Teaching Guide					
Identifying Data					2022/23
Subject (*)	Physics: Electricity and Magnetism			Code	610G04007
Study programme	Grao en Nanociencia e Nanotecnoloxía				
Descriptors					
Cycle	Period	Year		Type	Credits
Graduate	2nd four-month period	First		Basic training	6
Language	SpanishEnglish				
Teaching method	Face-to-face				
Prerequisites					
Department	Física e Ciencias da Terra				
Coordinador	Cabeza Gras, Oscar		E-mail	oscar.cabeza@udc.es	
Lecturers	Cabeza Gras, Oscar Nogueira Lopez, Pedro Fernando		E-mail	oscar.cabeza@udc.es pedro.nogueira@udc.es	
Web					
General description	O obxectivo fundamental da materia é a adquisición de conceptos básicos de electricidade e magnetismo, que faciliten a comprensión das materias de Física ou outras disciplinas que forman parte do plan de estudos.				

Study programme competences / results	
Code	Study programme competences / results
A1	CE1 - Comprender los conceptos, principios, teorías y hechos fundamentales relacionados con la Nanociencia y Nanotecnología.
A2	CE2 - Aplicar los conceptos, principios, teorías y hechos fundamentales relacionados con la Nanociencia y Nanotecnología a la resolución de problemas de naturaleza cuantitativa o cualitativa.
A3	CE3 - Reconocer y analizar problemas físicos, químicos, matemáticos, biológicos en el ámbito de la Nanociencia y Nanotecnología, así como plantear respuestas o trabajos adecuados para su resolución, incluyendo el uso de fuentes bibliográficas.
B1	CB1 - Que los estudiantes hayan demostrado poseer y comprender conocimientos en un área de estudio que parte de la base de la educación secundaria general, y se suele encontrar a un nivel que, si bien se apoya en libros de texto avanzados, incluye también algunos aspectos que implican conocimientos procedentes de la vanguardia de su campo de estudio
B2	CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio
B5	CB5 - Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía
B6	CG1 - Aprender a aprender
B7	CG2 - Resolver problemas de forma efectiva.
B8	CG3 - Aplicar un pensamiento crítico, lógico y creativo.
B9	CG4 - Trabajar de forma autónoma con iniciativa.
B11	CG6 - Comportarse con ética y responsabilidad social como ciudadano/a y como profesional.
C1	CT1 - Expresarse correctamente, tanto de forma oral coma escrita, en las lenguas oficiales de la comunidad autónoma
C2	CT2 - Dominar la expresión y la comprensión de forma oral y escrita de un idioma extranjero
C4	CT4 - Desarrollarse para el ejercicio de una ciudadanía respetuosa con la cultura democrática, los derechos humanos y la perspectiva de género
C7	CT7 - Desarrollar la capacidad de trabajar en equipos interdisciplinares o transdisciplinares, para ofrecer propuestas que contribuyan a un desarrollo sostenible ambiental, económico, político y social.
C8	CT8 - Valorar la importancia que tiene la investigación, la innovación y el desarrollo tecnológico en el avance socioeconómico y cultural de la sociedad
C9	CT9 - Tener la capacidad de gestionar tiempos y recursos: desarrollar planes, priorizar actividades, identificar las críticas, establecer plazos y cumplirlos

Learning outcomes

Learning outcomes	Study programme competences / results		
Understand the description of physical interactions through fields, for which the notions of scalar and vector fields and the operations they support will be introduced: gradient, circulation and rotational.	A1 A2 A3	B5 B7 B8	
Understand the fundamentals of electrostatics and electrokinetics.	A1 A2 A3	B1 B2 B5 B6 B7 B8 B9	C1 C2 C4 C7 C8 C9
To know the bases of magnetism and the properties of magnetic dipoles	A1 A2 A3	B1 B2 B5 B6 B7 B8 B9 B11	C1 C2 C4 C7 C8 C9
To know the basics of electrodynamics, that is, generation and reception of electromagnetic waves.	A1 A2 A3	B1 B2 B5 B6 B7 B8 B9 B11	C1 C2 C4 C7 C8 C9

Contents	
Topic	Sub-topic
BLOCK 1. Introduction	1.1. Escalar Fields 1.2. Vectorial Fields 1.3. Mathematical operators associated to fields
BLOCK 2. Electrostatic	2.1. Forces, fields and electric potential. 2.2. Methods for calculating the electric field and potential. 2.3. Work and electrical energy. 2.4. Electric dipoles and quadrupoles.
BLOCK 3. Electrokinetic	3.1. Current, resistance, capacity, back electromotive force. 3.2. Kirchhoff's Laws 3.3. Resolution of electrical circuits of direct current.
BLOCK 4. Magnetism	4.1. Magnetostatics. 4.2. Magnetic dipoles. 4.3. Earth's magnetic field.
BLOCK 5. Electromagnetism	5.1. Lorentz's force. 5.2. Electromagnetic induction. 5.3. Alternating and direct current generators.

BLOCK 6. Classical Electrodynamics	6.1. Maxwell's laws. 6.2. Generation of electromagnetic waves. 6.3. Reception of electromagnetic waves.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A3 B5 B8 B9 B11 C4 C7 C8 C9	32	48	80
Seminar	A1 A2 A3 B1 B2 B7 B8 B9 B11	16	32	48
Supervised projects	A1 A2 A3 B1 B2 B5 B6 B7 B8 B9 B11 C1 C2 C4 C7 C8 C9	0	16	16
Mixed objective/subjective test	A1 A2 A3 B1 B2 B5 B7 B8 B9 B11 C1 C4 C9	4	0	4
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	Presentation of the concepts and laws associated with the fundamentals of electromagnetism.
Seminar	Application of the concepts presented in the master sessions by solving exercises interactively.
Supervised projects	Completion of two supervised works, one will be addressed individually while the other will consist of developing a series of tasks collaboratively within a group.
Mixed objective/subjective test	Carrying out tests on the theoretical and practical contents of the subject individually.

Personalized attention	
Methodologies	Description
Supervised projects	A atención personalizada consistirá no seguimento da evolución do traballo ou ben na resolución das dúbidas relacionadas coa súa elaboración, e terán lugar de forma individual ou en grupos, dependendo da natureza do traballo. Todas as tutorías poderanse realizar de forma virtual.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Supervised projects	A1 A2 A3 B1 B2 B5 B6 B7 B8 B9 B11 C1 C2 C4 C7 C8 C9	Two supervised works will be proposed. One will be done individually and the other in a group. Each work will have a weight in the qualification of 20%.	40
Mixed objective/subjective test	A1 A2 A3 B1 B2 B5 B7 B8 B9 B11 C1 C4 C9	Two partial tests will be carried out, each of them contributing a weight in the qualification of 30%.	60

Assessment comments

To pass the subject, students must achieve a minimum of 5 points and, in addition, they must obtain a minimum score of 4.5 points out of 10 in each partial test. The evaluation criteria will be the same on all occasions. The approval of each two parts is kept for the final, both in the 1st and in the 2nd opportunity.
The evaluation of students with recognition of part-time dedication and academic exemption from attendance exemption will follow the same criteria, and will consist of the same tests as the rest of the students, adapting the activities requested to their circumstances.
QUALIFICATION at the end of the evaluation process:
1. Those students who meet the minimum requirements and reach a minimum of 5 points, would pass the subject.
2. Those students who do not reach the minimum score established in any of the partial tests (4.5/10 points), this will not compute in the final qualification and in addition, after adding the qualifications, they will only be able to obtain a maximum global qualification of 4.5 points.
The qualification of "Non Presented" will appear to those students who do not present more objective tests.

Sources of information	
Basic	- R. A. Serway (2005). Electricidad yMagnetismo.. México. Thomson. - J.R. Reitz, F.J. Milford y R.W. Christy (1993). Fundamentos de la teoría electromagnética. . Addison-Wesley Iberoamericana. - Tipler y Mosca (2011). Física. Volumen 2. Reverté
Complementary	E. Gullón de Senespleda (1976). Electricidad y magnetismo. Problemas de Física. Madrid: Internacional de RomoSantiago Burbano de Ercilla, Enrique Burbano Garcia, Carlos Gracia Muñoz (2006). Problemas de física. TébarRichard P. Feyman, Robert B. Leighton, Matthew Sands (1975). The Feyman lectures on physics Feynman física. Fondo Educativo InteramericanoRaymond A. Serway, John W. Jewett, Jr. (2014). Physics for scientists and engineers. Brooks/Cole, Cengage Learning

Recommendations
Subjects that it is recommended to have taken before
Numerical and Statistical Methods/610G04013 Fundamentals of Mathematics/610G04001 Integrated Basic Laboratory/610G04004
Subjects that are recommended to be taken simultaneously
Advanced Calculus /610G04009
Subjects that continue the syllabus
Physics of the Nanoscale/610G04041 Polymers/610G04028 Solid State/610G04022 Fundamentals of Quantum Theory/610G04015
Other comments
Programa Green Campus Facultade de CienciasPara axudar a conseguir unha contorna inmediata sustentable e cumprir co punto 6 da "Declaración Ambiental da Facultade de Ciencias (2020)", os traballos documentais que se realicen nesta materia:a. Solicitaranse maioritariamente en formato virtual.b. De realizarse en papel:- Non se empregarán plásticos.- Realizaranse impresións a dobre cara.- Empregarase papel reciclado.