Teaching Guide				
Identifying Data				2021/22
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	Química			
Coordinador	Jimenez Gonzalez, Carlos	E-mail	carlos.jimenez@udc.es	
Lecturers	Jimenez Gonzalez, Carlos	E-mail	carlos.jimenez@udc.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.			
Contingency plan	1. Modifications to the contents There are no changes to the contents. 2. Methodologies * Teaching methodologies that are maintained Master class, seminar and mixed test. * Teaching methodologies that change There is no modification in the teaching methodologies, except that they will be taught synchronously or asynchronously using the Moodle and Teams platform or any other that the UDC makes available to students. 3. Mechanisms for personalized attention to students Email, student demand. Equipment (or other similar platform), at the request of the student 4. Changes in the evaluation There are no changes in the methodology or percentage of evaluation of the different activities. * Evaluation observations: In the event that master classes or seminars cannot be held synchronously, attendance and active participation in these activities will not be evaluated. The mixed test will be carried out using Moodle, Teams or any other teletraining platform that the UDC makes available to the university community. 5. Modifications to the bibliography or webography There is no modification. *Teaching methodologies that are modified 3. Mechanisms for personalized attention to students 4. Modifications in the evaluation *Evaluation observations: 5. Modifications to the bibliography or webgraphy			

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 understand how molecular properties and supramolecular interactions determine the properties of molecular materials	AC1 AC3 AC4	BC1 BC4 BC5 BC7 BC10	CC1
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 main specific characteristics of polymeric materials, composites and nanocomposites	AC1 AC3 AC4	BC1 BC4 BC5 BC7 BC10	CC4
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

Contents	
Topic	Sub-topic
Chapter 1. Molecular materials: basic concepts	Conceptos básicos

Chapter 2. Molecular structures of molecular materials	Polímeros conxugados: poliacetilenos, polifenilenvinilenos, politiofenos --estrutura, propiedades e sínteses Compostos policíclicos aromáticos: --bidimensionales: acenos, rilenos, nanografenos, grafeno --estrutura, propiedades e sínteses --tridimensionales: fullerenos, nanotubos de carbono --estrutura, propiedades e sínteses Outros compostos: poliaminas, compostos heterocíclicos, complexos metálicos --estrutura, propiedades e sínteses
Chapter 3. Types of molecular materials	Liquid crystals, organic semiconductors, carbon allotropes (fullerenes, nanotubes and graphenes), photonic and optoelectronic materials, molecular magnets
Chapter 4. Polymers	Classification and uses. Polymers in solution. Properties in the solid state and property-structure relationship. Degradation, stability and recycling of polymeric materials
Chapter 5. 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
Seminar	B7 B10	9	0	9
Oral presentation	C1	2	9	11
Mixed objective/subjective test	A1 A4 A3	2	7	9
Guest lecture / keynote speech	B1 B4 B5 C4 C3	12	34	46
Personalized attention		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	Given that the tutorials will be essentially face-to-face, they may be partially carried out with virtual success
Oral presentation	Realización de traballos, tanto individualmente, como en grupo, sobre temas científicos relacionados coas distintas materias do Máster. Exposición oral de traballos, informes, etc., incluíndo debate con profesores e alumnos
Mixed objective/subjective test	The final tests will be face-to-face
Guest lecture / keynote speech	An expository and interactive teaching will be face-to-face. However, and with exceptional success, in order to facilitate the compatibility of teaching activities and the gradual development of the teaching skills of teachers and students, face-to-face teaching can be combined with virtual teaching in a maximum of 10% of cases. the total hours of the subject. In any case, this limitation will not apply to titles whose reports include a higher percentage

Personalized attention	
Methodologies	Description

Seminar	The proposed teaching methodology is based on student work, which thus becomes the main protagonist of the teaching-learning process. In order for the student to obtain an optimal performance of his effort, it is essential that there is a continuous and close student-teacher interaction, so that the latter can guide the former in this process. This interaction will be given in a special way in the workshops and problem solving sessions. Through the student-teacher interaction, as well as the different evaluation activities, it will be determined to what extent the students have achieved the competence objectives established in each thematic unit, and will decide the students who need personalized attention through individualized tutorials. Therefore, teachers may periodically invite students to tutorials, which will be held at the most appropriate times for each student, with the intention that they receive the necessary guidance. Regardless of the tutorials proposed by the teachers, students can attend the tutorial, at their own request, as many times as they wish, and at the time that is most appropriate for them

Assessment			
Methodologies	Competencies	Description	Qualification
Guest lecture / keynote speech	B1 B4 B5 C4 C3	Será avaliada a participación do alumno nas sexións expositivas, a través de preguntas formuladas polo profesor ou a través do debate cos compañeiros	5
Seminar	B7 B10	Dentro dos seminarios realizaranse unha serie de actividades evaluables: Resolución de problemas e casos prácticos (10%) Realización de traballos e informes escritos (10%)	15
Oral presentation	C1	O alumno presentará de forma oral, ao longo do desenrolo da materia, un ou varios dos resultados obtidos dentro das actividade plantexadas nos seminarios	15
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	65

Assessment comments
SISTEMA DE AVALIACIÓN PONDERACIÓN MÍNIMA PONDERACIÓN MÁXIMA establecida na pagina web da USCExame final 55.0 75.0 Resolución de problemas e casos prácticos 10-15 Realización de traballos e informes escritos 5-10 Exposición oral (traballos, informes, problemas e casos prácticos) 5-10 Avaliación continua do alumno mediante preguntas e cuestións orais durante o curso 5-10

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