Teaching Guide					
Identifying Data					2024/25
Subject (*)	Water supply and drainage systems			Code	632844202
Study programme	Mestrado Universitario en Enxeñaría da Auga (plan 2012)				
Descriptors					
Cycle	Period	Year		Type	Credits
Official Master's Degree	1st four-month period	First		Obligatory	6
Language	English				
Teaching method	Face-to-face				
Prerequisites					
Department	Dereito PúblicoEconomíaEnxeñaría CivilMatemáticas				
Coordinador			E-mail		
Lecturers			E-mail		
Web	caminos.udc.es/hosting/masteragua/				
General description	Historical introduction to water supply and sewer systems. Water catchment and drinking water treatments. Water supply networks: general concepts, description and design. Sewer systems: general concepts , description and design. Sustainable drainage systems (SUDS). Waste water treatments prior to discharge to the aquatic media. Legal framework.				

Study programme competences / results	
Code	Study programme competences / results
A1	Knowledge, understanding and capacity to apply legislation related with water engineering during professional development. Capacity to analyse the working mechanism of the economy and public and private management of water
A2	Capacity to resolve basic physical problems of water engineering and theoretic and practical Knowledge of the chemistry, physics, mechanics and technologic properties of the water
A3	Capacity to apply the mechanics of the fluids and the fundamental flow equations in calculate for conductions at pressure and in free layer
A4	Capacity to apply the hydrology knowledge and the principles of flow mechanics in the method of calculations about hydrology as well as surface and underground. Capacity to make the evaluation of the hydraulic resources and apply the principal tools to do the hydrologic planning and the regulation and lamination of the inputs Capacity to analyse the river hydraulics and to apply the knowledge acquired in the restauration of the river direction and other works about rivers and their surroundings
A5	Knowledge of the basic concepts about ecology applied to water engineering. Capacity to act in the respectful way and enriching way about the environment contribution to the sustainable development. Capacity to analyse the ecological quality of water. Knowledge of the basic principles of the ecology and basic understanding of the working continental water systems
A6	Capacity to analyse the mechanism of the economy working and the public and private management of water
A11	Knowledge of numerical models applied to hydraulic engineering. Capacity to use and analyse the results of the hydraulic models. Capacity to design, develop and analyse numerical schemes used in a hydraulic models
A12	Capacity to use commercial numerical models for flux in free layer, flow pressure, drainage, hydrologic calculations for avenues, sediment transport in rivers and costal zones, transport of contaminants and wave propagation
A13	Knowledge of the experimental technics applied to the water engineering. Capacity to design experiments. Capacity to develop reduced models in the laboratory. Capacity to use different types of experimental instrumentation, including flowmeter, depth probes, three-dimensional speedometer, limnimeter, windlass..
A15	General vision and balanced of the basic aspects and application of underground hydrologic from the needs of civil engineering. Capacity to Project or interpret the different hydraulic trials of hydrodynamic characterization, interpret hydrogeological maps and know the constructive aspects of the water uptake
A16	Knowledge of the chemical basis of water which totally condition its behaviour in nature and its uses. Understanding and knowledge of the different water regulations for quality at local, national and European level
A17	A global vision of water supply by the distinct elements which form it, at the same time having the necessary knowledge for its basis dimensioning and technological aspects related to its management and constructive implementation
A18	Capacity to realize an integral use and efficient use of water resource. Knowledge of the working of the basin organisms and general analysis of water engineering projects in the area of cooperation and development and humanitarian aid.

A19	Knowledge of advanced water treatment with different conclusions: depuration, re-use, purification, elimination of nutrients and regeneration treatments
A24	Capacity to design and manage the water supply and treatment in a population area, including design and Project for solutions regarding water treatment, drainage, and advanced management of residual waters in the city. Knowledge regarding advanced processes for the water treatment, elimination of nutrients, and management strategy in times of rainwater
A25	Knowledge and understanding of water in different situations: the working of ecosystems, environmental factors with the purpose of to make an inventory of medium, applying the methodology to value the impact and its use in studies and evaluations of the environmental impact.
B1	To resolve problems effectively
B2	To apply critical thinking, logic and creativity
B3	To work individually with initiative
B4	To communicate effectively in work surroundings
B5	Continuous recycling of knowledge in a general perspective in a global situation of water engineering
B6	Understanding of the need to analyse history to understand the present
B7	Facility to integrate in multidiscipline teams
B8	Capacity to organize and plan
B9	Capacity for analysis, synthesis and structure of information and ideas
C1	To understand the importance of the enterprising culture and to know the means at the reach of the enterprising people
C2	To value knowledge critically, technology and available information to resolve problems that they will face
C3	To assume as a professional and citizen the importance of learning throughout life
C4	To value the importance of the investigation, innovation and technology development in the social ?economic advance and cultural in society
C5	To posses and understand knowledge that gives a base or oportunity to be original in the development and for applications of ideas, often in the context of investigation
C6	The students must be able to apply the acquired knowledge and their capacity to resolve problems in new surrandings or not well known within wider contexts (or multidiscipline) related with the study area
C7	The students must be able to integrate knowledge and to affront the complexity to formulate judgements from information that, been incomplete or limited, include reflexions about social responsabilities and ethics related to the application of the knowledge and judments
C8	The students must be able to comunicate their conclusions, knowledge and the last reasons that support them, to spezialated publics and not spezialated in a clear and unambiguous way.
C9	The student must possess the learning ability with permits them to continues to study in a manner wich will be in a great measure self directed and individual

Learning outcomes			
Learning outcomes	Study programme competences / results		
Overview of water supply and sanitation systems through their components	AC1 AC5 AC6 AC17 AC24 AC25	BC2 BC3 BC4 BC5 BC7 BC8 BC9	CC2 CC3 CC5 CC8 CC9

Ability to design solutions and basic dimensioning water catchment, water treatment, water supply, sewer systems, waste water treatment and SUDS	AC2 AC5 AC11 AC16 AC17 AC18 AC24 AC25	BC1 BC2 BC3 BC4 BC5 BC6 BC7 BC8 BC9	CC2 CC3 CC4 CC5 CC6 CC7 CC8 CC9
Ability to design solutions and basic dimensioning water catchment, drinking water treatment , water supply networks, sewer systems, wastewater treatment and systems of urban water.	AC1 AC2 AC3 AC4 AC5 AC11 AC12 AC13 AC15 AC17 AC18 AC19 AC24 AC25	BC1 BC2 BC3 BC4 BC5 BC7 BC8 BC9	CC1 CC2 CC3 CC4 CC5 CC6 CC7 CC8 CC9

Contents	
Topic	**Sub-topic**
1. Introduction to water supply systems	1.1. Basic concepts and description of the elements of a water supply system
2. Water catchment systems	2.1 Introduction and review of hydrology 2.2. Catchment of surface water: rivers, lakes, reservoirs,.. 2.3. Spring catchments 2.4. Pumping wells
3. Water treatment for human consumption	3.1. Introduction to drinking water treatment 3.2. Pretreatments 3.3. Primary treatments 3.4. Secondary treatments 3.5. Desinfection 3.6. Advanced treatments
4. Water supply networks	4.1. General concepts: overview of water supply and review of basic concepts of hydraulics 4.2. Description of each component: pipes, valves, pumps, reservoirs and other elements. 4.3. Design and modelling
5. Urban drainage systems	5.1. General concepts: runoff generation and management, sewer systems and wastewater treatments 5.2. Urban drainage management 5.3. Structures of runoff detention and treatment 5.4. Sustainable urban drainage systems
6. Sewer systems	6.1. Description 6.2. Design and modelling

7. Hystoryof water supply and sanitation systems and their role in society	7.1. Historical introduction to supply and sewer systems 7.2. Characteristics of nowadays water services
8. Legal Framework	8.1. European legal framework

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Introductory activities	A17 B2 B3 B4 B6 B8 B9 C2 C3 C8 C9	4	0	4
Guest lecture / keynote speech	A1 A4 A5 A6 A16 A17 A18 A19 A24 B2 B6 B9 C2 C3 C4 C5 C6 C7 C9	24	0	24
Document analysis	A1 A2 A3 A4 A5 A11 A15 A17 A18 A24 B2 B3 B7 B8 B9 C2 C3 C4 C5 C6 C7 C8 C9	2	10	12
Collaborative learning	A1 A2 A3 A4 A5 A15 A16 A17 A18 A24 A25 B1 B2 B3 B4 B5 B6 B7 B8 B9 C1 C2 C5 C6 C7 C8 C9	4	14	18
Problem solving	A1 A2 A3 A4 A13 A15 A16 A17 A18 A24 A25 B1 B2 B3 B4 B5 B7 B8 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	4	10	14
ICT practicals	A2 A3 A4 A11 A12 A17 A18 A24 B1 B2 B3 B5 B8 B9 C2 C3 C4 C5 C6 C7 C8 C9	8	20	28
Field trip	A17 A18 A19 A24 A25 B1 B2 B4 B5 B7 B9 C2 C3 C4 C5 C7 C8 C9	8	2	10
Objective test	A2 A3 A5 A11 A15 A16 A17 A18 A24 A25 B2 B3 B8 B9 C2 C3 C4 C5 C6 C9	4	12	16
Oral presentation	A24 A25 B2 B3 B4 B8 B9 C2 C3 C4 C5 C6 C7 C8 C9	2	6	8
Critical bibliographical	A1 A5 A6 A18 A25 B2 B3 B5 B6 B7 B8 B9 C1 C3 C4 C6 C7 C8 C9	0	6	6
Personalized attention		10	0	10
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Introductory activities	Opening of the sessions with an activity that helps to put the student in context and to motivate him/her.
Guest lecture / keynote speech	Lectures where the main theoretical contents of the subject are regarded. Practical examples and real cases are shown also.
Document analysis	Individual review of documentation as introduction to concepts or as review and deepening methodology. The understanding and asimilation of the mean ideas should be shown in a collaborative learning activity or in an objective test.
Collaborative learning	Go in depth in supply and sewer systems elements and design methodologies. Working will be divided between groups and shared at the end.
Problem solving	Solution of problems proposed by the theachers to strengthen theoretical concepts.
ICT practicals	Design and dimension of components of supply and sewer systems by usign technical software.
Field trip	Visit to drinking water and/or wastewater treatment in A Coruña Visit to works on a water supply or sewerage system
Objective test	Multiple choices or true/false tests answered individually or in groups.
Oral presentation	Preparation of a poster or a set of slides and oral presentation at class. Not only the contents are evaluated but the prepared material and the performance.
Critical bibliographical	Reviewing an article and writing an essay based on it

Personalized attention	
Methodologies	**Description**
Critical bibliographical Introductory activities Oral presentation Document analysis Problem solving Field trip Collaborative learning ICT practicals Guest lecture / keynote speech	Answering of questions arising from the theoretical contents exposed in class, problem resolution and other activity. Monitoring of collaborative tasks.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Critical bibliographical	A1 A5 A6 A18 A25 B2 B3 B5 B6 B7 B8 B9 C1 C3 C4 C6 C7 C8 C9	Essay based on an article which should be previously reviewed	15
Oral presentation	A24 A25 B2 B3 B4 B8 B9 C2 C3 C4 C5 C6 C7 C8 C9	Short oral presentation of a subject at class using support material (poster or slides).	5

Problem solving	A1 A2 A3 A4 A13 A15 A16 A17 A18 A24 A25 B1 B2 B3 B4 B5 B7 B8 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	Resolution of proposed problems individualy or in teams	10
Field trip	A17 A18 A19 A24 A25 B1 B2 B4 B5 B7 B9 C2 C3 C4 C5 C7 C8 C9	Attendance and related activities	5
Collaborative learning	A1 A2 A3 A4 A5 A15 A16 A17 A18 A24 A25 B1 B2 B3 B4 B5 B6 B7 B8 B9 C1 C2 C5 C6 C7 C8 C9	Development of the proposed tasks and conclusions exposition.	0
Objective test	A2 A3 A5 A11 A15 A16 A17 A18 A24 A25 B2 B3 B8 B9 C2 C3 C4 C5 C6 C9	Multiple choice or true/false tests	25
ICT practicals	A2 A3 A4 A11 A12 A17 A18 A24 B1 B2 B3 B5 B8 B9 C2 C3 C4 C5 C6 C7 C8 C9	Resolution of proposed simulations usign technical software.	40

Assessment comments
Students with recognition of part-time dedication and academic dispensation of exemption from attendance will have access to audiovisual material for the presentation of the different theoretical and practical contents. For their evaluation they should present the proposed problems (15%), the ICT practices (40%) and the bibliographic reviews (15%) and will pass the objective tests (30%). All this must be done through the Virtual Campus by deadlines indicated on the platform.The regulations fot the assessment og the part-time students will be applied for all the students in the second opportunity.The fraudulent performance of the assessment tests or activities, once verified, will directly imply a failing grade of "0" in the subject in the corresponding exam session, thus invalidating any grade obtained in all the assessment activities in the extraordinary exam session.

Sources of information

Basic	Advanced water distribution modeling and management. Haestad Methods, Thomas M. Walski...[et al.] http://kmelot.biblioteca.udc.es/search~S8*gag?/dAgua+--+Depuraci{226}on./dagua+depuracion/-3%2C-1%2C0%2CB/frameset&FF=dagua+distribucion&6%2C%2C30 Analysis of water distribution networks. P.R. Bhave, R. Gupta. http://kmelot.biblioteca.udc.es/search~S8*gag?/dAgua+--+Depuraci{226}on./dagua+depuracion/-3%2C-1%2C0%2CB/frameset&FF=dagua+distribucion&8%2C%2C30 Design of water supply pipe networks. Prabhata K. Swamee, Ashok K. Sharma. http://kmelot.biblioteca.udc.es/search~S8*gag?/dAgua+--+Depuraci{226}on./dagua+depuracion/-3%2C-1%2C0%2CB/frameset&FF=dagua+distribucion&10%2C%2C30 Urban Drainage. 3rd Ed. Butler y Davies (2011). Taylor Francis. http://kmelot.biblioteca.udc.es/search~S8*gag?/turban+drainage/turban+drainage/1%2C3%2C4%2CB/frameset&FF=turban+drainage&2%2C%2C2/indexsort=- Wastewater hydraulics theory and practice. Hager (2010). Springer. http://kmelot.biblioteca.udc.es/search~S8*gag?/twastewater+/twastewater/1%2C25%2C27%2CB/frameset&FF=twastewater+hydraulics+theory+and+practice&1%2C%2C2/indexsort=- EPANET: https://www.epa.gov/water-research/epanetSWMM: https://www.epa.gov/water-research/storm-water-management-model-swmmITOGH Instruccións Ténicas para Obras Hidráulicas en Galicia. http://augasdegalicia.xunta.gal/seccion-tema/c/Obras_AHG_saneamento_depuracion?content=/Portal-Web/Contidos_Augas_Galicia/Seccions/itohg/seccion.html&std=itohg.html
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Hydrological planning and projects/632844201 Physico-chemistry and quality of water/632844203 Water treatment and energy efficiency/632844206 Groundwater engineering/632844207
Subjects that continue the syllabus
Other comments

(*)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.