Teaching Guide				
Identifying Data				2015/16
Subject (*)	Análise Instrumental Avanzado		Code	610500023
Study programme	Mestrado Universitario en Ciencias. Tecnoloxías e Xestión Ambiental (plan 2012)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optativa	3
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química Analítica			
Coordinador	Soto Ferreiro, Rosa MariaTurnes Carou, Maria Isabel	E-mail	rosa.soto.ferreiro@udc.esisabel.turnes@udc.es	
Lecturers	Soto Ferreiro, Rosa Maria Turnes Carou, Maria Isabel	E-mail	rosa.soto.ferreiro@udc.es isabel.turnes@udc.es	
Web				
General description	In this course advanced and novel aspects of instrumental techniques currently used on solving analytical problems related to the environment analysis, industry, etc are taught. Especially explores issues related to the experimental development of them.			

Study programme competences	
Code	Study programme competences
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.
A9	Coñecer algunhas aplicacións básicas da química computacional e dos programas de cálculo máis utilizados nos ámbitos da química e o medio ambiente.
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 coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
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.
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.
C4	Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
C6	Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C9	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C10	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.
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		
Learn the applicability and potential of the different instrumental techniques in solving problems related to the environment, industry, etc.	AC1 AC22	BC1 BC5	CC2 CC11
Be able to select the most appropriate technique depending on the type of species to be determined, its contents, sample type, cost, etc.	AC3 AC22	BC2	CC3 CC9
Acquire skill in the use of different instruments and adjusting the instrumental variables.	AC22	BC7	
Be able to get the most reliable information from experimental results.	AC9	BC6	CC4 CC6 CC10

Contents	
Topic	Sub-topic
1.- Introduction	Presentation. Documentation for the students.
2.- Mass spectrometry	Fundamentals. Sources of ionization. Analyzers. Detectors. Tandem mass spectrometry (MS/MS). Aplications: environmental, industry.
3.- Atomic absorption spectrometry	Atomization systems. Advances in instrumentation. Operational considerations. Aplications: environmental, industry.
4.- ICP optical emision spectrometry. ICP mass spectrometry	Operational considerations. Aplications: environmental, industry.
5.- Gas chromatography	Advances in instrumentation and modes of operation. Operational considerations. Coupled and multidimensional techniques. Aplications: environmental, industry.
6.- Liquid chromatography	Advances in instrumentation and modes of operation. Operational considerations. Coupled and multidimensional techniques. Aplications: environmental, industry.
7.- Capillary electrophoresis	Fundamentals. Instrumentation and modes of operation. Operational considerations. Aplications. Electrochromatography.
Experimental work	1.- Determination of organic contaminants by high performance liquid chromatography (HPLC) with diode array. 2.- Determination of organic contaminants by gas chromatography with mass spectrometry. 3.- Slurry sampling for metal determination by electrothermal atomic absorption spectrometry. 4.- Trace metal determination by ICP-MS. Seminar: report preparation.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A22 A1 B5 C2 C9 C10 C11	10	28	38
Seminar	A3 A9 B1 B2 B6 C3 C6	1.5	4	5.5
Laboratory practice	A9 B2 B6 B7 C9 C11	14	14	28
Objective test	A22 B2 B5 C4	2	0	2
Personalized attention		1.5	0	1.5
(*)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 teacher presents the fundamental concepts and develops the essential aspects of the subject. It also raises different issues to be discussed and resolved by the students, thereby encouraging their participation. At the end of each block the students are given a questionnaire to be solved and given to the teacher, which will contribute to the evaluation of the subject.
Seminar	In the theoretical session, the course is presented and the material for the development of the different subjects is provided, as are: scripts or previous schemes with the fundamental aspects of the subject, which the student must know to understand and take advantage of what are taught in the course. In the laboratory session the questions related to the preparation of the report are addressed.
Laboratory practice	The script of the laboratory practice includes: - Questions that the student has to solve before entering the laboratory that will help him to achieve the knowledge and skills related to the experimental work. - A scheme of the experimental procedure. - Issues related to the work done in the laboratory: justification for selection of instrumental parameters, obtaining information from the experimental results, etc.. In the laboratory, the student performs the selection of the experimental conditions, contributes to the adjustment and optimization of the experimental variables, the introduction of the samples, performs calculations of experimental parameters, concentrations, etc. At the end he must submit a report of the practices carried out.
Objective test	It consists of a written exam that includes short answer and/or choice questions about the theoretial and practical contents taught in the course.

Personalized attention	
Methodologies	**Description**
Seminar Laboratory practice	In the seminar students pose thier questions and comments and the teacher serves in a personalized way the different aspects. In the laboratory sessions, the teacher monitors each student performing operations, so that an incident will not happen, taking into account that complex instrumentation is being used in most cases.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Objective test	A22 B2 B5 C4	Exam score.	50
Guest lecture / keynote speech	A22 A1 B5 C2 C9 C10 C11	Attendance at keynote sessions, active participation in them and the resolution of the questionnaires will be assessed.	20
Laboratory practice	A9 B2 B6 B7 C9 C11	Skill in conducting the experimental activities and the quality of the delivered report will be assessed.	30

Assessment comments

Sources of information

Basic	- ALLER, J.A. (2003). Espectroscopía Atómica Electrotérmica Analítica. Secretariado de Publicaciones y Medios Audiovisuales, Universidad de Leon - ESTEBAN, L. (1993). La Espectrometría de Masas en Imágenes. ACK Editores - HOFFMANN, E.; STROOBANT, V (2005). Mass Spectrometry. Principles and Applications. Ed. Wiley - HILL, S.J. (Ed) (2007). Inductively Coupled Plasma Spectrometry and its Aplications. Ed. Blackwell Publishing - WELZ, B.; SPERLING, M. (1999). Atomic Absorption Spectrometry. Ed. Wiley-VCH - CELA, R.; LORENZO, R.A.; CASAIS, M.C. (2002). Técnicas de Separación en Química Analítica. Ed. Síntesis - SKOOG, D.; HOLLER, F.J.; NIEMAN T.A. (2000). Principios de Análisis Instrumental . Ed. McGraw-Hill - NIESSEN, W.M.A. (2006). Liquid chromatography-mass spectrometry. Chromatographic science series, vol. 97. . Ed. Boca Ratón: Taylor & Francis Utilizaranse distintos recursos web que axuden ó alumno a comprender e fixar os coñecementos que se imparten nas clases teóricas e prácticas. Ex: simulacións, esquemas, etc. Os alumnos terán acceso a artículos de revistas científicas, tesinas de licenciatura da Facultade de Ciencias e outros documentos que mostren a aplicación práctica das técnicas que estudiaron ó longo da asignatura.
Complementary	- RUBINSON, K.A.; RUBINSON, J.F. (2002). Análisis Instrumental. Ed. Prentice Hall - ROUESSAC, F., ROUESSAC, A. (2007). Chemical Analysis. Ed. Wiley - KELLNER, R.; MERMET, M.; OTTO, M.; VALCARCEL, M.; WIDMER, H. M. (1998). Analytical Chemistry . Ed. Wiley-VCH - MONTASER, A.; GOLIGHTLY, D.W. (Eds) (1992). Inductively Coupled Plasmas in Analytical Atomic Spectrometry. Ed. VCH - CULLEN, M. (Ed.) (2004). Atomic Spectroscopy in Elemental Análisis . Ed. Blackwell Plublishing Ltd. - DEDINA J., TSALEV D. L. (1995). Hydride Generation Atomic Absorption Spectroscopy . John Wiley & Sons

Recommendations
Subjects that it is recommended to have taken before
Estratexias Analíticas Aplicadas ao Medio Ambiente/610500002
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.