UNIVERSIDADE DA CORUÑA

| Teaching Guide | | | |
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| Identifying Data | | | 2019/20 |
| Subject (*) | Techniques of Characterization of Materials and Biointerphases | Code | 610509102 |
| Study programme | Mestrado Universitario en Investigación Química e Química Industrial (Plan 2017) | | |

| Descriptors | | | | |
|---|---|---|---|---|
| Cycle | Period | Year | Type | Credits |
| Official Master's Degree | Yearly | First | Obligatory | 3 |

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|---|---|---|---|
| Language | SpanishGalicianEnglish | | |
| Teaching method | Face-to-face | | |
| Prerequisites | | | |
| Department | Química | | |
| Coordinador | Castro Garcia, Socorro | E-mail | socorro.castro.garcia@udc.es |
| Lecturers | Castro Garcia, Socorro<br>Platas Iglesias, Carlos | E-mail | socorro.castro.garcia@udc.es<br>carlos.platas.iglesias@udc.es |
| Web | | | |
| General description | This course includes a description of the fundamentals and main applications of various characterization techniques related to Materials Science and which (in many cases) have not been taught in the Degree in Chemistry. These contents are fundamental to address other optional subjects of the master and, in particular, module 5 - Nanochemistry and New Materials.<br>In addition, also includes a part of computational techniques in which will be used computer programs that allow the visualization of molecules. These contents are essential for any chemist. | | |

| Study programme competences / results | |
|---|---|
| Code | Study programme competences / results |
| A1 | Define concepts, principles, theories and specialized facts of different areas of chemistry. |
| 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 |
| A4 | Apply materials and biomolecules in innovative fields of industry and chemical engineering. |
| 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. |
| B3 | Students should be able to integrate knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments. |
| 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 |
| B10 | Use of scientific terminology in English to explain the experimental results in the context of the chemical profession |
| B11 | Apply correctly the new technologies to gather and organize the information to solve problems in the professional activity. |
| C1 | CT1 - Elaborar, escribir e defender publicamente informes de carácter científico e técnico |
| C2 | CT2 - Traballar en equipo e adaptarse a equipos multidisciplinares. |
| 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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| The student will be able to use computer programs that allow him to visualize molecules. | AC1 | BC2 | CC1 |
| The student will understand the fundamentals of some basic techniques of solid state analysis. | AC2 | BC3 | CC2 |
| The student will be able to interpret the results of the most common techniques of characterization of solids. | AC3 | BC5 | CC3 |
| The student will be able to select the techniques of characterization of solids most appropriate for solving specific problems. | AC4 | BC7 | CC4 |
| | AC7 | BC10 | |
| | AC9 | BC11 | |

| Contents | |
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| **Topic** | **Sub-topic** |
| Unit I. | Visualization of molecules. |
| Unit II. | Thermal analysis of materials: thermogravimetry (TGA), differential scanning calorimetry (DSC), differential thermal analysis (DTA), isothermal titration calorimetry (ITC). |
| Unit III. | Diffraction techniques: powder X-ray diffraction (PXRD). |
| Unit IV. | Modern Microscopic Techniques: Scanning Tunneling Microscopy (STM), Atomic Force Microscopy (AFM). |
| Unit V. | Spectroscopy for characterization of surfaces and interfaces: surface plasmon resonance (SPR), Raman spectroscopy, X-ray photoelectron spectroscopy (XPS) and Auger spectroscopy. |
| Unit VI. | Characterization of colloidal dispersions: dynamic light scattering (DLS) and zeta potential. |

| Planning | | | | |
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| **Methodologies / tests** | **Competencies / Results** | **Teaching hours (in-person & virtual)** | **Student?s personal work hours** | **Total hours** |
| Guest lecture / keynote speech | A1 A9 B2 B10 | 12 | 0 | 12 |
| Seminar | A2 A4 A3 B3 B5 C2 C4 | 4 | 0 | 4 |
| Supervised projects | C3 | 2 | 0 | 2 |
| ICT practicals | A1 B5 C3 | 4 | 0 | 4 |
| Problem solving | A7 B7 B11 C1 | 20 | 0 | 20 |
| Document analysis | B10 B11 C3 C4 | 0 | 26 | 26 |
| Objective test | A1 A2 B3 B5 C1 C4 | 2 | 0 | 2 |
| Laboratory practice | A7 B5 C3 | 5 | 0 | 5 |
| 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** |
| Guest lecture / keynote speech | Interactive lectures by the teacher, with active participation of the students. |
| Seminar | Seminars with master's or guest professors, from other institutions, as well as with experts in the field. They will be interactive sessions. |
| Supervised projects | Individual or small group tutoring. |
| ICT practicals | Practical classes in computer classrooms. |
| Problem solving | Solution to problems or development of short projects, proposed by the teacher, or by the student himself (if deemed appropriate). |
| Document analysis | Personal study based on the different sources of information. |
| Objective test | One or several tests for the verification of the acquisition of knowledge and acquisition of the skills and attitudes proposed for this subject. |

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| Laboratory practice | Characterization of materials. |

| Personalized attention | |
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| **Methodologies** | **Description** |
| Problem solving<br>Objective test | Individual or group tutoring. |

| Assessment | | | |
|---|---|---|---|
| **Methodologies** | **Competencies / Results** | **Description** | **Qualification** |
| Seminar | A2 A4 A3 B3 B5 C2 C4 | LECTURES, SEMINARS, PROBLEM SOLVING: compute together (25% of the overall rating) | 0 |
| Guest lecture / keynote speech | A1 A9 B2 B10 | LECTURES, SEMINARS, PROBLEM SOLVING: compute together (25% of the overall rating) | 0 |
| Problem solving | A7 B7 B11 C1 | LECTURES, SEMINARS, PROBLEM SOLVING: compute together (25% of the overall rating) | 25 |
| Objective test | A1 A2 B3 B5 C1 C4 | (75% of the overall rating) | 75 |

| Assessment comments |
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| The evaluation<br>of this subject will be done through continuous assessment and the<br>completion of a final exam, with access to the exam being subject<br>to participation in at least 80% of the compulsory teaching<br>activities (theoretical classes, seminars and tutorials).<br>The<br>teacher will verify the attendance to the classes according to the<br>system of control officially established in the<br>Center/University.Absences must be documented. Excused absences will<br>count as attendance to teaching activities in order to attend the exam. |

| Sources of information | |
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| **Basic** | P. Atkins, J. de Paula: "Physical Chemistry", 10th ed.; Oxford University Press, 2014I. N. Levine: "Principios de Fisicoquímica", 6ª ed.; McGraw-Hill, 2014A.R. West: "Solid State Chemistry and its Applications"; 2nd ed.; Wiley, 2014L.E. Smart, E.A. Moore: "Solid State Chemistry: An Introduction". 4th ed.; CRC Press, 2012 |
| **Complementary** | - J.M. Hollas: "Modern Spectroscopy"; 4th ed.; John Wiley&Sons, 2004.- S.R. Morrison: "The Chemical Physics of Surfaces"; 2nd ed.; Plenum Press, 1990.- F. MacRitchie: "Chemistry at Interfaces"; Academic Press, 1990.- D. Myers: "Surfaces, Interfaces and Colloids: Principles and Applications"; VCH, 1999.- G. Cao: "Nanostructures and Nanomaterials: Syntesis, Properties and Applications". Imperial College Press, 2004. - S.E. Lyshevski (ed.): "Dekker Encyclopedia of nanoscience and nanotechnology" (7 volumes), 3ª Edición. CRC Press, 2014.- John P. Sibilia: ?A guide to materials characterization and chemical analysis?. VCH Publishers, 1998.- J. Bermúdez Polonio: "Métodos de difracción de rayos X. Principios y aplicaciones". Editorial Pirámide, 1981.- C. Hammond: "The basics of Crystallography and Diffraction", 4th ed.; International Union of Crystallography, Oxford University Press, 2015.- B. D. Cullity S.R. Stock: ?Elements of X-Ray Diffraction? 3rd ed.; Prentice Hall 2014- C. Giacovazzo (ed.): ?Fundamentals of Crystallography? 3rd ed.; International Union of Crystallography, Oxford University Press, 2011.Ademais recomendaranse para cada tema textos complementarios (artículos, páxinas web, textos específicos). |

| Recommendations |
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| **Subjects that it is recommended to have taken before** |
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| **Subjects that are recommended to be taken simultaneously** |

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| Subjects that continue the syllabus |
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| Other comments |
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(*)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.