# Universida<sub>de</sub>Vigo

Subject Guide 2023 / 2024

IDENTIFYIN	G DATA				
Physics: Ph	<b>.</b>				
Subject	Physics: Physics II				
Code	007G410V01202				
Study	Grado en				
programme	Ingeniería				
	Aeroespacial				
Descriptors	ECTS Credits		Choose	Year	Quadmester
	6		Basic education	1st	2nd
Teaching	#EnglishFriendly				
language	Spanish				
	Galician				
Department					
Coordinator	Salgueiro Piñeiro, Jose Ramon				
Lecturers	Cerdeiriña Álvarez, Claudio				
	Michinel Álvarez, Humberto Javier				
	Salgueiro Piñeiro, Jose Ramon				
E-mail	jrs@uvigo.es				
Web	http://aero.uvigo.es				
General	The matter of Physics II is fundame			and basic co	empetences on the basic
description	electromagnetism, including its ma	in theoretical pra	actical aspects.		
	English Friendly subject: Internation references in English, b) tutoring se				

# **Training and Learning Results**

Code

- A1 That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
- Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
- C2 Understanding and mastery of the basic concepts about the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to solve problems related to engineering.
- D1 Capability of analysis, organization and planification.
- D3 Capability of oral and written communication in native lenguage
- D4 Capability of autonomous learning and information management
- D5 Capability to solve problems and draw decisions
- D6 Capabiliity for interpersonal communication
- 8 Capabiliity for critical and self-critical reasoning

Expected results from this subject							
Expected results from this subject			Training and Learning Results				
Knowledge and understanding of the basic principles of Physics and their application to the analysis and to the resolution of problems in engineering	A1	B2	C2	D1 D3 D4 D5 D6 D8			
Knowledge, understanding and application of the principles of electromagnetism, including	A1		C2	D5			
telectrostatics, magnetostatics and Maxwell's equations.				D8			

C2

D5 D8

Contents	
Topic	
Presentation of the course and historical introduction	Historical introduction.
Scalar and vector fields	Coordinate systems in two and three dimensions. Field concept. Vectorial operators. Gradient of a scalar. Circulation of a vector. Flow. Divergence. Divergence theorem. Rotational. Stokes theorem.
Electrostatics	Charge and charge density. Coulomb's law. Electrostatic field. Flow of the electrostatic field. Gauss' Law. Electrostatic potential. Poisson and Laplace equations. Electrostatic field energy. Potential multipole expansion. Dipoles. Conductors and dielectrics. Electrostatics in presence of matter. Capacitors.
Electrical currents and magnetostatics	Current and current density. Continuity equation. Ohm's law. Conductivity and resistivity. Introduction to the magnetic field. Force between currents. Magnetic induction. Lorentz's force. Biot and Savart's law. Magnetic flux. Ampère's circuital law. Vector potential. Multipolar expansion of vector potential. Magnetic dipoles. Magnetic dipolar moment. Magnetism in presence of matter. Magnetic response of the materials. Magnetic field. Hysteresis cycles.
Electrical circuits	Combination of resistors. Electromotive force. Electrical circuits. Electric power and energy. Voltage and current sources. Measurement of voltages currents and resistors. Kirchhoff's laws and circuit analysis. Thévenin and Norton theorems.
Introduction to Electrodynamics	Faraday's induction law. Inductance. Generators, motors and transformers Magnetic energy. Displacement current. Maxwell's equations. Energy and momentum of the electromagnetic field.
Alternating current	Capacitive and inductive reactances. Impedance. Mean and effective power. Complex magnitudes. RLC series and parallel circuits. Resonance. Quality factor. Apparent and reactive power. Transitory states.
Introduction to electromagnetic waves	Types of waves. Energy carried by a wave. Huygens' principle. Superposition of waves of different frequency. Phase and group velocities. Electromagnetic wave equation. Hertz's experiment. Electromagnetic spectrum. Propagation of electromagnetic waves. Electromagnetic energy. Radiometric magnitudes and units. Polarization. Reflection and refraction. Interference and diffraction.
Introduction to thermodynamics. Law zero.	Historical introduction. Fundamental concepts. Thermal equilibrium. Temperature. Temperature measurement: thermometric scales. Types of thermometers.
First law of thermodynamics	Work.Heat concept. Internal energy. Heat capacity. Latent heat.
Second law of thermodynamics	Thermal and freezing machines. Second law statements. Carnot's cycle. Carnot's theorem. Thermodynamic scale of temperatures. Entropy. Entropy increase principle. Third law of thermodynamics. Fundamental equations and state equations.
ldeal gases	Definition of an ideal gas. Status equation. Joule's experiment. Mayer's law. Isocoric, isobaric, isotermic and adiabatic processes for an ideal gas. Slope of isotherms and adiabats.
Laboratory experiences	Measurement of basic electromagnetic properties with multimeter and oscilloscope. Measurement of the capacity of a capacitor. Measurement of Laplace's force. Helmholtz coils. Measurement of the terrestrial magnetic field. Magnetic dipole. Electromagnetic induction. Circuits. Ideal gas state equation.

Planning				
	Class hours	Hours outside the classroom	Total hours	
Lecturing	20	40	60	
Laboratory practical	12	18	30	
Problem solving	7	10.5	17.5	
Introductory activities	1	0	1	
Seminars	10	15	25	
Essay questions exam	2.5	0	2.5	
Report of practices, practicum and ex	ternal practices 0	14	14	

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description
Lecturing	Classes one hour long to exposed the main theoretical concepts of the matter.
Laboratory practical	Development of experiments in laboratory to illustrate the main theoretical concepts previously developed on the lectures.
Problem solving	Resolution of selected exercises similar to those the student will face later in an autonomous way.
Introductory activities	Presentation of the subject and lecturers. Presentation of the laboratory.
Seminars	Approach, discussion and resolution of questions and problems in relation with the theoretical
	concepts previously developed in lectures.

Personalized assistance				
Methodologies	Description			
Laboratory practical	The lecturer individually explains the development of the experiments to be carried out at the laboratory.			
Lecturing	The lecturer individually supervises the correct assimilation of the theoretical concepts developed in the lectures.			
Seminars	The lecturer individually supervises resolution of the problems proposed in the seminar lectures.			
Introductory activities	Presentation of the subjects at the beginning of the course.			
Problem solving	The lecturer solves problems of similar difficulty to those the student will face later in an autonomous way and attending questions made by the students			

	Description	Qualification	n Tr	ainii	ng a	and
			Lea	ning	g Re	sults
Essay questions exam	Four problem-solving and question-solving tests distributed throughout the semester, each of which will account 20% of the total score for the subject. These tests will be recoverable.	80	A1	(	C2	D1 D3 D8
Report of practices, practicum and external practices	Attendance to the laboratory sessions and realization of laboratory tasks (10%).  Subsequent preparation of a report on laboratory activities and realization of a project (10%). Laboratory activities are not recoverable. Laboratory report and project are recoverable.	3 20		32 (	C2	D1 D3 D4 D5 D6 D8

# Other comments on the Evaluation

No minimum score is established for any of the continuous assessment tests.

Commitment of the student to continuous assessment: this commitment is materialized by attending the four exams distributed throughout the semester or by attending any of the recovery tests on the day of the final exam. The student who fail to attend to any of these four exams and to all the recovery tests will receive the grade of "non presentado".

Recovery of continuous assessment tests:

On the day of the final exam, students will be able to recover each of the four exams taken throughout the semester. They will be able to choose which exams they want to recover or improve. The highest score obtained between the recovery exam and the exam carried out during the semester will always be recorded. The students will also have the option of submitting the laboratory report and the project until the day of the final exam in case they did not submit it within the established period or if they just wish to improve it.

Second call and end-of-program call evaluation: it will be done in the same way as the recovery of the first call, but on the dates officially established for each of the calls.

### Exam-only assessment:

The student has the right to opt for the global assessment according to the procedure and the deadline established by the centre for each call. Students who opt for this modality will take an exam that covers the contents of the entire subject and might also contain questions or exercises related to laboratory activities.

Examination dates: the exam schedule is published on the website http://aero.uvigo.es/gl/docencia/exames

#### Sources of information

#### **Basic Bibliography**

Griffiths, D.J, Introduction to electrodynamics, 3ª edición, Prentice Hall, 1999

Burbano de Ercilla, Física General, 31ª, Mira, 1993

Hecht, E., **Óptica**, 5ª ed., Pearson, 2016

# **Complementary Bibliography**

Wangsness, R. K., Campos electromagnéticos, Limusa, 1983

Sears, F. W., Salinger, G. L., **Termodinámica, teoría cinética y termodinámica estadística**, Reverté, 1973

Nilsson, J, Circuitos eléctricos, 4ª, Addison Wesley Iberoamericana, 1993

Feynman, R. P., Física (vol. I), Addison Wesley, 1998

Feynman, R. P., **Física, vol. II**, Adidison Wesley, 1998

Cheng, D.K., Fundamentos de electromagnetismo para ingeniería, Addison Wesley Iberoamericana, 1988

Edminister, J.A., Circuitos Eléctricos, McGraw-Hill, 1997

Edminister, J.A., Electromagnetismo, McGraw-Hill, 1993

Jackson J.D., Electrodinámica clásica, Alhambra, 1980

Serrano, V, **Electricidad y Magnetismo: Estrategias para la resolución de problemas y aplicaciones**, Prentice Hall, 2001

Sabah, N.H., Electric circuits and signals, CRC Press, 2008

Callen, H. B., Termodinámica: introducción a las teorías físicas de la termostática del equilibrio y de la termodinámica, AC, 1981

Varios, http://wikipedia.org,

# Recommendations

# Subjects that are recommended to be taken simultaneously

Mathematics: Calculus II/007G410V01201

# Subjects that it is recommended to have taken before

Physics: Physics I/007G410V01103 Mathematics: Calculus I/007G410V01101