



IDENTIFYING DATA

Physics: Physics II

Subject	Physics: Physics II			
Code	007G410V01202			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Salgueiro Piñeiro, Jose Ramon			
Lecturers	Cerdeiriña Álvarez, Claudio Michinel Álvarez, Humberto Javier Salgueiro Piñeiro, Jose Ramon			
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Web	http://aero.uvigo.es			
General description	The matter of Physics II is fundamentally oriented to provide the training and basic competences on the basic electromagnetism, including its main theoretical practical aspects.			

English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.

Skills

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
B2	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 language
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capability for interpersonal communication
D8	Capability for critical and self-critical reasoning

Learning outcomes

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
Knowledge, understanding and application of the principles of electromagnetism, including electrostatics, magnetostatics and Maxwell's equations.				D8
	A1		C2	D5
				D8

Knowledge, understanding and application of the general laws of classical Thermodynamics, introducing the concept of thermodynamic equilibrium and the most important thermodynamic magnitudes.

A1

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.
Ideal gases	Definition of an ideal gas. Status equation. Joule's experiment. Mayer's law. Isocoric, isobaric, isothermic 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 external 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

Assessment					
	Description	Qualification	Training and Learning Results		
Essay questions exam	Two control-exams including resolution of problems and questions (that will suppose a total of 20% of the final mark). A final examination that will be 60% of the note. Should the student is not evaluated by means of the control-examination, the final examination will suppose 80% of the mark.	80	A1	C2	D1 D3 D8
Report of practices, practicum and external practices exam.	Delivery and oral presentation if necessary of experiments inform and/or activities realized in the laboratory. The students that do not realize experimental work will be specifically evaluated on these aspects at the final	20	B2	C2	D1 D3 D4 D5 D6 D8

Other comments on the Evaluation

Continuous assessment exams will be carried out within lecturing time slots.

The marks of the control-examination can be taken into account at the second call exam. The marks of the laboratory reports can be taken into account at the second call examination as well as the end of program call.

In the case that the student do not present himself/herself to the control-examinations, the final examination (exam-only assessment) will suppose 80% of the mark and the students that have not atended the laboratory sessions will be evaluated specifically on these aspects the day of the final examination. This applies to the first call exam as well as the second call and end-of-program calls.

The evaluation dates are on the calendar 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

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

Complementary Bibliography

Wangness, R. K., **Campos electromagnéticos**, Limusa, 1983

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/O07G410V01201

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103

Mathematics: Calculus I/O07G410V01101
