



(*)Escola de Enxeñaría Aeronáutica e do Espazo

Presentation

The School of Aeronautic and Space Engineering (EEAE) of the University of Vigo at the Campus of Ourense offers the degrees of the University of Vigo that are related both to bachelor's and to master's level in the field of aeronautical or aerospace engineering.

More information about the Center and its degrees is found in this document or on the web page (<http://aero.uvigo.es>).

Address

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Regulations and legislation

The information is available on the Center's web site (<http://aero.uvigo.es> in the section: School -> Regulations).

(*)Grao en Enxeñaría Aeroespacial

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
007G410V01101	Matemáticas: Cálculo I	1st	6
007G410V01102	Matemáticas: Álgebra lineal	1st	6
007G410V01103	Física: Física I	1st	6
007G410V01104	Informática: Informática	1st	6
007G410V01105	Expresión gráfica: Expresión gráfica	1st	6
007G410V01201	Matemáticas: Cálculo II	2nd	6
007G410V01202	Física: Física II	2nd	6
007G410V01203	Química: Química	2nd	6
007G410V01204	Empresa: Administración da tecnoloxía e a empresa	2nd	6
007G410V01205	Tecnoloxía aeroespacial	2nd	6

IDENTIFYING DATA				
Mathematics: Calculus I				
Subject	Mathematics: Calculus I			
Code	007G410V01101			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Galician English			
Department				
Coordinator	Area Carracedo, Iván Carlos			
Lecturers	Area Carracedo, Iván Carlos			
E-mail	area@uvigo.es			
Web	http://area.webs.uvigo.es			
General description	The aim of this course is that the student acquires the techniques of differential calculus both in one and several variables, and integral calculus in one variables, necessary both for other courses of the degree and for professional practice.			

Competencies		
Code		Typology
CB1	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	• know • Know How
CG2	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.	• know • Know How
CE1	Capability to solve mathematical problems that may arise in engineering. Aptitude to apply the knowledge about: linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.	• know • Know How
CE32	Appropriate knowledge applied to engineering: methods of calculation and development of materials and defence systems; management of experimental techniques, equipment and measuring instruments; numerical simulation of the most significant physical-mathematical processes; inspection, quality control and fault detection techniques; their most appropriate methods and repair techniques.	• know • Know How
CT1	Capability of analysis, organization and planification.	• Know be
CT3	Capability of oral and written communication in native language	• Know be
CT4	Capability of autonomous learning and information management	• Know be
CT5	Capability to solve problems and draw decisions	• Know How • Know be
CT6	Capabiliity for interpersonal communication	• Know be
CT8	Capabiliity for critical and self-critical reasoning	• Know How • Know be

Learning outcomes	
Learning outcomes	Competences
Knowledge and understanding of the main concepts and techniques of differential calculus in one and several variables as well as of integral calculus in one variable and numerical integration	CB1 CG2 CE1 CE32 CT1 CT3 CT4 CT5 CT6 CT8

Capacity of applying them to other branches of Mathematics and Engineering Sciences.

CB1
CG2
CE1
CE32
CT1
CT3
CT4
CT5
CT6
CT8

Contents

Topic	
Functions of one real variable.	Functions of one real variable. Limits. Continuity.
Differentiability of functions of one real variable. Mean value theorems. Limited expansions and Taylor's formula. Extrema.	Differentiability of functions of one real variable. Mean value theorems. Limited expansions and Taylor's formula. Extrema.
Integration of functions of one real variable	Primitives. Definite integral. Fundamental theorem of calculus. Geometric applications. Numerical integration
Sequences and series.	Sequences and series. Convergence. Numeric series of positive terms. Convergence criteria. Power series.
Functions of several real variables.	The n-dimensional euclidean space. Functions of several real variables. Limits. Continuity. Differentiability. Expansion and Taylor's formula. Relative extrema. Constrained optimization.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	36	54
Problem solving	14	26.6	40.6
Introductory activities	1	1.4	2.4
Autonomous problem solving	5	9.5	14.5
Laboratory practical	12	24	36
Essay questions exam	2.5	0	2.5

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

Methodologies

	Description
Lecturing	The professor will present in the theoretical classes the contents of the subject. Students will have basic reference texts for tracking the subject.
Problem solving	The professor will solve problems and exercises manually and the student will have to solve similar exercises to acquire the necessary skills.
Introductory activities	Activities to make contact and gather information on the students, and to present the subject.
Autonomous problem solving	The students will have to solve exercises independently to check the acquisition of the skills.
Laboratory practical	The professor will solve problems and exercises with computer tools and the student will have to solve similar exercises to acquire the necessary skills.

Personalized assistance

Methodologies	Description
Lecturing	The professor will personally solve the doubts of students. The doubts will be solved in-person, specially during problems and laboratory lectures and during tutorials, and also by using the remote options available for the course.
Laboratory practical	The professor will personally solve the doubts of students. The doubts will be solved in-person, specially during problems and laboratory lectures and during tutorials, and also by using the remote options available for the course.
Problem solving	The professor will personally solve the doubts of students. The doubts will be solved in-person, specially during problems and laboratory lectures and during tutorials, and also by using the remote options available for the course.

Assessment

Description	Qualification	Evaluated	Competences
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Autonomous problem solving	Written tests and / or work to assess will be made to evaluate solving exercises and / or problems autonomously.	40	CB1 CG2 CE1 CE32 CT1 CT3 CT4 CT5 CT6 CT8
Essay questions exam	A final exam on the contents of all the course will be made.	60	CB1 CG2 CE1 CE32 CT1 CT3 CT4 CT5 CT8

Other comments on the Evaluation

It is required to obtain at least 30% of the maximum of the mark of each of the blocks of the subject to pass the exam. The final exam will last at most 3 hours if there is no break or 5 hours if there is an intermediate break (being 3 hours the maximum for each part)

The evaluation system of June-July is the same as in December-January, maintaining the grades obtained for the resolution of problems and/or exercises and class attendance and participation.

Non-attending students to classes can take an exam in both December and July that covers 100% of the final grade

The dates of the final exams are published on the website of the Escola de Enxeñaría Aeronáutica e do Espazo.

Ethical commitment:

"It is expected is that students present an adequate ethical behavior. If a not appropriate ethical behavior is detected (copying, plagiarism, non authorized use of electronic devices, etc.) the student will not meet the requirements to pass the course. In this case the overall rating in the current academic year will be suspense (0.0). If necessary, a new exam to verify the acquisition of skills and knowledge by the student(s) involved could be performed."

It is recalled the prohibition of the use of mobile devices or laptops in exercises and practices since Real Decreto 1791/2010, of December 30, approving the Statute of University Students, establishes in its article 13.2.d), concerning the duties of university students, the duty to:

"Refrain from using or cooperating in fraudulent proceedings in the evaluation tests, in the works that are carried out or in official documents of the university".

Sources of information

Basic Bibliography

J. Burgos, Cálculo Infinitesimal de una variable, McGraw-Hill, 2007,

J. Burgos, Cálculo Infinitesimal de varias variables, McGraw-Hill, 2008,

R. Larson et al., Cálculo 1, McGraw-Hill, 2010,

R. Larson et al., Cálculo 2, McGraw-Hill, 2010,

J. Rogawski, Cálculo. Una variable, Reverté, 2012,

J. Rogawski, Cálculo. Varias variables, Reverté, 2012,

Complementary Bibliography

A. García et al., Cálculo I, CLAGSA, 2007,

A. García et al., Cálculo II, CLAGSA, 2002,

Recommendations

Subjects that continue the syllabus

Physics: Physics II/O07G410V01202
Mathematics: Calculus II/O07G410V01201
Aerospace technology/O07G410V01205

Subjects that are recommended to be taken simultaneously

Physics: Physics I/O07G410V01103
Computer science/O07G410V01104
Mathematics: Linear algebra/O07G410V01102

IDENTIFYING DATA**Mathematics: Linear algebra**

Subject	Mathematics: Linear algebra			
Code	O07G410V01102			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Garcia Martinez, Xabier			
Lecturers	Garcia Martinez, Xabier			
E-mail	xabier.garcia.martinez@uvigo.gal			
Web	http://faitic.uvigo.es			
General description	This subject is part of Mathematics and it is taught in the first semester of the first course. The other subjects of Mathematics are: Calculus I, in the first semester of the first course and Calculus II in the second semester of the first course. Competences of linear algebra are acquired, being a part of them fundamental for the other subjects of Mathematics.			
	The subject has the character of basic training. It provides the mathematical basis to different disciplines in the field of the aeronautical engineering such as the calculation and manufacture of vehicles and numerical simulation.			
	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.			

Competencies

Code		Typology
CB1	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	• know • Know How
CG2	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.	• know • Know How
CE1	Capability to solve mathematical problems that may arise in engineering. Aptitude to apply the knowledge about: linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.	• know • Know How
CE32	Appropriate knowledge applied to engineering: methods of calculation and development of materials and defence systems; management of experimental techniques, equipment and measuring instruments; numerical simulation of the most significant physical-mathematical processes; inspection, quality control and fault detection techniques; their most appropriate methods and repair techniques.	• know • Know How
CT1	Capability of analysis, organization and planification.	• Know be
CT3	Capability of oral and written communication in native language	• Know be
CT4	Capability of autonomous learning and information management	• Know be
CT5	Capability to solve problems and draw decisions	• Know How • Know be
CT6	Capabiliity for interpersonal communication	• Know be
CT8	Capabiliity for critical and self-critical reasoning	• Know How • Know be

Learning outcomes

Learning outcomes	Competences
Capacity to apply the main concepts, technical and numerical methods of linear algebra to other branches of mathematics and engineering.	CB1 CG2 CE1 CE32 CT1 CT3 CT4 CT5 CT6 CT8

Contents	
Topic	
BLOCK I	1. Real and complex numbers. 2. Systems of linear equations.
BLOCK II	3. Vector spaces. 4. Linear transformations and matrices.
BLOCK III	5. Euclidean vector spaces. 6. Diagonalisation. Orthogonal transformations.
BLOCK IV	7. Numerical methods: resolution of systems of linear equations. Computation of eigenvalues.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Lecturing	13	17	30
Problem solving	29	37	66
Autonomous problem solving	5	20	25
Essay questions exam	2	10	12
Essay questions exam	2.5	12.5	15

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

Methodologies	
	Description
Introductory activities	Activities directed to take contact and gather information on the students, as well as to present the subject.
Lecturing	Exposition of the contents of the subject. It will be illustrated with numerous examples and applications.
Problem solving	Approach, analysis, resolution and debate of a problem or exercise related with the subject, given to illustrate and complete the explanation of each lesson.
Autonomous problem solving	It will be proposed exercises and problems that the students have to resolve in group by using collaborative learning as a integrated methodology.

Personalized assistance	
Methodologies	Description
Introductory activities	Attention and resolution of doubts to the students in relation to the different activities of the matter.
Lecturing	Attention and resolution of doubts to the students in relation to the different activities of the matter.
Problem solving	Attention and resolution of doubts to the students in relation to the different activities of the matter.
Autonomous problem solving	Attention and resolution of doubts to the students in relation to the different activities of the matter.
Tests	
	Description
Essay questions exam	Before the realisation of the exam, attention and resolution of doubts to the students in relation to the different activities of the matter.
Essay questions exam	Before the realisation of the exam, attention and resolution of doubts to the students in relation to the different activities of the matter.

Assessment		
	Description	QualificationEvaluated Competences

Autonomous problem solving	Resolution of a collection of exercises where it will be employed collaborative learning.	20	CB1 CG2 CE1 CE32 CT1 CT3 CT4 CT5 CT6 CT8
Essay questions exam	Partial exam that takes in the corresponding contents to the master sessions and the resolution of problems of the thematic blocks I and II. It consists of two parts: *One of short questions of theoretical-practical character(20%). *Another one of problems/exercises (80%). Length: 2 hours	40	CB1 CG2 CE1 CE32 CT3 CT4 CT5 CT8
Essay questions exam	Long answer tests and development Partial exam that takes in the corresponding contents to the master sessions and the resolution of problems of the thematic block III. It consists of two parts: *One of short questions of theoretical-practical character(20%). *Another one of problems/exercises (80%). Length: 2.5 hours	40	CB1 CG2 CE1 CE32 CT3 CT4 CT5 CT8

Other comments on the Evaluation

CRITERIA OF EVALUATION FOR THE FIRST CERTIFICATED QUALIFICATION

- If a student does not carry out any of the deliveries of exercises or does not present any of the exams, they will be assigned a qualification of 0 points.
- **Minimum requirements to pass the subject:** P1: qualification of the first partial exam (out of 10); P2: qualification of the second partial exam (out of 10); E: qualification of problems resolution (out of 10)
 - $P1, P2 \geq 2,5$
 - $(P1 + P2)/2 \geq 4$

- In case of not fulfilling the minimum requirements to pass the subject, the certificated qualification will be:

$$\min(4, (P1 + P2)/2)$$

- In case to fulfil the minimum requirements to pass the subject, the certificated qualification will be:

$$\max((P1 + P2)/2, 0.8 \times (P1 + P2)/2 + 0.2 \times E)$$

CRITERIA OF EVALUATION FOR THE SECOND CERTIFICATED QUALIFICATION and non-assistant students

Proof of long answer and development:

Description: Exam with two parts: one theoretical-practical and another one in which they will solve exercises. This exam will be about the contents related to the master sessions and to the resolution of problems.

Qualification: E: resolution of problems during the semester (out of 10); P: exam (out of 10)

The qualification of the students will be calculate by the following formula:

$$\max (P, 0.8 \times P + 0.2 \times E)$$

DATES OF EVALUATION

The calendar of exams approved officially by the Xunta de Centro of the EEAE is published in the webpage <http://aero.uvigo.es/gl/docencia/exames>

Sources of information

Basic Bibliography

Burgos, Juan de, Álgebra lineal y geometría cartesiana, 3ª ed, S.A. Mc Graw Hill, 2006,

Grossman, S. I., Álgebra lineal, 7ª, S.A. Mc Graw Hill, 2012,

Hernández, E., Álgebra y Geometría, 3ª, Addison-Wesley, 2012,

Lay, D. C., Álgebra lineal y sus aplicaciones, 4ª ed, Pearson, 2012,

Complementary Bibliography

Castellet, M. ; Llerena, I., Álgebra Lineal y Geometría, 1ª ed, Reverté, 1991,

Lipschutz, S., Álgebra Lineal, 2ª ed, S.A. Mc Graw Hill, 1992,

Merino, L.; Santos, E., Álgebra Lineal con métodos elementales, 1ª ed, Paraninfo, 2006,

Baker, R.; Kuttler, K., Linear algebra with applications, 1st ed, World Scientific, 2014,

Recommendations

IDENTIFYING DATA**Physics: Physics I**

Subject	Physics: Physics I			
Code	O07G410V01103			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Lorenzo Gonzalez, Maria de las Nieves			
Lecturers	Cabrera Crespo, Alejandro Jacobo Lorenzo Gonzalez, Maria de las Nieves			
E-mail	nlorenzo@uvigo.es			
Web	http://aero.uvigo.es/			
General description	<p>This course will provide the fundamental basis of mechanics, in particular, classical mechanics. Mechanics is the branch of the Physics focused on the study of the behaviour of bodies at rest or moving bodies.</p> <p>During the course of Physics I, the basis of classical mechanics will be studied, which will be extended in the next year in the course of Classical Mechanics.</p> <p>Both basics of the kinematics and the dynamics will be addressed in this Physics I. The kinematics is devoted to study the movement of the bodies, without considering the causes of that movement. That is, the kinematics gives answer to the question of How does a body move?. On the other hand, the dynamics is devoted to study the causes of the movement of the bodies and its evolution. That is, the dynamics, unlike the kinematics, gives answer to the question Why is this body moving?</p> <p>This course is fundamental since the principles of the phenomena related with the behaviour of the bodies (at rest or moving bodies) are based on this course.</p> <p>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.</p>			

Competencies

Code	Typology
CB1 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	• know • Know How
CG2 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.	• know • Know How
CE2 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.	• know • Know How
CT1 Capability of analysis, organization and planification.	• Know be
CT3 Capability of oral and written communication in native language	• Know be
CT4 Capability of autonomous learning and information management	• Know be
CT5 Capability to solve problems and draw decisions	• Know How • Know be
CT6 Capabiliity for interpersonal communication	• Know be
CT8 Capabiliity for critical and self-critical reasoning	• Know How • Know be

Learning outcomes

Learning outcomes	Competences
- Knowledge, understanding of the basic principles of the Physics and his application to the analysis and to the resolution of problems of engineering	CB1 CT1 CT3 CT6 CT8
- Knowledge, understanding and application of the general laws of the Classical Mechanics, with special upsetting in the relative movements, the cinematic and dynamics of the point, the theorems of the quantity of movement and of the moment kinetical, and the cinematic, static and dynamics of the rigid solid.	CG2 CE2 CT4 CT5 CT6

Contents

Topic	
1) Basic vectorial Calculus	- Vectors and scalars - Coordinate system
2) Kinematics	- Reference system, trajectories, velocity and acceleration - Rectilinear and curvilinear motion - Tangential and normal accelerations
3) Relative movement	- Translation - Rotation - Components of the acceleration
4) Newton's laws	- Force - Newton's first law \square inertia - Newton's second law \square weight - Newton's third law \square action-reaction - Linear momentum - Angular momentum - Work and energy
5) Particle system	- External and internal forces - Linear impulse. Collisions - Centre of mass. - Linear momentum, angular momentum, work and energy of a particle system
6) Rigid solids	- Concept of rig solid. Centre of mass - Moment of inertia - Translation - Rotation around a fixed axis - Rolling motion
7) Particle statics and rigid solid statics	- General equations of the equilibrium of rigid solid - System of forces - Stability
8) Fluid statics	- Density and hydrostatic pressure - Archimedes' principle - Surface tension. Capillarity

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32	64	96
Autonomous problem solving	4.5	9.5	14
Research based methodologies	0.5	3	3.5
Laboratory practical	12	0	12
Essay questions exam	2.5	0	2.5
Practices report	0	5	5
Problem and/or exercise solving	0	10	10
Presentation	1	6	7

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

Methodologies

	Description
Lecturing	The theory of the course will be presented and it will be applied to solve problems
Autonomous problem solving	The student should solve exercises following some instructions.
Research based methodologies	They will program hours so that the student can resolve his doubts in relation with the matter and the works proposed
Laboratory practical	Tasks related with the contents of the course will be carried out in the laboratory. The realisation of these tasks is mandatory to pass the course

Personalized assistance

Methodologies	Description
Laboratory practical	During the tasks in the laboratory, a personal follow-up will be carried out to guide the students to achieve the objectives
Research based methodologies	Tutoring sessions will be scheduled to solve any doubt of the students

Assessment

	Description	Qualification	Evaluated Competences
Laboratory practical	In order to pass the course, laboratory tasks should be carried out. Continuous assessment will be used during the realisation of the tasks. The maximum marks of this part will be 15% of the final total marks. (Mandatory)	15	CB1 CE2 CT1 CT4 CT6 CT8
Research based methodologies	Students will present the results of their research. The maximum marks of this part will be 10% of the final total marks. (Optional)	10	CT1 CT3 CT4 CT6
Problem and/or exercise solving	The maximum marks of this part will be 5% of the final total marks. (Optional)	5	CE2 CT3 CT6
Essay questions exam	There will be an exam that include questions and exercises. The maximum marks of this part will be 70% of the final total marks. However, a minimum of 5 over 10 has to be reached in the exam to pass the course. (Mandatory)	70	CB1 CG2 CE2 CT1 CT3 CT4 CT5 CT8

Other comments on the Evaluation

Assessment system in July will be the same as explained before. Marks achieved in Laboratory, research based methodologies and Troubleshooting can be saved. Laboratory tasks should have been carried out in order to attend the July call.

Dates of evaluation:

the official dates can be found in

[http : //aero.uvigo.es/gl/docencia/exames](http://aero.uvigo.es/gl/docencia/exames)

Off-site students should notify the situation to the coordinator of the course. In this case the maximum marks of the exam will be 85% of the final total marks and 15% will correspond to laboratory.

In summary:

Assessment of on-site students:

- Exam up to 70% (a minimum of 5 over 10 has to be reached in the exam to pass the course)
- Troubleshooting up to 5%
- Research based methodologies up to 10%
- Laboratory tasks up to 15% (mandatory)

Evaluation for students who do not choose a continuous assessment.

- Exam up to 85% (a minimum of 5 over 10 has to be reached in the exam to pass the course).
- Laboratory tasks up to 15% (mandatory)

VERY IMPORTANT:

A minimum of 5 over 10 has to be reached in the exam to pass the course. In the case that the mark of 5 (over 10) is not reached in the exam, the mark that will appear in the record will be the mark of that exam. The duration of the exam will be approximately 2.5 hours.

Off-site students that do not pass in DECEMBER can attend the assessment in JUNE by solving one unique exam with questions regarding all contents of the course (whenever they have done the laboratory practices)

In special cases, where for justified and previously notified reasons, the students can not attend the practices, or participate in continuous assessment. The 100% of the evaluation will correspond to a final exam in which all the competences of the course will be evaluated.

Sources of information**Basic Bibliography**

Sears-Zemansky, Física Universitaria Volumen I, 12ª, Addison-Wesley, 2009, México

Alcaraz i Sendra O., López López J., López Solana Vicente, Física. Problemas y ejercicios resueltos, 1ª, Pearson Prentice Hall, 2006, Madrid

Complementary Bibliography

Serway R.A., Jewett J.W., Física para ciencias e ingeniería, 7ª, Cengage Learning, 2008, México

Tipler, Paul Allen, Física, 5ª, Reverte, 2003, México

Ferdinand P. Beer ; E. Russell Johnston, Jr. ; Elíot R. Eisenberg, Mecánica vectorial para ingenieros (Estática), 8ª, McGraw-Hill Interamericana, 2007, México

Ferdinand P. Beer ; E. Russell Johnston, Jr. ; Phillip J. Cornwell, Mecánica vectorial para ingenieros (Dinámica), 9ª, McGraw-Hill Interamericana, 2010, México

Burbano de Ercilla, Santiago, Burbano García, Enrique y Carlos Gracia Muñoz, Problemas de Física, 27ª, Tébar, 2006, Madrid

Hugh D. Young, Roger A. Freedman, Sears and Zemansky's university physics : with modern physics, 13ª, Addison-Wesley, 2012, United States of America

Recommendations**Subjects that continue the syllabus**

Physics: Physics II/O07G410V01202

Subjects that are recommended to be taken simultaneously

Mathematics: Linear algebra/O07G410V01102

Mathematics: Calculus I/O07G410V01101

IDENTIFYING DATA**Computer science**

Subject	Computer science			
Code	O07G410V01104			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Formella , Arno			
Lecturers	Formella , Arno Gálvez Gálvez, Juan Francisco			
E-mail	formella@uvigo.es			
Web	http://formella.webs.uvigo.es/doc/aero19/index.html			
General description	In this subject, the basic computer contents and introduction to the programming for graduates in Aerospace Engineering. 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.			

Competencies

Code	Typology
CB1 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	• know • Know How
CE3 Basic knowledge about use and programming of computers, operating systems, databases and software with application in engineering.	• know • Know How
CT1 Capability of analysis, organization and planification.	• Know How • Know be
CT2 Leadership, initiative and entrepreneurship	• Know How • Know be
CT3 Capability of oral and written communication in native language	• know • Know How • Know be
CT4 Capability of autonomous learning and information management	• Know How • Know be
CT5 Capability to solve problems and draw decisions	• know • Know How • Know be
CT6 Capabiliity for interpersonal communication	• Know How • Know be
CT8 Capabiliity for critical and self-critical reasoning	• Know How • Know be
CT9 Capability to work in interdisciplinary teams	• Know How • Know be

Learning outcomes

Learning outcomes	Competences
Knowledge, comprehension and application of the basic programming techniques and their use in the resolution of numerical problems in engineering.	CB1 CE3 CT4 CT5 CT9
Knowledge, understanding and application of programming methodologies (data and basic operations, modular programming, input-output operations, etc.).	CB1 CE3 CT1 CT2 CT4 CT5 CT6 CT8 CT9

Basic knowledge about operating systems and programming languages, mainly oriented to the formulation and implementation of specific numerical methods in engineering.

CB1
CE3
CT1
CT3
CT4
CT5
CT9

Contents

Topic	
Introduction to computing	Hardware: basic components Basic concepts of software Operating systems Collaborative tools Computer security Computer networks / big data
Conceptos de programación básicos	Types of programming languages: low and high level Variables Functions Flow control Input / Output
Advanced programming concepts	Advanced data types Exceptions Object-oriented programming
Programming being oriented to numerical models used in engineering	Mathematical libraries Parallel calculation Graphical representation

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0.5	1
Lecturing	22	44	66
Computer practices	22	44	66
Laboratory practice	4	4	8
Problem and/or exercise solving	2	5	7
Essay questions exam	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

	Description
Introductory activities	Presentation of the subject: objectives, competences to be acquired by the student, contents, evaluation system. Building of work groups.
Lecturing	Presentation by the teacher of the contents of the course, theoretical bases and/or guidelines of the works, exercises or projects to be developed by the student.
Computer practices	Resolution of exercises formulated in the practical sessions, starting with the knowledge as worked in class.

Personalized assistance

Methodologies	Description
Computer practices	The students will have a continuous follow-up and a personalized attention through classes dedicated to the resolution of exercises and the control of the works carried out. They may also attend, if they wish, personalized office hours.

Assessment

	Description	Qualification	Evaluated Competences
Computer practices	Attendance and active participation	5	CB1 CE3 CT3 CT4 CT5 CT8

Laboratory practice	Development of programs and documents in which the students reflect the characteristics of their works carried out. The students should describe the tasks and procedures they developed, show the results and observations they carried out, as well as the analysis and processing of data.	65	CB1 CE3 CT1 CT3 CT4 CT5 CT6 CT8 CT9
Problem and/or exercise solving	Evaluation tests that include theoretical questions or theoretical exercises to solve. The students must respond to the activity formulated and apply the theoretical and practical knowledge of the subject autonomously.	20	CB1 CE3 CT3 CT4 CT5 CT8
Essay questions exam	Evaluation tests that include activities and problems or practical exercises to solve. The students must respond to the activity formulated and apply the theoretical and practical knowledge of the subject autonomously.	10	CB1 CE3 CT3 CT4 CT5 CT8

Other comments on the Evaluation

June-July evaluation:

The evaluation system of June-July is the same as in December-January, maintaining the grades obtained for the resolution of problems and/or exercises and class attendance and participation.

Non-attending students to classes can take an exam in both December and July that covers 100% of the final grade.

Evaluation dates: the exam calendar is published on the web <http://aero.uvigo.es/gl/docencia/exame>.

Sources of information

Basic Bibliography

Bahit, Eugenia, Curso Python para Principiantes, Buenos Aires : Safe Creative, 2012,

González Duque, Raúl, Python para todos, Creative Commons, 2008,

Summerfield, Mark, Python 3, Anaya, 2009,

Gutttag, John V., Introduction to computation and programming using Python, MIT Press, 2013,

Complementary Bibliography

Recommendations

Other comments

RECOMMENDATIONS

Guidelines for the study:

- Attend classes.
- Do the exercises in the practices.
- Review the bibliography and resources presented in class.

Proposals for improvement and recovery:

- Students who have problems in following the pace of learning of the subject should attend the tutorials with the teachers and extend the time dedicated to independent and autonomous learning.

IDENTIFYING DATA**Graphic expression: Graphic expression**

Subject	Graphic expression: Graphic expression			
Code	O07G410V01105			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Pérez Vázquez, Manuel			
Lecturers	Pérez Vázquez, Manuel			
E-mail	maperez@uvigo.es			
Web	http://faitic.uvigo.es			
General description	<p>The main objective of this subject is to train students in the handling and exploitation of representation systems and techniques currently more employed by the aerospace industry, which are based on geometry, be this: metric, projective, analytical, descriptive or computational.</p> <p>Knowledge of forms generation methods, its properties and management of the same in diverse engineering contexts, so much in the plane how in the 3D space, requires a proper development of the capacities for analysis, synthesis and visualization (abstraction and idealization), as well as the utilization of the graphic language.</p> <p>Normalization is necessary for exhaustive definition of forms, components, objects, mechanisms or installations, in respective projects, it requires knowledge of basic rules on formats, lines, ways of representation, dimensioning, symbology or geometrical product specifications (GPS).</p> <p>Training in any current graphic application that facilitate creation of 3D models, the consequent obtaining of planes, assembly of components, simulation and movement, interactiveness between different files or the parametric dimensioning, complete this approach.</p>			

Competencies

Code	Typology
CB1 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	• know • Know How
CE5 Capability for spatial vision and knowledge of graphical representation techniques, both by traditional methods of metric geometry and descriptive geometry, as well as through computer aided design applications.	• know • Know How
CT1 Capability of analysis, organization and planification.	• know • Know How • Know be
CT3 Capability of oral and written communication in native language	• know • Know How
CT4 Capability of autonomous learning and information management	• know • Know How
CT6 Capability for interpersonal communication	• Know How • Know be
CT8 Capability for critical and self-critical reasoning	• know • Know How

Learning outcomes

Learning outcomes	Competences
- Development of the capacity for analysis and graphic interpretation of statements, properties and situations of diverse nature posed in contexts of engineering.	CB1 CE5
- Development of capacities for abstraction and idealization.	CT1
- Knowledge of general principles for geometrical design.	CT3
- Knowledge of the main tools and techniques of representation.	CT4 CT6 CT8

Contents

Topic
THEORY

1- Introduction to Standarization	<p>1.1-Graphic in the Engineering for data visualization, communication and objects definition.</p> <p>1.2-Normalization and Graphic Language.</p> <p>1.3-Organisms of Normalization.</p> <p>1.4-Basic Norms to obtain planes: formats, scales, lines and sights.</p> <p>1.5-General Principles of Representation. Selection of sights and cuts. Rules.</p> <p>1.6-European and American Systems. Adaptation to CAD systems.</p>
2- Flat Curves and its applications	<p>2.1-Conicals: traced, characteristic and applications.</p> <p>2.2-Projective study of the conicals.</p> <p>2.3-Rolling Curves. Applications.</p> <p>2.4-Other curves: spirals, envelopes, evolutes. Applications.</p> <p>2.5-Polygonal approach to flat curve.</p> <p>2.6-Warped Curves. The helix. Evolution of the intrinsic trihedron</p>
3- Fundamentals and Techniques of Representation Systems	<p>3.1-Projective fundamentals of representation systems. Projection types.</p> <p>3.2-Move from one system to another.</p> <p>3.3-Pairs, ternas and quaterns. Invariants.</p> <p>3.4-Projective forms.</p> <p>3.5-Homology and affinity.</p> <p>3.6-Diedric System: measure of angles and distances. Basic operations for bodies representation.</p> <p>3.7-Axonometric System, direct and indirect. Types of axonometrie.</p> <p>3.8-Bounded plane system. Applications: topography and roofs.</p>
4- Bodies visualization and representation	<p>4.1-Bodies representation in diverse systems .</p> <p>4.2-Specific Operations to obtain sights in a determined direction, intersections and unseen parts.</p> <p>4.3-Determination of true magnitudes by means of twists and plane changes.</p>
5- Rulated surfaces and its applications	<p>5.1-General surfaces ranking.</p> <p>5.2-Rulated surfaces: developable and warped. Applications.</p> <p>5.3-Curved surfaces . The sphere.</p> <p>5.4-Cuadratic surfaces. Applications.</p> <p>5.5-Intersections between surfaces.</p> <p>5.6-Polyhedric surfaces. Types, characteristic, elements of symmetry.</p> <p>5.7-Grouping of polyhedra and space compartmentation.</p>
6- Elements and forms of dimensioning	<p>6.1-Dimensioning. Basic elements.</p> <p>6.2-General principles of dimensioning.</p> <p>6.3-Reference systems.</p> <p>6.4-Types of dimensioning. Criteria.</p> <p>6.5-Basic normative.</p> <p>6.6-Functional dimensioning</p> <p>6.7-Dimensional Tolerances . Adjustments.</p>
7- Standardized elements and sets representation	<p>7.1-Representation of normalized components. Elements of union. Elements of transmission. Others.</p> <p>7.2-Drawings of assambly. Characteristics.</p> <p>7.3-Dimensioning of set drawings</p> <p>7.4-List of pieces.</p> <p>7.5-3D assembly in the computer, establishment of relations between components, animations, movement studies and simulations.</p>
8- Bases of symbology and schematic representations in Engineering	<p>12.1-Symbology in Engineering. Iconicity.</p> <p>12.2-Schematic representations.</p> <p>12.3-Applications.</p> <p>12.4-Norms.</p>
PRACTICES.	
1- Computer aided design (CAD)	<p>Program presentation by the teacher, the first day. Description of the main characteristics and possibilities of the tool. Exercises guided to the training and familiarization, with commands and fundamental functions. Direct generation of 3D models from which we will derive the views and necessary cuts for normalized definition 2D. Finally it make the assembly of components with the appropriate restrictions that allow the animation and simulation. Along the course it will be used the distinct types of dimensions (conductives, conducted and dependents of a mathematical equation or of a parameter) .</p>

2- Common practices

It will begin with a review of the geometrical basic constructions, handmade, that necessarily requires work at home. Each theoretical part will be supplemented with exercises to realize during the hours of practice, in the successive weeks, that students must to complete at home. In parallel they will realize the training in the application and will go resolving exercises in the computer in order to adquire capacity to elaborate the final work with the computer.

3- Practical work (TrP)

It proposes the realization of a practical work (TrP) to develop during the course, in groups of 1-3 students, by way of a small project related with the career (display, assably or group of components that exert any function related with the aeroespacial thematic), in respect at the graphic part. The complexity varies accordance with the election of each group.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	52	78
Mentored work	0	2	2
Seminars	0	2	2
Autonomous practices through ICT	0	4	4
Introductory activities	0	1	1
Computer practices	24	36	60
Problem and/or exercise solving	2	0	2
Essay questions exam	1	0	1

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

Methodologies

	Description
Lecturing	Magistral session active in which each thematic unit will be presented by the professor and complemented with the comments of the students, based in the general bibliography that facilitates and in another specific that will be able to add for each particular subject.
Mentored work	With follow-up of the professor in the selection and in the development.
Seminars	For the orientation of the work, the integration in the groups and the resolution of doubts.
Autonomous practices through ICT	For the resolution of complementary exercises out of the class
Introductory activities	Presentation of the matter in the date established by the Centre. Appearances to review and freshen on fundamental concepts and basic geometrical constructions
Computer practices	In the practical sessions will propose exercises to resolve of individual or collective way, to the hand and/or with computer, oriented to the application of the theory and to reach skill so much in the utilisation of the traditional tools as automated.

Personalized assistance

Methodologies	Description
Mentored work	Practical work election by the group of students, guided by the professor, with continuous follow-up in the practical classes and tutorials.

Assessment

	Description	Qualification	Evaluated	Competences
Lecturing	Proof of evaluation or common Exam, to realize in the date established by the centre, of theory and practical, about the contents treaties in classes sessions.	60		CB1 CE5 CT1 CT3 CT4 CT6 CT8
Computer practices	Evaluation of the practices realized weekly.	20		CB1 CE5 CT1 CT4 CT6

Mentored work	With tracking of the professor. He values the assistance and participation.	10	CT4 CT6 CT8
Autonomous practices through ICT	Resolution of exercises of autonomous form, that supplement the class.	10	CE5 CT1 CT4 CT8

Other comments on the Evaluation

Continuous evaluation will include all the work developed in class or home, individually or in a group. The subject can be approved by continuous evaluation when he reaches 5.00 points in each part. In case of not reaching 5.00 in each part, the question can also be overcome if in each of the parts exceeds 4.5 and the average is equal to or greater than 5.00. In case of not following the continuous assessment process, the student will only be able to take the final exam of the subject. In this case, the grade will be the one obtained in the exam.

For the July evaluation, the ratings of the previously approved parties are maintained, and those that were unsuccessful must be recovered and presented to those approved to improve the final grade. Evaluation dates: according to the exam calendar officially approved by the School Board, which is published on its website: <http://aero.uvigo.es/gl/docencia/exames>. The practical part, if it were the case, could require some type of exam outside of these dates.

Ethical commitment: the student is expected to show appropriate ethical behavior. In case of detecting inappropriate ethical behavior (copying, plagiarism, use of unauthorized electronic devices and others), it will be considered that the student does not meet the necessary requirements to solve the problem. In this case, the general grade of this academic year will be suspended (0.0). If necessary, a new test could be carried out to verify the acquisition of skills and knowledge on the part of the student involved.

Sources of information

Basic Bibliography

AENOR, Normas varias, actualizadas, Segundo cada norma, uvigo/biblioteca/bases de datos/norweb

Félez Mindán, J., Ingeniería Gráfica y Diseño, Síntesis D.L., 2008, Madrid

Izquierdo Asensi, F., Geometría Descriptiva Superior y Aplicada, 6ª, Ed. Dossat, 2013, Madrid

Prieto Alberca, M., Fundamentos Geométricos del Diseño en Ingeniería, ADI, 1992, Madrid

Complementary Bibliography

Félez Mindán, J., Dibujo Industrial, 3ª, Ed. Síntesis, 2000, Madrid

Izquierdo Asensi, F., Geometría Descriptiva, 24ª, Ed. Paraninfo, 2000, Madrid

Prieto Alberca, M., Geometría Aplicada al Diseño, ADI, 2010, Madrid

Company, P.; Vergara, M; Mondragón, S., Dibujo Industrial, Universitat Jaume I, 2007, Castelló

Recommendations

Other comments

It recommends to had studied the subjects of "Technical Drawing" in the bachelor's degree of Sciences and Technological.

IDENTIFYING DATA				
Mathematics: Calculus II				
Subject	Mathematics: Calculus II			
Code	O07G410V01201			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Cid Iglesias, María Begoña			
Lecturers	Cid Iglesias, María Begoña			
E-mail	bego@uvigo.es			
Web				
General description	The objective of the subject is that the students know and dominate the basic techniques of the integral calculus, vector calculus, ordinary differential equations and their applications, necessary both for other subjects of the qualifications and the professional exercise.			
	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.			

Competencies		
Code		Typology
CB1	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	• know • Know How
CG2	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.	• know • Know How
CE1	Capability to solve mathematical problems that may arise in engineering. Aptitude to apply the knowledge about: linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.	• know • Know How
CE32	Appropriate knowledge applied to engineering: methods of calculation and development of materials and defence systems; management of experimental techniques, equipment and measuring instruments; numerical simulation of the most significant physical-mathematical processes; inspection, quality control and fault detection techniques; their most appropriate methods and repair techniques.	• know • Know How
CT1	Capability of analysis, organization and planification.	• Know be
CT3	Capability of oral and written communication in native language	• Know be
CT4	Capability of autonomous learning and information management	• Know be
CT5	Capability to solve problems and draw decisions	• Know How • Know be
CT6	Capabiliity for interpersonal communication	• Know be
CT8	Capabiliity for critical and self-critical reasoning	• Know How • Know be

Learning outcomes	
Learning outcomes	Competences
Knowledge and understanding of the main concepts and techniques of the integral calculus in several variables.	CB1 CG2 CE1 CE32 CT1 CT3 CT4 CT5 CT6 CT8

Knowledge and understanding of the models that adopt the form of ordinary differential equations and the main elementary techniques of integration. CB1
CG2
CE1
CE32
CT1
CT3
CT4
CT5
CT6
CT8

Knowledge, understanding and application of the numerical methods of resolution of the models and typical problems of the aerospace technology; in concrete, polynomial interpolation, numerical differentiation and the resolution of ordinary differential equations. CB1
CG2
CE1
CE32
CT1
CT3
CT4
CT5
CT6
CT8

Contents

Topic	
Multiple integrals. Fubini's theorem. Change of variable.	Multiple integrals. Fubini's theorem. Change of variable.
Line and surface integrals.	Line and surface integrals.
Gauss' and Stokes' theorems	Gauss' and Stokes' theorems
Introduction to the ordinary differential equations. Existence and uniqueness.	Introduction to the ordinary differential equations. Existence and uniqueness.
Linear systems and systems with constant coefficients.	Linear systems and systems with constant coefficients.
Numerical resolution of ordinary differential equations.	Numerical resolution of ordinary differential equations.
Polynomial interpolation.	Polynomial interpolation.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Lecturing	28	56	84
Problem solving	15	15	30
Autonomous problem solving	0	13.5	13.5
Computer practices	6	12	18
Essay questions exam	2.5	0	2.5

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

Methodologies

	Description
Introductory activities	Activities to make contact and gather information on the students, and to present the subject.
Lecturing	The professor will present in the theoretical classes the contents of the subject. Students will have basic reference texts for tracking the subject.
Problem solving	The professor will solve problems and exercises manually and the student will have to solve similar exercises to acquire the necessary skills.
Autonomous problem solving	The students will have to solve exercises independently to check the acquisition of the skills.
Computer practices	The professor will solve problems and exercises with computer tools and the student will have to solve similar exercises to acquire the necessary skills.

Personalized assistance

Methodologies	Description
Lecturing	The professor will personally solve the doubts of students. The doubts will be solved in-person, specially during problems and laboratory lectures and during tutorials, and also by using the remote options available for the course.

Problem solving	The professor will personally solve the doubts of students. The doubts will be solved in-person, specially during problems and laboratory lectures and during tutorials, and also by using the remote options available for the course.
Autonomous problem solving	The professor will personally solve the doubts of students. The doubts will be solved in-person, specially during problems and laboratory lectures and during tutorials, and also by using the remote options available for the course.

Assessment			
	Description	Qualification	Evaluated Competences
Autonomous problem solving	Written tests and / or work to assess will be made to evaluate solving exercises and / or problems autonomously. RA1, RA2, RA3	40	CB1 CG2 CE1 CE32 CT1 CT3 CT4 CT5 CT6 CT8
Essay questions exam	A final exam on the contents of all the course will be made. RA1, RA2	60	CB1 CG2 CE1 CE32 CT1 CT3 CT4 CT5 CT8

Other comments on the Evaluation

In any call it is necessary to obtain 5 points to pass the subject. The exam will be scored over 10 points. Since the subject has two different parts, it will be necessary to have a minimum of 2 points out of 5 in each part. In the case of obtaining a grade lower than 2 points in any of the parts, the final grade that will appear in the record will be the sum of both notes limiting it to a maximum of 4.8 points. (*)

The maximum duration of any exam will be 3 hours. **June-July evaluation (assistants):**

Carrying out an exam in which the learning results will be evaluated and the competences indicated in the teaching guide will be obtained. This exam will provide 100% of the rating of this call. The criterion indicated in (*) will also apply. Evaluation procedure for non-assistants (December-January and June-July):

Carrying out an exam in which the learning results will be evaluated and the competences indicated in the teaching guide will be obtained. This exam will provide 100% of the rating of this call. The criterion indicated in (*) will also apply. Dates evaluation:

The dates of realization of the final examinations are published in the page web of the School of Aeronautical Engineering and of the Space.

Ethical commitment:

It is expected that the students present a suitable ethical behaviour. In case to detect an ethical behaviour no suitable (copy, plagiarism, utilisation of electronic devices non authorised, and others) will consider that the student does not gather the necessary requirements to surpass the subject. In this case the global qualification in the present academic course will be of suspense (0.0). In the case to be necessary, it will be able to realise a new exam to verify the acquisition of competitions and knowledges by part of the students involved.

It remembers the prohibition of the use of mobile devices or portable computers in exercises and practical since the Royal decree 1791/2010, of 30 December, by which approves the Statute of the University Student, establishes in his article 13.2.d), relative to the duties of the university students, the duty of :

"Abstain of the utilisation or cooperation in fraudulent procedures in the proofs of evaluation, in the works that realise or in official documents of the university".

Sources of information

Basic Bibliography

E. Marsden, A.J. Tromba, Cálculo Vectorial, Pearson, 2004,

R. Larson, B.H. Edwards, Cálculo 2 de varias variables, 10ª, McGraw-Hill, 2016,

G.F. Simmons, Ecuaciones Diferenciales con aplicaciones y notas históricas, McGraw-Hill, 1993,

Complementary Bibliography

A. García et al., Cálculo II, CLAGSA, 2002,

D.G. Zill, Ecuaciones diferenciales con aplicaciones de modelado, 9ª, International Thomson Edit., 2009,

A. García et al., Ecuaciones diferenciales ordinarias, CLAGSA, 2006,

D. Kincaid, W. Cheney, Análisis numérico: las matemáticas del cálculo científico, Addison-Wesley Iberoamericana, 1994,

Recommendations

Subjects that continue the syllabus

Mathematics: Mathematical methods/O07G410V01301

Subjects that are recommended to be taken simultaneously

Physics: Physics II/O07G410V01202

Aerospace technology/O07G410V01205

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103

Computer science/O07G410V01104

Mathematics: Linear algebra/O07G410V01102

Mathematics: Calculus I/O07G410V01101

Other comments

It is recommended attend to class and work the contents weekly.

IDENTIFYING DATA**Physics: Physics II**

Subject	Physics: Physics II			
Code	O07G410V01202			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Salgueiro Piñeiro, Jose Ramon			
Lecturers	Gómez Gesteira, Ramón Salgueiro Piñeiro, Jose Ramon			
E-mail	jsalgueiro@gmail.com			
Web	http://optics.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.

Competencies

Code	Typology
CB1 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	• know
CG2 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.	• Know How
CE2 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.	• know • Know How
CT1 Capability of analysis, organization and planification.	• Know be
CT3 Capability of oral and written communication in native language	• Know be
CT4 Capability of autonomous learning and information management	• Know be
CT5 Capability to solve problems and draw decisions	• Know How
CT6 Capabiliity for interpersonal communication	• Know How • Know be
CT8 Capability for critical and self-critical reasoning	• Know be

Learning outcomes

Learning outcomes	Competences
Knowledge and understanding of the basic principles of Physics and their application to the analysis and to the resolution of problems in engineering	CB1 CG2 CE2 CT1 CT3 CT4 CT5 CT6 CT8
Knowledge, understanding and application of the principles of electromagnetism, including telectrostatics, magnetostatics and Maxwell's equations.	CB1 CE2 CT5 CT8

Contents

Topic	
Presentation of the course and historical introduction	Historical introduction.
Scalar and vectorial fields	Coordinate systems in two and three dimensions. Vectorial operators. Gradient of a scalar. Circulation of a vector. Flux. Divergence. Divergence theorem. Rotational. Stokes theorem.

Electrostatics	Charge and charge density. Coulomb's law. Electrostatic field. Flux of the electrostatic field. Gauss' law. Electrostatic potential. Poisson and Laplace equations. Energy of the electrostatic field. Potential multipolar expansion. Dipoles. Conductors and dielectrics. Electrostatics in presence of matter. Capacitors.
Electrical current 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' force. Biot and Savart's law. Magnetic flux. Ampère's law. Vector potential. Multipolar vector-potential expansion. Magnetic dipoles. Magnetism in presence of matter. Magnetic response of materials. Magnetic field. Hysteresis.
Electrical circuits	Association of resistors. Electromotive force. Dynamos. Electrical circuit. Power and energy. Voltage and current sources. Voltage, current and resistance measurement. Kirchhoff's laws and circuit analysis. Superposición, Thévenin and Norton theorems.
Introduction to electrodynamics	Faraday's induction law. Inductance. Dynamos, engines and transformers. Magnetic energy. Maxwell's displacement current. Maxwell's equations. Systems of units.
Introduction to the waves	One-dimensional waves. Harmonic waves. Phase velocity. Complex notation. Three-dimensional waves. Plane, spherical and cylindrical waves. Energy carried by a wave. Huygens' principle. Superposition of waves of different frequency. Group velocity.
Electromagnetic waves	Wave equation for electromagnetic waves. Hertz' experiment. Electromagnetic spectrum. Propagation of electromagnetic waves. Electromagnetic energy. Poynting's vector. Radiometric units. Polarisation. Reflection and refraction. Interference and diffraction.
Radiation-matter interaction	Types of interaction. Dipolar radiation. Model of electronic oscillator. Rayleigh scattering. Dispersion in dielectrics: Lorentz model. Dispersion in metals: Drude model.
Laboratory	Measurement of basic electromagnetic properties with multimeter and oscilloscope. Measurement of the capacity of a capacitor. Laplace's law. Helmholtz coils. Terrestrial magnetic field measurement. Magnetic momentum. Electromagnetic induction. Electrical circuits.

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
Practices report	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.

Assessment			
	Description	Qualification	Evaluated Competences
Essay questions exam	Two partial examinations: problem solving and questions (10% each one). A final exam (60%). In case the student does not attend the partial exams, the final exam will suppose 80% of the total mark.	80	CB1 CE2 CT1 CT3 CT8
Practices report	Inform and (if necessary) oral presentation about the activities realized at the laboratory. The students that do not attend the laboratory will be specifically evaluated about this topic together with the final examination.	20	CG2 CE2 CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

The marks of the partial examinations and laboratory report will be maintained in June/July.

In case the student does not attend the partial examinations, the final examination will rank 80% of the mark and the students not attending the laboratory sessions will be evaluated about such topics on the day of the final exam.

Evaluation dates: the examinations calendar is published at 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

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

Burbano de Ercilla, Física General, Mira, Zaragoza, 1993

Complementary Bibliography

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

Feynman, R.P. Leighton R.B., Lectures on Physics, Vol II, Addison Wesley Publishing, 1996

Cheng, D.K., Fundamentos de electromagnetismo para ingeniería, Addison Wesley Iberoamericana, 1998

Edminister, J.A., Circuitos Eléctricos, McGraw-Hill, 1994

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

Jackson J.D., Classical electrodynamics., Elsevier, Amsterdam, 1985

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

Feynman, R.P. Leighton R.B., Sands M., Exercises for the Feynman Lectures on Physics, Addison Wesley Publishing, 1998

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

Cheng, D.K., Field and wave electromagnetics, Addison Wesley Publishing, 1991

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

IDENTIFYING DATA				
Química: Química				
Subject	Química: Química			
Code	O07G410V01203			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1	2c
Teaching language	Castelán Galego			
Department	Enxeñaría química			
Coordinator	Parajó Liñares, Juan Carlos			
Lecturers	Alonso González, José Luís Parajó Liñares, Juan Carlos			
E-mail	jcparajo.correo@gmail.com			
Web	http://aero.uvigo.es			
General description	Os contidos da asignatura pretenden formar aos alumnos nunha diversidade de aspectos teóricos e aplicados (incluíndo capacidades de cálculo, estrutura da materia, termoquímica, equilibrios, cinética química e química industrial), que resultan necesarios para abordar con posterioridade outras asignaturas específicas da titulación.			

Competencias		
Code		Typology
CB1	Que os estudantes demostrasen posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral, e adóitase atopar a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo	• saber • saber facer
CE4	Capacidade para comprender e aplicar os principios de coñecementos básicos da química xeral, química orgánica e inorgánica e as súas aplicacións na enxeñaría.	• saber • saber facer
CT1	Capacidade de análise, organización e planificación	• saber • saber facer
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• saber • saber facer
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• saber facer
CT5	Capacidade de resolución de problemas e toma de decisións	• saber facer
CT6	Capacidade de comunicación interpersoal	
CT8	Capacidade de razoamento crítico e autocrítico	• saber facer • Saber estar / ser
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos	• saber • saber facer

Resultados de aprendizaxe	
Learning outcomes	Competences
Coñecer os conceptos básicos das distintas magnitudes empregadas en Química, das súas unidades, y da súa agrupación en sistemas de unidades; así como as leis básicas da Química que resultan de interés nos cálculos estequiométricos.	CB1 CE4 CT1 CT3 CT4 CT5 CT6 CT8 CT13
Comprender a natureza do átomo e dos enlaces entre átomos, e aplicar os conceptos relacionados a problemas profesionais	CB1 CE4 CT1 CT3 CT4 CT5 CT8 CT13

Contidos
Topic

TEMA 1. ASPECTOS XERAIS E CONCEPTOS PREVIOS	<ul style="list-style-type: none"> 1.1 Magnitudes, dimensións, unidades e sistemas de unidades 1.2 Cambios de unidades 1.3 Ecuaciones dimensionais e adimensionais 1.4 Modos de expresión da concentración 1.5 Estequiometría e conceptos relacionados
TEMA 2. O ÁTOMO	<ul style="list-style-type: none"> 2.1 Estrutura e partículas constituintes 2.2 Teoría atómica: orbitais atómicos 2.3 Orbitais atómicos e enerxía: estruturas atómicas 2.4 Características dos átomos 2.5 Isótopos
TEMA 3. ENLACE COVALENTE	<ul style="list-style-type: none"> 3.1 Natureza do enlace químico 3.2 Teoría de Lewis: estruturas moleculares 3.3 Xeometría molecular 3.4 Teoría de enlace-valencia 3.4 Teoría de orbitais moleculares
TEMA 4. ENLACE IÓNICO	<ul style="list-style-type: none"> 4.1 Ions 4.2 Sólidos iónicos: natureza 4.3 Enerxía de rede 4.4 Propiedades dos sólidos iónicos
TEMA 5. ENLACE METÁLICO	<ul style="list-style-type: none"> 5.1 Sólidos metálicos 5.2 Enlace metálico
TEMA 6. INTERACCIÓN INTERMOLECULARES	<ul style="list-style-type: none"> 6.1 Natureza das interaccións intermoleculares 6.2 Tipos de interaccións intermoleculares 6.3 Interaccións moleculares e estados de agregación da materia
TEMA 7. GASES E DISOLUCIONS	<ul style="list-style-type: none"> 7.1 Estado gas: características 7.2 Gases ideais 7.3 Gases reais 7.4 Disolucións 7.5 Líquidos e disolucións líquidas 7.6 Propiedades coligativas das disolucións
TEMA 8. TERMOQUÍMICA	<ul style="list-style-type: none"> 8.1 Calor, enerxía interna e entalpía 8.2 Cambios entálpicos asociados a reaccións químicas 8.3 Entropía e enerxía libre: criterio de evolución espontánea das reaccións químicas
TEMA 9. EQUILIBRIO QUÍMICO	<ul style="list-style-type: none"> 9.1 Concepto de equilibrio 9.2 Constante de equilibrio 9.3 Tipos de equilibrios 9.4 Cociente de reacción 9.5 Principio de Le Chatelier 9.6 Relacións termodinámicas
TEMA 10. EQUILIBRIO ÁCIDO-BASE	<ul style="list-style-type: none"> 10.1 Definicións de ácido e base. 10.2 Autoionización do auga e produto iónico. pH e pOH 10.3 Forteza de ácidos e bases. Cálculo do pH 10.4 Ácidos polipróticos 10.5 Hidrólisis 10.6 Disolucións reguladoras
TEMA 11. EQUILIBRIO DE SOLUBILIDADE	<ul style="list-style-type: none"> 11.1 Solubilidade das sales 11.2 Sales pouco solubles: solubilidade e produto de solubilidade 11.3 Factores que afectan á solubilidade 11.4 Precipitación fraccionada
TEMA 12. EQUILIBRIO REDOX	<ul style="list-style-type: none"> 12.1 Conceptos básicos de oxidación e redución 12.2 Reaccións redox: axuste en medio ácido ou básico 12.3 Valoracións redox
TEMA 13. ELECTROQUÍMICA	<ul style="list-style-type: none"> 13.1 Celas electroquímicas: conceptos básicos 13.2 Potenciais estándar de electrodo e de cela 13.3 Termodinámica das reaccións electroquímicas 13.4 Ecuación de Nerst. Aplicacións 13.5 Baterías e pilas 13.6 Procesos industriais de electrólisis 13.7 Corrosión
TEMA 14. CINÉTICA QUÍMICA	<ul style="list-style-type: none"> 14.1 Conceptos básicos 14.2 Factores que modifican a velocidade dunha reacción 14.3 Determinación da ecuación cinética dunha reacción

TEMA 15. INTRODUCCIÓN Á QUÍMICA ORGÁNICA	15.1 Estrutura dos compostos orgánicos 15.2 Alcanos, alquenos, alquinos e derivaddos haloxenados dos hidrocarburos 15.3 Hidrocarburos aromáticos 15.4 Alcohois, fenoles e éteres 15.5 Aldehídos e cetonas 15.6 Ácidos carboxílicos, ésteres e derivados 15.7 Aminas e amidas 15.8 Nitrilos e nitroderivados 15.9 Reaccións dos compostos orgánicos 15.10 A química orgánica na industria aeroespacial
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Planificación docente

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	22	44	66
Seminario	16	31.9	47.9
Prácticas de laboratorio	12	21.6	33.6

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

Metodoloxía docente

	Description
Lección maxistral	Expoñeranse os fundamentos teóricos e prácticos de cada un dos temas da materia, co apoio da bibliografía e materiais audiovisuaps. Estimularase a participación do alumnado.
Seminario	De xeito paralelo ás sesións maxistras, nos seminarios abordaranse exercicios relacionados coa materia. O alumno dispoñerá previamente de boletins que inclúan todos os exercicios da materia. Contémplase a posibilidade de que os alumnos resolvan de modo autónomo unha parte dos mesmos
Prácticas de laboratorio	Os alumnos realizarán prácticas relacionadas cos contidos da asignatura, onde se aplicarán as destrezas e competencias adquiridos na mesma

Atención personalizada

Methodologies	Description
Seminario	Estimularase a participación en clase, de xeito que os alumnos poidan propoñer cuestións para discusión adicional ou resolver exercicios de aplicación ante os seus propios compañeiros
Lección maxistral	Procurarase involucrar aos alumnos nas explicacións, dirixíndolles preguntas e permitíndolles suscitar dúbidas, que eventualmente poderían resultar en temas de discusión que os propios alumnos poderían expoñer en clase trala adecuada preparación
Prácticas de laboratorio	Os alumnos contarán con asesoramiento individual para axudarlles no manexo de instrumentos, identificación de problemas de operación, obtención de datos representativos e análise de erros

Avaliación

	Description	Qualification	Evaluated Competences
Seminario	Os exercicios e os problemas da asignatura que se resolveron nos seminarios ou de xeito autónomo servirán de base para avaliar o cumprimento dos obxectivos nas partes prácticas dos exames parcial e final. A participación na cualificación final está medida pola importancia do tempo adicado aos aspectos prácticos na docencia de aula. Contémplase a posibilidade de outorgar cualificación adicional ata un máximo dun 5% para premiar traballo autónomo excelente. En todo caso, o conxunto de cualificacións adicionais por achegas individuais en sesións magistras, seminarios e prácticas de laboratorio só será outorgable aos alumnos que superen os exames.	40	CB1 CE4 CT1 CT3 CT4 CT5
Lección maxistral	Avaliaranse as capacidades dos alumnos relacionadas cos contidos teóricos da asignatura e cos aspectos que derivan deles a traveso das partes teóricas e aplicadas dos exames parcial e final. A participación na cualificación final está medida pola importancia do tempo dedicada aos aspectos teóricos e aplicados na docencia de aula. Contémplase a posibilidade de adicar ata un máximo dun 5% da cualificación a premiar un traballo autónomo excelente. En todo caso, o conxunto de cualificacións adicionais por traballo autónomo en sesións magistras, seminarios e prácticas de laboratorio só será otorgable aos alumnos que superen os exames.	55	CB1 CE4 CT1 CT4 CT5

Prácticas de laboratorio	Realizar as práctica con resultado apto. Contémplase a posibilidade de outorgar calificación adicional para premiar traballo autónomo excelente que resulte en achegas relevantes para o traballo de laboratorio. En todo caso, o conxunto de cualificacións adicionais por traballo autónomo en sesións magistrais, seminarios e prácticas de laboratorio só será outorgable ós alumnos que superen os exames, e non poderá superar o 10% da cualificación final.	5	CE4 CT1 CT4 CT5 CT6 CT13
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Other comments on the Evaluation

Os exercicios e os problemas da asignatura que se resolveron nos seminarios ou de forma autónoma servirán de base para avaliar o cumprimento dos obxectivos nas partes prácticas dos exames parcial e final. A participación na cualificación final está medida pola importancia do tempo dedicada aos aspectos prácticos na docencia de aula. Avaliaranse vía exame as capacidades dos alumnos relacionadas cos contidos teóricos (55%) da asignatura e cos aspectos que derivan deles a través das partes teóricas e aplicadas (40%). Prevese a posibilidade de realizar un exame parcial, de carácter voluntario, que tería como único obxectivo evitar que a parte aprobada no parcial formase parte dos contidos do exame final. A participación na cualificación final está medida pola importancia do tempo dedicada aos aspectos teóricos e aplicados na docencia de aula. O exame final terá unha duración máxima estimada de 4 horas en total, con un descanso intermedio.

A avaliación realizarase sobre os seguintes principios:

a) Clases prácticas.

a.1) Alumnos con ensino presencial: teñen a obriga de realizar as prácticas da asignatura dun modo que o profesor xulgue como satisfactorio. Aqueles alumnos que realicen o traballo de laboratorio dunha forma que o profesor non xulgue satisfactoria deberán presentarse a un exame específico de prácticas, nas mesmas condicións que os alumnos non presenciais (véxase máis abaixo). Superar as prácticas é un requisito imprescindible para aprobar a asignatura. Os alumnos con ensino presencial que mostren un desempeño excepcional en prácticas poderán ver aumentada a súa cualificación final na asignatura (coas limitacións especificadas con anterioridade).

a.2) Alumnos con ensino non presencial: deberán comunicar ó profesor que non cursarán ensino presencial coa maior prontitude, tras o cal convocaráselles para realizar un exame de prácticas sobre os fundamentos e obxectivos destas. O exame será o mesmo que terán que realizar os alumnos con ensino presencial para os que o traballo no laboratorio non sexa considerado satisfactorio. Aprobar o exame de prácticas é condición necesaria para superar a asignatura.

b) Exames escritos. Realizarase un exame final de 4 horas de duración estimada, con un descanso intermedio, que poderá incluír cuestións teóricas e/ou aplicadas relativas á materia impartida, en forma de test ou de preguntas curtas, así como exercicios e/ou problemas e/ou cuestións prácticas. O exame final constará de dous partes (parte A e parte B da asignatura). A parte A comprenderá os oito primeiros temas, e a parte B é resto do temario. En términos xerais, aprobar a asignatura requirirá aprobar tanto a parte A e como a parte B. No seu caso, podería considerarse compensar unha parte suspensa con nota próxima a 5 (A ou B) con outra aprobada (B ou A), sendo requisitos imprescindibles que deben cumprirse simultaneamente: a) que a media das dúas cualificacións sexa maior de 5, e b) que a cualificación máis baixa sexa igual ou maior a 4. Prevese a posibilidade de realizar un exame parcial da parte A, de xeito dos alumnos que o aproben poidan (si o desexan) realizar o exame final só da parte B.

c) Primeira e segunda edicións. Se o alumno o desexa, na segunda edición pode manter as cualificacións de prácticas e/ou da parte A da asignatura e/ou da parte B da asignatura. Se na segunda edición o alumno desexa manter a cualificación dalgunha(s) parte(s) da materia, deberá advertilo ao profesor antes de realizar o exame. Neste caso, a posibilidade de manter algunha cualificación debe ser autorizada expresamente polos docentes da asignatura.

d) Outros aspectos da avaliación. Como aspectos complementarios ó citado anteriormente, os alumnos que alcancen a suficiencia vía exame poderán obter cualificacións adicionais, ata un 10% na súa suma, coas condicións e limitacións mencionadas máis arriba.

e) Datos chave. O calendario de probas de avaliación aprobado oficialmente atópase publicado na páxina web <http://aero.uvigo.es/gl/docencia/exames>; e as datas asignadas para a realización de prácticas de laboratorio para o conxunto de grupos son como segue: 11, 12, 13, 25, 26 e 27 de marzo; 1, 2 e 3 de abril.

f) Outras consideracións. Calquera comportamento non ético (copia ou intento de copia, utilización de recursos non permitidos, etc.) terá un efecto na cualificación da asignatura proporcional á súa gravidade.

Bibliografía. Fontes de información

Basic Bibliography**Complementary Bibliography**

Petrucci, R. H., Herring, F.G., Madura, J.D., Bissonette, C, Fundamentos de Química, 10, 2011

Chang, R., Química, 11, 2013

Atkins, P.; Jones, L., Química, 2, 1998

E. Quiñoá Cabana, Nomenclatura y formulación de los compuestos inorgánicos, 2, 2006

Ramos Carpio, M. A., Refino de Petróleo, Gas Natural y Petroquímica, 1, 1997

Vian Ortuño, A., Introducción a la Química Industrial, 1, 1994

Herrero Villén, M.A., Atienza Boronat, J.A., Nogera Murray, P.; Tortajada Genaro, L.A., La Química en problemas. Un enfoque práctico, 1, 2008

Llorens Molina, J.A., Ejercicios para la introducción a la Química Orgánica, 1, 2008

Sánchez Coronilla, A., Resolución de Problemas de Química, 1, 2008

Recomendacións**Subjects that are recommended to be taken simultaneously**

Física: Física II/O07G410V01202

Matemáticas: Cálculo II/O07G410V01201

Subjects that it is recommended to have taken before

Física: Física I/O07G410V01103

Matemáticas: Cálculo I/O07G410V01101

Other comments

Os alumnos que cursaron a Química de segundo de Bacharelato teñen unha formación moito máis adecuada que os que non o fixeron. Por tanto, estes últimos deberán realizar un esforzo adicional para porse ao nivel dos primeiros.

IDENTIFYING DATA**Empresa: Administración da tecnoloxía e a empresa**

Subject	Empresa: Administración da tecnoloxía e a empresa			
Code	O07G410V01204			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1	2c
Teaching language	Castelán			
Department	Organización de empresas e márketing			
Coordinator	Sánchez Sello, Francisco Javier			
Lecturers	Sánchez Sello, Francisco Javier			
E-mail	javiss@uvigo.es			
Web	http://aero.uvigo.es			
General description	Conceptos básicos de Teoría Económica, Administración e Xestión de Empresas e Tecnoloxía; aplicación ao Sector Aeroespacial			

Competencias

Code		Typology
CB1	Que os estudantes demostrasen posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral, e adóitase atopar a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo	• saber
CG2	Planificación, redacción, dirección e xestión de proxectos, cálculo e fabricación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.	• saber • saber facer
CG5	Capacidade para levar a cabo actividades de proxección, de dirección técnica, de peritación, de redacción de informes, de ditames, e de asesoramento técnico en tarefas relativas á Enxeñaría Técnica Aeronáutica, de exercicio das funcións e de cargos técnicos genuinamente aeroespaciais.	• saber facer
CG8	Coñecemento, comprensión e capacidade para aplicar a lexislación necesaria no exercicio da profesión de Enxeñeiro Técnico Aeronáutico.	• saber facer
CE6	Coñecemento adecuado do concepto de empresa, marco institucional e xurídico da empresa. Organización e xestión de empresas.	• saber
CT1	Capacidade de análise, organización e planificación	• saber facer
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• saber • saber facer
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• saber • saber facer
CT5	Capacidade de resolución de problemas e toma de decisións	• saber facer
CT6	Capacidade de comunicación interpersonal	• Saber estar / ser
CT8	Capacidade de razoamento crítico e autocrítico	• Saber estar / ser
CT9	Capacidade de traballo en equipo de carácter interdisciplinar	• Saber estar / ser
CT10	Capacidade de tratar e actuar en situacións de conflitos e negociación	• Saber estar / ser
CT12	Compromiso ético e democrático	• Saber estar / ser

Resultados de aprendizaxe

Learning outcomes	Competences
- Coñecemento, comprensión, análise e síntese da microeconomía e macroeconomía	CB1 CG5 CT1 CT3 CT4 CT6 CT8 CT9 CT10 CT12

- Coñecemento dos aspectos básicos dos tipos de empresas e a súa xestión e organización

CB1
CG2
CG8
CE6
CT1
CT3
CT4
CT5
CT6
CT8
CT9
CT10
CT12

Contidos

Topic

A Empresa no Sistema Económico

Dirección Comercial

Dirección Financeira

Natureza e Estrutura Organizativa das Empresas:
cambio e innovación

Organizacións e Recursos Humanos: motivación e
liderado

Planificación docente

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	30	30	60
Actividades introdutorias	1	1	2
Estudo de casos	18	36	54
Resolución de problemas e/ou exercicios	1.5	16.5	18
Resolución de problemas e/ou exercicios	2	14	16

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

Metodoloxía docente

	Description
Lección maxistral	Exposición por parte do profesor dos contidos sobre a materia obxecto de estudo, bases teóricas . As sesións teóricas, poden completarse con dinámicas como análises de textos que axuden á comprensión dos conceptos teóricos da materia.
Actividades introdutorias	Presentación da Materia, antes do inicio do curso normal
Estudo de casos	Análise dun feito, problema ou suceso real coa finalidade de coñecelo, interpretalo, resolvelo, xerar hipótese, contrastar datos, reflexionar, completar coñecementos, diagnosticalo e adestrarse en procedementos alternativos de solución.

Atención personalizada

Methodologies	Description
Estudo de casos	Realización individual ou en grupo de informes, resposta a problemas de empresas aeroespaciais e formulación de solucións alternativas con seguimento e indicacións do docente, a partir de contidos da materia e a súa adaptación a problemáticas empresariais e sectoriais

Avaliación

	Description	Qualification	Evaluated Competences
Resolución de problemas e/ou exercicios	Exames parciais e/ou final sobre contido teórico-práctico da materia	60	CB1 CG2 CG5 CG8 CE6 CT1 CT3 CT4 CT5

Resolución de problemas e/ou exercicios	Entrega de exercicios, informes, resolución de problemas e toma de decisións, individual e en grupo (de forma autónoma)	40	CT1 CT3 CT4 CT5 CT6 CT8 CT9 CT10 CT12
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Other comments on the Evaluation

A planificación da materia supón a aplicación dun sistema de avaliación continua (asistencia mínima do 80%). Polo que a cualificación final obterase da avaliación dos traballos de aula e realización dun exame final. Para ter en conta ditas cualificacións é necesario obter unha nota mínima de 4 sobre 10 no exame final. As datas e horarios das probas de avaliación das diferentes convocatorias son as especificadas no calendario de probas de avaliación aprobado pola xunta de centro para o curso 2019-2020. En caso de conflito ou disparidade entre as datas dos exames, prevalecerán as sinaladas na páxina web da titulación. Segunda convocatoria: a nota correspondente aos traballos de aula conservarase durante un curso académico, convocatorias de xuño e xullo. O estudantado non asistente pode participar nun exame final que cobre todo o contido da materia.

Bibliografía. Fontes de información

Basic Bibliography

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Schilling, M.A., Dirección Estratégica de la Innovación Tecnológica, 2008, McGraw-Hill

Complementary Bibliography

Bueno Campos, E., Curso Básico de economía de la empresa, 2004, Pirámide

Fernández Sánchez y otros, Introducción a los negocios para ingenieros, 2008, Paraninfo

Hidalgo Nuchera y otros, La Gestión de la Innovación y la Tecnología en las Organizaciones, 2008, Pirámide

Fernández Sánchez, E., Estrategia de Innovación, 2005, Paraninfo

Recomendacións

IDENTIFYING DATA**Tecnoloxía aeroespacial**

Subject	Tecnoloxía aeroespacial			
Code	007G410V01205			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	1	2c
Teaching language	Castelán Galego			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Campos Garrido, Carlos			
Lecturers				
E-mail				
Web	http://aero.uvigo.es			
General description	Esta materia proporciona unha introdución aos fundamentos da Enxeñaría Aeroespacial.			

Competencias

Code		Typology
CB1	Que os estudantes demostrasen posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral, e adóitase atopar a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo	• saber facer
CG1	Capacidade para o deseño, desenvolvemento e xestión no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.	• saber
CG2	Planificación, redacción, dirección e xestión de proxectos, cálculo e fabricación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.	• saber
CG3	Instalación, explotación e mantemento no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.	• saber
CG4	Verificación e Certificación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.	• saber
CG6	Capacidade para participar nos programas de probas en voo para a toma de datos das distancias de despegamento, velocidades de ascenso, velocidades de perdas, maniobrabilidade e capacidades de aterraxe.	• saber
CG7	Capacidade de analizar e valorar o impacto social e medioambiental das solucións técnicas.	• saber
CG8	Coñecemento, comprensión e capacidade para aplicar a lexislación necesaria no exercicio da profesión de Enxeñeiro Técnico Aeronáutico.	• saber
CE9	Comprender a globalidade do sistema de navegación aérea e a complexidade do tráfico aéreo.	• saber
CE10	Comprender como as forzas aerodinámicas determinan a dinámica do voo e o papel das distintas variables involucradas no fenómeno do voo.	• saber
CE13	Comprender a singularidade das infraestruturas, edificacións e funcionamento dos aeroportos.	• saber
CE17	Coñecemento adecuado e aplicado á enxeñaría de: Os elementos fundamentais dos diversos tipos de aeronaves; os elementos funcionais do sistema de navegación aérea e as instalacións eléctricas e electrónicas asociadas; os fundamentos do deseño e construción de aeroportos e os seus diversos elementos.	• saber
CE18	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos; os principios básicos do control e a automatización do voo; as principais características e propiedades físicas e mecánicas dos materiais.	• saber
CE19	Coñecemento aplicado de: a ciencia e tecnoloxía dos materiais; mecánica e termodinámica; mecánica de fluídos; aerodinámica e mecánica do voo; sistemas de navegación e circulación aérea; tecnoloxía aeroespacial; teoría de estruturas; transporte aéreo; economía e produción; proxectos; impacto ambiental.	• saber

CT1	Capacidade de análise, organización e planificación	• saber facer
CT2	Liderado, iniciativa e espírito emprendedor	• saber
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• saber facer
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• saber facer
CT6	Capacidade de comunicación interpersoal	• saber facer
CT8	Capacidade de razoamento crítico e autocrítico	• Saber estar / ser
CT9	Capacidade de traballo en equipo de carácter interdisciplinar	• Saber estar / ser
CT12	Compromiso ético e democrático	• Saber estar / ser
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos	• Saber estar / ser

Resultados de aprendizaxe

Learning outcomes	Competences
Coñecemento xeral dos distintos sistemas propulsivos dos vehículos aeroespaciais	CB1 CG1 CG2 CG3 CG4 CG7 CE17 CE18 CT3 CT4 CT6 CT9 CT13
Coñecemento xeral da tecnoloxía aeroespacial	CB1 CG1 CG2 CG3 CG4 CG6 CG8 CE9 CE10 CE13 CE17 CE18 CE19 CT1 CT2 CT3 CT4 CT6 CT8 CT9 CT12 CT13

Coñecemento, comprensión e aplicación dos fundamentos do voo atmosférico das aeronaves, incluíndo os lanzadores e misiles

CB1
CG1
CG2
CG3
CG4
CG6
CE9
CE10
CE17
CE18
CE19
CT1
CT3
CT4
CT6
CT8
CT9
CT13

Coñecemento, comprensión e aplicación dos fundamentos do voo orbital dos vehículos espaciais

CB1
CG1
CG2
CG3
CG4
CG7
CG8
CE10
CE18
CT1
CT3
CT4
CT6
CT8
CT13

Coñecemento, comprensión e aplicación das distintas infraestruturas aeroportuarias e a navegación aérea

CB1
CG1
CG2
CG3
CG4
CG6
CG7
CG8
CE9
CE13
CE17
CE19
CT1
CT3
CT4
CT6
CT8
CT9
CT13

Contidos

Topic

Industria Aeroespacial	- Introducción a industria aeroespacial - Organizacións aeronáuticas e espaciais
Infraestruturas Aeroportuarias	- Sistema Aeroportuario - Lonxitude de pista de voo - Configuración dos aeroportos - Terminais Aeroportuarias

Navegación e circulación aérea	<ul style="list-style-type: none"> - Seguridade na navegación aérea - Navegación e circulación aérea - Marco legal - Convenio de Aviación Civil Internacional - Marco organizativo - Sistema CNS - ATM - Marco técnico - Sistemas non autónomos. Axudas á navegación - Rutas e cartas aéreas - Organización do espazo aéreo
Vehículos aeroespaciais	<ul style="list-style-type: none"> - Clasificación de vehículos aeroespaciais - Aerostatos e aerodinós - Vehículos espaciais - Aeronaves de á rotativa
Arquitectura do avión	<ul style="list-style-type: none"> - Partes do avión - Materiais - Procesos de fabricación
Aerodinámica de perfís	<ul style="list-style-type: none"> - Orixe das cargas aerodinámicas - Perfís aerodinámicos - Curvas características - Entrada en perda de perfís - Perfís en réxime compresible
Actuacións do avión	<ul style="list-style-type: none"> - Forzas externas sobre o avión - Voo horizontal, rectilíneo e uniforme - Ascenso, descenso e planeo - Viraxe no plano vertical - Viraxe no plano horizontal - Actuacións en pista - Alcance - Autonomía
Sistemas de propulsión	<ul style="list-style-type: none"> - Introducción á propulsión - Propulsión a hélice - Propulsión a chorro
Instrumentos das aeronaves	<ul style="list-style-type: none"> - Instrumentos de voo e navegación - Instrumentos da planta propulsora - Agrupamento dos instrumentos

Planificación docente

	Class hours	Hours outside the classroom	Total hours
Actividades introductorias	1	0	1
Lección maxistral	26	52	78
Design Thinking	6	24	30
Resolución de problemas	12	16	28
Exame de preguntas obxectivas	1	0	1
Exame de preguntas obxectivas	1	0	1
Resolución de problemas e/ou exercicios	2	0	2
Resolución de problemas e/ou exercicios	2	0	2
Exame de preguntas de desenvolvemento	2	0	2
Proxecto	5	0	5

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

Metodoloxía docente

	Description
Actividades introductorias	Actividades encamiñadas a tomar contacto e reunir información sobre o alumnado, así como a presentar a materia.
Lección maxistral	O profesor exporá nas clases teóricas os contidos da materia. O alumnado terá textos básicos de referencia para o seguimento da materia.
Design Thinking	O profesor presentará un tema sobre o que se levará a cabo un proxecto de industrialización do sector aeroespacial. O traballo desenvolverase en equipos / grupos de alumnos. O obxectivo desta actividade é a resolución de problemas complexos baseados na lóxica, a imaxinación, a intuición e o razoamento sistémico de cada alumno
Resolución de problemas	O profesor resolverá problemas e exercicios tipo de forma manual e o alumnado terá que resolver exercicios similares para adquirir as capacidades necesarias.

Atención personalizada

Methodologies	Description
Lección maxistral	O profesor atenderá persoalmente as dúbidas e consultas do alumnado. Atenderanse dúbidas en forma presencial, en especial nas clases de problemas e laboratorio e en titorías, como de forma non presencial, polos sistemas telemáticos dispoñibles para a materia.
Resolución de problemas	O profesor atenderá persoalmente as dúbidas e consultas do alumnado. Atenderanse dúbidas en forma presencial, en especial nas clases de problemas e laboratorio e en titorías, como de forma non presencial, polos sistemas telemáticos dispoñibles para a materia.

Avaliación

	Description	Qualification	Evaluated	Competences
Resolución de problemas e/ou exercicios	Realizaranse probas escritas curtas para avaliar a adquisición de coñecemento de forma autónoma.	20		CB1 CG1 CG2 CG3 CG4 CG6 CG7 CG8 CE9 CE10 CE13 CE17 CE18 CE19 CT1 CT4 CT8
Resolución de problemas e/ou exercicios	Realizaranse probas escritas e/ou traballos para avaliar a resolución de exercicios e/ou problemas de forma autónoma así como a asistencia e participación activa.	30		CB1 CG1 CG2 CG3 CG4 CG6 CG7 CG8 CE9 CE10 CE13 CE17 CE18 CE19 CT1 CT2 CT3 CT4 CT6 CT8 CT9 CT12 CT13

Exame de preguntas de desenvolvemento	Realizarase un exame final sobre os contidos da totalidade da materia.	50	CB1 CG1 CG2 CG3 CG4 CG6 CG7 CG8 CE9 CE10 CE13 CE17 CE18 CE19 CT1 CT3 CT4 CT8 CT13
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Other comments on the Evaluation

Estudiantes non-asistentes ás clases presencias poden realizar un exame tanto en maio como en xuño/xullo que cobre 100% da nota final.

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

FRANCHINI, S Y LÓPEZ GARCÍA, O., Introducción a la Ingeniería Aeroespacial, Ed. Garceta, 2ª edición, 2011

ANDERSON, J.D., Introduction to flight, Ed. McGraw-Hill, 5th edition, 2005

ISIDORO CARMONA, Aerodinámica y actuaciones de avión, Ed. Paraninfo, 1996

TORENBEEK, E Y WITTENBERG, H., Flight Physics, Springer, 2009

F.J. SÁEZ NIETO, L PÉREZ SANZ Y V.F. GÓMEZ COMENDADOR, La navegación aérea y el aeropuerto, Fundación AENA, 2002

M. GARCÍA CRUZADO, Descubrir la operación de los aeropuertos, Fundación AENA, 2008

Recomendacións

Subjects that it is recommended to have taken before

Física: Física I/O07G410V01103

Matemáticas: Álgebra lineal/O07G410V01102

Matemáticas: Cálculo I/O07G410V01101