



| Teaching Guide           |  |        |  |           |
|--------------------------|--|--------|--|-----------|
| Identifying Data         |  |        |  | 2023/24   |
| Subject (*)              | Agricultural and Industrial Uses of Water          |        | Code   | 632549020 |
| Study programme          | Máster Universitario en Xestión Sostible da Auga   |        |  |           |
| Descriptors              |  |        |  |           |
| Cycle                    | Period   | Year   | Type   | Credits   |
| Official Master's Degree | 2nd four-month period                              | First  | Optional                                     | 3         |
| Language                 |  |        |  |           |
| Teaching method          | Face-to-face                                       |        |  |           |
| Prerequisites            |  |        |  |           |
| Department               | Enxeñaría Civil                                    |        |  |           |
| Coordinador              | Pena Mosquera, Luis                                | E-mail | luis.pena@udc.es                             |           |
| Lecturers                | Pena Mosquera, Luis<br>Vázquez González, Ana María | E-mail | luis.pena@udc.es<br>ana.maria.vazquez@udc.es |           |
| Web                      |  |        |  |           |
| General description      |  |        |  |           |

| Study programme competences |   |
|-----------------------------|---|
| Code                        | Study programme competences   |
| A1                          | CON1 Describe the principles, concepts, and dimensions that encompass integrated water resources management and its role as a key tool for achieving water security and advancing the associated Sustainable Development Goals (SDGs). Identify problems related to water development, use, and access. Identify and compare water legislation at the European, national, regional, and local levels, as well as interpret conceptual frameworks on sustainable development and their application to the water sector, with a specific focus on the SDGs. Provide tools to explain the economics of water. Enumerate aspects of public taxation that may be relevant in water management.   |
| A2                          | CON2 Identify the different urban systems directly or indirectly linked to water. Outline their interrelationships and apply an ecosystemic and interdisciplinary approach. Recognize the various water supply sources, the implications of their use, and their impact on natural degradation, as well as their possibilities for recycling and reuse. Identify and explain the key aspects of integrating the circular economy into the urban water system. Explain the typical tools used for conceptualizing water-related urban systems. Review current trends in nature-based solutions for managing urban stormwater. Interpret the territory to advocate for more centralized or decentralized approaches to urban water management in areas with dispersed population and economic activities. |
| A3                          | CON3 Explain the foundations of chemistry, biology, and morphology of continental aquatic ecosystems. Provide the common methodology of the EU for assessing the status of water bodies and its adaptation to different territorial contexts. Identify models for assessing pressures and impacts on water bodies, understanding their opportunities and limitations. Suggest solutions for the maintenance and improvement of the status of water bodies across their different quality elements. Identify bioindicators.  |
| A4                          | CON4 Enumerate the water treatment systems, both for supplying populations or industries, and for the purification and subsequent return to natural environments and reuse of regenerated water. Identify and describe the emerging challenges in water treatment.  |
| A5                          | CON5 Describe the fundamentals of water resources assessment and the main tools for hydrological planning, based on the Water Framework Directive, legislation, and global frameworks for water resource allocation, including the environmental component. Demonstrate that ecosystem services linked to water have high added value and that nature-based solutions enable a sustainable approach to water resource management.   |
| B1                          | HAB1 Use and compare water legislation and conceptual frameworks related to sustainable development. Operate with tools that allow estimating economic variables (macro and micro) related to water, and employ the tools to apply appropriate taxation and cost policies to water  |
| B3                          | HAB3 Select and operate innovative treatment systems adapted to different realities, geographical environments, and quality requirements, including emerging challenges and applications.   |



|    |   |
|----|---|
| B4 | HAB4 Analyze the European Union's Water Framework Directive and Floods Directive, their technical implications, and their implementation through hydrological planning. Utilize computer tools for problem-solving related to water management within the framework of both directives. Develop measurements and analysis of hydrologically relevant data and data related to the state of water bodies. Evaluate the effect of urban use on the watershed and analyze the consequences of discharging water (treated or untreated) into receiving water bodies. Additionally, develop strategies to protect areas of surface water and groundwater generation within watersheds, based on the principle of recognizing and enhancing ecosystem services. |
| C1 | COM1 Validate, evaluate, and adapt water legislation for a specific situation. Synthesize the economic variables involved in a problem related to water management. Adapt conceptual frameworks, particularly the Sustainable Development Goals (SDGs), to a specific problem   |
| C2 | COM2 Integrate all urban water systems into a comprehensive planning framework for an entire area. Evaluate their performance and optimize them. Compare different types of solutions, including those suitable for scattered settlements and nature-based solutions  |
| C3 | COM3 Judge the performance and suitability of various water treatment proposals. Compare different alternatives. Incorporate expert judgment in the planning of water treatment systems, considering emerging challenges and green solutions.   |
| C4 | COM4 Integrate the various sources that generate the water supply and the uses that create the demand into systems or balances that allow for proper management. Plan the water resource at both macro and micro scales, allocating water to different uses while integrating environmental and social demands  |
| C6 | COM6 Integrate diverse data sources into decision frameworks to facilitate improved management of water resources   |

| Learning outcomes  |                             |     |     |
|--|-----------------------------|-----|-----|
| Learning outcomes  | Study programme competences |     |     |
| Adquirir os coñecementos teórico-prácticos necesarios dominar con soltura os conceptos básicos relacionados cos usos agrícolas e industriais da auga | AJ1                         |     | CJ2 |
|  | AJ3                         |     | CJ3 |
|  | AJ5                         |     | CJ4 |
|  |                             |     | CJ6 |
| ferramentas necesarias para o estudo e deseño de instalacións de rega  | AJ4                         | BJ1 | CJ3 |
|  |                             | BJ4 | CJ4 |
| comprender as características intrínsecas de cada un dos sistemas de rego  | AJ2                         | BJ3 | CJ3 |
|  | AJ4                         |     | CJ4 |
| coñecementos sobre outros usos industriais da auga   | AJ2                         | BJ1 | CJ1 |
|  | AJ4                         | BJ3 | CJ2 |
|  |                             | BJ4 | CJ3 |
|  |                             |     | CJ4 |
|  |                             |     | CJ6 |

| Contents                                     |   |
|--|---|
| Topic  | Sub-topic   |
| TEMA 1. Introducción: A auga na agricultura  | 1.1 Relacións Solo-Auga<br>1.2 Relacións Auga-Planta  |
| TEMA 2. Demanda de auga nos sistemas de rego | 2.1 Introducción<br>2.2 Evapotranspiración<br>2.3 Necesidades hídricas dos cultivos<br>2.4 Calidade da auga de rego<br>2.5 Programación do rego             |
| TEMA 3. Sistemas de Rego                     | 3.1 Introducción<br>3.2 Rego por superficie<br>3.3 Rego por aspersión<br>3.4 Rego localizado: Goteo. Micoraspersión<br>3.5 Rego subterráneo. Fertirrigación |



|                                    |  |
|------------------------------------|--|
| TEMA 4. Deseño de Sistemas de Rego | 4.1 Canles. Tuberías. Redes<br>4.2 Bombas. Automatismos. Accesorios<br>4.3 Proxecto de sistema de rego. Exemplo<br>4.4 Resolución de caso práctico |
| TEMA 5. A auga na industria        | 5.1 A auga na industria  |

| Planning                       |  |                      |                               |             |
|--------------------------------|--|----------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies                                 | Ordinary class hours | Student?s personal work hours | Total hours |
| Guest lecture / keynote speech | A1 A2 A3 A4 B1 B3<br>B4 C1 C2 C3 C4 C6       | 12                   | 36                            | 48          |
| Field trip                     | A1 A2 A4 B1 B3 B4<br>C1 C2 C3 C4             | 6                    | 0                             | 6           |
| Supervised projects            | A1 A2 A3 A4 A5 B1<br>B3 B4 C1 C2 C3 C4<br>C6 | 1                    | 10                            | 11          |
| Oral presentation              | A1 A2 A3 A4 A5 B1<br>B3 B4 C1 C2 C3 C4<br>C6 | 1                    | 5                             | 6           |
| Multiple-choice questions      | A1 A2 A3 A5 B1 B3<br>B4 C1 C2 C3 C4 C6       | 1                    | 3                             | 4           |
| Personalized attention         |  | 0                    |                               | 0           |

(\*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

| Methodologies                  |   |
|--------------------------------|---|
| Methodologies                  | Description   |
| Guest lecture / keynote speech | Exposición oral dos temas que constituen os contidos da materia diante do alumnado. Esta exposición irá precedida dunha presentación na que se propoñen algunhas preguntas aos estudantes para motivar a reflexión e o diálogo aberto. A obxectivo final pasa pola transmisión de coñecementos e ao tempo facilitar a súa aprendizaxe, potenciando a participación dos/as estudantes na construción significativa do coñecemento. |
| Field trip                     | Realizaranse entre 1e 3 visitas a complexos industriais que serán ilustrativas dos usos industriais da auga. As explicacións didácticas correrán a cargo dos encargados do traballo diarios das empresas, con exemplos prácticos.   |
| Supervised projects            | Se realizarán 2 traballos relacionados con a docencia impartida. Los pasos a seguir son: selección del tema, documentación, guiñon general, sesións periódicas con el profesorado para el seguimienton, preparación de la presentación y exposición en el aula  |
| Oral presentation              | Realizaranse unha exposicións en grupo a toda a clase do traballo tutelado  |
| Multiple-choice questions      | Realizaranse breves probas, a través do campus virtual, para fixar coñecementos e verificar o grado de adquisicións da aprendizaxe  |

| Personalized attention                   |  |
|--|--|
| Methodologies                            | Description  |
| Oral presentation<br>Supervised projects | O alumnado será tutelado individualmente para resolver todas as dúbidas. |

| Assessment        |  |  |               |
|-------------------|--|--|---------------|
| Methodologies     | Competencies                                 | Description                                | Qualification |
| Oral presentation | A1 A2 A3 A4 A5 B1<br>B3 B4 C1 C2 C3 C4<br>C6 | Presentación na aula do traballos tutelado | 10            |



|                           |  |  |    |
|---------------------------|--|--|----|
| Multiple-choice questions | A1 A2 A3 A5 B1 B3<br>B4 C1 C2 C3 C4 C6       | Probas de resposta múltiple (tipo test) a través do Campus Virtual dos coñecementos adquiridos nas clases maxistras e nas saídas de campo. | 20 |
| Supervised projects       | A1 A2 A3 A4 A5 B1<br>B3 B4 C1 C2 C3 C4<br>C6 | Traballos tutelados sobre: 1) deseño dunha instalacións de rega 2) usos industriais da auga  | 70 |

### Assessment comments

### Sources of information

|                      |  |
|----------------------|--|
| <b>Basic</b>         | <ul style="list-style-type: none"> <li>- Losada Villasante, Alberto (2000). El Riego: fundamentos hidráulicos.</li> <li>- Tarjuelo-Martín Benito (2005). El Riego por aspersión y su tecnología.</li> <li>- Medina San Juan, José A (1997). Riego por goteo : teoría y práctica.</li> </ul> <p>Davis, C., Rosenblum, E. (eds.). 2021. Sustainable Industrial Water Use: Perspectives, Incentives, and Tools. IWA Publishing<br/> <a href="https://www.iwapublishing.com/books/9781789060669/sustainable-industrial-water-use-perspectives-incentives-and-to-ols?">https://www.iwapublishing.com/books/9781789060669/sustainable-industrial-water-use-perspectives-incentives-and-to-ols?</a> Zhang, Y., Geissen, S.U., Track, T. (eds.). 2023. Water in Industry. IWA Publishing<br/> <a href="https://www.iwapublishing.com/books/9781789064148/water-industry">https://www.iwapublishing.com/books/9781789064148/water-industry</a> Davis, C., Rosenblum, E. (eds.). 2021. Sustainable Industrial Water Use: Perspectives, Incentives, and Tools. IWA Publishing<br/> <a href="https://www.iwapublishing.com/books/9781789060669/sustainable-industrial-water-use-perspectives-incentives-and-to-ols?">https://www.iwapublishing.com/books/9781789060669/sustainable-industrial-water-use-perspectives-incentives-and-to-ols?</a> Zhang, Y., Geissen, S.U., Track, T. (eds.). 2023. Water in Industry. IWA Publishing<br/> <a href="https://www.iwapublishing.com/books/9781789064148/water-industry">https://www.iwapublishing.com/books/9781789064148/water-industry</a></p> |
| <b>Complementary</b> |  |

### Recommendations

#### Subjects that it is recommended to have taken before

#### Subjects that are recommended to be taken simultaneously

#### Subjects that continue the syllabus

#### Other comments

Segundo se recolle nas distintas normativas de aplicación para a docencia universitaria deberase incorporar a perspectiva de xénero nesta materia (usarase linguaxe non sexista, utilizarase bibliografía de autores/as de ambos sexos, propiciarse a intervención en clase de alumnos e alumnas...)

-Traballarase para identificar e modificar prexuízos e actitudes sexistas e influirase na contorna para modificalos e fomentar valores de respecto e igualdade.

-Deberanse detectar situacións de discriminación por razón de xénero e proporanse accións e medidas para corrixilas.

(\*The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.