Teaching Guide				
Identifying Data				2022/23
Subject (*)	Polymeric and Molecular Materials		Code	610509320
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	Criado Fernández, Alejandro	E-mail	a.criado@udc.es	
Lecturers	Criado Fernández, Alejandro Guitian Rivera, Enrique Labandeira García, José Luis Lazzari , Massimo Peña Gil, Diego	E-mail	a.criado@udc.es jose.luis.labandeira@correo.udc.es massimo.lazzari@usc.es	
Web	https://www.usc.gal/gl/estudos/masteres/ciencias/master-universitario-investigacion-quimica-quimica-industrial/20202021/materiai			
General description	The subject completes the training module of Nanochemistry and new materials from the molecular point of view. It also provides overviews of the most important applications of these materials.			

Study programme competences	
Code	Study programme competences
A1	Define concepts, principles, theories and specialized facts of 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.
B1	Possess knowledge and understanding to provide a basis or opportunity for originality in developing and / or applying ideas, often within a research context
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
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		
The student will know the main specific characteristics of molecular materials	AC1 AC3 AC4	BC1 BC4 BC5 BC7 BC10	

The student will know the main types of molecular materials (liquid crystals, semiconductors, etc.), and their characteristics	AC1 AC3 AC4	BC1 BC4 BC5 BC7 BC10	CC3
The student will know the techniques used for the study of molecular materials (optical microscopy with polarized light, differential scanning calorimetry, etc.)	AC1 AC3 AC4	BC1 BC4 BC5 BC7 BC10	CC1
The student will know the main specific characteristics of polymeric materials, composites and nanocomposites	AC1 AC3 AC4	BC1 BC4 BC5 BC7 BC10	CC4

Contents	
Topic	**Sub-topic**
Chapter 1. Molecular materials	Basic concepts. Molecular structures of molecular materials.
Chapter 2. Types of molecular materials	Liquid crystals, organic semiconductors, carbon allotropes (fullerenes, nanotubes and graphenes), photonic and optoelectronic materials, molecular magnets
Chapter 3. Polymers	Classification and uses. Polymers in solution. Properties in the solid state and property-structure relationship. Degradation, stability and recycling of polymeric materials
Chapter 4. Polymeric composites and nanocomposites.	Porous materials and molecular cavities. Metalosupramolecules. Molecular imprint polymers

Planning				
Methodologies / tests	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
Guest lecture / keynote speech	B1 B4 B5 C3 C4	12	24	36
Seminar	B7 B10 C1	7	18	25
Mixed objective/subjective test	A1 A4 A3	2	10	12
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	Theoretical face-to-face classes. Lectures (use of blackboard, computer, projector), complemented with virtual teaching tools.
Seminar	Resolution of practical exercises (problems, multiple-choice questions, interpretation and treatment of information, evaluation of scientific publications, etc.) both individually and in groups, on scientific topics related to the different subjects of the Master. Oral presentation of papers, reports, etc., including discussion with professors and students. Tutorials will be mainly face-to-face, which may be partially carried out with virtual success.
Mixed objective/subjective test	A final exam is foreseen, which will objectively evaluate the degree of assimilation and ability. The final tests will be face-to-face.

Personalized attention	
Methodologies	**Description**

Seminar Mixed objective/subjective test	Tutorials are scheduled by the professor and coordinated by the Center. In general, each student will have two hours per semester. These sessions will include control activities such as directed exercises, clarification of doubts about the theory or problems, exercises, readings or other proposed tasks, presentations, debates, etc. In many cases, the professor may require the students to hand in the exercises before the classes are held. These deliveries will be included in the calendar of activities to be developed by the students throughout the course in the Teaching Guide of the corresponding discipline. Participation in these classes is compulsory. For students with part-time dedication or specific learning modalities or support for diversity, personalized attention will be given within the flexibility allowed by the coordination of schedules and material and human resources.

Assessment			
Methodologies	Competencies	Description	Qualification
Guest lecture / keynote speech	B1 B4 B5 C3 C4	Será avaliada a participación do alumno nas sexións expositivas, a través de preguntas formuladas polo profesor ou a través do debate cos compañeiros	10
Seminar	B7 B10 C1	Dentro dos seminarios realizaranse unha serie de actividades evaluables: Resolución de problemas e casos prácticos (10%) Realización de traballos e informes escritos (10%)	30
Mixed objective/subjective test	A1 A4 A3	Co propósito de avaliar a adquisición de coñecementos e competencias realizarase unha proba final (de acordo co calendario establecido no Centro). Nesta proba exporanse problemas e cuestións relativas aos contidos da materia, análogos aos realizados durante as sesións presenciais durante o curso	60

Assessment comments
The qualification of this subject will be done through continuous evaluation and the completion of a final exam. Students with academic exemption are exempt from attending seminars and tutorials (40% of the overall grade) and will be evaluated only by the mixed test, both in first and second opportunity, which will account for 100% of the overall grade. Fraudulent performance of tests or evaluation activities will be sanctioned in accordance with the regulations.

Sources of information	
Basic	- E. V. Anslyn, D. A. Dougherty (2006). Modern Physical Organic Chemistry. University Science Books - M. C. Petty (2008). Molecular Electronics; From Principles to Practice. Wiley - J. Scheirs (1998). Polymer recycling : science, technology and applications. John Wiley & Sons
Complementary	- Fernando Langa, Jean-Francois Nierengarten (2008). Fullerenes : principles and applications. Royal Society of Chemist - Michael M. Haley and Rik R. Tykwinski (2006). Carbon-rich compounds : from molecules to materials. Weinheim : Wiley - Guldi, D. M.; Martín, N.Eds. Kluwer (2002). Fullerenes: From Synthesis to Optoelectronic Properties. Academic Press, Dordrecht, Netherland - Y. Li (2015). Organic Optoelectronic Materials. Springer - C. Brabec, U. Scherf, V. Dyakonov (2014). Organic Photovoltaics: Materials, Device Physics, and Manufacturing Technologies. Weinheim: Wiley-VCH - P. J. Collings (2001). Introduction to Liquid Crystals Chemistry and Physics. London: Taylor & Francis - S. Kumar (2001). Liquid Crystals: Experimental Study of Physical Properties and Phase Transitions. Cambridge: Cambridge University Press - S. Chandrasekhar (1992). Liquid Crystals: Experimental Study of Physical Properties and Phase Transitions. Cambridge: Cambridge University Press,

Recommendations
Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously
Advanced Materials Characterization Techniques/610509121 Material Properties/610509122
Subjects that continue the syllabus
Other comments
It is compulsory to have previously taken the subjects of the Advanced Compulsory Training module and it is recommended to take the remaining subjects of the Nanochemistry and New Materials module