



| Teaching Guide | | | | |
|--------------------------|--|--------|---------------------|---------|
| Identifying Data | | | 2023/24 | |
| Subject (*) | Advanced Atomic Techniques and Sensors | Code | 610509127 | |
| Study programme | Mestrado Universitario en Investigación Química e Química Industrial (Plan 2020) | | | |
| Descriptors | | | | |
| Cycle | Period | Year | Type | Credits |
| Official Master's Degree | 1st four-month period | First | Optional | 3 |
| Language | Spanish | | | |
| Teaching method | Face-to-face | | | |
| Prerequisites | | | | |
| Department | Departamento profesorado másterQuímica | | | |
| Coordinador | Moreda Piñeiro, Jorge | E-mail | jorge.moreda@udc.es | |
| Lecturers | Bermejo Barrera, Pilar Moreda Piñeiro, Antonio Moreda Piñeiro, Jorge | E-mail | jorge.moreda@udc.es | |
| Web | master-universitario-investigacion-quimica-quimica-industrial/20202021/tecnicas-atomicas-avanzadas-sensores-17772-17018-3-98955 | | | |
| General description | This subject will address the following objectives: 1. Complete acquisition of the different advanced atomic spectroscopic techniques, both in theoretical aspects and in their practical application. 2. Complete acquisition of the different hybrid techniques used in metallomics and metalloproteomics, both in theoretical aspects and in their application. 3. Complete acquisition of the different types of optical, electrochemical, thermal and mass sensors, theoretical aspects and application examples | | | |

| Study programme competences / results | |
|---------------------------------------|---|
| Code | Study programme competences / results |
| A2 | Suggest alternatives for solving complex chemical problems related to the different areas of chemistry. |
| A3 | Innovate in the methods of synthesis and chemical analysis related to the different areas of chemistry |
| A6 | Design processes involving the treatment or disposal of hazardous chemicals |
| A7 | Operate with advanced instrumentation for chemical analysis and structural determination. |
| A9 | Promote innovation and entrepreneurship in the chemical industry and in research. |
| B2 | Students should apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study. |
| B4 | Students should be able to communicate their conclusions, and the knowledge and the reasons that support them to specialists and non-specialists in a clear and unambiguous manner |
| B5 | Students must possess learning skills to allow them to continue studying in a way that will have to be largely self-directed or autonomous. |
| B7 | Identify information from scientific literature by using appropriate channels and integrate such information to raise and contextualize a research topic |
| B9 | Demonstrate ability to analyze, describe, organize, plan and manage projects |
| B10 | Use of scientific terminology in English to explain the experimental results in the context of the chemical profession |
| C1 | CT1 - Elaborar, escribir e defender publicamente informes de carácter científico e técnico |
| C3 | CT3 - Traballar con autonomía e eficiencia na práctica diaria da investigación ou da actividade profesional. |
| C4 | CT4 - Apreciar o valor da calidade e mellora continua, actuando con rigor, responsabilidade e ética profesional. |

| Learning outcomes | |
|-------------------|---------------------------------------|
| Learning outcomes | Study programme competences / results |
| | |



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|--|---------------------------------|---------------------------|-----|
| Acquisition (theoretical aspects and application) of the several hybrid techniques used in matallomics and metalloproteomics | AC2 AC7 AC9 | BC2 BC5 BC7 | CC3 |
| Acquisition (theoretical aspects and application) of advanced atomic spectroscopic techniques both in theoretical aspects and in their practical application | AC2 AC7 AC9 | BC2 BC4 BC5 BC7 | CC1 |
| Acquisition (theoretical aspects and application) of several types of optical, electrochemical, thermal and mass sensors | AC2 AC3 AC6 AC7 AC9 | BC2 BC4 BC9 BC10 | CC4 |

| Contents | |
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| Topic | Sub-topic |
| 1. ATOMIC TECHNIQUES | (1) Electrothermal atomic absorption spectrometry. (2) Continuous source atomic absorption spectrometry. (3) Inductively coupled plasma atomic emission spectrometry. (4) Inductively coupled plasma mass spectrometry. (5) Atomic fluorescence spectrometry. (6) Atomic X ray spectrometry. |
| 2. ALTERNATIVE SAMPLING TECHNIQUES | (1) Solid sampling (2) Slurry sampling (3) Vapour generation techniques Cold vapour and covalent hydride generation). (4) Others solid sampling techniques (Laser ablation) |
| 3. HYBRID TECHNIQUES IN THE ANALYSIS OF ORGANOMETALLIC COMPOUNDS AND METALOPROTEINS (METALLOMIC AND METALOPROTEOMIC) | (1) Liquid chromatography coupled with inductively coupled plasma atomic emission. (2) Liquid chromatography coupled with inductively coupled plasma mass spectrometry (3) Liquid chromatography coupled with atomic fluorescence spectrometry (4) Gas chromatography coupled with inductively coupled plasma mass spectrometry. (5) Capilar electrophoresis coupled with inductively coupled plasma mass spectrometry. (6) Filed flow fractionation coupled with inductively coupled plasma mass spectrometry |
| TEMA 4. SENSORES | (1) Concepts. (2) Types of sensors. (3) Electrochemical sensors. (4) Optical sensors. (5) Gas sensors. (6) Remote sensors |

| Planning | | | | |
|--------------------------------|--------------------------------------|--------------------------------------|-------------------------------|-------------|
| Methodologies / tests | Competencies / Results | Teaching hours (in-person & virtual) | Student?s personal work hours | Total hours |
| Seminar | A2 B2 B4 B9 B10 C4 | 7 | 14 | 21 |
| Supervised projects | A2 A3 A9 B2 B4 B5 B7 B9 B10 C1 C3 | 2 | 8 | 10 |
| Objective test | A2 A3 A6 A7 | 2 | 0 | 2 |
| Guest lecture / keynote speech | A2 A3 A7 | 12 | 30 | 42 |
| Personalized attention | | 0 | 0 | 0 |

(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

| Methodologies | |
|---------------|--|
| Methodologies | Description |
| Seminar | Seminars given by Master's teachers, and professionals from companies, public administration and other universities Interactive sessions related to the different subjects with debates and exchange of opinions with students Resolution of practical exercises (problems, test questions, interpretation and processing of information, evaluation of scientific publications, etc.) |



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| Supervised projects | Study based on different sources of information Oral presentation of papers, reports, etc., including discussion with teachers and students |
| Objective test | Carrying out the different tests for verifying the acquisition of both theoretical and practical knowledge and the acquisition of skills and attitudes |
| Guest lecture / keynote speech | Theoretical classes. Lectures (use of slate, computer, cannon), complemented with the tools of virtual teaching |

Personalized attention

| Methodologies | Description |
|--------------------------------|---|
| Guest lecture / keynote speech | The supervised works and problem solving will be carried out under the supervision of the teacher |
| Seminar | Doubts and work done, etc. will be reviewed by the teacher |
| Supervised projects | |

Assessment

| Methodologies | Competencies / Results | Description | Qualification |
|---------------------|-----------------------------------|---|---------------|
| Seminar | A2 B2 B4 B9 B10 C4 | Seminars will be evaluated through continuous evaluation of the student's work and the individual resolution of problems and cases | 15 |
| Supervised projects | A2 A3 A9 B2 B4 B5 B7 B9 B10 C1 C3 | Supervised projects involve the realization of a memory and an exposition r | 10 |
| Objective test | A2 A3 A6 A7 | Theoretical contents will be evaluated by means of a test that may include test with multiple choice, short questions and reasoned answer | 75 |

Assessment comments

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| <p>-The student must review the theoretical concepts introduced in the different topics, using the reference manual and the summaries. The degree of success in solving the proposed exercises provides a measure of the student's preparation to face the final exam of the subject. Those students who encounter significant difficulties when working on the proposed activities should attend the teacher's tutoring hours, with the aim that he can analyze the problem and help solve these difficulties.</p> <p>-Competence assessment system: Final exam: CB7; CB9; CB10; Problem solving and case studies: CG2; CG4; CG5; Completion of work and written reports: CG2; CG4; CG5; Oral presentation (works, reports, problems and practical cases: CG2; CT1; CT3; CT4; Continuous evaluation of the student by means of questions and oral questions during the course: CB7; CB9; CT1</p> <p>-Indication referring to plagiarism and the inappropriate use of technologies in the development of tasks or tests: "In cases of fraudulent performance of exercises or tests, the provisions of the Regulations for the evaluation of students' academic performance and the review of assessments"</p> |
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Sources of information

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|----------------------|--|
| Basic | <ul style="list-style-type: none"> - Skoog, Holler, Nieman (2008). Principios de Análisis Instrumental. Ed. Thonsom-Paraninfo - R. Keller, J. M. Mermet, M. Otto, H. M. Widmer, (2004). Analytical Chemistry, . Ed. Wiley - C. Cámara, C. Pérez-Conde (2011). Análisis Químico de Trazas. Ed. Síntesis - B. Welz, M. Sperling (1999). Atomic Absorption Spectrometry. Ed. Wiley - B. Welz, H. Becker-Ross, S. Florek, U. Heitmann (2004). High Resolution Continuum Source AAS. Ed. Wiley - J. D?dina, D. L. Tsalev (1995). Hydride Generation Atomic Absorption Spectrometry. Ed. Wiley - R. Cornelis (2003). Handbook of Elemental Speciation I/II. Ed. Wiley - C. Pérez Conde (1996). Sensores Ópticos. Universidad de Valencia - S. Alegret, M. del Valle, A. Merkoçi (2004). Sensores electroquímicos. Universidad Autónoma de Barcelona |
| Complementary | |

Recommendations



Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

Other comments

Recommendations for evaluationThe student must review the theoretical concepts introduced in the different topics, using the reference manual and the summaries. The degree of success in solving the proposed exercises provides a measure of the student's preparation to face the final exam of the subject. Those students who have significant difficulties when working on the proposed activities should attend the teacher's tutoring hours, so that the teacher can analyze the problem and help solve those difficulties. It is very important, when preparing for the exam, to solve some of the exercises that appear at the end of each of the chapters of the reference manual.
Recommendations for recoveryThe teacher will analyze with those students who do not successfully pass the evaluation process and, if they so wish, the difficulties encountered in learning the contents of the subject. It will also provide them with additional material (questions, exercises, exams, etc.) to reinforce the learning of the subject. It is highly recommended to attend the exhibition classes from day one, as the different topics in the program are linked to each other. It is important to keep the study up to date. After reading a topic, it is useful to summarize the important points, identifying the basic issues to remember and making sure you know both their meaning and the conditions under which they can be applied.

(*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.