrigation quality.

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Project in Agronomical Engineering (ERU10444M)

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Dissertation Seminar (ERU10445M)

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Crop Protection II (FIT10446M)

The subject(s) of this course will change every year. Matters to be covered are related to plant protection in several ways, require previously knowledge on several areas, and will be dealt with by different conference speakers. These will be professors from both national and international universities, specialists and policy makers concerning agricultural/food industries related fields. Examples of topics to be addressed: 'Climate
changes and risk of emergence of new parasites'; ' Biological control of plant parasites in agriculture – where do they come from and what is their fate'; 'Biofungicides – case studies'; 'Mycotoxins in crops, a threat to animal and human health'; 'Transgenic herbicide - resistance crops: a potential to increase food yield?'; 'Biosecurity and bioterrorism'; 'New strategies to stimulate plant innate defense mechanisms'; 'New developments in epidemic risk forecast'; etc.

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Conservation Agriculture (FIT10447M)

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Precision Agriculture (ERU10452M)

Introduction to Precision Agriculture: Precision Agriculture Cycle.

Precision Agriculture and GPS

The importance of GIS and Remote Sensing in Precision Agriculture

The decision: i) in real time; ii) based in previous information. Study cases: The yield spatial and temporal variability (cereals: dry and irrigation production), pasture quality differential management, grape quality differential management, precision irrigation.

Production factors differential application.

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Integrated Management of Agricultural Wastes (ERU13964M)

1. Introduction to Integrated waste management. Definitions and Regulations.
2. Notions of Circular Economy and its applications in agriculture
3. Hierarchy and phases of the waste integrated Management
3.1. Production
3.2 Collection
3.3. Storage
3.4. Treatment
3.5. Utilization
4. Valorisation of agricultural wastes
4.1. Agronomic valorisation
4.2. Energetic valorisation
4.3. Other ways of valorisation
5. Examples of good practices and Industrial Symbiosis