



Teaching Guide				
Identifying Data				2017/18
Subject (*)	Surface and groundwater hydrology	Code	632G01050	
Study programme	Grao en Enxeñaría de Obras Públicas			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Fourth	Obligatoria	4.5
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Civil			
Coordinador	Padilla Benitez, Francisco	E-mail	francisco.padilla@udc.es	
Lecturers	Juncosa Rivera, Ricardo Padilla Benitez, Francisco	E-mail	ricardo.juncosa@udc.es francisco.padilla@udc.es	
Web				
General description	Provide a comprehensive and balanced view of the basic and applied aspects of surface hydrology and groundwater from the specific needs of civil engineering, so that the student is able to project and interpret the various hydraulic tests of hydrodynamic characterization of the medium, interpret hydrogeological maps, find constructive aspects of captions and analyze surface and groundwater interactions			

Study programme competences / results	
Code	Study programme competences / results
A2	Conocimientos básicos sobre el uso y programación de los ordenadores, sistemas operativos, bases de datos y programas informáticos con aplicación en ingeniería.
A19	Conocimiento de los conceptos básicos de hidrología superficial y subterránea.
A28	Capacidad para construcción y conservación de obras marítimas.
A30	Conocimiento y capacidad para proyectar y dimensionar obras e instalaciones hidráulicas, sistemas energéticos, aprovechamientos hidroeléctricos y planificación y gestión de recursos hidráulicos superficiales y subterráneos.
B1	Que los estudiantes hayan demostrado poseer y comprender conocimientos en un área de estudio que parte de la base de la educación secundaria general, y se suele encontrar a un nivel que, si bien se apoya en libros de texto avanzados, incluye también algunos aspectos que implican conocimientos procedentes de la vanguardia de su campo de estudio
B2	Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio
B3	Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética
B4	Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado
B5	Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía
B8	Aplicar un pensamiento crítico, lógico y creativo.
B11	Comportarse con ética y responsabilidad social como ciudadano y como profesional.
B13	Expresarse correctamente, tanto de forma oral como por escrito, en las lenguas oficiales de la comunidad autónoma.
B14	Dominar la expresión y la comprensión de forma oral y escrita de un idioma extranjero.
B15	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de la vida.
B16	Desarrollarse para el ejercicio de una ciudadanía abierta, culta, crítica, comprometida, democrática y solidaria, capaz de analizar la realidad, diagnosticar problemas, formular e implantar soluciones basadas en el conocimiento y orientadas al bien común.
B18	Valorar críticamente el conocimiento, la tecnología y la información disponible para resolver los problemas con que deben enfrentarse.
B19	Asumir como profesional y ciudadano la importancia del aprendizaje a lo largo de la vida.
B20	Valorar la importancia que tiene la investigación, la innovación y el desarrollo tecnológico en el avance socioeconómico y cultural de la sociedad.



C1	Reciclaje continuo de conocimientos en el ámbito global de actuación de la Ingeniería Civil.
C2	Comprender la importancia de la innovación en la profesión.
C3	Aprovechamiento e incorporación de las nuevas tecnologías
C4	Entender y aplicar el marco legal de la disciplina.
C5	Comprensión de la necesidad de actuar de forma enriquecedora sobre el medio ambiente contribuyendo al desarrollo sostenible.
C7	Apreciación de la diversidad.
C8	Facilidad para la integración en equipos multidisciplinares.
C10	Capacidad de análisis, síntesis y estructuración de la información y las ideas.
C12	Capacidad de abstracción.
C14	Capacidad de autoaprendizaje mediante la inquietud por buscar y adquirir nuevos conocimientos, potenciando el uso de las nuevas tecnologías de la información.
C18	Capacidad para aplicar conocimientos básicos en el aprendizaje de conocimientos tecnológicos y en su puesta en práctica
C19	Capacidad de realizar pruebas, ensayos y experimentos, analizando, sintetizando e interpretando los resultados

Learning outcomes			
Learning outcomes	Study programme competences / results		
Review the concepts of groundwater hydrology previously acquired in other subjects of the degree. Basic knowledge of hydrogeology	A2 A19 A28 A30	B1 B2 B3 B4 B5 B8 B11 B13 B14 B15 B16 B18 B19 B20	C1 C2 C3 C4 C5 C7 C8 C10 C12 C14 C18 C19
Acquire and develop the basics of surface hydrology in quantitative aspects related to hydrographs and gauging stations	A19 A30		
Analyze the behavior of groundwater flow in the unsaturated zone, studying the transport of solutes and pollutants in the environment	A2 A19 A30		
Know how to design and analyze uptake by hydrodynamic characterization testing the underground environment. Acquire skills in prospecting and exploration aspects of the underground environment. Learn and calculate the perimeters of protection of groundwater resources	A2 A19 A30		
Acquire the ability to plan the set of surface and groundwater resources and the interaction of such use. Knowledge of artificial recharge techniques.	A2 A19 A30		

Contents	
Topic	Sub-topic
1. Introduction	T1. Review concepts of surface hydrology: hydrological cycle, watershed and balances
2. Surface hydrology	T2. Hydrographs: unit hydrograph, rainfall-runoff transformation T3. Gauging: flow duration curve, gauging analysis



3. Foundation of groundwater hydrology	T4. Basics: overview of basic equations. Fundamentals. Porous, fractured and karstic media. T5. Type of underground formations. Analysis of coastal aquifers
4. Water flow in the unsaturated zone	T6. Saturation curve. experimentation T7. Basic equations: analytical solutions
5. Hydraulic uptakes	T8. Hydrodynamic tests in porous media characterization: simple tests and staggered trials T9. Hydrodynamics characterization tests in fractured media T10. Theory of superposition. Theory of images T11. Constructive aspects of deposits: design and drilling T12. Exploration and prospecting
6. Solute and heat transport	T13. Transport and transformation processes T14. Equations and resolution T15. hydrogeochemistry basic
7. Protection perimeters	T16. Design of protection perimeters of abstractions
8. Hydrological planning	T17. Surface water and groundwater interaction T18. Artificial recharge T19. Aggregated and distributed models T20. Joint use. Planning

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student's personal work hours	Total hours
Guest lecture / keynote speech	A2 A19 A28 A30 B1	30	45	75
Problem solving	B2 B3 B4 B5 B11 B13 B14 B15 B16 B8 B18 B19 B20 C1 C3 C4 C5 C7 C10 C12 C14 C18 C2 C8 C19	10	15	25
Multiple-choice questions	A19	3.5	0	3.5
Objective test	A19 A30	6	0	6
Personalized attention		3	0	3

(*)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	The main agenda will be taught by classroom lectures where student participation is sought. The theoretical knowledge will be transmitted in joint sessions with all students, working on the assimilation of fundamental concepts and equations. The teacher explains the subject and the students, if they wish, take notes. In the theory sessions the teacher will ask about the assimilation of contents by students. Lately, the students would study
Problem solving	The problems associated with the core subject in the classroom and individual levels will be resolved. In addition, a newsletter be provided with unresolved problems, the student must submit for evaluation
Multiple-choice questions	Throughout the development of the matter, four material tracking tests will be carried out to analyze the assimilation of knowledge of students and promote the routine monitoring of the contents covered in the course
Objective test	In the official dates on the core exams, theoretical and practical contents of the subject will be made.

Personalized attention



Methodologies	Description
Problem solving Guest lecture / keynote speech	Regarding the personal attention it should be noted that in lectures the teacher would ask about the assimilation of content by students and will be available in his office during working hours. Troubleshooting be conducted together, guiding the teacher at all times students toward solving practices. They may perform specific group tutorials depending on the number of students interested.

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Multiple-choice questions	A19	4 monitoring tests are performed	40
Problem solving	B2 B3 B4 B5 B11 B13 B14 B15 B16 B8 B18 B19 B20 C1 C3 C4 C5 C7 C10 C12 C14 C18 C2 C8 C19	Problems will be solved in class and will solve other problems on your own, that you will have to deliver.	10
Objective test	A19 A30	Tests will be conducted in the official announcements	50

Assessment comments
The course is worth 100 points. For the approved must get 50 points. For evaluation they may be gaining points along the course, by solving problems and multiple response tests. Still, in the objective test the student could be optionally evaluated of the already continuously evaluated. In that case, the mark obtained in that part replaced to that achieved in the continuous evaluation.
There are two official exams in times designated by the Head of Studies.

Sources of information	
Basic	<ul style="list-style-type: none"> - Bear, J. (1972). Dynamics of fluids in porous media. American Elsevier - Bear, J. (1979). Hydraulics of groundwater. Mc Graw Hill - Custodio, E. y Llamas, M.R. (1983). Hidrologia subterránea. Omega - Domenico, P.A. and Schwartz, F. W. (1990). Physical and chemical hydrogeology. Wiley - Feiter, C.W. (1999). Contaminant Hydrogeology. Prentice hall - Feiter, C.W. (2001). Applied hydrogeology. Prentice hall - Freeze, R.A. and Cherry, J.A. (1979). Groundwater. Prentice hall - Mays, Larry W. (2011). Water Resources Engineering. Wiley - Ven te Chow, Maidment, D.R. and Mays, L.W. (1994). Hidrologia aplicada. Mc Graw Hill - Weight, Willis D. (2009). Hydrogeology field manual. Mc Graw Hill
Complementary	- Gray, D.M. (1970). Handbook on the principles of hydrology. National research Council

Recommendations
Subjects that it is recommended to have taken before
Geology/632G01004 Hydraulics and hydrology/632G01016 Soil engineering I/632G01020 Hydrology applied to public works/632G01052
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Water resources control/632G01051
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.