Teaching Guide					
Identifying Data					2017/18
Subject (*)	Physico-chemistry and quality of water			Code	632844203
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		Obligatoria	6
Language	English				
Teaching method	Face-to-face				
Prerequisites					
Department	Enxeñaría Civil				
Coordinador	Vázquez González, Ana María		E-mail	ana.maria.vazquez@udc.es	
Lecturers	Delgado Martin, Jordi Vázquez González, Ana María		E-mail	jorge.delgado@udc.es ana.maria.vazquez@udc.es	
Web	caminos.udc.es/info/asignaturas/201/masterindex.html				
General description	Basic principles of water chemistry. Sampling procedures and design of sampling surveys. Analitical techniques for the determination and measurement of chemical constituents of water and its contaminants. Assessment of the quality of analytical data. Data analysis and interpretation: Graphic approaches. Statistical description of water chemistry data. Hydrochemical processes. Introduction to hydrochemical modelling.				

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
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
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
A19	Knowledge of advanced water treatment with different conclusions: depuration, re-use, purification, elimination of nutrients and regeneration treatments
A20	Use and management of measuring equipment in the field and in the laboratory. Knowledge of the methodology of control process and the determination of design parameters for water treatment processes
A21	Knowledge of water quality control models. Capacity to analyse and propose solutions to problems in water quality control
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		
Learning the basic principles of water chemistry.	AC1 AC2 AC5 AC16 AC19 AC20 AC21 AC25	BC1 BC4 BC5 BC6 BC9	CC1 CC2 CC3 CC4 CC5 CC6 CC7 CC8 CC9
Learning the basic principles of the analytical techniques aimed at quantifying the concentrations of water contaminants and their constituents.	AC2 AC16	BC1 BC2 BC4 BC5 BC7 BC9	CC2 CC3 CC4
Ability to plan and execute sampling surveys for water chemistry	AC1 AC2 AC20 AC21 AC25	BC1 BC2 BC3 BC5 BC7 BC8 BC9	CC4
Ability to establish relationships between physico-chemical data and the chemical state of a water body or the prescribed legal environmental quality objectives.	AC1 AC25	BC2 BC5 BC7	CC2 CC3 CC4
Ability to perform statistical descriptions relative to the chemical quality of water.	AC2 AC16 AC20 AC21	BC1 BC2 BC4 BC7 BC8 BC9	CC2 CC3 CC4

Ability to perform graphical representations of water chemistry	AC2 AC25	BC1 BC2 BC3 BC8 BC9	CC2 CC3 CC4
Learning basic hydrochemical processes	AC16 AC19	BC1 BC2 BC7 BC9	CC3 CC4
Learning the basic principles of hydrochemical modelling	AC21	BC1 BC2 BC7 BC9	CC4

Contents	
Topic	**Sub-topic**
Basics of water chemistry	Structure and properties of water Mol and stoichiometry Aqueous interactions and chemical bonding Concentration units Colligative properties Mass action law and the equilibrium constant
Sampling and monitoring	Routine parameters Special determinations In situ vs. laboratory determinations Sampling surveys for ground, precipitation, stream and lake/reservoir waters Sampling frequency
Analitical techniques and quality assessment	Accuracy, precission, bias Detection and quatification limits Titrations Analytical techniques (spectrophtometry, ICP, ...)
Data analysis and interpretation	Fundamentals of descriptive statistics Graphic analysis of water chemistry data Time series representation and analysis
Hydrochemical processes and modelling	Chemical reactions and temperature dependence Equilibrium Acidity and alkalinity Solid dissolution/precipitation processes

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Guest lecture / keynote speech	A1 A2 A5 A16 A19 A21 A25 B5	30	30	60
Seminar	A1 A2 A5 A16 A19 A20 A21 A25 B1 B2 B3 B4 B5 B6 B7 B8 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	30	30	60
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

Personalized attention	
Methodologies	**Description**
Seminar Guest lecture / keynote speech	Pernonalized attention to be provided for the seminars and tutorings

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Seminar	A1 A2 A5 A16 A19 A20 A21 A25 B1 B2 B3 B4 B5 B6 B7 B8 B9 C1 C2 C3 C4 C5 C6 C7 C8 C9	The attendance to the semminars and the work being developed at the semminars will be considered for the final mark	50
Guest lecture / keynote speech	A1 A2 A5 A16 A19 A21 A25 B5	The knowledge of the concepts developed at the magistral lectures will be assesed and considered for the final mark	50

Assessment comments

Sources of information	
Basic	- James I. Drever (1997). The Geochemistry of Natural Waters: Surface and Groundwater Environments (3rd Edition). Prentice Hall - Werner Stumm and James J. Morgan (1996). Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters (3rd Ed.). Wiley Interscience - C.A.J. Appelo and D. Postma (2005). Geochemistry, Groundwater And Pollution (2nd Ed.). Balkema - John D. Hem (1985). Study And Interpretation of the Chemical Characteristics of Natural Water. U.S. Geological Survey - Arthur Hounslow (1995). Water Quality Data: . Lewis Publishers
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.