Teaching Guide				
Identifying Data				2020/21
Subject (*)	Instrumental Analytical Chemistry 1		Code	610G01013
Study programme	Grao en Química			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Third	Obligatory	6
Language	Spanish			
Teaching method	Hybrid			
Prerequisites				
Department	Química			
Coordinador	Moreda Piñeiro, Jorge	E-mail	jorge.moreda@udc.es	
Lecturers	Moreda Piñeiro, Jorge Soto Ferreiro, Rosa Maria	E-mail	jorge.moreda@udc.es rosa.soto.ferreiro@udc.es	
Web				
General description	This course is intended for students to understand the fundamentals and the possibilities of the most common spectroscopic techniques. Focus will be on the physical and chemical bases of the main techniques, equipment configuration, experimental conditions and main applications.			
Contingency plan	1. Modifications to the contents Contents changes are not considered 2. Methodologies *Teaching methodologies that are maintained Teaching methodologies are maintained *Teaching methodologies that are modified All teaching methodologies are adapted to the non-face-to-face modality through Moodle and Teams and the programming established in the coordination calendar of the Center is maintained. The guest lectures and seminars will be taught through the Moodle Platform synchronously at the time specified in the course schedule. The laboratory practices will be replaced by virtual practices and supervised project that will be delivered by the student at the end of the semester. The multiple choice questions and the seminar solving test will be carried out through the Moodle Platform (on-line test). 3. Mechanisms for personalized attention to students All teaching methodologies will be supervised virtually (through the Moodle Platform and Teams) by the teacher during class time. The personalized follow-up will be done through email, the Moodle platform and the TEAMS tool, at the request of the students and, as far as possible, at the time established for the tutorials. For students with part-time dedication or specific learning modalities or diversity support, personalized attention will be provided within the flexibility allowed by coordination schedules and material and human resources. 4. Modifications in the evaluation Contents changes are not considered *Evaluation observations: Remarks included in the guide are maintained. 5. Modifications to the bibliography or webgraphy Bibliography suport changes are not considered. All the necessary materials will be available in Moodle or through access to the electronic resources available in the Library of the Center.			

Study programme competences / results	
Code	Study programme competences / results

A7	Knowledge and application of analytical methods
A15	Ability to recognise and analyse new problems and develop solution strategies
A19	Ability to follow standard procedures and handle scientific equipment
A20	Ability to interpret data resulting from laboratory observation and measurement
A21	Understanding of qualitative and quantitative aspects of chemical problems
A23	Critical standards of excellence in experimental technique and analysis
B2	Effective problem solving
B3	Application of logical, critical, creative thinking
B4	Working independently on own initiative
B5	Teamwork and collaboration
C6	Ability to assess critically the knowledge, technology and information available for problem solving

Learning outcomes			
Learning outcomes	Study programme competences / results		
Know the fundamentals and characteristics of the most common spectroscopic techniques	A7	B4	
Ability to select the most appropriate instrumental technique in solving a particular analytical problem	A7 A15	B4	C6
Skill in the use of different instruments and adjusting the instrumental variables	A19 A21 A23	B4 B5	
Ability to get the most reliable information from experimental data. Making calculations.	A20 A21	B2 B3 B4	C6

Contents	
Topic	Sub-topic
1. Principles of instrumental analysis	Resolution of analytical problems. Figures of merit of the instrumental techniques. Calibration. Characteristics and classification of the instrumental techniques. Basic components of the instruments. Signals and noise.
2. UV-VIS spectroscopy	Fundamentals. Instrumentation. Aplications. Derivative spectroscopy.
3. IR spectroscopy	IR absorption spectroscopy: fundamentals, instrumentation, practical aspects and applications. IR reflectance spectroscopy.
4. Molecular luminescence spectroscopy	Fundamentals. Variables affecting fluorescence. Relation between concentration and fluorescence. Emission and excitation spectra. Aplications. Phosphorescence.
5. Mass spectrometry	Fundamentals. Instrumentation. Aplications.

6. Atomic absorption spectrometry	Fundamentals. Flame atomization, electrothermal atomization, vapour generation: Instrumentation. Aplications.
7. Atomic emisión spectrometry	Fundamentals. Plasma sources. Instrumentation. Aplications. ICP-MS.
8. Atomic X Ray spectrometry	Fundamentals. Fluorescence, absorption and difraction spectrometry. Analytical and operational considerations. Instrumentation. Sample preparation. Aplications.
Experimental work	Experiment 1.- Evaluation of the presence of interferents and determination of binary mixtures by UV-VIS spectroscopy. Experiment 2.- Identification of plastics by FT-IR spectroscopy. Experiment 3.- Determination of PAH by molecular fluorescence spectroscopy. Experiment 4.- Determination of Zn in water by flame atomic absorption spectrometry (FAAS). Study of interferences in the determination of Zn and Ca. Experiment 5.- Determination of K in marine water by flame atomic emission spectrometyy (FAES). Experiment 6.- Study of the experimental conditions in electrothermal atomic absorption spectrometry: optimization of the atomization program and use of modifiers.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A7 A15 A21	20	60	80
Seminar	A15 A20 A21 B2 B3 B4	8	24	32
Laboratory practice	A7 A15 A19 A20 A21 A23 B5	20	0	20
Multiple-choice questions	A7 A15 A20 A21 C6	4	0	4
Workshop	A7 B3 B4	0	12	12
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	Learning involve incorporating key concepts on each spectrochemical technique. This 20 Guest lectures will be held on the most important content of the program. For full use of these, it is recommended that students have previously read on their own fundamental aspects of these topics in the recommended texts
Seminar	These seminars will constitute 7 sessions in small group in which the teacher and students solve numerical problems. The work of students in these seminars is assessed by solving problems on the day of the objective test.
Laboratory practice	Learning the contents of the course involves 6 sessions of labs in which students will practice the theoretical concepts acquired, manipulate analytical tools and solve problems. The teacher will advise these activities.
Multiple-choice questions	Farase un examen final para evaluar o grado de aprendizaxe o longo do cuatrimestre. A data do mesmo está indicada no calendario de exámenes do grao
Workshop	The contents explained will be consolidated performing several self-assessment questionnaires.

Personalized attention	
Methodologies	Description

Laboratory practice Seminar	The labs and seminars for the numerical solution of problems are conducted under the supervision of the teacher at school hours. Tutorial sessions (if necessary) will be made in which doubts will be resolved and the work performed by the student will be supervised, etc. For students with part-time dedication seminars for the numerical solution of problems will be performed by students outside the academic timetable established; Professor resolve any questions and review the work done tutorials established with the student. It shall be mandatory laboratory practices in the academic schedule.

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Multiple-choice questions	A7 A15 A20 A21 C6	The students' work will be evaluated through a Multiple choice question Test which enclosed all theoretical and practical contents.	50
Laboratory practice	A7 A15 A19 A20 A21 A23 B5	The Labs will be mandatory throughout the semester. The students will anwered several cuestions during at the end of lab sesions.	20
Seminar	A15 A20 A21 B2 B3 B4	The seminars will be avaluated by the individual resolution of numerical problems on the day of the multiple choice question test.	20
Workshop	A7 B3 B4	The questionnaires will completed by the students at the end of each topic.	10

Assessment comments

To pass the course three basic requirements are
required:
-mandatory attendance at labs and regular attendance at other activities (seminars
for the numerical solution of problems),
-implementation of all activities (workshops) and
-achieve a minimum final score of 5 points in
each of the activities.
If minimum valuea are not achieved in any of
activities, and the average is greater than or equal to 5, the student
will not pass the course and will appear a qualification of 4.5. The student
will obtain the qualification of ?No presentado? when they do not perform labs and the multiple-choice questions. The qualifications for the labs and seminars will remain in the July second chance. While the qualification of the multiple-choice questions made in July will replace that obtained in February. The students evaluated on the second opportunity
will obtain ?Matrícula de honor? only if the maximum number of those for the
corresponding course has not been fully covered at the first opportunity.
An objective test of the first half of the teoric contents of the programme will be conducte before the official data (First Oportunity). Students who surpass the these contents (minimum final score of 5 points) will not have to re-examine in the official data of the First Opportunity in January
For students with part-time dedication, labs
practices will be mandatory and will be provided within the flexibility to
allow coordinating
schedules and material and human resources. Students with part-time
dedication will be evaluated by the qualifications obtained in the mixed
test (65%), labs practices (20%) and workshops (15%). This will apply to both opportunities.

Sources of information

Basic	- GAVIRA VALLEJO, J.M.,HERNANZ GISMERO, A. (2007). Técnicas Físicoquímicas en Medio Ambiente. Universidad Nacional de Educación a Distancia - RÍOS CASTRO, A.; MORENO BONDI, M.C.; SIMONET SUAU, B.M. (2012). Técnicas Espectroscópicas en Química Analítica. Volumen I y II. Ed. Síntesis - SKOOG, D.A., WEST, D.M., HOLLER F.J. (1996). Fundamentos de Química Analítica. Vol 2 . Editorial Reverté - ANDRADE GARDA JM, CARLOSENA ZUBIETA A., GÓMEZ CARRACEDO MP, , MAESTRO-SAAVEDRA MA, PRIETO BLANCO MC, (2017). Problems of Instrumental Analytical Chemistry. A Hands-On Guide. Editorial World Scientific (London) Utilizaranse distintos recursos web que axuden ao alumno a comprender e fixar os coñecementos que se imparten nas actividades. Ex: simulacións, esquemas, videos, etc.
Complementary	- Mc MAHON, G. (2007). Analytical Instrumentation. A guide to laboratory, portable and miniaturized instruments . Ed. Wiley - REEVE, R.N. (2002). Introduction to Environmental Analysis . Ed. John Wiley and Sons - SOGORB SÁNCHEZ, M.A., VILANOVA GISBERT, E. (2004). Técnicas Analíticas de Contaminantes Químicos . Ed. Díaz de Santos - ESTEBAN, L. (1993). La Espectrometría de Masas en Imágenes . ACK Editores - WILLARD, H.H., MERRITT Jr., L.L., DEAN J.A. y SETTLE Jr. J.A. (1991). Métodos instrumentales de análisis . Editorial Iberoamericana - SKOOG, D.; HOLLER, F.J.; NIEMAN T.A. (2000). Principios de Análisis Instrumental. Ed. McGraw-Hill - PETROZZI, S. (2013). Practical Instrumental Analysis. Ed Wiley - RUBINSON, K.A., RUBINSON, J.F. (2001). Análisis Instrumental. Ed. PrenticE Hall

Recommendations
Subjects that it is recommended to have taken before
Analytical Chemistry 1/610G01011 Analytical Chemistry 2/610G01012
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments
Recommended:- Be able to redact, synthesize and present a work neatly. - Knoledge of basic computing tools (use of internet, word processing, presentations, etc.). - Be able to handle textbooks. - Basic knowledge of English. - Study and review the contents taught weekly using bibliographic material to understand and deepen the information obtained in class. - Clarify any doubts with the teacher. - Prepare the seminars thoroughly. - Participate actively in class.