Study Plan

School: School of Sciences and Technology
Degree: *** TRANSLATE ME: Pós-Graduação ***
Course: Water Resources Planning and Management (cód. 735)

1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours

***** TRANSLATE ME:Módulo 1 - Fundamentos *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU14227O	Basics Hydraulics	Rural Engineering	3	Semester	78
ERU14228O	Hydrology and Water Resources Planning	Rural Engineering	3	Semester	78
ERU14243O	Chemistry and Biochemistry of Aquatic Systems	*** TRANSLATE ME: Engenharia Química ***	3	Semester	78
ERU14229O	Soil-Water-Plant-Atmosphere Relationships	Rural Engineering	3	Semester	78

***** TRANSLATE ME:Módulo 2 - Qualidade e Tratamento da Água *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU14245O	Water quality	*** TRANSLATE ME: Engenharia Química ***	6	Semester	156
ERU14244O	Water Sanitation	*** TRANSLATE ME: Engenharia Química ***	6	Semester	156

***** TRANSLATE ME:Módulo 3 - Água para Uso Agrícola *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU14230O	Technology of Irrigation Systems	Rural Engineering	6	Semester	156

1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours

***** TRANSLATE ME:Módulo 3 - Água para Uso Agrícola *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU10452M	Precision Agriculture	Rural Engineering	6	Semester	156

***** TRANSLATE ME:Módulo 4 - Gestão das Bacias Hidrográficas *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU14231O	Geographic Information Technologies for Watershed Management	Rural Engineering	6	Semester	156
ERU14232O	Watershed Management	Rural Engineering	6	Semester	156

1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours

***** TRANSLATE ME:Módulo 5 - Tecnologias de Rede e Hidrográficas *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU14246O	Management of water supply and sewage system	*** TRANSLATE ME: Engenharia Hidráulica ***	6	Semester	156
ERU14247O	Maintenance and Conservation of Storage and Regulation Infrastructures	*** TRANSLATE ME: Engenharia Hidráulica ***	6	Semester	156

***** TRANSLATE ME:Módulo 6 - Gestão Integral do Processo *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU14249O	Project	*** TRANSLATE ME: Engenharia Hidráulica ****** TRANSLATE ME: Engenharia Química ***Rural Engineering	6	Semester	156
ERU14248O	Final Work	*** TRANSLATE ME: Engenharia Hidráulica ****** TRANSLATE ME: Engenharia Química ***Rural Engineering	6	Semester	156

Conditions for obtaining the Degree:

The postgraduate course in Planning and Management of Water Resources is a course in association between the University of Évora (UÉvora) and the University of Extremadura (UEx). The course program is structured into six training modules of 12 ECTS each (Fundamentals, Water Quality and Treatment, Water for Agricultural Use, Watershed Management, Network and Hydrographic Technologies and Integral Process Management. Module 6 is the unique mandatory module of the course, with flexibility in the choice of the remaining modules. Modules 3 and 4 are taught at UÉvora, modules 2 and 5 are the responsibility of UEx and modules 1 and 6 are shared by the two universities. To complete the Post-Graduation, the student must complete 60 ECTS, being awarded a diploma by each institution (double degree).

Program Contents

Back

Basics Hydraulics (ERU14227O)

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; Channel design.
8. Holes and Weirs: Control and measurement of flow.

Back

Hydrology and Water Resources Planning (ERU14228O)

1.Hydrological cycle and the river basin
2.Hydrological processe in the watershed.
3.Water resources assessment
4.Uses of water in the watershed and assessment of environmental impacts.
5.Identify the different types of infrastructure existing in the watershed for the use of water resources and impacts on the environment.
6.Urban water cycle: capture, transport, treatment, storage, distribution, drainage and wastewater treatment.
7.Integrated management and sustainable use of water and energy resources.

Back

Chemistry and Biochemistry of Aquatic Systems (ERU14243O)

1. Water composition and properties.
2. Fundamentals of phisico-chemical processes: gas dissolution, hydrolysis, acid-base equilibria, redox, precipitation, complex formation, photochemical processes.
3. Bioindicators and aquatic toxicology.
4. Simulation of aquatic systems

Back

Soil-Water-Plant-Atmosphere Relationships (ERU14229O)

1. Climate and its influence on crop growth
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.
2. Soil water
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. Balance and control of salts in the soil. Water quality for irrigation.
3. Water movement in 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
4. Crop water requirements and crop productivity
Irrigation requirements and irrigation management, stress indexes. Water use efficiency.

Back

Water quality (ERU14245O)

1. Water pollution and environmental effects.
2. New types of contamination: emerging contaminants, nanoparticles, ARB, ARG, microplastics.
3. The EU Water Framework Directive.
4. Water legislation in Spain and Portugal.
5. Water quality parameters. Analytical methods.
6. Water quality indexes.

LAB1 – Analytical evaluation of water quality of samples.
LAB2 - Water quality of superficial water and groundwater

Back

Water Sanitation (ERU14244O)

1. Overall view of water sanitation.
2. Drinking water.
3. Wastewater treatment.
4. Water reuse.
5. Desalination

LAB1 – Water treatment processes.
LAB2 - Drinking water plant simulation.
LAB3 – Wastewater treatment plant simulation.

Back

Technology of Irrigation Systems (ERU14230O)

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.

Back

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.

Back

Geographic Information Technologies for Watershed Management (ERU14231O)

1. Principles and general bases of geographic information for watershed management: Cartographic databases, Meteorological databases: Hydrological databases. Import of georeferenced information into the Geographic Information Systems (GIS) environment.
2. GNSS-GPS: Global positioning systems to identify incidents at the river basin level: GNSS concepts; Triangulation between satellites; Distance measurement; Satellite position; Correction of errors; Differential GPS operation and correction; GNSS data applications. - Structuring spatial databases, as models of reality.
3. GIS: Data models (A-grid and B-vector); Map algebra; MDT; Hydrological Modeling; Geostatistical Analysis; GIS alert systems; Preparation of layouts.
4. Remote Detection: Monitoring and inspection of consumption and quality of surface and underground water; Alert systems in remote sensing.
5. Case study: the hydrographic basin of the Guadiana River.

Back

Watershed Management (ERU14232O)

1. National Water Plan (Hydrological Plan)
2. Hydrographic Region Management Plans, with emphasis on shared river basins.
3. Flood Risk Management Plans
4. Application of hydrological and hydraulic models (Free software HEC-HMS, HEC-RAS and SWAT) in the assessment of water availability and in the assessment of flooded areas.
5. Water uses at the hydrographic basin level and their evaluation.
6. Decision support model in extreme hydrological situations: droughts and floods.
7. The strategy for adapting to climate change.
8. Risk mitigation measures in the water sector.
9. Case study: the hydrographic basin of the Guadiana River.

Back

Management of water supply and sewage system (ERU14246O)

1. Water distribution infraestructure
2. Supply network and storage infraestructures and elements
3. Design and legal requirements
4. Monitoring and follow-up network: integration with SCADA systems
5. Auscultation and new data capture technologies

Seminar: Numerical modelization of supply networks.

6. System maintenance: ageing and economic evaluation of a sustainable maintenance

Technical visit to the command centre of a supply system

7. Sewage network and storage infraestructures and elements
8. Design and legal requirements
9. Monitoring and environmental assessment processes
10. System maintenance and management

Seminar: Numerical modelization of sewage networks.

Back

Maintenance and Conservation of Storage and Regulation Infrastructures (ERU14247O)

1. Introduction, general questions and historical evolution of dams
2. Legislative framework: regulations, technical guides and previous studies
3. Analysis of typologies and loads estimation

Seminar: Checking the stability of concrete and earth dams

4. Drainage structures and spillways. Flood studies and evaluation of hydrological safety.
5. Reservoir operation rules, conservation and action in emergency situations
6. Safety of dams and reservoirs, technical documents and auscultation

Seminar: Evaluation of lamination strategies and procedures

Back

Project (ERU14249O)

1. General theory of the project
2. Project morphology
3. Project planning
4. Project development
5. Time management in projects
6. Risk management in project management
7. Practical cases in integral water cycle management projects
8. Practical cases in agricultural and efficient use of resources projects
9. Practical cases in basin management and hydrological planning projects
10. Practical cases in hydraulic infrastructures and management of water resources projects.

Back

Final Work (ERU14248O)

To be defined according to the theme of the work