



Teaching Guide				
Identifying Data			2023/24	
Subject (*)	Frontiers in Inorganic Chemistry	Code	610500004	
Study programme	Mestrado Universitario en Ciencias, Tecnoloxías e Xestión Ambiental (plan 2012)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Optional	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Esteban Gomez, David	E-mail	david.esteban@udc.es	
Lecturers	Esteban Gomez, David Platas Iglesias, Carlos Sanchez Andujar, Manuel Señaris Rodriguez, Maria Antonia	E-mail	david.esteban@udc.es carlos.platas.iglesias@udc.es m.andujar@udc.es m.senaris.rodriguez@udc.es	
Web				
General description	<p>This is a optional subject within the Specialization in Chemistry Master of Science, Technology and Environmental Management. Its main purpose is to provide students an overview of the latest topics of modern inorganic chemistry. This subject will focus on aspects related to the technological, industrial and medical application of inorganic compounds. Its fundamental purpose is to provide the students an overview of the most modern aspects of current research in Inorganic Chemistry. A particular emphasis on aspects related to the technological, industrial and medical application of inorganic compounds will also be treated. The course aims to be useful to students intending to begin in the research activity not only in the field of Inorganic Chemistry, but also in other related, such as Organic Chemistry, Materials Science and Physical Chemistry areas. Therefore, this subject has an important multidisciplinary character and both theoretical and practical issues are considered.</p>			

Study programme competences / results	
Code	Study programme competences / results
A1	Coñecemento das realidades interdisciplinares da Química e do Medio Ambiente, dos temas punteiros nestas disciplinas e das perspectivas de futuro.
A2	Deseño de novas especies químicas e materiais con propiedades determinadas.
A3	Capacitar ao alumno para o desenvolvemento dun traballo de investigación nun campo da Química ou do Medio Ambiente, incluíndo os procesos de caracterización de materiais, o estudo das súas propiedades fisicoquímicas e biolóxicas e dos procesos que poden sufrir no medio natural.
A4	Coñecer en profundidade as características e fundamentos de diversos modelos químicos para o estudo de sistemas orgánicos, inorgánicos e biolóxicos, incluídos os materiais con proxección tecnolóxica.
A8	Coñecer os fundamentos das interaccións intermoleculares e as súas aplicacións no campo da catálise supramolecular, recoñecemento molecular e biocatálise.
A9	Coñecer algunhas aplicacións básicas da química computacional e dos programas de cálculo máis utilizados nos ámbitos da química e o medio ambiente.
A11	Coñecer as distintas técnicas experimentais e computacionais orientadas á caracterización de mecanismos de reacción.
A20	Coñecemento dos principais tipos de produtos naturais: enzimas, receptores moleculares, etc. Entender a súa participación en procesos de catálise e autoensamblaxe.
A22	Dominar as técnicas instrumentais de análises máis típicas no ámbito químico profesional.
B1	Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, a miúdo nun contexto de investigación.
B2	Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornas novas ou pouco coñecidas dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.

B3	Que os estudantes sexan capaces de integrar coñecementos e afrontar a complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
B5	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun modo que haberá de ser en gran medida autodirixido ou autónomo.
B6	Ser capaz de analizar datos e situacións, xestionar a información dispoñible e sintetizala, todo iso a un nivel especializado.
B7	Ser capaz de planificar adecuadamente desenvolvementos experimentais, a un nivel especializado.
C1	Ser capaz de traballar en equipos, especialmente nos interdisciplinares e internacionais.
C3	Ser capaz de adaptarse a situacións novas, mostrando creatividade, iniciativa, espírito emprendedor e capacidade de liderado.
C4	Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
C5	Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.
C6	Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C9	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben afrontarse.
C11	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

Learning outcomes			
Learning outcomes	Study programme competences / results		
To understand the main topic of the nanochemistry field, its applications and future prospects for nanomaterials.	AC1 AC2 AC3 AC22	BC1 BC2 BC3 BC5 BC6 BC7	CC1 CC3 CC4 CC5 CC6 CC11
To understand the relevance of inorganic species and new materials with technological applications, industrial and medical.	AC1 AC2 AC3 AC4 AC9 AC22	BC1 BC2 BC3 BC5 BC6 BC7	CC1 CC3 CC4 CC5 CC6 CC11
To know the fundamentals of Supramolecular Chemistry.	AC2 AC8 AC20	BC2 BC3	CC1 CC3 CC4 CC5 CC11
To know different advanced techniques of characterization and modeling of inorganic species.	AC8 AC9 AC11 AC22	BC3 BC5 BC6	CC3 CC4 CC5 CC9

Contents	
Topic	Sub-topic
1.- Nanochemistry and nanomaterials.	<ul style="list-style-type: none"> <li>- General introduction. Basic principles.</li> <li>- Design, preparation and characterization of nanomaterials.</li> <li>- Properties of nanomaterials.</li> <li>- Applications.</li> </ul>
2.- Supramolecular chemistry.	Supramolecular Chemistry. Molecular recognition and self-assembly. Hydrogen bond.



3.- Inorganic species and new materials with technological applications, industrial and medical.	Overview of different topics of activity in the field of "Advanced Materials": thermoelectric materials, magnetoresistivity, fuel cells, dielectric materials, MOFs, etc... main applications. Sensors photophysical: selective recognition of anions and metabolites. Contrast agents RMI. Selective Extraction.
4.- Advanced techniques of characterization and modeling of inorganic species.	-Absorption spectroscopy and electron emission in molecular recognition.
Practical program: 1. - Seminar: bibliographic resources. 2. - Synthesis and characterization of nanomaterials 3. - Properties photophysics groups of chromophores and fluorophores in recognition of substrates. 4. - Selective extraction of inorganic salts.	- Databases and bibliographic resources.  - Synthesis and characterization of magnetic nanoparticles, MOFs, etc  - Determination of the association constant-receptor substrate by spectroscopic methods.  - Conformational study in solution using techniques espectrocópicas.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student's personal work hours	Total hours
Guest lecture / keynote speech	C4 C6 C11	20	24	44
Seminar	A1 A3 A4 A9 A20 B1 B2 B5 B6 C4 C5 C6 C9 C11	4	20	24
Laboratory practice	A1 A2 A3 A4 A8 A9 A11 A22 B1 B2 B5 B6 B7 C9 C11	10	12	22
Case study	A1 A3 A4 A9 A20 B1 B2 B3 B5 B6 C3 C1 C4 C5 C6 C9 C11	6	12	18
Supervised projects	A1 A3 A4 A9 A20 B1 B2 B5 B6 C4 C5 C6 C9 C11	0	20	20
Objective test	A1 A3 A4 A8 A20 B1 B2 B5 B6 C4 C5 C9 C11	2	18	20
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	In these lectures the teacher will present the contents of the different themes, emphasizing their main aspects.
Seminar	There will be taught in small groups. This methodology is designed to enforcement activities of the theoretical and resolution of issues, discussion sessions and directed discussion, problems, cases, etc..
Laboratory practice	In addition to the lectures, students will also have sessions of laboratory work that are compulsory. Non-completion of this activity will prevent passing the subject.
Case study	There will be taught in very small groups of students, and they shall be written and developed experiments, calculations or treatment procedures and data analysis, and interpreted the results.



Supervised projects	There will be complement to the lectures and the workshops and seminars. Also, there will be carried out through the use of ICTs.
Objective test	This test will be used to assess the degree of acquisition of skills by students as well as to point out those aspects of the subject that present greater difficulty.

### Personalized attention

Methodologies	Description
Guest lecture / keynote speech Case study Supervised projects Seminar Laboratory practice	<p>There will be tutorial sessions to supervise: case study, supervised project, seminar and laboratory sessions. These tutorials are configured not only as individual interviews to supervise their work, but also to guide the students in a clear definition of the objectives and prevent the spread of content, thereby ensuring that they achieve the competencies described in the matter.</p> <p>Those students having a part-time dedication to the course, and thus waiver of assistance to the on-site academic activities according to the regulations of UDC, follow different dynamics that require additional personalized attention. The waiver applied to each student is fixed after a personal interview with the instructor on the basis of the student's personal circumstances. The tutoring sessions are scheduled in this interview upon agreement between the student and the instructor, who fixes the number of different workshops to be graded using this methodology and the deadlines for the presentation of the problem-sheets. The grade obtained by the student in these activities will correspond to the average of the grades achieved for each workshop. The tutoring sessions focus on discussions about the contents of the course and revision of the problem sheets solved by the student. The student might also have short tests to assess the degree of compliance with the objectives of the course.</p>

### Assessment

Methodologies	Competencies / Results	Description	Qualification
Case study	A1 A3 A4 A9 A20 B1 B2 B3 B5 B6 C3 C1 C4 C5 C6 C9 C11	Assessed the degree of the practical work, as well as other reports that students will have to issue. A: 1,3,4,9,20 B: 1,2,5,6 C: 4,5,6,9,11	20
Supervised projects	A1 A3 A4 A9 A20 B1 B2 B5 B6 C4 C5 C6 C9 C11	Evaluate the work done by students in accordance with the planning section. A: 1,3,4,9,20 B: 1,2,5,6 C: 4,5,6,9,11	20
Seminar	A1 A3 A4 A9 A20 B1 B2 B5 B6 C4 C5 C6 C9 C11	Evaluate the participation and the level of knowledge demonstrated by students. A: 1,3,4,9,20 B: 1,2,5,6 C: 4,5,6,9,11	10
Objective test	A1 A3 A4 A8 A20 B1 B2 B5 B6 C4 C5 C9 C11	It will be a test to be held at the end of the semester. This test consists in the development of a case study, related to content covered during the course. A: 1,3,4,8,20 B: 1,2,5,6 C: 4,5,9,11	30
Laboratory practice	A1 A2 A3 A4 A8 A9 A11 A22 B1 B2 B5 B6 B7 C9 C11	The teacher will evaluate the student's experimental work, in particular with regard to the planning, organization, expertise and analysis of results. A: 1,2,3,4,8,9,11,22 B: 1,2,5,6,7 C: 4,5,9,11	20

