



## Teaching Guide

Identifying Data					2021/22
<b>Subject (*)</b>	Analytical Estrategies and the Environment	<b>Code</b>	610500002		
<b>Study programme</b>	Mestrado Universitario en Ciencias, Tecnoloxías e Xestión Ambiental (plan 2012)				
Descriptors					
Cycle	Period	Year	Type	Credits	
Official Master's Degree	1st four-month period	First	Obligatory	6	
<b>Language</b>	SpanishEnglish				
<b>Teaching method</b>	Face-to-face				
<b>Prerequisites</b>					
<b>Department</b>	Química				
<b>Coordinador</b>	Muniategui Lorenzo, Soledad	<b>E-mail</b>	soledad.muniategui@udc.es		
<b>Lecturers</b>	Beceiro Gonzalez, Maria Elisa Carlosena Zubieta, Alatzne Gonzalez Castro, Maria Jose Muniategui Lorenzo, Soledad Prieto Blanco, Maria del Carmen Terán Baamonde, Javier	<b>E-mail</b>	elisa.beceiro.gonzalez@udc.es alatzne.carlosena@udc.es m.j.gonzalez.castro@udc.es soledad.muniategui@udc.es m.c.prieto.blanco@udc.es javier.teran.baamonde@udc.es		
<b>Web</b>	<a href="http://campusvirtual.udc.es">http://campusvirtual.udc.es</a>				
<b>General description</b>	This subject has an approach eminently practical, whose main aim is to help students to develop the "analytical approach" for solving diverse problems, selecting the most suitable analytical methodology in each case. Developments and trends in the sample treatment and instrumental determination shall be considered; and its application for the determination of priority and emerging pollutants in samples of environmental interest (air, water, soil, sediment, biological samples, food, etc..).				



<b>Contingency plan</b>	<p>(i) ADAPTATION TO BE CARRIED OUT IN THE EVENT OF NON-APPEARANCE due to outbreaks of disease.</p> <p>1. Modifications to the content No changes will be made</p> <p>2. Methodologies *Teaching methodologies that are kept. Seminars, supervised works, mixed test, personalized attention.</p> <p>*Teaching methodologies that are modified. Laboratory practices: if it is not possible to do them in person at the Faculty, they will be replaced by the resolution of a practical case presented by the professor to groups of students who will have to submit a report.</p> <p>3. Mechanisms for personalised attention to students</p> <p>- Email: Daily. Used to make queries, request a virtual meeting to resolve doubts and follow up the case study and supervised work.</p> <p>- Moodle: Daily. According to the needs of the students. It has "thematic forums" to formulate the necessary consultations.</p> <p>- Teams: 1 session per week of the large group for the advancement of the theoretical contents and the seminars, in the time slot assigned to the subject. From 1 to 2 weekly sessions (according to the students' needs) in small groups (&lt; 6 people), for the follow-up and support of the study and programmed activities related to the seminars, tutored works and practical cases.</p> <p>4. Modifications in the evaluation</p> <p>- The resolution of a case study replaces laboratory practices with the same percentage of qualification. The methodological suitability, the approach, detail and clarity in the reports, as well as the final critical discussion of the report will be assessed according to the problem to be solved.</p> <p>*Evaluation observations: - The rest of the methodologies of the teaching guide are maintained, except that the mixed test and defence/exhibition of tutored works will be carried out in a virtual or telematic way (via Moodle and/or Teams), both at the first and second opportunity.</p> <p>5. Modifications to the bibliography or webgraphy No changes will be made. All the subjects are already available in Moodle.</p> <p>(ii) ADAPTATION PROVIDED AT THE CENTER FOR CASES WHEN THE CLASSROOM CAPACITY ASSIGNED FOR THE SUBJECT IS EXCEEDED: additional spaces will be reserved in which students will be able to follow the activities through the Teams platform. In the case of practical activities, the groups will be divided to adapt them to the capacity of the laboratory.</p>
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Study programme competences / results	
Code	Study programme competences / results
A1	Coñecemento das realidades interdisciplinares da Química e do Medio Ambiente, dos temas punteiros nestas disciplinas e das perspectivas de futuro.



A3	Capacitar ao alumno para o desenvolvemento dun traballo de investigación nun campo da Química ou do Medio Ambiente, incluíndo os procesos de caracterización de materiais, o estudo das súas propiedades fisicoquímicas e biolóxicas e dos procesos que poden sufrir no medio natural.
A10	Relacionar a presenza de especies químicas no medio natural cos conceptos de toxicidade e biodisponibilidade.
A21	Comprender os fundamentos dos procesos de calidade e o modo de xestionalos.
A22	Dominar as técnicas instrumentais de análises máis típicas no ámbito químico profesional.
B1	Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, a miúdo nun contexto de investigación.
B2	Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornas novas ou pouco coñecidas dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
B3	Que os estudantes sexan capaces de integrar coñecementos e enfrontarse á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
B5	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun modo que haberá de ser en gran medida autodirixido ou autónomo.
B6	Ser capaz de analizar datos e situacións, xestionar a información dispoñible e sintetizala, todo iso a un nivel especializado.
B7	Ser capaz de planificar adecuadamente desenvolvementos experimentais, a un nivel especializado.
C1	Ser capaz de traballar en equipos, especialmente nos interdisciplinares e internacionais.
C2	Ser capaz de manter un pensamento crítico dentro dun compromiso ético e no marco da cultura da calidade.
C3	Ser capaz de adaptarse a situacións novas, mostrando creatividade, iniciativa, espírito emprendedor e capacidade de liderado.
C9	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C11	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

## Learning outcomes

Learning outcomes	Study programme competences / results		
	AC	BC	CC
To know how to analyze and solve chemical problems related to the environment based on analytical criteria. Planning and implementation of the stages of an analytical process	AC1 AC3 AC10 AC22	BC1 BC2 BC5 BC6 BC7	CC1 CC2 CC11
To know how to select and implement best practice measurement and analytical experimentation, ensuring the quality of the chemical data	AC1 AC3 AC10 AC21 AC22	BC1 BC2 BC6 BC7	CC1 CC2
To know advanced techniques of sampling, sample treatment and instrumental determination in environmental analysis	AC1 AC3 AC10 AC22	BC1 BC2 BC6 BC7	CC1 CC2
To know how to interpret environmental data and information from measurements	AC1 AC3 AC10 AC22	BC1 BC2 BC3 BC6 BC7	CC1 CC2 CC3 CC9

## Contents

Topic	Sub-topic
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Chapter 1.- ANALYTICAL PROBLEM	Defining the problem and designing the analytical method. Classification of methodology and selection criteria. Development of an analytical method. Performance characteristics of analytical method. Method Validation. Sustainable Analytical Chemistry.
Chapter 2.- SAMPLING	Sampling methodology. Representative sample. Sampling strategies and sampling plan. Passive sampling. Automatic sampling.
Chapter 3.- SAMPLE PREPARATION	Recent advances in sample preparation techniques. Green sample treatments. Microextraction techniques. New extractants materials. Automated systems. Miniaturization of the sample preparation systems.
Chapter 4.- INSTRUMENTAL METHODS OF ANALYSIS	Current trends in spectroscopic and chromatographic methods. Hyphenated techniques.
Chapter 5.- CHEMICAL SPECIATION	Importance of chemical speciation in environment. Speciation methodology. Analytical challenges. Methods of analysis and applications.
Chapter 6.- ENVIRONMENTAL APPLICATIONS	Contaminants in environment. Air quality analysis. Water analysis. Analysis of soil and sediment. Analysis of biological samples. Food analysis and food safety

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A3 A10 A21 A22 C2 C9 C11	18	20	38
Laboratory practice	A22 B2 B7	10	10	20
Seminar	A1 A10 B1 B2 B3 B6 C3 C1	7	21	28
Supervised projects	A3 A10 A21 A22 B1 B2 B3 B5 B6 C3 C11	5	55	60
Mixed objective/subjective test	A3 A10 A21 A22 B2	2	0	2
Personalized attention		2	0	2

(\*)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	Teacher explains the fundamental concepts and the most important contents of each subject. It also proposes different issues that should be discussed and resolved by the students, encouraging participation
Laboratory practice	In the lab sessions the student will perform the application of theoretical concepts studied throughout the course and will also acquire the practical skills on techniques under study. The student will make a brief report on the obtained results
Seminar	Seminars clarify and extend some aspects covered in lectures and laboratory practice, especially related to the practical application of the studied methodologies. Students participate and discuss possible strategies to solve industrial and environmental problems under the teacher guidance
Supervised projects	Supervised projects will include finding information from different sources, presentation and oral defense of a topic proposed by the teacher related to any environmental, industrial, etc problem
Mixed objective/subjective test	A final exam will be done to assess the degree of learning both the theoretical and practical

Personalized attention	
Methodologies	Description



Seminar	Throughout the course the teacher resolves any doubts on the subject that the student needs.
Supervised projects	In seminars and supervised projects, the teacher supervises the methodology used to solve the proposed problems, solves the student's doubts and guides the learning process Students with recognition of part-time dedication and academic assistance waiver regime will be treated in tutoring (by appointment)

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Guest lecture / keynote speech	A1 A3 A10 A21 A22 C2 C9 C11	Attendance at master classes and active participation will be evaluated	5
Laboratory practice	A22 B2 B7	Practice work and active participation of students will be evaluated on a continuing process.	10
Seminar	A1 A10 B1 B2 B3 B6 C3 C1	Work and active participation of students will be evaluated	5
Supervised projects	A3 A10 A21 A22 B1 B2 B3 B5 B6 C3 C11	The academic activities will be evaluated by performing and oral defense of the supervised activities	50
Mixed objective/subjective test	A3 A10 A21 A22 B2	Learning degree for the course contents and skill acquisition by students will be assessed through an objective test. It will consist of theoretical questions and applied problems	30

Assessment comments
<p>To pass the subject, students must regulary atendance to all available lessons and to attain a minimun cualification in each of them. The student will obtain the qualification of not submitted when he/she don't make the supervised project and not presented to the mixed test. As regards the successive academic years, the teaching-learning process, including continuous assessment, refers to an academic course and, therefore, would comezar a new course, including all activities and procedures the Assessment that is scheduled for that course.</p> <p>For students with part-time dedication and academic assistance waiver regime. in the event that the student can not perform all activities or continuous assessment tests, the teacher take appropriate measures to avoid prejudicing their qualification.</p> <p>In the evaluation of the subject, all that is established in article 14, regarding the Fraud Commission and disciplinary responsibilities, of the UDC's Rules for the Evaluation of Bachelor's Degrees and Master's Degrees will be applied.</p>

Sources of information	
Basic	<ul style="list-style-type: none"> <li>- C. Cámara, C. Pérez Conde (Ed.) (2010). Análisis Químico de Trazas. Editorial Síntesis. Madrid</li> <li>- J.R. Dean (1998). Extraction methods for environmental analysis. Chichester, John Wiley &amp; Sons</li> <li>- F.W. Fifield; P.J. Haines (2005). Environmental Analytical Chemistry. Londres, John Wiley &amp; Sons</li> <li>- E. Prichard (1996). Trace Analysis: A structured approach to obtaining reliable results. Royal Society of Chemistry, Cambridge</li> <li>- C. Cámara (Ed.), P. Fernández, A. Martín-Esteban, C. Pérez-Conde, M. Vidal (2002). Toma y tratamiento de muestra. Editorial Síntesis. Madrid</li> <li>- Reeve, Roger N. (1994). Environmental analysis. Chichester : John Wiley &amp; Sons,</li> <li>- VanLoon, Gary W (2011). Environmental chemistry : a global perspective. Oxford, Oxford University Press</li> <li>- R.Compañó Beltrán, A. Ríos Castro (2002). Garantía de calidad en los laboratorios analíticos. Síntesis, Madrid</li> <li>- Se consultarán direcciones web y enlaces de interés relacionados con la materia impartida. - Material complementario: resumen de presentaciones, métodos oficiales de análisis, artículos científicos, etc. - Se utilizarán todos los medios disponibles en la plataforma de la facultad virtual de la UDC</li> </ul>



Complementary	
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<b>Recommendations</b>
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Subjects that it is recommended to have taken before
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Subjects that are recommended to be taken simultaneously
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Subjects that continue the syllabus
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<b>Other comments</b>
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GREEN CAMPUS PROGRAM RECOMMENDATION: in order to help achieve an immediate sustainable environment and comply with point 6 of the "Environmental Declaration of the Faculty of Science (2020)", the documentary works requested in this subject:(a) Will be requested mostly in virtual format and computer support.(b) If paper is used: -No plastics will be used -Double-sided printing will be used -Recycled paper will be used -The use of drafts will be avoided.

(\*)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.