Teaching Guide				
Identifying Data				2020/21
Subject (*)	Hydrological planning and projects		Code	632844201
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	Hybrid			
Prerequisites				
Department	Enxeñaría CivilMatemáticas			
Coordinador	Padilla Benitez, Francisco	E-mail	francisco.padilla@udc.es	
Lecturers	Acinas Garcia, Juan Ramon Naves García-Rendueles, Acacia Padilla Benitez, Francisco	E-mail	j.acinas@udc.es acacia.naves@udc.es francisco.padilla@udc.es	
Web	caminos.udc.es/hosting/masteragua/			
General description	Assessment and analysis of water resource systems. Groundwater management. Surface-water management. Water withdrawals and uses. Methods of analysis: identification, optimization, uncertainties, objectives and control of water management plans. Data management systems by GIS. Design of water resources systems and planning.			
Contingency plan	1. Modifications to the contents 2. Methodologies *Teaching methodologies that are maintained *Teaching methodologies that are modified 3. Mechanisms for personalized attention to students 4. Modifications in the evaluation *Evaluation observations: 5. Modifications to the bibliography or webgraphy			

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
A6	Capacity to analyse the mechanism of the economy working and the public and private management of water
A7	Knowledge of the fundamentals about the evaluation of water resources and the principal tools for the hydrological planning, starting from theoretical justification and practical applications that lead to the specific problem resolution and the use of updated methodologic (programs and models) for the evaluation of the exploitation, uses, defence, and the management the combined planning of surface and underground water. Knowledge of national and hydrological plans
A9	Knowledge of geographical information systems (SIG) applied to the management of water resources. Knowledge of the basic working of the system for the analysis of the geographical data, making use of SIG tools and support management and the analysis of data regarding water resources. Knowledge of the geospatial data and his characteristics and the processes for its acquisition, storage treatment analysis, modelling and presentation
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.

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		
To acquire the ability to plan the joint use of surface and underground water resources and the methodologies for analyzing the interaction between them. To know techniques of exploitation and analysis of the regulation of water resources in river basins	AC1 AC6 AC7 AC9 AC18	BC1 BC2 BC3 BC4 BC5 BC6 BC7 BC8 BC9	CC1 CC2 CC3 CC4 CC5 CC6 CC7 CC8 CC9

Contents	
Topic	Sub-topic
1. Assessment and analysis of water resource systems.	Hydrological resources. Purposes of water resources planning. The hydrological watershed. Integrated groundwater and surface water planning. Water withdrawals, supplies and uses. Data management and appraisal. Water balances. Flow water management and historical restitution.
2. Groundwater management.	Groundwater resources and storages. Recharges and discharges. Groundwater balances. Natural and artificial groundwater recharges. Simulation of groundwater as related to surface water systems. Calibration and validation of groundwater systems.

3. Surface-water management.	Flow data management and analysis. Deterministic river basin modelling. Synthetic streamflow generation. Stochastic river basin planning models. Water for hydroelectric generation.
4. Methods of analysis.	Identification and evaluation of water management plans. Control and efficiency of water management plans. Water resources planning under uncertainty. Reservoir design and operation. Water resources planning objectives and optimization.
5. Hydrological planning.	Design of integrated water resources systems and planning. Mathematical models for the development of planning alternatives. Data management systems by GIS. Water economy and legislation. Administration of hydrological planning programs.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A6 A7 A9 A18	28	28	56
Seminar	A1 A6 A7 A9 A18 B1 B2 B3 B4 B5 B6 B7 B8 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	16	30	46
ICT practicals	A1 A18 B1 B2 B3 B4 B5 B6 B7 B8 C2 C5 C6 C8 C9	4	2	6
Field trip	A6 A7 A18 B2 B4 B5 B7 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	12	0	12
Personalized attention		30	0	30
(*)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	Regular lectures where the main theoretical contents of the subjects are regarded
Seminar	Practical lectures related to the theoretical aspects regarded at the magistral lectures
ICT practicals	Resolution of proposed cases using technical software.
Field trip	Field trips for technical visits

Personalized attention	
Methodologies	Description
Seminar Guest lecture / keynote speech ICT practicals	Personal attention that will be provided for seminars and practices usign ICT

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Seminar	A1 A6 A7 A9 A18 B1 B2 B3 B4 B5 B6 B7 B8 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	The knowledge of the concepts developed at the magistral lectures will be assessed and considered for the final mark	30

Guest lecture / keynote speech	A1 A6 A7 A9 A18	The attendance to the seminars and the work being developed at the seminars will be considered for the final mark	50
ICT practicals	A1 A18 B1 B2 B3 B4 B5 B6 B7 B8 C2 C5 C6 C8 C9	The resolution of proposed cases using technical software will be evaluated and considered for the final grade	20

Assessment comments

Sources of information	
Basic	- Andreu J. (1993). Conceptos y métodos para la planificación hidrológica. Ed. CIMNE - Balairón, L. (2000). Gestión de recursos hídricos. E.U.I.T. Obras Públicas de Ávila, Universidad de Salamanca - Estrada, L. (1994). Garantía en los sistemas de explotación de los recursos hidráulicos. CEDEX - Estrella, T. (1993). Modelos matemáticos para la evaluación de los recursos hídricos. CEDEX - Ferrer F.J. (1993). Recomendaciones para el cálculo hidrometeorológico de avenidas. CEDEX - Goodman A. (1984). Principles of Water Resources Planning. Prentice-Hall - Liria J. y Sáinz J.A. (1982). Recursos Hidráulicos y su Planificación. Apuntes de la ETSICCP de Santander - Loucks D., Stedinger J. y Haith D. (1981). Water Resource Systems Planning and Analysis. Prentice-Hall - Mays, L.W. (2011). Water resources engineering. John Wiley & Sons - Sainz, J.A. y Ascorbe, A. (1984). Metodología aplicada a estudios de regulación. Univ. de Santander - Vallarino E. (1980). Planificación Hidráulica. Apuntes de la ETSICCP de Madrid
Complementary	

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

(*)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.