UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2017/18
Subject (*)	Instrumental Analytical Chemistry 1		Code	610G01013
Study programme	Grao en Química			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Third	Obligatoria	6
Language	Spanish			
Teaching method	Face-to-face			
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.			

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.
Supervised work	Raman spectroscopy. X-ray photoelectron spectrometry, Auger spectroscopy and scanning electron microscopy. Radiochemical methods of analysis. Nuclear magnetic resonance spectroscopy.
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	17	51	68

Seminar	A15 A20 A21 B2 B3 B4	7	21	28
Laboratory practice	A7 A15 A19 A20 A21 A23	20	9	29
Supervised projects	A7 A15 A21 B2 B5	0	5	5
Mixed objective/subjective test	A7 A15 A20 A21 C6	2	0	2
Workshop	A7 B3 B4	4	12	16
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 17 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 continuously assessed and by solving problems on the day of the objective test.
Laboratory practice	Learning the contents of the course involves 7 sessions of labs in which students will practice the theoretical concepts acquired, manipulate analytical tools and solve problems. The teacher will advise these activities.
Supervised projects	This activity will be conducted in small groups. Learning contents involve seeking information from different sources and the development of a theme of the course from a script provided by the teacher. The theme must be done in Word format. The teacher will advise each group at different stages of this activity.
Mixed objective/subjective test	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 Workshop Supervised projects	The labs, supervised work, workshops 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 supervised work, obradoiros and 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**
Mixed objective/subjective test	A7 A15 A20 A21 C6	The students' work will be evaluated through a Mixed Objetive Test which enclosed all theoretical and practical contents. This evaluation will be a 60% of the final grade.	60
Laboratory practice	A7 A15 A19 A20 A21 A23	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 continuous assessment of the work of the student and the individual resolution of numerical problems.	10

Supervised projects	A7 A15 A21 B2 B5	The Supervised projects involve making a memory from the script given by the teacher. The project must be enclosed a Contents and a References sections.	10

Assessment comments
To pass the course three basic requirements are required: mandatory attendance at labs and regular attendance at other activities (supervised work, obradoiros and seminars for the numerical solution of problems), implementation of all activities 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 final exam. The qualifications for the labs, supervised work, workshop and seminars will remain in the July second chance. While the qualification of the objective test 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. Regarding the successive academic years, the process of teaching and learning, including evaluation, refers to an academic course and, therefore, it would start with a new academic course, including all activities and assessment procedures that are scheduled for that course. 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 solely by the qualifications obtained in the mixed test (65%), labs practices (20%) and tutored work (15%). This will apply to both opportunities. An objective test of the different contents of the programme will be conducte before the official data (First Oportunity). Students who surpass the different contents will not have to re-examine in the official datas (First Opportunity in January and Second Opportunity in July).

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.