UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2016/17
Subject (*)	Química Analítica Instrumental 2		Code	610G01014
Study programme	Grao en Química			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Third	Obligatoria	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química Analítica			
Coordinador	Andrade Garda, Jose Manuel	E-mail	jose.manuel.andrade@udc.es	
Lecturers	Andrade Garda, Jose Manuel Gonzalez Castro, Maria Jose Prieto Blanco, Maria del Carmen	E-mail	jose.manuel.andrade@udc.es m.j.gonzalez.castro@udc.es m.c.prieto.blanco@udc.es	
Web				
General description	The basics, advantages and typical limitations, as well as normal working protocols on several analytical techniques are to be presented. In particular: electroanalytical, chromatographic (gases and liquids), capillar electrophoresis, thermal analysis and enzimatic and inmunologic analyes.			

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
A16	Ability to source, assess and apply technical bibliographical information and data relating to chemistry
A17	Ability to work safely in a chemistry laboratory (handling of materials, disposal of waste)
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
A22	Ability to plan, design and develop projects and experiments
A23	Critical standards of excellence in experimental technique and analysis
A24	Ability to explain chemical processes and phenomena clearly and simply
A26	Ability to follow standard laboratory procedures in relation to analysis and synthesis of organic and inorganic systems
B1	Learning to learn
B2	Effective problem solving
B3	Application of logical, critical, creative thinking
B4	Working independently on own initiative
B5	Teamwork and collaboration
C1	Ability to express oneself accurately in the official languages of Galicia (oral and in written)
C3	Ability to use basic information and communications technology (ICT) tools for professional purposes and learning throughout life
C6	Ability to assess critically the knowledge, technology and information available for problem solving
C7	Acceptance as a professional and as a citizen of importance of lifelong learning

Learning outcomes	
Learning outcomes	Study programme competences / results

- Explain adequately the basics and processes related to some fundamental analytical techniques. - Understand their fundamentals, instruments, advantages and limitations. - Get, evaluate and use any source of technical information related to these techniques. - Design and develop strategies to solve analytical problems. - Select the most adequate analytical technique for each particular situation. - Interpret the analytical data. - Get a critical behaviour during the experimental work	A7 A15 A20 A21 A24	B1 B2 B3 B4 B5	C1 C3 C6 C7
- Adquirir destreza no traballo de laboratorio. Nomeadamente: - avaliar e utilizar información bibliográfica relacionada coas técnicas de análise. - deseñar e desenvolver estratexias para a resolución de problemas. - interpretar os datos e expresar os resultados analíticos. - desenvolver unha actitude crítica no traballo experimental	A15 A16 A17 A19 A20 A22 A23 A26		C3 C6

Contents	
Topic	**Sub-topic**
Chapter 1: Electroanalytical techniques	Fundamentals of the potentiometric measurements. Fundamentals of polarography and voltamperometry. Electrochemical sensors. Examples Numerical exercises
Chapter 2: Chromatographic techniques	Fundamentals of gas chromatography. Fundamentals of liquid chromatography. Fundamentals of high resolution liquid chromatography. Examples Numerical exercises
Chapter 3: Electrophoretical techniques	Fundamentals of the electrophoresis Examples
Chapter 4: Enzimatic and inmunochemical techniques	Fundamentals of the enzimatic techniques Fundamentals of the inmunochemical techniques
Laboratory classes	In total, 20 hours of laboratory classes will be given. They will show the most relevant issues of the instrumentation studied in this subject, taking into account the infrastructure limitations of the Faculty.

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Laboratory practice	A7 A16 A17 A19 A20 A22 A23 A26 B3 B4 B5 C3 C6	20	10	30
Mixed objective/subjective test	A7 A20 A21 A24 B2 C1	3	0	3
Seminar	A15 A16 A20 A21 B1 B2 C7	7	24.5	31.5
Guest lecture / keynote speech	A7 A15 A21 A22 A23 A24 B3 C6 C7	21	63	84
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**
Laboratory practice	It is inteded that the student works with the analytical techniques studied in the theoretical lessons, taking into account the infrastructure limitations of the Faculty. A laboratory notebook (logbook) has to be kept by the student in order to address his/her practical lessons. The use of leaflets will not be allowed anyway and its use will strongly penalize the final score. A formal notebook has to be used instead.
Mixed objective/subjective test	The test to evaluate the knowlege gained by the student will include both theoretical and numerical questions. The former will consist mainly in short questions and one or two questions to be developed longer. They will evaluate the theoretical classes and the seminars. An exam will be made at the end of the first chapters so that (if passed) the student can simplify the first official exam.
Seminar	Seminars will be mostly devoted to solve numerical excercises. They must be tried previously by the students so that the seminars would be devoted mainly to solve their doubts.
Guest lecture / keynote speech	The conceptual basis of the different analytical techniques considered in the subject will be reviewed and explained. The underlying chemical, physical or biological bases will be presented. The basic instrumental equipments will be studied and discussed.

Personalized attention	
Methodologies	**Description**
Laboratory practice Seminar	Students may solve their doubts both during the theoretical classes and the seminars. However, dedicated attention can be obtained in special attention hours (tutorships) which will be agreed between the student and the teacher. Students being recognized officially as partial-time and entitled not to attend the lectures will be attended in a tutorships regime (set hour with teacher in advance).

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Laboratory practice	A7 A16 A17 A19 A20 A22 A23 A26 B3 B4 B5 C3 C6	Daily evaluation: actitude, order, attention, correct experimental work, correct answers. At the end, a general evaluation will be undergone using the student's laboratory notebook.	25
Guest lecture / keynote speech	A7 A15 A21 A22 A23 A24 B3 C6 C7	Actitude and degree of participation of the student in the classes.	5
Seminar	A15 A16 A20 A21 B1 B2 C7	Actitude and degree of participation of the student in the classes. Degree of preparation of the numerical exercises before the seminars.	5
Mixed objective/subjective test	A7 A20 A21 A24 B2 C1	Correctness and adequacy in the responses to the theoretical questions. Correct solution to the numerical exercises. Calculations and final exact result.	65

Assessment comments

To pass the subject two basic requisites will be mandatory: (i) attendance to all the activities planned for the subject and (ii) get a minimum score on all (and each) activities (5 point out of 10). The test will consists of two parts containing theoretical questions and numerical exercises. Each of these two parts are evaluated sepparately.

After finishing the first chapters, an objective test will be carried out (including theoretical questions and numerical exercises) so that the students passing it (score of 5, out of ten, in each part) may reduce the amount of chapters to be studied for the first examination (first opportunity, May-June).

Accordingly, all the scores must yield a minimum sum of 5 (out of 10). However, note that the subject will not be aproved (even when the overall sum exceeds 5) if a particular score does not reach 4. In this case, the final score of the subject will be "fail" (score = 4).

The "Not presented" score will be obtained in case the student makes less than 25% of the academic activities.

Note that "continuous evaluation" means that the second opportunity of July is a second opportunity for the exam (Mixed/subjective test). Following, the scores of the laboratory classes, seminars, etc. obtained previously will be maintained. The score of the new exam will substitute that from the first opportunity.

For next courses, no score will be maintained and all activities will have to be repeated.

The maxixum score (10, Matricula de Honor) will be obtained by pupils doing the second exam (July) only if that score was not given in the first exam (May-June), according to the Administrative requirements.

Students being recognized officially as partial-time and entitled not to attend the lectures will be evaluated considering only the scores obtained in the objective tests (75%) and the laboratory practices (25%). This applies to both opportunities

Sources of information	
Basic	- RUBINSON, K.A.; RUBINSON, J.J. (2001). Análisis instrumental. Madrid, Prentice Hall - HARRIS, D.C. (2007). Análisis químico cuantitativo. Barcelona, Reverté - SKOOK, D.A.; WEST, D.M.; HOLLER, F.J. (1996). Fundamentos de química analítica (volumen 2). Barcelona, Reverté - CHRISTIAN, G.D. (2004). Química analítica (6a edición). México, McGraw Hill
Complementary	- KELLNER, R (Editor) (2004). Analytical chemistry. Winheim, Willey - SKOOG, D.A.; HOLLER, F.J.; NIEMAN, T.A. (2001). Principios de análisis instrumental (5a edición). Madrid, McGraw Hill

Recommendations
Subjects that it is recommended to have taken before
Química 1/610G01007 Química 2/610G01008 Química 3/610G01009 Química 4/610G01010 Química Analítica 1/610G01011 Química Analítica 2/610G01012 Química Analítica Instrumental 1/610G01013 Laboratorio de Química/610G01032
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus

Química Analítica Avanzada e Quimiometría/610G01015 Medio ambiente e calidade/610G01037
Other comments
The subject will not be passed in case the student shows errors in the presentation of the equilibria, estechiometric calculations and / or formulation of chemical equationsFor this, the student should be aware of the need of have been studied (and passed) other subjects; at the very least: QA1, QA2, Laboratorio de Química y QAI1

(*)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.