



| Teaching Guide | | | | |
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| Identifying Data | | | | 2015/16 |
| Subject (*) | Química Analítica Instrumental 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 Analítica | | | |
| Coordinador | Moreda Piñeiro, Jorge | E-mail | jorge.moreda@udc.es | |
| Lecturers | Moreda Piñeiro, Jorge Rodríguez González, Noelia Soto Ferreiro, Rosa Maria | E-mail | jorge.moreda@udc.es noelia.rodriguez.gonzalez@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 |
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| 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. Applications. 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. Applications. Phosphorescence. |
| 5. Mass spectrometry | Fundamentals. Instrumentation. Applications. |
| 6. Atomic absorption spectrometry | Fundamentals. Flame atomization, electrothermal atomization, vapour generation: Instrumentation. Applications. |
| 7. Atomic emisión spectrometry | Fundamentals. Plasma sources. Instrumentation. Applications. ICP-MS. |
| 8. Atomic X Ray spectrometry | Fundamentals. Fluorescence, absorption and diffraction spectrometry. Analytical and operational considerations. Instrumentation. Sample preparation. Applications. |
| 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 Cu in water by flame atomic absorption spectrometry (FAAS). Study of interferences in the determination of Cu and Ca. Experiment 5.- Determination of Na in marine water by flame atomic emission spectrometry (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 | 17 | 51 | 68 |



| | | | | |
|---------------------------------|---------------------------|----|----|----|
| Seminar | A15 A20 B2 B4 | 7 | 21 | 28 |
| Laboratory practice | A7 A15 A19 A20 A21 A23 | 20 | 9 | 29 |
| Supervised projects | B5 | 0 | 5 | 5 |
| Mixed objective/subjective test | A7 A15 A21 C6 | 2 | 0 | 2 |
| Workshop | A7 B3 | 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 very 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 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 exames do grao |
| Workshop | The contents explained will be consolidated performin a workshop in the classroomat the end of each topic. This will consist on answering a questionnaire using student notes, books and other supplementary materials and teacher guidance also. |

| 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, which will resolve doubts, organize the literature search, etc. Tutorial sessions will be made in which doubts will be resolved and the work performed by the student will be supervised, etc. |

| Assessment | | | |
|---------------------------------|---------------------------|--|---------------|
| Methodologies | Competencies / Results | Description | Qualification |
| Mixed objective/subjective test | A7 A15 A21 C6 | The students' work will be evaluated through a Mixed Objective Test which enclosed all theoretical and practical contents. This evaluation will be a 70% of the final grade. | 70 |
| Laboratory practice | A7 A15 A19 A20 A21 A23 | The Labs will be mandatory throughout the semester. The students will answered several cuestions during the Objective test. | 20 |
| Seminar | A15 A20 B2 B4 | The seminars will be avaluated by continuous assessment of the work of the student and the individual resolution of numerical problems, the same day of the objective test. | 0 |
| Workshop | A7 B3 | The questionnaires completed by the students at the end of each topic will be assessed. | 5 |



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|---------------------|----|--|---|
| Supervised projects | 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. | 5 |
|---------------------|----|--|---|

Assessment comments

To pass the course two basic requirements are required: regular attendance at all the activities and achieve a minimum final score of 5 points and at least a minimum of 4 points in each of the activities.

To take into account the qualifications in the different activities subject to evaluation requires obtaining the minimum qualification indicated above for each one. Therefore, if this minimum value is not achieved in any of them, and the average is greater than or equal to 5 (out of 10), 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 he attends less than 25% of the scheduled academic activities, and he does not make 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.

Sources of information

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| Basic | <ul style="list-style-type: none"> - 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 <p>Utilizaranse distintos recursos web que axuden ao alumno a comprender e fixar os coñecementos que se imparten nas actividades. Ex: simulacións, esquemas, videos, etc.</p> |
| Complementary | <ul style="list-style-type: none"> - 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

Química Analítica 1/610G01011

Química Analítica 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. - Knowledge 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.



(*)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.