



Teaching Guide

Identifying Data					2020/21
Subject (*)	Materials Physical Chemistry		Code	610500014	
Study programme	Mestrado Universitario en Ciencias, Tecnoloxías e Xestión Ambiental (plan 2012)				
Descriptors					
Cycle	Period	Year	Type	Credits	
Official Master's Degree	2nd four-month period	First	Optional	3	
Language	Spanish				
Teaching method	Face-to-face				
Prerequisites					
Department	Química				
Coordinador	Sastre De Vicente, Manuel Esteban	E-mail	manuel.sastre@udc.es		
Lecturers	Sastre De Vicente, Manuel Esteban	E-mail	manuel.sastre@udc.es		
Web					
General description	Overview of structural, thermodynamic and kinetic properties of some materials of environmental interest: adsorbents, ion exchangers and membranes, with both a theoretical and practical focus.				
Contingency plan	<p>1. Modifications to the contents</p> <p>2. Methodologies</p> <p>*Teaching methodologies that are maintained</p> <p>*Teaching methodologies that are modified</p> <p>3. Mechanisms for personalized attention to students</p> <p>4. Modifications in the evaluation</p> <p>*Evaluation observations:</p> <p>5. Modifications to the bibliography or webgraphy</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.
A7	Coñecer o marco teórico e as aplicacións da electroquímica e da fotocatalise nos campos da enerxía e o medio ambiente.
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 enfrontarse á 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.
C5	Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.
C8	Entender a importancia da cultura emprendedora e coñecer os medios ao alcance das persoas emprendedoras.
C9	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
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		
Get a general overview of the intermolecular force concept and its relationship with size and other physicochemical properties, justifying the nature of nanomaterials.	AC3 AC7		
To know important adsorbent materials with emphasis in the properties and applications of activated carbons.	AC2 AC3		
To know the properties of natural and artificial ion exchangers with a focus on zeolites.	AC2 AC3		
To know the basic properties of membranes and its relevance in separation processes in chemistry.	AC1 AC3	BC2	CC11
To critically extract relevant information from the readings of papers treating real applications of nanomaterials.	AC1 AC2 AC3	BC1 BC2 BC3 BC5 BC6	CC5 CC8 CC9
To design adequate experiments to test the behaviour of adsorbents and/ or ion exchangers coupled with membranes.	AC4	BC2 BC6 BC7	CC1 CC3 CC11

Contents	
Topic	Sub-topic
THEME 1. Intermolecular and surface forces.	General overview of intermolecular and surface forces. Physicochemical properties and size. Nanoscience.
THEME 2. Adsorbent materials	Adsorbent geo and biomaterials: structural and energetical aspects. Surface areas estimation. Activated carbons. Nanosorbents.
THEME 3. Ion Exchangers	Natural and artificial ion exchangers. Thermodynamics and kinetics of ion exchange. Zeolites.
THEME 4. Membranes.	Membranes: definitions. Permeability of porous membranes. Darcy equation. Polymeric membranes. Applications.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student's personal work hours	Total hours
Guest lecture / keynote speech	A1 A4 A7	11	22	33
Seminar	B1 B3	2	5	7
Supervised projects	A2 A3 B6 C5	1	10	11



Laboratory practice	B7 C3 C1	10	0	10
Events academic / information	C8 C9 C11	1.5	0	1.5
Mixed objective/subjective test	B2 B5	2.5	10	12.5
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
Guest lecture / keynote speech	Classroom presentation of the subject
Seminar	Solving in detail some selected problems. Any question/clarification that may arise in these sessions will be solved.
Supervised projects	Reading and discussion of some research papers on intermolecular forces and nanomaterials.
Laboratory practice	Some illustrative experiments on adsorption/ion exchange of selected materials.
Events academic / information	Supplementary activities such as visits to a research laboratory, informative video projections, talks/communications in the faculty or thematic searches on the internet.
Mixed objective/subjective test	Examination of subject contents.

Personalized attention	
Methodologies	Description
Supervised projects Seminar Laboratory practice	<p>Recoméndase aos alumnos o uso de titorías individualizadas para resolver todas as dúbidas, cuestións e conceptos que non quedasen claros referentes ao desenvolvemento dos contidos da materia.</p> <p>As prácticas (de laboratorio e da aula de informática) realizaranse coa presenza constante dos profesores da materia que resolverán persoalmente todas as dúbidas e problemas que poidan xurdir a cada alumno.</p> <p>Horario oficial atención personalizada: martes e xoves de 10 a 13 h.</p> <p>En calquera caso, ao longo da semana, o alumno pode consultar cantas dúbidas lle xurdan en relación coa materia.</p>

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Supervised projects	A2 A3 B6 C5	Delivery and presentation of a short summary of an article about intermolecular forces/nanomaterials. Assesment competencies: A1,A3,C9	5
Seminar	B1 B3	Delivery of one of the problems proposed in class. Assesment of competencies: B2,B6,,C9	10
Laboratory practice	B7 C3 C1	Compulsory attendance to all laboratory experiments. Assesment competencies: B7	10
Mixed objective/subjective test	B2 B5	Exam of the contents. Assesment competencies: AM1,AM2,AM3, BM2	75

Assessment comments

Sources of information



Basic	- Rolando M.A., Roque-Malherbe (2010). The Physical Chemistry of Material: Energy and Environmental Applications.. CRC Press - Israelachvili, J. (1991). Intermolecular and surface forces.. Academic Press, 2nd ed.
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

Conocimientos previos: licenciados/graduados en Ciencias y/o Ingeniería.

(*)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.